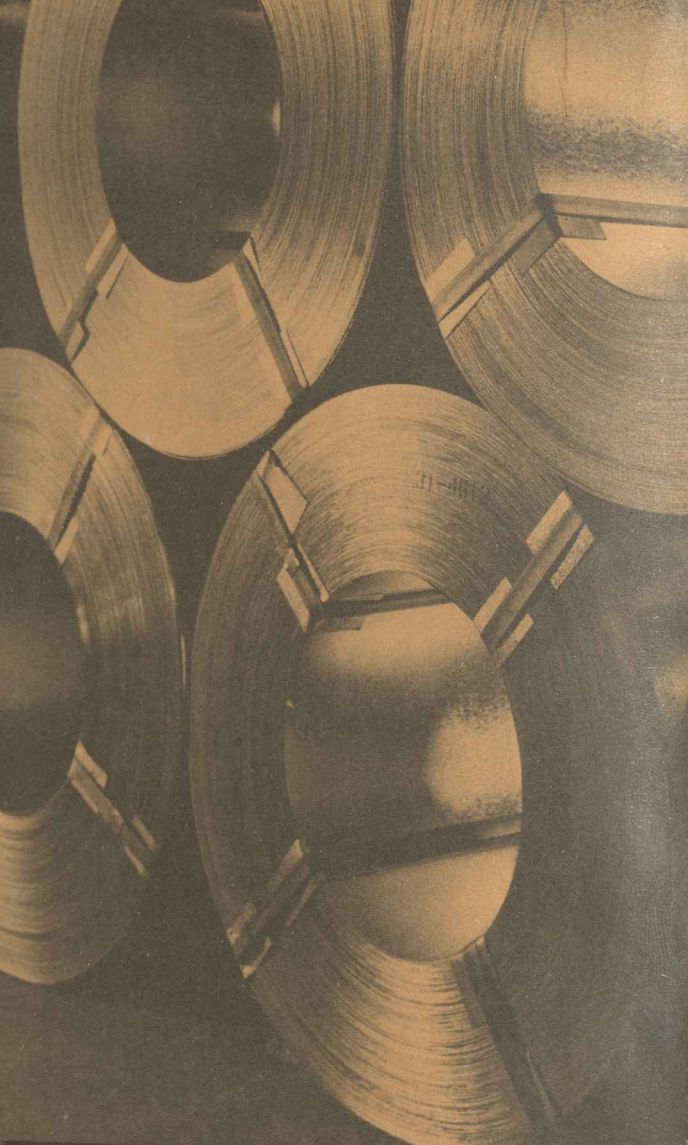
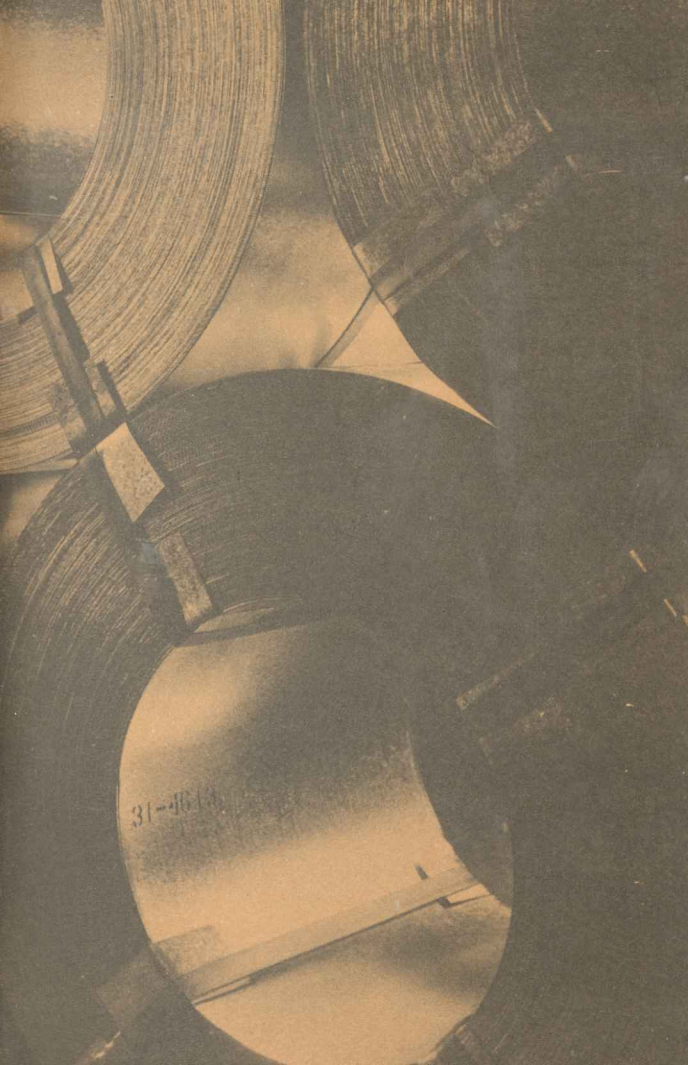




LYSAGHT REFEREE

25th EDITION
METRIC





31-4613



LYSAGHT REFEREE

25th EDITION (2)
METRIC

JOHN LYSAGHT (Australia) LIMITED

Head Office,
Export Department and International
Operations

50 Young Street, Sydney
GPO Box 196 Sydney, NSW 2001

Addresses for State Offices, Steel Manufacturing
Plants and International appear on pages
8 to 12.

FOREWORD

Following the Australian decision to convert to the metric system, John Lysaght (Australia) Limited changed from imperial measures to the widely accepted international units (SI) for its full range of steel products on January 1, 1974.

Being a major producer of basic manufacturing and building materials, it was important for Lysaght to conform with this national policy and it did so enthusiastically, recognizing the overwhelming advantages of metrication. To name a few:

- It is a far easier system to use — commercially, industrially, in design, in calculation, in learning.
- It has been adopted by most of the world, bringing about a high degree of international standardisation with all its resultant benefits in trade and industrial co-operation.
- It provided an opportunity to rationalise, reducing the often bewildering number of sizes, quantities, etc, which had grown up over the years, and thereby improving industrial efficiency.

By working closely with the Standards Association of Australia which is linked with the International Standards Organization, Lysaght ensured that its program of change conformed with the rest of Australian industry and most of the world.

Conversion was not merely a matter of adopting a new set of dimensional units. Virtually all of Lysaght's plants around Australia had to undergo some modification to bring production into line with the metric system. Careful planning over a number of years ensured a simple changeover.

Benefits of metrication naturally accrue to our customers. Their own efforts to change to metrication and benefit by standardisation with most of world industry would have been assisted by Lysaght's conversion.

In this, the first fully metricated Referee, the data and tables have been supplied by recognized authorities. While great care has been taken to ensure their accuracy, no responsibility can be accepted for any errors which may have escaped the attention of the editors.

This edition is issued gratis with the compliments of the Company, and it is hoped that it will be as useful as the previous issues of the Referee have been over the years.

JOHN LYSAGHT (Australia) LIMITED
50 YOUNG STREET, SYDNEY

LYSAGHT — A STORY OF CONTINUAL GROWTH

Australian sheet steel users are now reaping the benefit of a major expansion program by John Lysaght (Australia) Limited which has virtually duplicated, in three years, the growth of the previous 50 years.

As a result of the construction of a \$90 million Works at Westernport Bay in Victoria, to add to its Port Kembla, New South Wales, Works, Lysaght's capacity to produce steel sheet and coil has risen by 75% to around 1.75 million tonnes per annum. With modifications to the Westernport Plant when required, capacity can be further raised to a total for the Company of about 2.5 million tonnes.

The Westernport venture is a most spectacular advance for John Lysaght (Australia) Limited. It is, nevertheless, a part of a continuing story of growth which has characterised the business since it began well over a century ago.

It started in England at a time when that country, leading the industrial revolution, was pioneering new ways of making and using steel.

In 1857 the young man, John Lysaght, acquired a small galvanizing works at Bristol and quickly added a sheet rolling mill.

He began exporting galvanized steel for the burgeoning rural and building industries of Australia — and it was upon this Australian trade that the Company grew and prospered.

The high strength to mass ratio of galvanized corrugated sheet steel, its ease of transport, and the protection against the elements provided by its heavy zinc coating, made the product ideal for building in Australia. By 1900 Australia provided three-quarters of the total market for the English company's corrugated steel.

When BHP began producing steel in Australia, Lysaght followed by securing a site in Newcastle and subsequently began rolling and galvanizing sheet steel in 1921.

In the mid 1930's Lysaght started its second works, at Port Kembla, and in the post war years, embarked upon a major expansion program.

With the installation of a four-stand cold reduction mill, later enlarged to five stands, output was lifted to one million tonnes of steel coil by the early 1970's. In addition, three continuous galvanizing lines, commissioned during the 1960's made Port Kembla one of the largest galvanizing works in the world, certainly the biggest under one roof.

The Company also acquired in 1946, the nearby Commonwealth Rolling Mills and this is now the location for much of the Company's specialised plant — for producing its internationally acclaimed electrical steel and prepainted Colorbond steel sheet.

Well before the Port Kembla plant notched its first million tonnes of steel coil and sheet in a year, it was clear that the Company had to take dramatic investment action. Australian markets continued to expand substantially — in building, automotive, general manufacturing, containers and appliances, as well as the

traditional rural industries. And the high quality of the Lysaght product created keen demand in more than 50 export markets throughout the world.

It was decided to establish a completely new Cold Strip Plant, including galvanizing and coil painting lines, at Westernport Bay, Victoria, to meet the growing nationwide demand for wide strip and provide capacity for a significant surplus to take up export opportunities.

Along with the new computerised five-stand cold reduction mill at Westernport, Lysaght has installed the most modern continuous galvanizing line of its type in the world, doubling the Company's capacity to galvanize steel sheet and coil. This has more than maintained Australia's position as the largest producer of galvanized steel in the world per head of population.

Continued Lysaght development and advanced technology, as typified by Westernport, will ensure that Australia's changing needs will be served.

Port Kembla and Westernport Plants will meet Australia's steel sheet and coil requirements for many years ahead and will play their role in the continued growth of Australia's wealth, whether in the form of roofing and walling for factory buildings, steel studs for domestic dwellings, floor decking for city skyscrapers, bodies for cars, trucks and rolling stock, air-conditioning ducting for such projects as the Sydney Opera House, or a new hay shed on a country property.

SERVICE & SALES

New South Wales and Australian Capital Territory

JOHN LYSAGHT (Australia) LIMITED

Sydney

Anzac Street, Chullora
PO Box 144 Greenacre 2190

State Office
Steel Service Centre
Sheet and Coil

Brunker Road, Chullora
PO Box 103 Greenacre 2190

LBI Building Products

Newcastle

Abdon Close, Bennetts Green
PO Box 342 Charlestown 2290

LBI Building Products
Sheet and Coil

Albury/Wodonga

Urana Road, Lavington
Albury 2641

LBI Building Products

Canberra

95-97 Wollongong St. Fyshwick, ACT
PO Box 176 Manuka, ACT 2603

LBI Building Products
Sheet and Coil

BROWNBUILT STEEL EQUIPMENT

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Canberra

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PO Box 176 Manuka, ACT 2603

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GPO Box 2776Y Melbourne 3001

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Steel Service Centre
Sheet and Coil

Norcal Road, Nunawading 3131

LBI Building Products

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Clifton Hill
PO Box 6 Clifton Hill 3068

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PO Box 59 Rosewater East 5013

State Office
Steel Service Centre
Sheet and Coil
LBI Building Products

BROWNBUILT STEEL EQUIPMENT

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Private Box 120
Clarence Gardens 5039

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JOHN LYSAGHT (Australia) LIMITED

Brisbane

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PO Box 7 Sunnybank 4109

State Office
Steel Service Centre
Sheet and Coil
LBI Building Products

Townsville

Ingham Road, Garbutt
PO Box 857 Townsville 4810

Steel Service Centre
Sheet and Coil
LBI Building Products

Rockhampton

99 Stanley Street, Rockhampton
PO Box 822 Rockhampton 4700

Sheet and Coil
LBI Building Products

Now at Cairns. Aumuller Street, Portsmith 4870

BROWNBUILT STEEL EQUIPMENT

Brisbane

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PO Box 67 Salisbury North 4107

Western Australia

JOHN LYSAGHT (Australia) LIMITED

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PO Box 46 Applecross 6153

State Office
Steel Service Centre
Sheet and Coil
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JOHN LYSAGHT (Australia) LIMITED

Hobart

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Steel Service Centre
Sheet and Coil
LBI Building Products

Devonport

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Steel Service Centre
Sheet and Coil
LBI Building Products

BROWNBUILT STEEL EQUIPMENT

Hobart

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PO Box 221 Glenorchy 7010

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JOHN LYSAGHT (Australia) LIMITED

Darwin

Cnr Coonawarra &
Bombing Roads, Winnellie
PO Box 39466 Winnellie 5789

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Sheet and Coil
LBI Building Products

BROWNBUILT STEEL EQUIPMENT

Darwin

Cnr Coonawarra &
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PO Box 39466 Darwin 5789

STEEL MANUFACTURING PLANTS

JOHN LYSAGHT (Australia) LIMITED — SHEET MANUFACTURING DIVISION

Port Kembla, New South Wales

Springhill Works
Springhill Road, Wollongong
PO Box 77 Port Kembla 2505

CRM Works

Port Kembla Road, Port Kembla
PO Box 77 Port Kembla 2505

Westernport, Victoria

Westernport Works
Bayview Road, Hastings
Private Bag 1 Hastings 3915

INTERNATIONAL

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John Lysaght (South Pacific) Limited
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GPO Box 91 Suva

John Lysaght (South Pacific) Limited
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PO Box 702 Lautoka

Lysaght Brownbuilt Industries (Fiji) Limited
Lakeba Street, Samabula, Suva
GPO Box 91 Suva

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Besikayu (M) Sdn Bhd
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Shah Alam Industrial Estate, Selangor
PO Box 51 Sungei Renggam, Selangor

Lysaght Corrugated Pipe Sdn Bhd
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John Lysaght (Sabah) Sdn Bhd
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Lysaght Corrugated Pipe (S) Pte Limited
Room 5603, 5th Floor, Woh Hup Complex
Golden Mile, Beach Road, Singapore 7

Papua New Guinea

John Lysaght (PNG) Pty Limited
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PO Box 872 Lae

Brownbuilt (PNG) Pty Limited
Montoro Street, Lae
PO Box 872 Lae

Sheet Metal Industries (PNG) Pty Limited
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PO Box 872 Lae

John Lysaght (PNG) Pty Limited
Cnr Gabaka and Munahu Streets, Boroko, Port Moresby
PO Box 5979 Boroko, Port Moresby

Papua New Guinea (Cont)

Brownbuilt (PNG) Pty Limited
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PO Box 4072 Badili, Port Moresby
John Lysaght (Rabaul) Pty Limited
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Rabaul Metal Industries Pty Limited
Malaguna Road, Rabaul
PO Box 62, Rabaul

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City of Commerce
Los Angeles, California 90040

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COMPREHENSIVE INDEX

FLAT STEEL SHEET QUALITIES, COATED AND UNCOATED

Metrication within the Australian steel industry has resulted in a general rationalisation of dimensions, quantities, product, etc.

A complete range of Australian Standards has been or will be produced by the Standards Association of Australia with the assistance of expert working committees.

Two Australian Standards important to the understanding of metric change in Flat Sheet qualities are AS 1123-1972 "Preferred Metric Sizes of Wrought Ferrous and Non-Ferrous Sheet and Strip" and AS 1397-1973 "Hot-Dipped Zinc-Coated Coil or Cut Lengths".

PREFERRED DIMENSIONS

AS 1123 is of particular interest in that it provides for a rationalised approach to material thickness, width and length. Part of AS 1123 is reproduced on pages 126 to 129 of the Referee, and it will be noted that there is a "First Choice" and a "Second Choice" thickness listing. To these, John Lysaght (Australia) Limited has added a "Third Choice" list because of the current substantial use of particular applications in certain sizes. All three choices are termed "JLA Preferred Thicknesses" and are as follows:

LYSAGHT REFEREE

JLA PREFERRED THICKNESSES — in millimetres

AS 1123-1972		JLA
First Choice	Second Choice	Third Choice
0.25		
0.30	0.28	
	0.35	0.32
0.40		0.38
	0.45	0.42
0.50		0.48
0.60	0.55	
	0.70	0.65
0.80		0.75
	0.90	0.85
1.0		0.95
1.2	1.1	
	1.4	1.3
1.6		1.5
	1.8	1.7
2.0		1.9
2.5	2.2	
3.0	2.8	
		3.2

Preferred Widths and Lengths are:

	Width	Length
First preference	Multiples of 100 mm	Multiples of 100 mm
Second preference	Multiples of 5 mm	Multiples of 10 mm

Stock products are produced to selected first preference widths and lengths; second preferences being available to meet the needs of manufacturers.

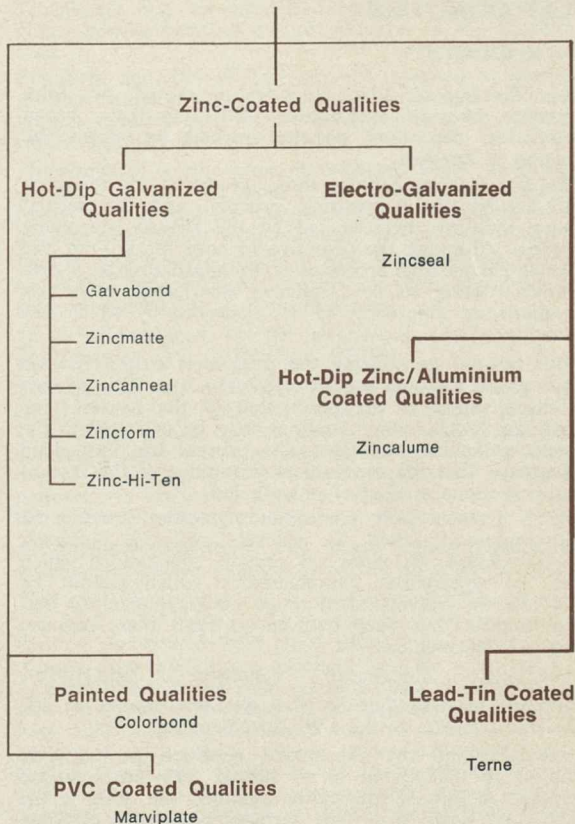
COATING CLASSIFICATION

Along with other countries and the International Standards Organization, John Lysaght (Australia) Limited has adopted the realistic method of zinc coating classification which is based on the minimum coating mass in grams per square metre as determined by the triple spot test. Conforming to AS 1397, the coating classifications for hot-dipped product are in the form of a prefix followed by a three-digit number equal to the minimum triple spot test value. The prefix for conventional zinc coatings is the letter "Z"; for zinc-iron alloy coatings the prefix letters are "ZF". Coating classes are shown throughout the Referee in the manner described, eg, Z300, Z430, AZ200.

All Lysaght hot-dip zinc-coated qualities conform to AS 1397-1973 specification.

Lysaght hot-dip zinc/aluminium alloy coated quality, Zinalume, conforms to Australian Standard 1397 under revision issued as Public Review Document DR76017. Coating classification prefix letters for Zinalume are "AZ".

SUMMARY OF COATED SHEET QUALITIES



ZINC-COATED AND ZINCALUME FLAT QUALITIES

INTRODUCTION

The Zinc-coated Flat Qualities marketed by John Lysaght (Australia) Limited, fall into two broad categories, depending on the method by which the coating is applied.

The first group includes those produced by the continuous hot-dip galvanizing process, and the second group includes those coated by the electro-galvanizing process. Although the objective in both the hot-dip and electro-galvanizing processes is to apply zinc as a protective coating to cold reduced steel strip, there are fundamental differences in the approach by which this is achieved.

With hot-dip galvanizing the preheated strip is coated as it passes through a bath of molten zinc. This process is more suited to the production of the heavier zinc coatings. Much lighter coatings may be achieved in the electro-galvanizing process. The process has the added advantage that the mechanical properties of the incoming strip remain relatively unaffected.

Of all Lysaght Flat Zinc-coated Qualities, by far the most commonly used, for general fabricating purposes, is Galvabond. As there are certain applications which call for specialised characteristics which cannot be provided in Galvabond, a range of supplementary hot-dip qualities has been evolved to meet these requirements. This includes —

Zincmatte Zincanneal Zincform Zinc-Hi-Ten.

All the Lysaght hot-dip flat qualities shown in the Referee conform to AS 1397 Specification.

Zincmatte and the Zincanneal qualities are basically similar to Galvabond in so far as they are intended as general purpose fabricating qualities, but differ in the important detail that their surfaces have been modified from that of the familiar spangled pattern of Galvabond to a smooth matt finish capable of taking high gloss

paints without any surface irregularities being apparent. Zincanneal may be painted directly but Zincmatte requires pretreatment to ensure adhesion of the finishing coat.

Zincform and Zinc-Hi-Ten are not intended as general purpose qualities but have been developed to meet market requirements where the emphasis is on strength rather than general formability.

Zincalume is a zinc/aluminium-coated sheet steel produced by the hot-dip method and added to the Lysaght range of roll-forming qualities for the production of roofing and walling with increased corrosion protection.

Due to their heavier coatings, qualities produced by the hot-dipped process have superior corrosion resistance to those produced by electro-galvanizing.

Qualities produced by the electro-galvanizing process are Zincseal CRC, CRD and CRDN.

The forming characteristics of the Zincseal group are closely related to equivalent Lysaght uncoated qualities. The zinc coatings applied to the Zincseal group give protection during storage and fabrication and to some degree in service, provided the manufactured article is painted. As normally supplied, Zincseal qualities have the added advantage of direct on paintability.

A summary comparing the major characteristics of various zinc-coated qualities is set out on pages **22 & 23**.

The corrosion protection of steel sheet by zinc coating has been well known and proven for over a century. Painted zinc-coated steel sheet offers even greater protection. Zinc provides an excellent base for paint but for successful results the paint system must be designed to suit the surface to which it is applied (see Painting, page **135**). Colorbond is zinc-coated or Zincalume steel pretreated and colour coated under completely controlled conditions which cannot be achieved in situ and permits the use of more durable stoved organic coatings not possible in air drying forms. For severe marine and industrial exposure very long term protection can be provided with Exterior Marviplate, a zinc-coated or Zincalume steel/PVC film laminate.

A GENERAL GUIDE TO COMPARATIVE FEATURES

QUALITY	GALVABOND	ZINCMATTE	ZINCANNEAL	ZINCFORM	ZINC-HI-TEN	ZINCSEAL
PROCESS	HOT-DIP	HOT-DIP	HOT-DIP	HOT-DIP	HOT-DIP	ELECTRO- LYTIC
Characteristics						
1) Main Feature	General Purpose	Smooth Surface	For Direct On Paintability	Improved Strength	High Strength	Protection during Fabrication - Direct On Paintability.
2) Corrosion Resistance	Good to Excellent**	Good	Fair to Good*	Very good to Excellent**	Very Good	Low*
3) Surface Finish	Full or Minimum Spangle	Minimum Spangle Extra Smooth	Smooth Matt	Full Spangle	Full Spangle	Smooth Matt
4) Paintability	Pretreatment required	Pretreatment required	Direct On	Pretreatment required	Pretreatment required	Direct On
Suitable Operations						
Roll-Forming—Bending	Excellent	Excellent	Moderate	Excellent	Restricted	Excellent
Pressing—Drawing	Good to Very Good	Good	Moderate	Not Recommended	Unsuitable	Good to Very Good

Lock-Forming	Excellent	Excellent	Not Recom- mended	Not Recom- mended	Unsuitable	Excellent
Soldering	Excellent	Excellent	Good	Excellent	Excellent	Excellent
Welding	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Coating	Zinc	Zinc	Zinc-iron alloy	Zinc	Zinc	Zinc
Coating Class	Z200, Z300, Z430	Z200	ZF100	Z200, Z300 Z430, Z550	Z200, Z300 Z430, Z550	Z10, Z25 Z50
Thickness***	0.25 to 3.2 mm	0.50 to 3.2 mm	0.50 to 2.5 mm	0.25 to 3.2 mm	0.40 to 2.5 mm	0.30 to 2.0 mm
Colour	Silver Grey	Silver Grey	Grey	Silver Grey	Silver Grey	Grey
Length	Cut Lengths & Coil	Cut Lengths & Coil	Cut Lengths & Coil	Cut Lengths & Coil	Cut Lengths & Coil	Cut Lengths & Coil
Australian Standard Specification	1397—1973 Grades GC or GD	1397—1973 Grade GC	1397—1973 Grade GC	1397—1973 Grades G250, G300 or G350	1397—1973 Grades G450, G500 or G550	

* Must be painted for external use.

** Depends on coating class selected.

*** JLA Preferred Thickness (first, second and third choice).

Zincalume is produced
in grades G300 and G550

GALVABOND GC, GD

Galvabond is a general purpose zinc-coated flat quality and is the most widely used of the Lysaght zinc-coated qualities. 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 base grade GC with regular coating class Z300 will permit severe forming (including lock-forming) and many drawing operations. For the more critical drawing or spinning operations base grade GD with regular coating class Z200 (for internal applications) is manufactured.

Coatings heavier than coating class Z300, while giving excellent protection against corrosive conditions, are not guaranteed for close forming. In Z430 coating class if resistance to fluting is of prime importance Galvabond NF should be specified (not guaranteed for lock-forming).

The coating with its characteristic spangled pattern, has excellent adherence and will permit a wide range of forming operations without peeling or flaking. Galvabond MS has a minimum spangle surface to suit special applications and may be specified where required. 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 under Painting (page 135) and in the Technical Information leaflet — Painting, available from any State Office of John Lysaght (Australia) Limited. Where higher standards of paint finish are required, alternative qualities (such as Zincmatte or Zincanneal) are available.

TYPICAL APPLICATIONS

Galvabond is recommended for:

Bus Body Framework	Containers
Cable Ladders	Door Channels

Metal Signs	Garage Doors
Meter Boxes	Garbage Cans
Motor Housings	Poultry Feeding Equipment
Ducting	Washing Machine Components
Expanded Metal	Wheelbarrows
Fascias and Trims	Swimming Pool Surrounds

ZINCMATTE GC

Zincmatte is a corrosion-resistant flat quality with a zinc coating modified to produce a minimum spangle extra smooth, silver grey surface. Zincmatte, with its virtual absence of visible spangle pattern, is intended for high gloss paint finishes, but pretreatment is necessary to promote paint adhesion. Where pretreatment involving phosphating is intended, Zincmatte should be ordered unchromated and oiled.

Zincmatte, produced in base grade GC, will permit a wide range of forming and drawing operations. The Z200 coating class is intended for internal or painted external applications and makes Zincmatte suitable for such items as appliance and architectural painted panels.

Soldering and welding, if carried out according to recommended practices, present no difficulties.

TYPICAL APPLICATIONS

Zincmatte is recommended for:

Automotive Body Components	Switchgear Cabinets
Washing Machine Components	Appliance and
Garage Doors	Architectural
Window Fittings	Panels

ZINCANNEAL GC

Modification by a post galvanizing heat treatment, which converts the coating into a zinc-iron alloy, gives Zincanneal its distinctive smooth grey surface with a complete absence of spangle appearance. The coating which possesses good adherence to the steel base, pro-

vides a corrosion-resistant surface which may be painted 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 must be painted for external applications.

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

Zincanneal 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 is recommended for:

Signs & Number Plates	Air Conditioners
Door Frames	Commercial Refrigerators & Freezers
Van & Bus Bodies	Cool Room Panels
Garage Doors	Domestic & Industrial Louvres
Hot Water Tank Jackets	Acoustic Ceiling Tiles

ZINCFORM G250, G300, G350

Zincform is produced to meet the minimum strength requirements of AS 1397 base grades G250, G300 and G350. It has been specially developed for structural applications, particularly roll-formed sections. Available in a variety of coating classes to suit particular end uses. Zincform is not suitable for applications where spring-back or fluting are critical (eg, Rima machines) or for drawing, pressing or lock-forming.

Zincform 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 is recommended, in the various coating classes, for:

Coating Class

Z200 (Internal applications only)	Building Sections — studs, plates, wall frames, purlins Ceiling Hangers Fittings General Roll-formed Sections
Z300	General Roll-forming Vertical Walling Painted Wall and Roof Cladding
Z430	Roof Decking Gutters and Downpipes Ridge Capping and Valleys Purlins Rain-water Goods and Accessories
Z550	Corrugated Tank Walls General Items exposed to severe corrosion conditions

ZINC-HI-TEN G450, G500, G550

Zinc-Hi-Ten is a flat zinc-coated quality 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 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.

While it is not intended for the same wide range of applications as Galvabond, Zinc-Hi-Ten has been used successfully in many roll-forming and bending operations.

Zinc-Hi-Ten 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 is usually used without any loss of structural strength. The technique of forming Zinc-Hi-Ten consists mainly in making provision for more liberal radii of bends, for slightly increased die clearances, and for more springback.

Zinc-Hi-Ten 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 Galvabond. Priming or pretreatment is necessary before painting to achieve satisfactory adhesion.

TYPICAL APPLICATIONS

Zinc-Hi-Ten is recommended, in the various coating classes, for:

Coating Class

Z200	Internal Structural Sections and Decking Concrete Formwork
Z300	Fence Droppers Windmill Blades Vertical Walling Silo Straps Tubing
Z430	Roll-formed Roof Decking Shipping Containers
Z550	General Items exposed to severe corrosion conditions

ZINCSEAL CRC, CRD, CRDN

Zincseal is an electro-galvanized flat sheet quality, with a light zinc coating which provides resistance to corrosion during storage and fabricating operations. In this respect the "dry" (ie, unoiled) Zincseal sheets are superior

to uncoated sheet as the necessity for oiling in-process stock is eliminated. Electro-galvanized sheets are not intended as a substitute for hot-dipped galvanized sheet in corrosive environments or external use.

Because of the relative thinness of the electro-coating, its fine-grained structure and the ductility of pure zinc, Zincseal can be subjected to all normal fabricating processes, such as deep drawing, spinning and pressing, without the coating showing any tendency to flake or peel. In fact some operations such as drawing are facilitated because the zinc coating acts as a lubricant and die lives are increased.

The phosphate coating applied to Zincseal qualities during processing permits direct-on application of high gloss paint finishes without priming. For applications involving exterior exposure a corrosion inhibitive primer (etch primer) must be used to upgrade the paint system as the thin zinc coating does not offer any significant degree of protection in corrosive environments.

Zincseal qualities offer the following advantages:—

- (a) A zinc coating sufficient to provide protection during storage and fabrication and an added degree of protection in service under paint.
- (b) Forming and drawing characteristics equivalent to those of the majority of Lysaght uncoated cold rolled low carbon qualities.
- (c) A smooth phosphated surface suitable for the direct on application of high gloss finishes.

The three Zincseal qualities

Zincseal CRC (Commercial Drawing Quality)

Zincseal CRD (Deep Drawing Quality)

Zincseal CRDN (Non-ageing, Deep Drawing Quality)

cover the whole range of forming and drawing operations, from moderate deformation to those of the most demanding nature involving a considerable degree of stretch forming.

Both Zincseal CRC and CRD are processed to be free from stretcher strain at the time of shipment, but freedom from stretcher strain during pressing may only be assured by effective roller levelling before pressing. Zincseal CRDN should be specified when continuing freedom from stretcher strain is required.

The zinc coating of Zincseal is tightly adherent and its ductility more than matches that of the steel base in drawing and forming operations.

Zincseal is readily welded and soldered but in these operations care must be taken to avoid damage to the light zinc coating.

Zincseal is normally supplied in the phosphated condition for direct on finishing with high gloss paints. The phosphate film is very durable and no loss of adhesion is experienced after forming or, in many cases, after drawing operations. If, however, the film should be damaged by severe working, paint adhesion may be restored by etch priming. Cleaning after fabrication is usually limited to wiping off process oils or any lubricant applied during fabrication.

TYPICAL APPLICATIONS

Zincseal's direct on paintability, smoothness of surface and excellent drawability make it most suitable as a replacement for uncoated steel sheets in a considerable range of products. Some recommended uses for Zincseal are:—

Switchgear Cabinets

Office Furniture

Flexible Tubing

Partitioning

Fluorescent Lights

Space Heaters

Convection Heaters

Bus & Van Bodies

Bathroom Cabinets

Lift Doors & Panels

Automotive Components

Acoustic Ceiling Tiles

Stove Parts

Plasterers' Angles

ZINCALUME G300, G550

Zincalume is sheet steel with a corrosion resistant zinc/aluminium alloy coating. It is produced by the established continuous hot dip coating process, using an alloy coating to provide significantly improved corrosion resistance under the same exposure conditions as traditional zinc-coated (galvanized) steel of similar coating thickness.

Zincalume is manufactured in structural grades G300 and G550, both of which are suitable for roll-forming, and with coating classes AZ200 and AZ150.

Recommended applications are roll-formed roofing and walling sheets, flashings and accessories.

All materials (except lead) that can be used in contact with traditional zinc-coated sheet steel can be used with complete safety in contact with Zincalume. As it is not practical to solder Zincalume in the field, soldering is not recommended. Economical joining and sealing systems are described on pages 90, 91 and 146.

FLAT ZINC-COATED SECONDS & REJECTS

The strict inspection standards applied to Lysaght Flat Zinc-Coated Qualities, result in the reclassification of some material falling outside the acceptable limits for primes, as Leopard (or seconds) and Rejects.

In view of the suitability of these classifications for a wide range of applications Leopard (or seconds) and Rejects are made available to customers.

Second quality sheet with a spangled pattern similar to Galvabond in appearance is marketed under the brand name of Leopard. Other second quality flat zinc-coated sheet is marketed under the original quality name followed by the words "Seconds" eg, Zincanneal Seconds.

Rejects are identified as either:—

Galvabond Rejects (Spangled Product)

Zinc-Hi-Ten Rejects (Spangled Product)

Zincmatte Rejects (Non Spangled Product)

Zincanneal Rejects (Modified Coating)

ZINC-COATED STEEL FLAT QUALITIES

APPROXIMATE MASS PER SHEET IN KILOGRAMS, AND SHEET COUNT PER NOMINAL TONNE
For Zinc Coating Class Z300

Preferred Thickness, mm	Preferred Length, mm	Preferred Width, mm					
		900		1200		1500	
		Sheet Mass	Sheet Count	Sheet Mass	Sheet Count	Sheet Mass	Sheet Count
0.30	1800	4.350	230	5.800	172		
0.40		5.621	178	7.495	133		
0.50		6.893	145	9.191	109		
0.60		8.165	122	10.886	92		
0.80		10.708	93	14.278	70		
1.0		13.252	75	17.669	57		
1.2		15.795	63	21.060	47		
1.6		20.882	48	27.842	36		
2.0	2400	25.969	39	34.625	29		
2.5		32.327	31	43.103	23		
3.0		38.686	26	51.581	19		
0.30		5.800	172	7.733	129		
0.40		7.495	133	9.994	100		
0.50		9.191	109	12.254	82		
0.60		10.886	92	14.515	69		
0.80		14.278	70	19.037	53		
1.0		17.669	57	23.558	42		
1.2		21.060	47	28.080	36		

LYSAGHT REFEREE

1.0	27.842	36	37.123	27	
2.0	34.625	29	46.166	22	
2.5	43.103	23	57.470	17	
3.0	51.581	19	68.774	15	
0.30	7.250	138	9.666	103	
0.40	9.369	107	12.492	80	
0.50	11.488	87	15.318	65	
0.60	13.608	73	18.144	55	44
0.80	17.847	56	23.796	42	22.680
1.0	22.086	45	29.448	34	29.745
1.2	26.325	38	35.100	28	36.810
1.6	34.803	29	46.404	22	43.875
2.0	43.281	23	57.708	17	58.005
2.5	53.878	19	71.838	14	
3.0	64.476	16	85.968	12	
0.30	8.699	115	11.599	86	
0.40	11.243	89	14.990	67	
0.50	13.786	73	18.382	54	
0.60	16.330	61	21.773	46	37
0.80	21.416	47	28.555	35	28
1.0	26.503	38	35.338	28	23
1.2	31.590	32	42.120	24	19
1.6	41.764	24	55.685	18	14
2.0	51.937	19	69.250	14	
2.5	64.654	15	86.206	12	
3.0	77.371	13	103.162	10	

TERNE SHEET

The designation Terne Sheet refers to steel sheets which have been coated with terne alloy by the hot-dip process. Terne alloy is defined as an alloy of lead and tin with no exact specified composition other than that a tin content of up to 25% is permitted for ease of manufacture. In practice, the tin content is approximately 12%. Terne Sheet, whilst not intended for general corrosion resistant applications, does offer a protective coating with a number of special features, some of which are enumerated below:—

1. In petrol tank construction a lead-tin coating has value in connection with the possibility of reducing frictional sparks in the neighbourhood of petrol vapours. Another important advantage of Terne Sheet in this application is that in conditions where zinc coating would form oxides and carbonates, terne metal remains virtually clean and free of corrosion products. This property is significant where corrosion product might otherwise detach from fuel tank metal surfaces and clog filters and fuel lines.
2. Soldering is greatly facilitated; the coating being composed of lead and tin (as is commercial solder) it is consequently natural that it should solder easily.
3. Drawing operations are made easier because the coating acts as an excellent lubricant and reduces friction and wear on the dies to a minimum.
4. Terne Sheet provides a good surface for painting, the only preparation normally needed is degreasing.

Terne Sheets are produced in steel base grades CRC, CRDA and CRDN.

COLORBOND

Colorbond is high quality prepainted steel sheet and coil which can be fabricated into an end product without further treatment. Produced on modern high speed continuous coil coating lines, Colorbond is available with a base of cold rolled uncoated, zinc-coated or Zincalume steel.

A range of colours, coating types and gloss levels has been developed for a wide variety of applications, both exterior and interior. These paints can be applied on either one or both sides of steel coil in the same or different colours.

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

Colorbond is available in widths from 25 mm to 1575 mm (in 5 mm increments) and in JLA preferred thicknesses from 0.30 mm to 1.6 mm depending on steel substrate. Other thicknesses may be available on application.

Typical Colorbond Coating Materials and Applications

The end product determines what paint coating type or finish is needed, and the following briefly outlines the more frequently used paint systems and their general characteristics.

If it is intended to use Colorbond in exterior applications within 1 km of salt marine locations or in severe industrial or unusually corrosive environments, please contact the nearest Lysaght State Office for specialised advice (refer pages 8 to 12).

EXTERIOR APPLICATIONS

(Coatings for exterior applications are applied over a corrosion-inhibitive primer).

SILICONE POLYESTER.— Developed specifically for exterior applications, this premium quality paint system

COLORBOND (Cont)

provides outstanding resistance to fading and chalking, coupled with excellent corrosion resistance. It has sufficient flexibility to withstand the general fabrication processing associated with building products, particularly roll-forming.

Typical Applications.— General exterior use for wall cladding, roofing shapes, rain-water goods.

INTERIOR APPLICATIONS

ACRYLIC AND POLYESTER.— These are hard, mar-resistant coatings which are used for selected applications in the building, lighting and appliance industries. They are not as flexible or formable as the vinyl paint system, but are resistant to heat and chemicals, particularly household stains, grease and detergents. On galvanized steel they are applied over a corrosion-inhibitive primer.

Typical Applications.— Fluorescent light fittings, and appliances including refrigerator wrapper panels and liners, cooking range panels, water heater wraps, etc. Polyester coatings are also recommended for cool room panel manufacture.

VINYL.— This paint system has been developed for applications which demand a high degree of flexibility and good corrosion resistance.

Typical Applications.— Recommended for automotive components, steam tubing, light fittings, curtain rods and applications involving severe fabrications.

ALKYD.— This system has been developed as a relatively low-cost finish with moderate forming capabilities. The colour range is limited.

Typical Applications.— Shelving and metal furniture.

SPECIALITY COATINGS

PATTERNED COLORBOND.— Several types of Patterned Colorbond coatings are available, with patterns ranging from very fine reproductions such as woodgrain, to solid such as brands, stripes and similar effects. Varying production processes provide standard or

COLORBOND (Cont)

special orders, all by negotiation. All systems are suitable for interior use, most for exterior applications.

Typical Applications.— Applications vary with the Patterned Colorbond systems, and may include garage doors, fascias, siding, carport walling, curtain rods and tracks, appliance wraps, shelving, office furniture, doors and door frames.

READY-PRIME.— Developed as a prime-coated sheet steel with a specially prepared surface which will readily accept normal household paints after forming into such products as gutters, downpipes, etc., and subsequent erection.

Ready-Prime contains chromate pigments for inbuilt corrosion resistance, and is a characteristic green colour to emphasise that it should be overpainted and not left in the as-erected state. Overpainting should be carried out as soon as possible after erection, at least within six months. Solvent-based or water-based household paints can be applied to Ready-Prime following a wipe with a clean rag moistened with mineral turpentine.

Typical Applications.— Formed gutters, downpipes, fascias, etc., where it is desired to overpaint with a colour to match or contrast with other painted areas of a building.

SPOT-WELDABLE PRIMER.— This is an epoxy primer with suitable formulation to allow spot-welding without the need for removing the primer from the weld area.

Typical Applications.— Such items as bus body parts, washing machine parts; in fact wherever spot-welding and subsequent painting is required.

EPOXY PRIMER — GENERAL PURPOSE.— This is the primer normally supplied on Colorbond preprimed strip. It contains chromate pigments for inbuilt corrosion resistance. It may be preformed into shape and may be overpainted with most air-drying and stoving finishes.

EPOXY PRIMER — TRICHLORETHYLENE RESISTANT.— This primer has been developed for customers who subject their product to trichlorethylene degreasing prior to finish coating. It is similar to the

COLORBOND (Cont)

general purpose primer in other respects.

Typical Applications.— For products where it is more convenient to paint after forming, eg, small production runs of articles in a wide colour range. Preprimed material makes it possible to combine the superior pretreatment and adhesion of coil coating with the flexibility required for short-run production.

STRIPPABLE COATING.— This is a clear plastic adhesive film applied for protecting metals of a high surface finish during fabrication after which it may be peeled off, leaving a scratch-free surface.

MARVIPLATE

Marviplate is a laminate of polyvinyl chloride (PVC) film bonded to either cold rolled or metallic coated steel, which can be fabricated into an end product without further finishing treatment. It is available in either sheet or coil form.

By selecting the correct combination of steel substrate and Marviplate film, standard fabrication techniques such as deep drawing, roll-forming, lock-seaming, stamping, spinning and press-brake forming are possible without damage or deterioration to the coating. In some fabricating techniques the PVC film acts as a lubricant and can measurably increase tool life.

The chemical stability of the PVC film enables Marviplate to withstand corrosive atmospheres and accidental contact with mineral acids, alkalis, alcohols and detergents.

A range of stylings and finishes has been developed for both interior and exterior applications, giving attractive surfaces which are colour fast and virtually maintenance free. These vinyls can be applied to either one or both sides of the sheet in the same or different finishes.

Typical Applications.— A wide variety of appliances including air conditioners, television wraps, oil and electric heaters, etc. Architectural uses include partitioning, acoustic ceilings, undersill units, general panelling and exterior roofing and wall cladding.

SUMMARY OF UNCOATED STEEL SHEET QUALITIES

Hot Rolled Qualities

—	HRC (Commercial Quality)
—	HRC-P (Pickled Commercial Quality)
—	HRD (Drawing Quality)
—	HRC1012
—	HRS1020
—	HRS1030
—	HRS1070
—	Ly-Ten HR340
—	HR320 (LPG Cylinder Steel)

Cold Reduced Qualities

—	Lynamel (Decarburized Enamelling Quality)
—	CRC (Commercial Drawing Quality)
—	CRD (Deep Drawing Quality)
—	CREN (Non-ageing Quality)
—	S1020
—	S1070
—	Ly-Ten CR310
—	CR320 (LPG Cylinder Steel)
—	Ly-Core (Electrical Steel)

HOT ROLLED FLAT QUALITIES

Lysaght hot rolled qualities are produced from selected slab steel by the continuous rolling process.

As rolling takes place at temperatures in excess of those at which oxidation occurs, hot rolled qualities, unless pickled, characteristically carry a surface scale.

Hot rolled cut lengths and coil may be supplied in the as-rolled condition or with such subsequent treatments as pickling and oiling, or to special tolerances on width, length and flatness, depending on the quality and the customer's specified requirements.

John Lysaght (Australia) Limited hot rolled products are marketed as the following qualities:

HRC	Hot Rolled Commercial Quality
HRC-P	Hot Rolled Pickled Commercial Quality
HRD	Hot Rolled Drawing Quality
HRC1012	Hot Rolled Sheet, Nominal Carbon Content 0.12%
HRS1020	Hot Rolled Sheet, Nominal Carbon Content 0.20%
HRS1030	Hot Rolled Sheet, Nominal Carbon Content 0.30%
HRS1070	Hot Rolled Sheet, Nominal Carbon Content 0.70%
Ly-Ten HR340	Hot Rolled Low-Alloy High-Tensile Quality
HR320	Hot Rolled Liquefiable Petroleum Gas Cylinder Quality

HRC, HRC-P and HRD may be ordered to AS 1594-1974; HR320 to AS B239 Grades 5 and 6.

Tolerances and designations in accordance with the principles incorporated in the Australian Standards are applied to those products which are designed to meet specialised needs not covered by a standard.

Hot Rolled Seconds and Rejects are also available.

GENERAL GUIDE TO COMPARATIVE FEATURES

	HRC	HRC-P	HRD
Surface	Not pickled	Pickled and oiled	Pickled and oiled
Formability	Forming and bending (not recommended for pressing because of surface oxide)	Simple pressing	Moderate drawing
Welding	Excellent	Excellent	Excellent
Preferred Thickness, mm Cut Lengths Coil	1.6 to 3.2 1.6 to 3.2	1.6 to 3.2 1.6 to 3.2	1.9 to 3.2 1.9 to 3.2
Applications	Items not requiring a quality finish	Items not requiring a quality finish	Drawn items where appearance is not of prime importance
Australian Standard Specifications	AS 1594/HRC	AS 1594/HRC	AS 1594/HRD
	HRC1012	HRS1020	HRS1030
Surface	Not pickled	Not pickled	Not pickled
Formability	Moderate drawing	Moderate forming and bending	Limited forming and bending
Welding	Excellent	Excellent	Limited
Preferred Thickness, mm Cut Lengths Coil	1.9 to 3.2 1.9 to 3.2	1.6 to 3.2 _____	1.6 to 3.2 _____
Applications	Primarily designed for automobile wheel centres	Automobile chassis and frames, lamp standards, etc	Items requiring greater strength and stiffness with limited formability
Australian Standard Specifications	_____	_____	_____

GENERAL GUIDE TO COMPARATIVE FEATURES (Cont)

	HRS1070	Ly-Ten HR340	HR320
Surface	Not pickled	Not pickled	Not pickled
Formability	Limited forming and bending	Moderate forming and bending	Moderate drawing
Welding	Limited	Excellent	Excellent
Preferred Thickness, mm Cut Lengths Coil	2.0 to 3.2 _____	2.2 to 3.2 _____	2.2 to 3.0 _____
Applications	Items requiring fully hardenable steel which retains a good cutting edge or abrasion resistance	Items requiring higher tensile strength, improved resistance to abrasion and atmospheric corrosion	Primarily designed for cylinders for liquefiable petroleum gas
Australian Standard Specifications	_____	_____	AS B239 Grades 5 and 6

HRC HOT ROLLED COMMERCIAL QUALITY

DESCRIPTION

HRC, available in both cut lengths and coil, is supplied in the as-rolled condition with a minimum of adherent surface oxides. Some minor surface faults may be included.

It is suitable for normal bending, forming and welding operations and for applications where the presence of oxides and some surface imperfections are not objectionable. It is not recommended for items requiring a quality finish.

HRC sheet should meet minimum bend tests, but is not subject to other mechanical test requirements.

TYPICAL APPLICATIONS

HRC is recommended and typically used for

Heavy-section drums and tanks

Shelving

Piping

Concrete mixers

Light structural members

Concrete formwork

HRC-P

HOT ROLLED

PICKLED COMMERCIAL QUALITY

DESCRIPTION

HRC-P, supplied in both cut lengths and coil, has similar mechanical properties to HRC and is suitable for the same types of forming and working operations. It may be used for some simple pressing applications. The surface is free from oxides and is oiled.

TYPICAL APPLICATIONS

HRC-P is recommended and typically used for

Rolling stock

Automotive components

Rotary mowers

Agricultural machinery

HRD

HOT ROLLED DRAWING QUALITY

DESCRIPTION

HRD, available in both cut lengths and coil, is intended for moderate drawing and severe forming applications where the surface finish is not of prime importance and some surface imperfections can be tolerated.

To prevent excessive die scoring, HRD is only supplied pickled and oiled, free from any surface oxides.

TYPICAL APPLICATIONS

HRD is recommended and typically used for
Sealed unit housings
Hydraulic jacks
Automotive brake components
Clutch parts
Compressors

HRC1012

HOT ROLLED SHEET, NOMINAL CARBON CONTENT 0.12%

DESCRIPTION

HRC1012 is suitable for drawn components requiring some additional strength compared to the normal drawing grades.

HRC1012 cut lengths and coil are supplied not pickled unless otherwise specified.

TYPICAL APPLICATIONS

Automobile wheel centres and similar products are the main recommended uses.

HRS1020

HOT ROLLED SHEET, NOMINAL CARBON CONTENT 0.20%

DESCRIPTION

HRS1020, available in cut lengths only, is suitable for moderate forming and bending operations. It is not recommended for drawing.

The increased carbon content, as compared with HRC1012, gives greater mechanical strength and hardness, but tends to lower formability.

HRS1020 is supplied not pickled unless otherwise specified.

TYPICAL APPLICATIONS

HRS1020 is typically used for automobile chassis frames and components, and lamp standards.

HRS1030
HOT ROLLED SHEET,
NOMINAL CARBON CONTENT 0.30%

DESCRIPTION

HRS1030, available in cut lengths only, has a carbon content which provides greater strength and stiffness as compared with HRS1020, while retaining limited formability. The mechanical properties vary with thickness and rolling conditions.

TYPICAL APPLICATIONS

HRS1030 is recommended and typically used for light structural members and similar components.

HRS1070
HOT ROLLED SHEET,
NOMINAL CARBON CONTENT 0.70%

DESCRIPTION

HRS1070, supplied in cut lengths only, is primarily intended for applications requiring a good cutting edge or resistance to abrasion.

As normally supplied, it is incapable of withstanding a significant amount of cold working. If ordered pickled and annealed it will be suitable for simple cold forming, but for substantial deformation it should be hot worked and radii should be liberal.

TYPICAL APPLICATIONS

HRS1070 is recommended and typically used for
 Agricultural machinery

Cane knives

Garden tools

Machetes

Plough discs

Shovels

LY-TEN HR340 HOT ROLLED LOW-ALLOY HIGH-TENSILE QUALITY

DESCRIPTION

Ly-Ten HR340 is a hot rolled low-alloy product, which combines high tensile strength with

1. improved resistance to atmospheric corrosion
2. greater impact resistance
3. high endurance limits
4. greater abrasion resistance
5. improved workability and weldability when compared to ordinary carbon grade steels of similar tensile strength.

Ly-Ten HR340, available in cut lengths only, is normally used for applications which require thicker sheets than can be produced by cold reduction, or where the surface finish of the manufactured article is not critical, allowing the use of the cheaper hot rolled quality.

Careful basic design is essential to take full advantage of the enhanced properties of Ly-Ten HR340. Advice should be sought from John Lysaght (Australia) Limited in applications for which this quality is used.

TYPICAL APPLICATIONS

Ly-Ten HR340 is recommended and typically used for

- Chassis frames
- Truck bodies
- Rail trucks
- Containers

HR320 HOT ROLLED LIQUEFIABLE PETROLEUM GAS CYLINDER QUALITY

DESCRIPTION

HR320 is a hot rolled low-alloy steel quality produced specifically for the manufacture of liquefiable petroleum gas cylinders.

It is normally supplied not pickled and is available in cut lengths only.

A final heat treatment must be carried out in accordance with Australian Standard B115 to develop the requisite mechanical properties.

TYPICAL APPLICATIONS

Liquefiable petroleum gas cylinders

COLD ROLLED FLAT QUALITIES

Lysaght Cold Rolled qualities are produced by a rolling process at temperatures substantially below that at which scaling or oxidation may occur, resulting in a smooth, matt surface which is suitable for most finishing operations.

The raw material for cold reduction is pickled, hot rolled coil. A continuous rolling operation reduces the thickness of this coil from between 50-80% to achieve the desired final thickness.

Rolling is usually followed by annealing, temper rolling, roller levelling, oiling, etc, to develop the properties required for the end use. These properties are superior to those of hot rolled qualities.

Most cold rolled qualities are supplied in either cut lengths or coil.

John Lysaght (Australia) Limited cold rolled products are marketed as the following qualities, each with a particular suitability to certain selected end applications:

CRC	Cold Rolled Commercial Drawing Quality
CRCA	Cold Rolled Commercial Drawing Quality, Not Temper Rolled
CRD	Cold Rolled Deep Drawing Quality
CRDA	Cold Rolled Deep Drawing Quality, Not Temper Rolled
CREN	Cold Rolled Non-Ageing Quality
CRS1020	Cold Rolled Quality, Nominal Carbon Content 0.20%

CRS1070	Cold Rolled Quality, Nominal Carbon Content 0.70%
Ly-Ten CR310	Cold Rolled Low-Alloy High-Tensile Quality
Lynamel	Cold Rolled Decarburized Enamelling Quality
CR320	Cold Rolled Liquefiable Petroleum Gas Cylinder Quality

CRC, CRCA, CRD, CRDA and CREN may be ordered to AS 1595 Part 1 — 1974; CR320 to AS B239 Grades 5 and 6.

Tolerances and designations in accordance with the principles incorporated in the Australian Standards are applied to those products which are designed to meet specialised needs not covered by a standard.

GENERAL GUIDE TO COMPARATIVE FEATURES

	CRC	CRCA	CRD	CRDA
Surface	Full finish	General purpose finish	Full finish	General purpose finish
Formability	Moderate drawing	Moderate drawing	Deep drawing	Deep drawing
Welding	Excellent	Excellent	Excellent	Excellent
Preferred Thickness, mm				
Cut lengths	0.30 to 3.2	0.30 to 3.2	0.60 to 2.5	0.60 to 2.5
Coil	0.30 to 3.2	0.30 to 3.2	0.60 to 2.5	0.60 to 2.5
Applications	Exposed panels	Non-exposed panels	Exposed panels	Non-exposed panels
Australian Standard Specifications	AS 1595/CRC(S)	AS 1595/CRCA	AS 1595/CRD(S)	AS 1595/CRDA

GENERAL GUIDE TO COMPARATIVE FEATURES (Cont)

	CREN	CRS1020	CRS1070
Surface	Full finish	General purpose finish	General purpose finish
Formability	Severe drawing and stretch forming	Moderate forming and pressing	Limited forming and pressing
Welding	Excellent	Excellent	Limited
Preferred Thickness, mm Cut lengths Coil	0.60 to 2.8 0.60 to 2.8	0.80 to 2.8 _____	1.0 to 3.2 _____
Applications	Exposed panels	Items requiring greater strength and stiffness with limited formability eg, structural members	Items requiring fully hardenable steel which retains a good cutting edge or abrasion resistance
Australian Standard Specifications	AS 1595/ CREN(S)	_____	_____
	LY-TEN CR310	LYNAMEL	CR320
Surface	General purpose finish	General purpose finish	General purpose finish
Formability	Moderate forming and pressing	Deep drawing	Moderate drawing
Welding	Excellent	Excellent	Excellent
Preferred Thickness, mm Cut lengths Coil	0.80 to 2.5 0.80 to 2.5	0.80 to 2.0 _____	1.6 to 3.2 _____
Applications	Items requiring high tensile strength and improved resistance to abrasion and atmospheric corrosion	Items intended for vitreous enamelling including "direct on" cover coats	Primarily designed for cylinders for liquefiable petroleum gas
Australian Standard Specifications	_____	_____	AS B239 Grades 5 and 6

CRC COLD ROLLED COMMERCIAL DRAWING QUALITY

DESCRIPTION

CRC, available in both cut lengths and coil, is intended for pressings of moderate severity. It is subject to ageing after final processing, but freedom from stretcher strain can be obtained by flex-rolling immediately prior to pressing.

CRC is produced to full finish standard and guaranteed to this standard for exposed panels. A marginal relaxation of surface standard is normal for less critical applications.

CRC may be ordered to Superior Surface Inspection when a premium surface is required, or to Bright Finish.

TYPICAL APPLICATIONS

CRC is recommended and typically used for

Interior automotive panels

Refrigerator wrappers

Washing machine wrappers

Office furniture

General pressings and spun components.

CRCA COLD ROLLED COMMERCIAL DRAWING QUALITY NOT TEMPER ROLLED

DESCRIPTION

CRCA, available in both cut lengths and coil, is a non-temper rolled Commercial Drawing Quality with an added margin of drawability.

CRCA is suitable for pressings of moderate severity, but should only be used for non-exposed panels because

of severe stretcher straining when pressed. It is not subject to ageing until cold worked.

The surface of CRCA is guaranteed to be free only from defects likely to lead to difficulty in forming or pressing.

Reasonable sheet flatness may be anticipated but, with the omission of temper rolling, conformity with flatness tolerances cannot be assured.

TYPICAL APPLICATIONS

CRCA is recommended and typically used for automotive floor panels and similar non-exposed panels, spun components and similar applications.

CRD

COLD ROLLED DEEP DRAWING QUALITY

DESCRIPTION

CRD, available in both cut lengths and coil, is suitable for all but the most severe deep drawing operations. It is subject to ageing after final processing, but freedom from stretcher strain can be obtained by flex-rolling immediately before pressing.

The surface is produced to full finish standard and is suitable for external panels.

TYPICAL APPLICATIONS

CRD is recommended and typically used for

Interior and exterior automotive panels

General pressings and spun components

CRDA

COLD ROLLED DEEP DRAWING QUALITY NOT TEMPER ROLLED

DESCRIPTION

CRDA, available in both cut lengths and coil, is intended for more severe applications than CRCA.

It should only be used for non-exposed panels where stretcher straining can be tolerated. The surface is free from defects likely to lead to difficulties in forming or pressing.

Reasonable sheet flatness can be expected but, with the omission of temper rolling, conformity with normal flatness tolerances cannot be assured.

TYPICAL APPLICATIONS

CRDA is recommended and typically used for automotive floor panels and other non-exposed panels, general spun components and similar applications.

CREN

COLD ROLLED NON-AGEING QUALITY

DESCRIPTION

CREN, available in both cut lengths and coil, is a stabilized steel processed to develop non-ageing characteristics and the highest degree of drawability. It is guaranteed to be free from ageing characteristics and from stretcher straining under normal storage conditions.

CREN is suitable for the most demanding drawing operations, particularly those involving a considerable amount of stretch forming. The exceptional uniformity of this quality can be used to advantage in many applications since there is no necessity to alter press settings to compensate for variations in sheet properties.

CREN is inspected to full finish standard and guaranteed to this standard for all exposed parts, but because of the nature of the basic steel used, it is not always possible to achieve a surface finish comparable to CRC and CRD.

TYPICAL APPLICATIONS

CREN is recommended and typically used for automotive panels and components.

CRS1020

COLD ROLLED SHEET, NOMINAL CARBON CONTENT 0.20%

DESCRIPTION

CRS1020 is suitable for moderate forming and pressing where some additional strength or hardness (wear resistance) compared to lower carbon qualities is desirable. It is supplied to "general purpose surface", and is available in cut lengths and coil.

TYPICAL APPLICATION

CRS1020 is recommended and typically used for light structural members and moulds.

CRS1070

COLD ROLLED SHEET, NOMINAL CARBON CONTENT 0.70%

DESCRIPTION

CRS1070 is produced with a nominal carbon content of 0.70% and possesses a high degree of hardenability. It is available in cut lengths only.

CRS1070 shows improved cold working characteristics over hot rolled annealed S1070 and because of its excellent hardenability, is particularly suited for applications requiring hard-wearing surfaces or cutting edges. The sheet is free of surface oxides, thus considerably reducing tool and die wear during fabrication.

CRS1070 is supplied in the annealed condition and must be heat treated to develop its full hardness.

TYPICAL APPLICATIONS

CRS1070 is recommended and typically used for
Shovels

Plough discs

Cane knives and other hard-wearing surfaces and cutting edges.

LY-TEN CR310

COLD ROLLED

LOW-ALLOY HIGH-TENSILE QUALITY

Ly-Ten CR310 is a cold rolled low-alloy quality produced in cut lengths and coil, with a superior surface finish to its hot rolled equivalent. It combines high tensile strength with

1. improved resistance to atmospheric corrosion
2. greater impact resistance
3. high endurance limits
4. greater abrasion resistance
5. improved workability and weldability when compared to ordinary carbon grade steels of similar tensile strength.

Significant mass reductions, of particular consequence in the transport industry, may be achieved by careful attention in basic design to exploit the improved properties of Ly-Ten.

When substituting thinner Ly-Ten sheet, the section profile must be suitably designed to provide rigidity. Advice should be sought from John Lysaght (Australia) Limited in applications for which this quality is used.

TYPICAL APPLICATIONS

- | | |
|----------------------|---|
| Agricultural: | Tractors, farm implements, hoppers, bins |
| Construction: | Buildings, guard rails, storage tanks |
| Containers: | Shipping containers |
| Electrical: | Transformers and generator tanks,
lighting standards |
| Mining: | Mine cars, hoppers, fan blades, bins |
| Shipping: | Small craft, barges |
| Transport: | Trailers, truck bodies, buses, railway
rolling stock |

LYNAMEL

DECARBURIZED ENAMELLING QUALITY

DESCRIPTION

Lynamel is a cold rolled decarburized drawing quality produced for vitreous enamelling.

Lynamel exhibits high resistance to warpage during firing. It has excellent enamelling characteristics either for "direct on" or two coat applications.

Single "direct on" cover coats are possible with suitable techniques.

TYPICAL APPLICATIONS

Lynamel is recommended for all vitreous enamelling applications.

CR320

COLD ROLLED LIQUEFIABLE PETROLEUM GAS CYLINDER QUALITY

CR320 is a cold rolled low-alloy steel quality, available in cut lengths only, produced specifically for the manufacture of welded liquefiable petroleum gas cylinders.

It is supplied in the spheroidized annealed condition for easy fabrication.

A final heat treatment must be given after fabrication in accordance with Australian Standard B115 to develop the requisite mechanical properties.

TYPICAL APPLICATIONS

Liquefiable petroleum gas cylinders

HOT ROLLED & COLD ROLLED SECONDS & REJECTS

The strict inspection standards applied to Lysaght Hot Rolled and Cold Rolled steel sheet result in the re-classification of some material falling outside the acceptable limits for primes, as seconds and rejects.

In view of the suitability of steel sheet of these classifications for a wide range of applications hot

rolled and cold rolled seconds and rejects are made available to customers.

Seconds and rejects retain their original quality designation eg,

HRD Seconds,

HRD Rejects.

ELECTRICAL STEEL QUALITIES

Lysaght Ly-Core fully processed cold reduced non-oriented electrical steel qualities provide the range of magnetic properties required by the electrical manufacturing industry.

All qualities are available as wide or slit coil and in cut lengths.

In addition to the Ly-Core qualities, Sankey-Newcastle also provides a service to the industry in the form of heat treated laminations, a general range of wound cores (including iron-nickel alloys) and other specialized stampings. Details of these are given in the Sankey Electrical Steel Laminations catalogue, available on request to Lysaght State Offices listed on pages 8 to 10 or to John Lysaght (Australia) Limited, Sankey-Newcastle, PO Box 589 Newcastle, NSW 2300.

PANELRIB

Panelrib is preformed rigidised sheet steel with shallow (4 mm) longitudinal flutes, which may be used in certain applications as an economical alternative to flat sheet steel. Refer page 83 for details.

GLOSSARY OF TERMS

Ageing.— Changes in the properties of steel occurring with the passage of time either at ambient or higher temperatures.

Ageing may be natural or artificial as defined below.

Natural Ageing:

Spontaneous changes in the properties of steel occurring at ambient temperature and usually following solution treatment.

Artificial Ageing:

Changes in the properties of steel occurring consequent upon its being held at some elevated temperature after solution treatment.

Annealing.— A process involving heating and cooling, applied usually to induce softening.

The term “annealing” is also used to cover treatments:—

- (a) to remove stresses,
- (b) to alter mechanical or physical properties,
- (c) to produce a definite microstructure, and
- (d) to remove dissolved gases.

Bend Test.— A test of ductility, wherein a test piece must withstand, without fracture, bending through a specified angle around a specified radius at ordinary temperatures.

Brazing.— Joining metals by fusion of a non-ferrous filler metal with a melting point above approx 450°C, but lower than those of the metals being joined.

The process may be accomplished by means of a torch (torch brazing), in each case with an appropriate flux, or by dipping in a molten flux bath (dip or flux brazing).

Carbon Steel.— A steel, free from intentionally added alloying elements, depending for its properties substantially upon its carbon content alone.

Camber.— Camber is the greatest deviation of a side edge of a sheet from a straight line. The measurement of a camber must be taken on the concave side with a straight-edge which is in the same plane as the sheet.

Commercial Flatness.— Commercial flatness is the normal standard of flatness to which sheets are supplied and this is usually obtained by temper rolling and/or roller levelling.

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.

Decarburization.— 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.

Ductility.— Relative ability of a metal to deform without fracture, that is, to work it into different or more complex shapes.

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.

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 a corrosive environment the subsequent failure is termed corrosion fatigue.

Finish.— Finish refers to the degree of smoothness or 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.

Galvanizing.— The process of applying a coating of zinc to a surface of iron or steel to provide a corrosion resistant surface.

Zinc coating may be applied by hot-dipping, electroplating, solid state diffusion (sherardizing) or spraying; the last two are not usually termed galvanizing.

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 electro-plating 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°C.

Mechanical Properties.— Properties relating to the behaviour of materials under load in conventional mechanical tests, such as elastic moduli, tensile strength, elongation, hardness.

Normalizing.— Heating steel to, and if necessary holding at, a suitable temperature above the transformation range, followed by cooling in a still atmosphere at 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.

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 electro-plating, 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.

Pipe.— An axial cavity formed (especially in ingots) during the final stages of solidification creates a void, in the vicinity of which is concentrated a large proportion of the low-melting-point inclusions. Pouring technique and the design of moulds have a strong influence on the occurrence and extent of pipes, but the concentration of impurities (central segregation) cannot be completely avoided with "dirty" metal.

Resquared.— This term describes a sheet which has been sheared to accurate dimensional limits as a last operation in its production.

Skin-passing.— A light cold rolling operation which must not cause significant changes in sheet ductility. It is called "skin-passing" because it is essentially a surface treatment as distinct from "temper rolling". Skin-passing is performed for three reasons:

(a) A small amount (about 1-2%) of cold work removes the yield point in steel which otherwise causes coil

break, fluting or stretcher strain in subsequent operations.

(b) To modify surface, for example, by reducing surface roughness for bright (lustre) qualities or by specially controlled roughening for matt finish for drawing qualities.

(c) Flattening.

Soldering.— Joining of metals by fusion with alloys that have relatively low melting points, most commonly lead-base or tin-base alloys, which are known as soft solders.

Joining with higher melting point alloys, sometimes termed hard solders at temperatures over 450°C , is generally termed brazing.

Stress Relieving.— Heating a metal to, and if necessary holding at some temperature generally below the recrystallization range, followed by uniform cooling, for the sole purpose of removing internal stresses.

Stretcher Levelled.— Stretcher levelled, as applied to sheets, indicates a standard of flatness. The term originated from an early method of obtaining flatness, that is, by gripping the ends of the sheet and stretching it to remove surface waves and buckles.

Stretcher Strain Markings.— Characteristic surface markings, usually of a wedge-shaped pattern, which appear during the early stages of the plastic deformation of mild steel and certain copper-base alloys. Their production is associated with the sudden extension at the yield point. In steel, they are called alternatively "Luders Lines".

Temper.— To modify hardness of metals.

(a) Adjustment of hardness of heat treated articles by controlled heating after quenching.

(b) Increase of hardness by cold rolling or drawing by small increments.

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.

LYSAGHT BROWNBUILT INDUSTRIES

ZINCALUME STEEL ROOFING AND WALL CLADDINGS

Zinc-coated roofing and wall cladding has had a long association with the Australian building industry and its advantages need no stressing. Its familiarity should not, however, be allowed to obscure even greater advantages derived from recent developments.

New Profiles.— Many modern profiles have been added to the range. Their benefits are individually discussed in following pages. Even the traditional corrugated sheet has been modernised.

Long Lengths.— LBI roofing and walling profiles are manufactured in long lengths so that on most applications one sheet will cover from ridge to gutter. The advantages of these long length sheets include neater appearance, reduced handling and fixing costs, wider spacing for supports, the elimination of end laps.

Improved Weather and Corrosion Resistance.— LBI roofing and walling is now produced from Zincalume, and gives improved corrosion resistance compared with traditional zinc-coated steel of similar coating thickness in similar environments. Anti-capillary side laps and new fastenings have been designed to ensure weather-tightness. In some profiles, fastenings are attached below or behind the cladding, avoiding the need for piercing. Exterior Marviplate has been developed to withstand conditions of exposure met in severe marine and industrial atmospheres.

Colour.— Colorbond and Exterior Marviplate sheets feature colourful organic coatings applied under controlled factory conditions.

A range of colour matched accessories and fastenings is available.

Strength and Fire Resistance.— Of the many roofing and walling materials now available, high tensile sheet steel remains the strongest. It offers high fire resistance;

it will not crack or explode and being continuous prevents entry of flying sparks.

Thermal Insulation

Lined dwellings.— The Commonwealth Experimental Building Station has carried out very extensive studies of the thermal behaviour of buildings, and it has found that the major factor controlling internal room temperatures is the heat capacity or mass of the building. The material used for roof sheathing has little or no effect on room temperature or personal comfort. The full findings are published in CEBS Technical Study No 34 "The Thermal Behaviour of Dwellings", from which the following passage is quoted: "It was popularly believed that a galvanized iron roof caused a house to be hotter than it would be if sheeted with asbestos or roofed with clay tiles. This view is not supported by the results obtained".

Unlined single membrane buildings.— A bright polished metal surface possesses relatively low thermal emissivity which reduces radiation intensity to a low value. At the same time the improved light reflectivity and distribution is a considerable advantage with a single membrane roof without ceiling.

Coolclad is Zinalume steel cladding with bright aluminium foil bonded to the underside.

Where Coolclad roofing and/or walling is used on buildings, particularly in high temperature regions, discomfort to the occupants — human or livestock — is reduced.

Roofing Performance (Standards).— LBI roofing and fixing procedures comply with the requirements of the Australian Standard 1562, "Design and Installation of Self-Supporting Metal Roofing Without Transverse Laps". The requirements of this Standard include stringent proof tests to measure the ability of the roofing medium to withstand simulated wind uplift loads and superimposed concentrated loads.

Fastening should always be in accordance with the manufacturer's published recommendations.

Service.— Lysaght Brownbuilt building profiles are now manufactured in every State and are available through Lysaght Roof and Wall Cladding Distributors, either in stock sizes or on prompt delivery, factory cut to a customer's own precise needs. A range of accessories and fasteners is also available. LBI State Offices can supply detailed technical literature for specific products and expert technical advice regarding any particular individual problems which may occur.

ZINCALUME STEEL ROOFING AND WALLING SELECTION GUIDE

New Homes.— One of the most extensive home building innovations of recent years has been the increased use of very low-pitched or flat roofs. It is in this area of design that the greater flexibility of steel over other materials has proved a significant factor. It is this flexibility that allows steel to be used successfully at lower pitches than most other roofing products, without even taking into account its other inherent advantages of strength, fire resistance, etc. In designs where a nearly flat roof is required, Klip-Lok or Brownbuilt Decking is the obvious choice since they allow pitches as low as 1°. Where the pitch is still low, but not as critical, other LBI profiles, such as Custom Orb, Trimdek Hi-Ten or Spandek may be used. In home construction the use of low-pitched roofing gives the dual advantage of design freedom with cost saving in structural framing.

Home Extensions.— With steel sheet roofing it is nearly always possible to add extensions beneath the existing roof eaves and yet still maintain sufficient ceiling height to meet building regulations. By avoiding the necessity to interfere with the existing roof structure and drainage, major cost savings are possible. Where the roof slope must be kept to a minimum, Klip-Lok or Brownbuilt Decking are the most suitable profiles. Where there is sufficient height to permit a slightly steeper roof fall, Custom Orb, Spandek and Trimdek Hi-Ten make excellent choices.

Carports, Garages, Roofed Outdoor Areas.— Where a flat roof is desired, use Klip-Lok or Brownbuilt Decking if long spans are necessary. Use Custom Orb, Spandek or Trimdek Hi-Ten where slightly more roof fall is possible. It should be noted that all these products have an underside which may be left exposed if desired, thus avoiding unnecessary additional costs where a ceiling is not required.

Fences, Privacy Screens.— LBI Custom Orb, Trimdek Hi-Ten, V-Crimp and Easyclad Cladding Systems are all suitable, and may be used horizontally or vertically to achieve a variety of pleasing effects. Each of these products is easily attached to conventional timber or metal framework. Literature on Lysaght Colorscreen steel fences is available from Lysaght State Offices listed on pages 8 to 10.

Colour.— Regular finish for all LBI roofing and walling profiles is hot dipped Zinalume. But with colour such an important consideration in so many applications, most LBI roofing and walling profiles are also available with a factory applied Colorbond painted finish.

In addition to Colorbond, Exterior Marvplate Building Shapes are also available in a selected colour range.

Exterior Marvplate has been developed to provide a building material which will withstand most severe conditions of exposure including those stemming from industrial or marine sources. It is manufactured by bonding specially formulated heavy-duty PVC film to one or both sides of Zinalume steel sheet.

A range of LBI roofing and walling profiles is roll-formed from Exterior Marvplate, together with a variety of matching fasteners and accessories.

The Colorbond paint system used for exterior applications is a specially formulated silicone polyester. The choice of profiles in this material is matched by an attractive range of colours. In addition, a range of colour and material matching accessories is available. Since colour and, often, a number of colours used in the same building or location is being increasingly used in modern design schemes, the wide range and variety offered in LBI prepainted and prelaminated profiles and accessories is often a significant factor in the choice of building materials.

Farm Buildings.— LBI Custom Orb is recommended as the most suitable material for the roofing and walling of sheds, barns and other farm buildings. Custom Orb is available in lengths up to 9000 mm and longer lengths by negotiation.

Shop Roofs.— All LBI Decking profiles are suitable for the roofing of shopping blocks. The final choice of profile will be influenced largely by the particular design. Generally, Klip-Lok or Brownbuilt Decking is used for modern low-pitched construction, while Span-deck, Trimdek Hi-Ten or Custom Orb is recommended for roofs of steeper pitch.

Shop Facades.— There are a number of LBI building shapes which can be used to achieve a pleasing variety of design in shop facades. Easyclad Cladding Systems can be used for a clean, sheer appearance. Alternatively, both V-Crimp and Trimdek Hi-Ten provide an attractive ribbed appearance. Brownbuilt Decking may also be used, erected with either the face or the reverse side exposed, with adequate weather protection, each side presenting a contrasting appearance.

Shop Awning Soffits.— LBI V-Crimp or Decking may be used for awning soffits. Available in a Zinalume finish or prefinished in Colorbond or Exterior Marvplate, V-Crimp long lengths virtually end the necessity for end lapping. The various types of cladding include the Easyclad Cladding Systems. The range takes in panels in differing tray modules, available in suitable Zinalume form for on-site painting or in Colorbond.

Factories, Warehouses.— Strength and economy make corrugated steel sheet the most commonly used material for the roofing and walling of factories and similar buildings. Custom Orb is available in long lengths and enables cladding to be carried out in a single run without end laps. The result is a saving in cladding time and a more pleasing finish.

As an alternative, Spandek is a form of corrugated sheet with a modern squared profile and can be used over longer spans, thus providing economies in framing costs.

V-Crimp is a walling that is eminently suitable for factory cladding and has a distinctive uncluttered appearance.

single run without end laps. The result is a saving in cladding time and a more pleasing finish.

As an alternative, Spandek is a form of corrugated sheet with a modern squared profile and can be used over longer spans, thus providing economies in framing costs.

V-Crimp is a walling that is eminently suitable for factory cladding and has a distinctive uncluttered appearance.

For prestige building, or for feature areas, use Klip-Lok or Brownbuilt Decking, the fixings for which are hidden from view. Where appearance is a factor to be considered, LBI prepainted and prelaminated profiles are an excellent choice. The range of colours and coating systems is wide enough and distinctive enough to ensure that no part of a factory area need look dreary merely because it is functional.

Buildings such as schools, hospitals, clubs and churches are usually architect-designed and the correct choice of roofing will usually be made from the individual design considerations.

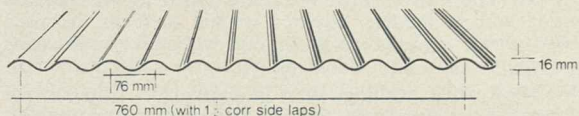
APPLICATION OF LBI CLADDING PROFILES

	Roofing	Walling	Fencing and Privacy Screens	Fascias Soffits Awnings
Custom Orb	*	*	*	*
Trimdek Hi-Ten	*	*	*	*
Spandek	*	*	*	*
Klip-Lok	*	*	*	*
V-Crimp	—	*	*	*
Tri-Lok	—	*	*	*
Brownbuilt 305 & 406 Decking	*	*	*	*
Easyclad Panels	—	*	*	*
Panelrib	—	*	*	*

*Suitable for Indicated Application.

CUSTOM ORB

CUSTOM BLUE ORB



Custom Orb and Custom Blue Orb are coated sheet steel roll-formed to the familiar conventional corrugated profile. Each of these building products is produced according to its base steel coating combination to suit particular requirements.

CUSTOM ORB

Custom Orb is a corrugated steel sheet combining high strength, lightness and Zincalume coating for outdoor exposure and corrosion resistance. It is intended for roof and wall cladding requiring high resistance to deformation, and wide spacing of support centres.

Custom Orb conforms to AS 1445 (under revision issued as Public Review Document DR 76018) — G550 — AZ 200; $10\frac{1}{2}$ x 76 mm corrugations; 760 mm cover width with $1\frac{1}{2}$ corrugations side lap; total coated thickness 0.48 mm, base steel thickness 0.42 mm.

Custom Orb is not suitable for curving. Custom Blue Orb may be used where curving and bull-nosing are required.

Custom Orb is available in stock lengths up to 9000 mm or factory cut to lengths in 10 mm increments. Lengths over 9000 mm can be supplied provided transport and on-site handling can be arranged.

The profile design, width and long sheet length of Custom Orb provide design and fixing advantages including:

- Custom cut lengths to avoid waste.

- Wide support spacings — Internal spans up to 1200 mm for roofing and up to 1800 mm for walling in non-cyclonic areas.

One sheet from roof peak to gutter — no end laps.
Minimum pitch of 5° (1 in 12) on roofs without end laps.

Consecutive side lapping and fixing without the need to turn over alternate sheets.

Weather resistant 1½ corrugations side laps.

Maximum eaves overhang of 200 mm unstiffened,
or 300 mm when stiffened with a 50 x 1.6 mm
angle or equivalent.

Custom Orb can also be supplied as a Colorbond (pre-painted) or Exterior Marviplate (vinyl laminate) or Coolclad (bright aluminium foil laminate) Building Shape.

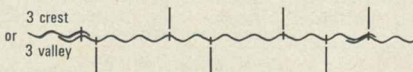
INSTALLATION DATA

Location of crest or valley fastenings for intermediate and end fixing areas (refer page 318):

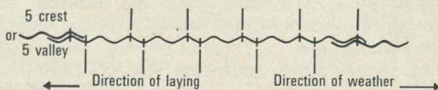
Side lapping:



Intermediate



End



CUSTOM BLUE ORB

Custom Blue Orb is a corrugated steel sheet produced with a heavy zinc coating particularly for tankmaking but is also used where ductility is required such as in curving or bending where Custom Orb is not suitable.

Custom Blue Orb specification conforms to AS 1445 — G300 — Z550; $10\frac{1}{2}$ x 76 mm corrugations; 760 mm cover width with $1\frac{1}{2}$ corrugations side lap; total coated thickness 0.69 mm, base steel thickness 0.60 mm.

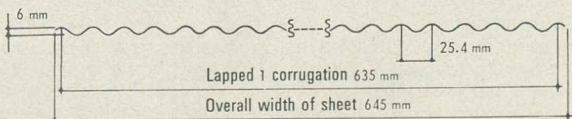
The long lengths available allow sheets to be curved into a full circle for tankmaking, particularly where a machine with vertical rollers is used.

Custom Blue Orb is available in stock lengths up to 9000 mm or factory cut to lengths in 10 mm increments. Lengths over 9000 mm can be supplied provided transport and on-site handling can be arranged.

When used as a roofing or walling sheet, design and fixing advantages and installation data are as shown for Custom Orb. A variation of Custom Blue Orb is Custom Blue Orb 8 x 76 mm which is produced essentially for the tankmaking trade.

Custom Blue Orb can also be supplied as a Colorbond (prepainted) or Exterior Marviplate (vinyl laminate) Building Shape.

BLUE ORB



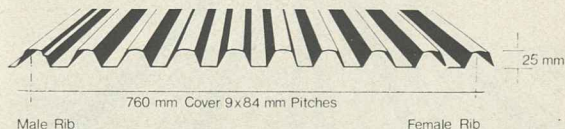
This 25 x 25.4 mm “ripple” corrugation Blue Orb walling sheet is typically used for linings, awnings, ceilings, showers, sheds and country halls. This sheet is suitable for curving.

Material specification conforms to AS 1397 — G300 — Z300; cover width is 635 mm with 1 corrugation side lap.

Total coated thickness 0.45 mm, base steel thickness 0.40 mm.

Available in sheet lengths 1500 mm to 3000 mm in increments of 300 mm.

SPANDEK



Spandek is a Zincalume lightweight steel roofing and wall cladding sheet, roll-formed to a modern mansard profile. Spandek is also available as a Colorbond (pre-painted) or Exterior Marviplate (vinyl laminate) Building Shape.

Material conforms to AS 1397 (under revision issued as Public Review Document DR 76017) — G300 — AZ200. 9 x 84 mm pitches, 760 mm cover width.

Two thicknesses are supplied

	Regular	Heavy
Total coated thickness:	0.54 mm	0.66 mm
Base steel thickness:	0.48 mm	0.60 mm

Available in factory-cut lengths up to 12 000 mm in 10 mm increments. Longer lengths available provided satisfactory transport and on-site handling can be arranged.

Features include:

Custom cut lengths to avoid waste.

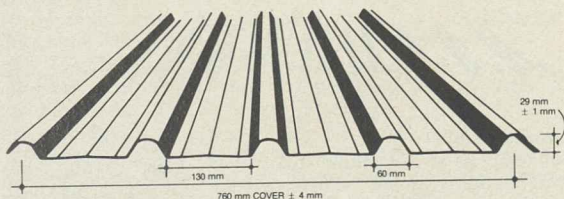
Wide support spacings — Regular product internal spans up to 1700 mm for roofing and up to 2700 mm for walling in non-cyclonic areas. (Refer page 318).

One sheet from roof peak to gutter — no end laps. Effective cover width of 760 mm.

Minimum pitch of 3° (1 in 20) on roofs without end laps.

Patented fluted side lap for protection against moisture entry by capillary action.

TRIMDEK HI-TEN



Trimdek Hi-Ten is a Zinalume, high-tensile, lightweight sheet steel roofing and walling sheet roll-formed to a modern shape.

Material conforms to AS 1397 (under revision issued as Public Review Document DR 76017) — G550 — AZ200. 760 mm cover width. Total coated thickness 0.48 mm, base steel thickness 0.42 mm.

Trimdek Hi-Ten is also available as a Colorbond (pre-painted) or Exterior Marvplate (vinyl laminate) Building Shape.

Available in factory cut lengths up to 9000 mm in 10 mm increments. Longer lengths available provided satisfactory transport and on-site handling can be arranged.

Features include:

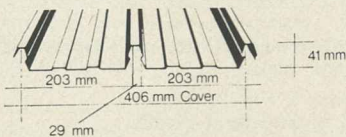
- Custom cut lengths to avoid waste.

- One sheet from roof peak to gutter — no end laps.

- Effective cover width of 760 mm.

- Minimum pitch of 3° (1 in 20) on roofs without end laps.

KLIP-LOK



Klip-Lok is a lightweight, self-supporting roof decking or wall cladding roll-formed from high strength Zinc-alume steel in a choice of three thicknesses.

Material specification is to AS 1397 (under revision issued as Public Review Document DR 76017) — G300 — AZ200. The zinc/aluminium alloy coating provides outdoor exposure protection and long life. Effective cover width of Klip-Lok decks is 406 mm.

Total coated thicknesses	0.76 mm	0.66 mm	0.54 mm
Base steel thicknesses	0.70 mm	0.60 mm	0.48 mm

Klip-Lok decks are designed particularly for low pitch roof applications. The interlocking ribs, together with concealed fixing (no puncturing) ensure weather resistance on roof pitches as low as 1° (1 in 60) where no end laps are used. When used as a wall cladding, Klip-Lok may be erected with either the face or reverse side exposed, with equal protection, each side presenting a contrasting appearance. Other design and fixing features include:

- Custom cut lengths to avoid waste.

- Increased support spacing.

- Long deck lengths.

- Special rib design which makes the deck a structural member in itself, thus permitting use of more economical framework.

Positive side rib interlocking with concealed fixing straps providing adequate fastening.

Effective spreading of loads from one deck to adjacent decks.

Modern architectural profile.

Colorbond (prepainted) or Exterior Marviplate (vinyl laminate) additional finishes are available.

Klip-Lok decks are available factory cut to lengths in 10 mm increments up to 15 000 mm. Longer lengths available provided satisfactory transport and on-site handling can be arranged.

DESIGN DATA

For normal conditions in non-cyclonic areas. (Refer to page 318).

Total coated thickness, mm	Maximum recommended spacing of supports — two or more spans		Maximum eaves overhang, mm
	Roofs	Walls	
	mm	mm	
0.76	2400	3000	300 (1200 stiffened*)
0.66	1900	2700	300 (900 stiffened*)
0.55	1200	1500	200 (600 stiffened*)

*The longer maximum eaves overhangs shown can be achieved when stiffened with a gutter system.

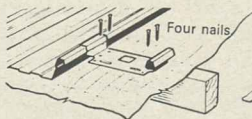
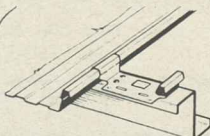
1° is the recommended minimum pitch. It is important that supports are in the same plane, as variation at the time of fixing (or later due to the uneven shrinking of timber supports) can cause a zero or negative fall. As a precaution, it is wise to design for a minimum 2° pitch to ensure a positive fall, and avoid any danger of "ponding" which could lead to a reduced service life.

INSTALLATION DATA

The top (KL45) and Side (KL41) Fixing Straps are a special feature of the Klip-Lok system. These are concealed during erection and the roofing is secured without being punctured.

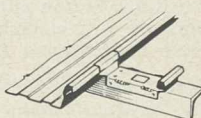
KL45

Pop rivets



KL41

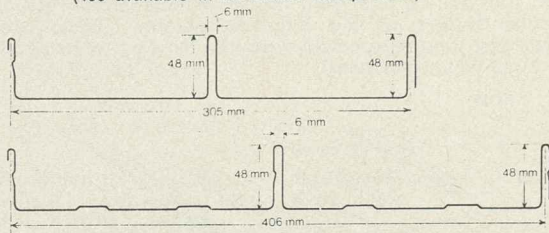
Four 20 mm welds



Installation accessories, tools, instructions and design data are available and detailed in the various published Klip-Lok leaflets.

BROWNBUILT 305 AND 406 DECKING

(406 available in all States except NSW)



Brownbuilt 305 and 406 Deckings are self-supporting, Zinalume roof deckings and wall claddings featuring the aesthetically pleasing narrow rib profile. The narrow rib allows positive button punching connection of decks, which technique is predictable in strength and contributes to both concentrated and live load supports.

Both deckings are roll-formed from Zinalume steel conforming to specification AS 1397 (under revision issued as Public Review Document DR 76017) — G300 — AZ200. Cover widths are 305 mm and 406 mm, rib height 48 mm. Available in lengths custom cut in 10 mm increments up to 15 000 mm. Longer lengths may be available provided satisfactory transport and on-site handling can be arranged.

Brownbuilt 305 and 406 Deckings are also produced in Colorbond prepainted finish; 406 is available in Exterior Marviplate finish.

These decking systems provide a weather resistant roof suitable for flat, low, gable or skillion applications. The narrow rib enables clean undersoffit appearance for exposed eaves, carports, canopies, etc. When used as a wall cladding, decks may be erected with either the face or reverse side exposed, with adequate weather protection, each side presenting a contrasting appearance.

Other design and fixing features include:

- Custom cut lengths to avoid waste.
- Long deck lengths.
- Less structural formwork required.
- Increased support spacing.
- Positive and predictable button punch rib connection.
- Positive male rib concealed clip securement.
- Quick erection saves time and cost.
- Aesthetically pleasing narrow rib.
- Effective spreading of loads from one deck to another.

The Brownbuilt Decking profile system embodies patented features which permit the fitting of insulating materials from the underside of the decking after completion of the roof.

DESIGN DATA

For normal conditions in non-cyclonic areas. (Refer to page 318).

Total coated thickness, mm	Base steel thickness, mm	Maximum recommended spacing of supports — two or more spans		Maximum eaves overhang, stiffened*, mm
		Roofs	Walls	
		mm	mm	
Brownbuilt 305				
0.61	0.55	1000	1300	900
0.76	0.70	2200	2400	1200
Brownbuilt 406				
0.61	0.55	1300	1500	900
0.76	0.70	2100	2400	1200

*Maximum eaves overhangs shown can be achieved when stiffened with a gutter system.

Minimum recommended pitch is 1° (1 in 60).

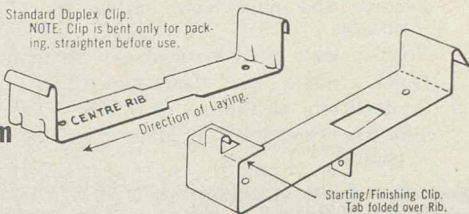
INSTALLATION DATA

When button punching, it is most important that the button punch tool be correctly oriented, ie, punch indenting under the return lip of the male rib.

Standard Duplex Clip.

NOTE: Clip is bent only for packing, straighten before use.

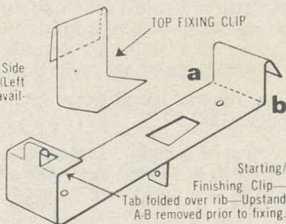
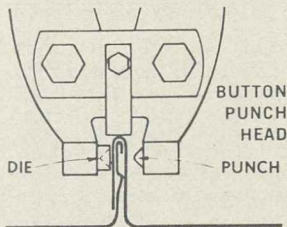
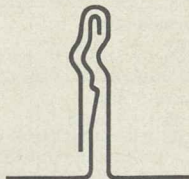
CLIPS FOR 406 mm DECK



CLIPS FOR 305 mm DECK



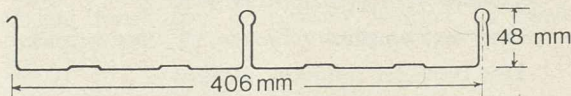
Right Hand Side
Fixing Clip (Left
Hand also avail-
able).



Punching must be 12 mm from the crown of the rib for effective locking. Punch head is preset to correct position.

BROWNBUILT MARK V 406 DECKING

(Available WA only)



Brownbuilt Mark V 406 Decking is a self-supporting, Zincalume roof decking and wall cladding featuring the aesthetically pleasing narrow rib profile. However, the rib profile differs from the Brownbuilt 406 decks in that it reduces from 11 mm radius bulb top to the 6 mm spacing between rib walls. This bulb rib top gives added rib strength and allows the positive button punching connection of decks, which technique is predictable in strength and contributes greatly to both concentrated and live load support.

Zincalume steel specification conforms to AS 1397 (under revision issued as Public Review Document DR 76017) — G300 — AZ200. Two thicknesses are produced:

Total coated thicknesses	0.61 mm	0.76 mm
Base steel thicknesses	0.55 mm	0.70 mm

Cover width is 406 mm, rib height 48 mm. Lengths are custom cut in 10 mm increments up to 15 000 mm. Longer decks may be available provided suitable transport and on-site handling can be arranged.

Mark V 406 decking is also available in Colorbond prepainted finish or in Exterior Marviplate finish.

This decking system provides a weather resistant roof suitable for flat, low, gable or skillion application. The narrow rib enables clean undersoffit appearance for exposed eaves, canopies, carports, etc. When used as a wall cladding, the decks may be erected with either the face or reverse side exposed, with adequate weather protection, each side presenting a contrasting appearance.

Other design and fixing features include:

Custom cut lengths to avoid waste.

Long deck lengths.

Less structural formwork required.

Increased support spacing.

Positive and predictable button punch rib connection.

Positive male rib concealed clip securement.

Quick erection saves time and cost.

Aesthetically pleasing narrow rib.

Effective spreading of loads from one deck to another.

The Brownbuilt Mark V 406 Decking profile system embodies patented features which permit the fitting of insulating materials from the underside of the decking after completion of the roof.

DESIGN DATA

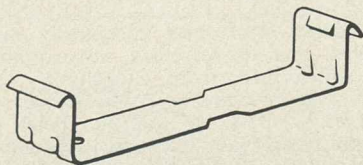
These recommendations are for normal applications in non-cyclonic areas. (Refer to page 318).

Total coated thickness, mm	Base steel thickness, mm	Minimum recommended pitch	Maximum recommended spacing of supports		Maximum eaves overhang stiffened*, mm
			Intermediate spans		
			Roofs	Walls	
			mm	mm	
0.61	0.55	1 in 60	1800	1800	900
0.76	0.70	1 in 60	2700	2700	1200

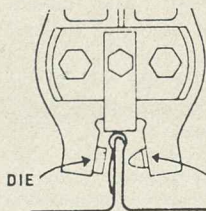
*Maximum eaves overhangs shown can be achieved when stiffened with a gutter system.

INSTALLATION DATA

When button punching, it is most important that the button punch tool be correctly oriented, ie, punch indenting under the return lip of the male rib.

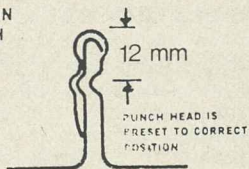


MK V DUPLEX CLIP



BUTTON
PUNCH
HEAD

PUNCH



PUNCHING MUST BE 12 mm FROM THE CROWN
OF THE RIB FOR EFFECTIVE LOCKING

V-CRIMP



V-Crimp is a coated steel sheet specifically designed for wall cladding and is therefore not suitable for roofing. It is roll-formed from Zinalume steel to AS 1397 (under revision issued as Public Review Document DR 76017) — G300 — AZ150. Total coated thickness 0.53 mm, steel base thickness 0.48 mm.

Colorbond (prepainted) or Exterior Marviplate (vinyl laminate) additional finishes are available.

V-Crimp is available factory cut to lengths in 10 mm increments up to 7500 mm. Longer lengths may be supplied provided satisfactory transport and on-site handling can be arranged.

INSTALLATION DATA

The correct side lapping of V-Crimp walling can only be accomplished with the "flat face" or "bottom" of the sheet against support member, ie, the sheet is not reversible. See detailed installation information in V-Crimp literature.

Side lapping:

Used vertically

Right

Weatherside



Wrong



Used horizontally

Right

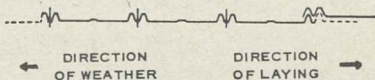
Weatherside



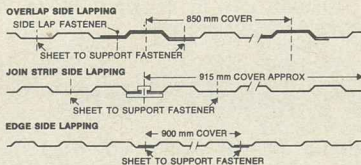
Wrong



Location of valley fastenings for all girts and battens under normal weather conditions. Crest fastening should not be used for V-Crimp walling.



PANELRIB



Panelrib is a flat steel sheet that has been given increased rigidity by forming into the sheet a series of longitudinal flutes.

These strengthening flutes give a vast improvement in stiffness and strength along the length of the sheet while retaining full flexibility across the width. Panelrib base steel thickness is 0.42 mm but longitudinal rigidity equivalent to a flat sheet of approximately double its thickness is achieved.

As the flute depth is only 4 mm Panelrib can often be used in lieu of flat sheet, resulting in material economies, enhanced appearance, and elimination of irregularities such as waviness.

Panelrib can also be used in the building field as cladding material for walls and sidings, fences, soffits, ceilings, etc. Other uses include bus and truck body cladding and lining, garage doors, steel furniture, containers and many other items.

As a regular product Panelrib is made from 0.42 mm thickness steel in either Zinalume or Colorbond pre-

painted finish. It can also be produced in Exterior Marviplate.

Cover widths are:

Overlap side lapped	850 mm
Edge side lapped	900 mm
Join strip side lapped	915 mm

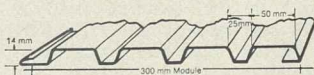
Panelrib is available in stock lengths from 1200 to 5000 mm or custom cut to lengths up to 6500 mm, longer lengths subject to enquiry.

EASYCLAD CLADDING SYSTEM

Easyclad Cladding System panels are used for sidings, feature panels, soffit linings, non-acoustic ceilings, in internal and external applications. Vertical or horizontal fixing for walls and fascias. A range of accessories is available. (Refer to trade literature for comprehensive data.)

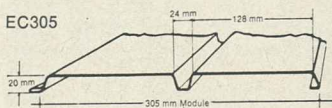
All shapes are produced in Zincalume finish or Color-bond prepainted finish. EG300 and ED305 are also manufactured with Exterior Marviplate finish. Zincalume steel used conforms to AS 1397 (under revision issued as Public Review Document DR 76017).

EG300



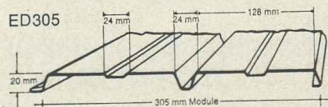
Flat trays. 300 mm metric sheet module. Suits current architectural trend for raised board profile with sharp shadow line. Concealed fixing using clip or direct fastening to grounds up to 1500 mm.

EC305



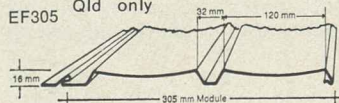
Flat trays. 305 mm sheet module. The clean, flat pans suit current architectural demands. Concealed clip fixing or direct fastening to grounds up to 1800 mm centres.

ED305



Fluted trays. 305 mm sheet module. The fluted trays enable use of thinner steel feed for economy. Concealed clip fixing or direct fastening to grounds up to 2400 mm centres.

EF305 Qld only



Doric trays. 305 mm sheet module. Curve eliminates ripple for very crisp profile. Concealed pierce fixing by nail, screw, rivet to grounds up to 1800 mm centres.

LB1 roofing and/or wall cladding decks such as Klip-Lok, Brownbuilt 305 and 406, Trimdek Hi-Ten, Spandek and V-Crimp can also be used to advantage in fascia, soffit, awning or walling applications. All of these shapes are produced in plain Zinalume finish; most are also available in Colorbond prepainted finish. Exterior Marvplate finish is available in a selection of shapes.

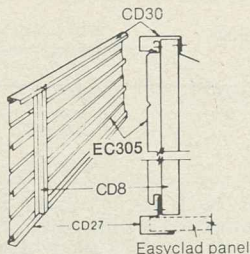
ACCESSORIES

Feature Fascia System

Easyclad Panel "Feature Fascia" systems meet flexible design needs with unique standardization of componentry, and offer almost unlimited scope for Commercial, Industrial and Domestic fascia and facade applications.

The basis of this system is the use, in combination, of components from the wide range of standard Panel profiles and accessories, thus providing great design freedom.

Example of typical feature fascia



EC 3 / 159 mm



Accessory Sections

The Easyclad wide range of work-saving accessories comprises trims, membranes, purlins, secondary grounds and fixings to reduce prime cost of panel and ceiling systems.

CD1



Trim channel

CD3



Fascia to soffit section

CD4



Feature section fascia to soffit

CD5



External corner trim

CD6



Internal corner trim

CD8



Purlin hat section

CD15



Tee section

CD27



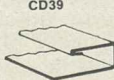
Fascia to soffit section

CD30



Fascia capping or trim

CD39



Trim channel

Accessory Clips

Easyclad accessory clips in many cases remove the need for power tools and hole drilling. These clips reduce fixing cost considerably.

CD29



Lightning
fix clip

CD34



Adjustable
suspension
clip

CD37



Termination
clip

CD38



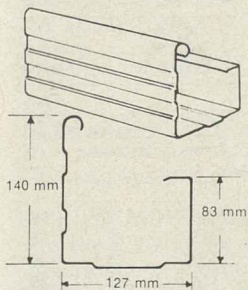
Fixing clip

ROOFING ACCESSORIES

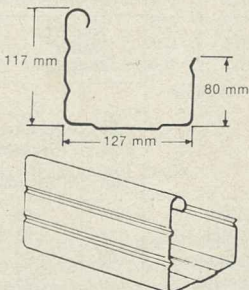
GUTTER SYSTEMS

Two LBI gutter profiles suitable for all types of roofs are Sheerline and Trimline. Fixing clips to suit various requirements are available.

SHEERLINE



TRIMLINE



These are available in plain or prepainted zinc-coated steel; Sheerline also in Exterior Marvplate. Other materials may be available on application.

ROOF DRAINAGE

Data for the Determination in Various Localities, of Gutter Sizes and Corresponding Roof Areas Drained.

The following data is based on information given in the CSIRO Division of Building Research Report No 02.2-30 and is supplied for guidance only. The roof area drained is the product of the distance between downpipes and the length of the roof slope (gutter to ridge). Therefore, if the area of roof drained, as given in the tables is divided by the length of the roof slope, the correct spacing of downpipes will be obtained.

The area of downpipes must not be less than half the area of the gutter.

ROOF AREAS DRAINED BY VARIOUS TYPES AND SIZES OF GUTTERS FOR A RISK OF OVERFLOW OF ONCE IN TWENTY YEARS

Locality	Eaves Quadrant Gutters			Eaves Half Round Gutters		
	Approx Gutter Dimension		Approx Area of Roof Drained, m ²	Approx Gutter Dimension		Approx Area of Roof Drained, m ²
	Nominal Size,	Area of Cross Section,		Nominal Size,	Area of Cross Section,	
	mm	10 ² mm ²		mm	10 ² mm ²	
Hobart	100	65	60	115	52	50
Broken Hill ..	100	65	60	115	52	50
Melbourne ..	100	65	45	115	52	35
Adelaide	115	75	50	125	65	45
Perth	115	75	45	125	65	40
Canberra ..	115	75	50	125	65	45
Alice Springs	115	75	50	125	65	45
Sydney	115	75	40	125	65	35
Brisbane	125	90	45	150	90	45
Port Moresby	125	90	40	150	90	40
Darwin	150	125	30	180	125	30
Cairns	150	125	35	180	125	35

LYSAGHT REFEREE

ROOF AREAS DRAINED BY VARIOUS TYPES AND SIZES OF GUTTERS FOR A RISK OF OVERFLOW OF ONCE IN TWENTY YEARS

Locality	Eaves Box Gutters			Internal Box Gutters (1)		
	Approx Gutter Dimension		Approx Area of Roof Drained, m ²	Gutter (2) Dimension, mm	Area of (3) Cross Section, 10 ² mm ²	Approx Area of Roof Drained, m ²
	Nominal Size, mm	Area of Cross Section, 10 ² mm ²				
Hobart	75x 75	60	55	300x100	230	220
Broken Hill ..	75x 75	60	55	300x100	230	220
Melbourne ..	75x 75	60	40	300x100	230	200
Adelaide .. .	100x 75	80	50	300x125	310	220
Perth	100x 75	80	45	300x125	310	230
Canberra ..	100x 75	80	50	300x125	310	240
Alice Springs	100x 75	80	50	300x125	310	240
Sydney .. .	100x 75	80	40	300x125	310	200
Brisbane .. .	125x 75	100	50	300x150	390	220
Port Moresby	125x 75	100	45	300x150	390	210
Darwin .. .	125x100	130	35	300x175	460	135
Cairns	125x100	130	40	300x175	460	145

NOTES:

- (1) Based on a risk of overflow of once in 100 years.
- (2) A minimum gutter width of 300 mm.
- (3) Does not include freeboard of 25 mm in gutter depth.

SIZE OF DOWNPIPES

For every 10 square metres of actual roof area drained, 700 square millimetres of downpipe is required, whether round or square. This calculation is based on the assumption that the maximum rainfall does not exceed 125 mm per hour.

It is considered the best practice to drain to different points, using smaller downpipes rather than to one large outlet. Where possible, downpipes should be spaced at not more than 12 000 mm centres.

LYSAGHT REFEREE

ROUND

Diameter, mm	Area, 10 ² mm ²	Roof Area Drained, m ²
50	20	30
60	28	40
75	44	65
100	79	115
125	120	170
150	177	250

RECTANGULAR

Size of Piping, mm	Area, 10 ² mm ²	Roof Area Drained, m ²
75 x 50	38	55
100 x 50	50	70
100 x 75	75	105
100 x 100	100	140
125 x 100	125	180
150 x 100	150	210

INSTRUCTIONS FOR USE OF SEALANT FOR ROOFING SEAMS AND JOINTS

LBI Roofing and Walling is manufactured in several coating finishes — Exterior Marvplate, Colorbond, Zinalume and zinc-coated. Four neutral type sealants suitable for use with all of these finishes are GE Silglaze silicone rubber, Selleys Silicone Rubber 790, Perennator V23-4 and GE Silpruf.

Seams should **always** be mechanically fastened for strength, whether soldered or sealant sealed, using fasteners such as blind (Pop) rivets or similar approved fasteners. When sealing laps in roof sheeting, additional fasteners are not necessary where the join is held together by the roof fixings.

For bonding, **all surfaces must be clean and dry, and free from contaminants such as old sealant or oil.** An oil-free solvent such as toluol or xylol should be used to clean the surface, but this should be wiped off with a clean dry cloth before evaporation occurs. Mineral turpentine is a suitable and practical alternative, but being less volatile than toluol or xylol more wipe-off care may be necessary to ensure complete removal of residual solvent.

Sealant must be applied on the same day that the surface is prepared.

To use the sealer, place cartridge in gun, and make a 45° cut close to the small end of the nozzle, but at a point which will provide a 3 mm diameter bead. Leaving the nozzle as long as possible will make sealer application easier.

The preferred method for lap seam fabrication is:

1. Assemble and drill.
2. Separate components and remove drilling debris etc.
3. Clean joint surfaces.
4. Apply sealant bead in a continuous line so that it envelops the fastener hole.
5. Relocate components and fasten as soon as practical after sealant placement.
6. Place some sealant over and around fasteners.

Fastening techniques are well established, but the need to seal over and around fasteners with a long lasting sealant is emphasised due to total exposure to sunlight in this situation.

For practical purposes it is sometimes necessary to place sealant prior to drilling.

The recommended sealants are neutral, curing types with maximum open times approximating 10 to 15 minutes in highly humid conditions, 30 minutes in dry conditions. The joints should be finished as soon as

practical after sealant placement to prevent premature curing causing poor bonding to the second surface. To ensure complete sealant cure, the width of sealant in lap should not exceed 25 mm when compressed.

If clean up is required **uncured** sealant can be removed with a clean, dry rag, and any excess then removed with toluol, xylol or mineral turpentine. Excess **cured** sealant is best removed with a plastic spatula to avoid substrate damage.

More detailed information on the use of sealants is contained in a publication available from Lysaght State Offices. Advice on specific sealants can be obtained from sealant manufacturers or Lysaght State Offices.

FIXING INSTRUCTIONS AND SITE NOTES

CARE AND STORAGE PRIOR TO USE

LBI plain Zinalume, galvanized or organic coated 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, should be protected by loose tarpaulins or similar covers allowing for adequate air circulation. On no account should bundles be left exposed to the weather. Rain or condensation are easily drawn in between tightly nested sheets by capillary action, and because this moisture cannot then evaporate in the normal way, will cause unsightly stains which can detract seriously from the finished appearance of the installation. In the extreme a significant loss of coating will occur.

Wet storage stain can occur from condensation alone—even in dry weather. Keep the product dry.

HANDLING

On large building projects handling time can be reduced by lifting bundles by crane directly on to the roof. If required, Lysaght local offices will give advice on lifting long-length bundles.

For small and medium jobs without mechanical handling facilities, sheets can be easily passed up one at a time by hand. Gloves should always be worn.

SPECIAL NOTES ON HANDLING COLORBOND AND MARVIPLATE

Do not drop sheets or drag one sheet over another. Wear smooth-soled rubber shoes, not ribbed soles that may pick up stones.

Do not drag tools, etc, over the painted surface. Carefully sweep away any metal shavings caused by drilling or sawing. If cutting discs are used on Colorbond, it is good practice to cut on the reverse side so that any heat marks are confined to that side. Where possible cut on the ground so that hot swarf will fall harmlessly away. If cutting must take place on a roof, prevent hot swarf from falling onto and damaging painted deck surfaces.

PERFORMANCE

LBI roofing and walling will perform as specified if fixed in accordance with the recommendations set out in individual product literature.

MOVEMENT ON ROOFS DURING FIXING

Sheets freshly taken from packs may have an oily surface, and care should be exercised when walking over newly laid sheets until the oil has had a chance to evaporate.

Always walk in the pans of decking such as Klip-Lok and Trimdek Hi-Ten, and over two or more ribs on Custom Orb and Spandek. Always wear rubber-soled shoes.

When purlin spacings are fairly close (eg, 900 mm to 1200 mm as on Custom Orb) always walk on or close to the purlins. With wider purlin spacings (eg, on Spandek and Klip-Lok), avoid walking on mid-span.

Generally, keep the load evenly distributed over the soles of both feet. When rising from a squatting position, try not to place the whole load on the toe or heel on one spot.

GALVANIC OR ELECTRO-CHEMICAL ACTION

These terms refer to the corrosion set up when dissimilar metals are in contact with one another in the presence of moisture. 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 Zinalume steel and likewise the corrosion of the underlying steel. Do not use lead in contact with Zinalume.

CLEANING UP

On most roofing jobs it is necessary to trim sheets or flashings with a hacksaw or abrasive wheel, or to drill holes for fasteners. This gives rise to fine steel particles which collect in the vicinity of each operation and, in time, will rust. Likewise, 'Pop' type rivet shanks, broken twist drills and carpenters' nails will also rust if left on the roof. This rusting not only causes unsightly stains but can also lead to the serious weakening of the adjacent zinc alloy coating due to its normal sacrificial protective action.

Before leaving the job each day:—

- (i) Remove all rubbish and left-overs — rivet shanks, sheet off-cuts, nails, etc.
- (ii) Carefully sweep down the entire roof with a soft broom, paying particular attention to areas where drilling or sawing has taken place. Similarly, sweep out all gutters.

CEILING PANELS

Although many of the roll-formed claddings produced by LBI may be used for ceiling panels, the Easyclad Cladding Systems and Tri-Lok ranges are especially suited for this purpose.

Both systems employ concealed fixing and a full range of accessories is available.

STRUCTURAL DECKING

BONDEK

Bondek is a high strength zinc-coated steel composite decking which acts as both permanent formwork and positive tensile reinforcement in one-way reinforced concrete slab construction. It is suited for all types of construction, high-rise steel or concrete framed buildings, or traditional load-bearing brickwork such as home units, hospitals, cottages, bathroom, patio and porch slabs.

Bondek composite slab construction conforms to SAA Concrete Structures Code AS 1480. Panels are roll-formed from zinc-coated steel to specification AS 1397 — G500 — Z200 in base steel thicknesses 0.75 mm and 1.00 mm, and custom cut to required lengths. 12 000 mm is the practical length limit, but longer lengths may be supplied provided satisfactory transport and on-site handling can be arranged.

The high tensile steel provides increased resistance to handling and erection damage, and a greater margin of safety on design stresses. Other features include:

- Simple construction.

- Requires only limited propping.

- Long lengths for continuous spans.

- Reduces need for other reinforcement to a minimum.

- Very fast fixing time with unskilled labour.

- Safe working platform.

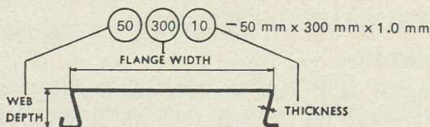
- Weatherproof cover to workmen on floors below.

- Reduced risk of falling objects.

- Effective rib location permits thinner slabs.

Bondek slabs either with additional fine reinforcement or with soffit sprayed with 12 mm thickness of fire protection material such as vermiculite plaster qualifies for a two hour fire resistance rating.

TRI-LOK



Cataloguing: The system of cataloguing Tri-Lok panels is illustrated by the above diagram.

The interlocking design of Tri-Lok panels provides strength, economy and durability. Suitable for walls, floors, awnings, facades and similar applications, Tri-Lok can be fixed "ribs out" or "ribs in" with equal effect.

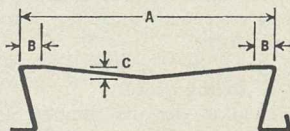
The panels are formed from zinc-coated steel to specification AS 1397 — G250 — Z300 in a variety of sizes. The profile variations are to the web depths and flange widths.

DIMENSIONS

Standard Panels

Catalogue Number	Web Depth, mm	Flange (Cover) Width, mm	Length
5030010	50	300	Custom cut up to 7500 mm
7530010	75	300	
7530012	75	300	
10022510	100	225	
10022512	100	225	

"W" Type Panel



Catalogue Number	Dimension "A", mm	Dimension "B", mm	Dimension "C", mm
5030010	300	25	13
7530010	300	25	13

"W" type panels are supplied custom cut in lengths up to 7500 mm.

PURLIN & GIRT SYSTEMS

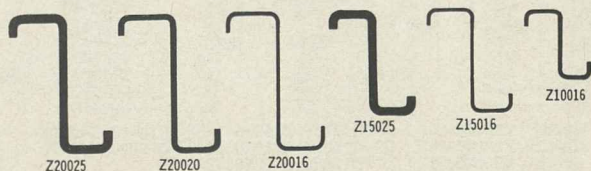
LYSAGHT ZED AND C SECTIONS

Lysaght Zed Sections and C Sections are light section structural members with an asymmetrical Z or C profile, cold formed from high strength zinc-coated steel strip, and are specially designed for use as purlins and girts for the support of roof and wall cladding in framed structures.

Zed and C Sections are designed in accordance with the SAA Cold Formed Steel Structures Code AS 1538-1974.

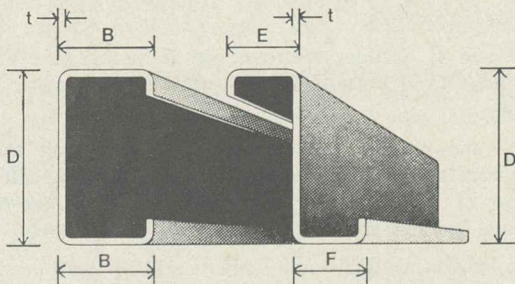
They are available pierced and notched to suit most requirements, together with bracing, fastening and a range of accessories. Sections are available to suit normal building span requirements.

The lengths available are limited only by convenience in transporting but are regular up to 12 000 mm and may be supplied up to 15 000 mm on inquiry.



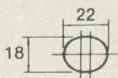
LYSAGHT REFEREE

Catalogue Number	ZED SECTION Dimension, mm				Catalogue Number	C SECTION Dimension, mm		
	D	E	F	t		D	B	t
Z10016	102	53	49	1.6	C10016	102	51	1.6
Z10020	102	53	48	2.0	C10020	102	51	2.0
Z15016	152	65	61	1.6	C15016	152	64	1.6
Z15020	152	65	61	2.0	C15020	152	64	2.0
Z15025	152	66	60	2.5	C15025	152	64	2.5
Z20016	203	79	74	1.6	C20016	203	76	1.6
Z20020	203	79	74	2.0	C20020	203	76	2.0
Z20025	203	79	73	2.5	C20025	203	76	2.5

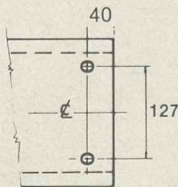


HOLE DETAILS AND GAUGE LINES FOR ZED AND C SECTIONS

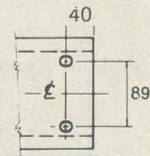
Dimensions in mm



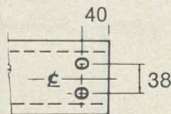
Standard elongated
punched hole.
Holes equally spaced
above and below
centreline



Z20016, Z20016
Z20020, Z20020
Z20025, Z20025



Z15016, Z15016
Z15020, Z15020
Z15025, Z15025



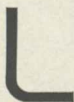
C10016, Z10016
C10020, Z10020

STANDARD COLD FORMED SECTIONS

Lysaght Cold Formed Sections are roll-formed from zinc-coated or hot rolled steel strip in four profiles — Angles, Plain Channels, Lipped Channels (ex stock) and Top Hat Sections (by arrangement).

Many different shapes and sizes are available with a wide range of uses in the fields of construction and general fabrication.

ANGLES



Designation	Leg Lengths, mm	Thickness, mm	kg/m	
			Zinc-coated	Hot Rolled
LA3225	32 x 22	2.5	1.00	0.98
LA4632	46 x 35	3.2	1.93	1.91
LA5132	51 x 30	3.2	1.93	1.91

PLAIN CHANNELS

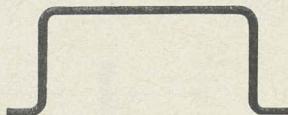


Designation	Web, mm	Flange, mm	Thickness, mm	kg/m	
				Zinc-coated	Hot Rolled
LC01916	19	12	1.6	0.49	0.48
LC02516	25	13	1.6	0.58	0.57
LC03816	38	16	1.6	0.84	0.82
LC05116	51	15	1.6	0.97	0.94
LC05132	51	25	3.2	2.29	2.26
LC05725	57	26	2.5	2.00	1.96
LC06425	64	22	2.5	2.00	1.96
LC07632	76	37	3.2	3.56	3.52
LC08332	83	34	3.2	3.56	3.52
LC08932	89	31	3.2	3.56	3.52
LC09532	95	35	3.2	3.92	3.87
LC10332	103	31	3.2	3.92	3.87
LC10232	102	55	3.2	5.09	5.02
LC12732	127	49	3.2	5.45	5.38
LC15232	152	50	3.2	6.11	6.03

LC05116 WILL NEST INTO LC05725
 LC05725 WILL NEST INTO LC06425
 LC09532 WILL NEST INTO LC10332



LIPPED CHANNELS



TOP HAT SECTIONS

LIPPED CHANNELS AND TOP HAT SECTIONS

Designation							
Lipped Channel	Top Hat Section	Web, mm	Flange, mm	Lip, mm	Thickness, mm	kg/m Zinc-coated	kg/m Hot Rolled
LL05116	LT05116	51	35	9	1.6	1.61	1.57
LL06420	LT06420	64	38	10	2.0	2.32	2.28
LL07620	LT07620	76	44	11	2.0	2.73	2.67
LL08920	LT08920	89	51	12	2.0	3.21	3.14
LL08932	LT08932	89	51	15	3.2	5.09	5.02
LL10225	LT10225	102	51	14	2.5	4.27	4.20
LL10232	LT10232	102	51	16	3.2	5.45	5.38
LL12725	LT12725	127	51	14	2.5	4.79	4.71
LL12732	LT12732	127	51	16	3.2	6.11	6.03
LL15232	LT15232	152	64	16	3.2	7.38	7.28
LL17832	LT17832	178	70	17	3.2	8.40	8.29
LL20325	LT20325	203	70	15	2.5	7.06	6.95
LL20332	LT20332	203	76	18	3.2	9.42	9.29
LL25432	LT25432	254	89	23	3.2	11.63	11.48

LYSAGHT BROWNBUILT INDUSTRIES CUSTOM COLD ROLL-FORMED SECTIONS

Custom Cold Roll-Forming is a service offered to manufacturers and designers to meet their requirements when standard sections are unsuitable. A great variety of shapes and sizes can be produced with accuracy and consistency.

The roll-forming machines are capable of handling a wide range of basic materials including:

- (1) Uncoated hot rolled and cold reduced steel strip.
- (2) Galvanized steel strip.
- (3) Prepainted galvanized or cold reduced steel or aluminium strip.
- (4) Stainless steel strip.
- (5) Aluminium strip.
- (6) Copper strip.
- (7) Zinc, bronze and magnesium are also available.

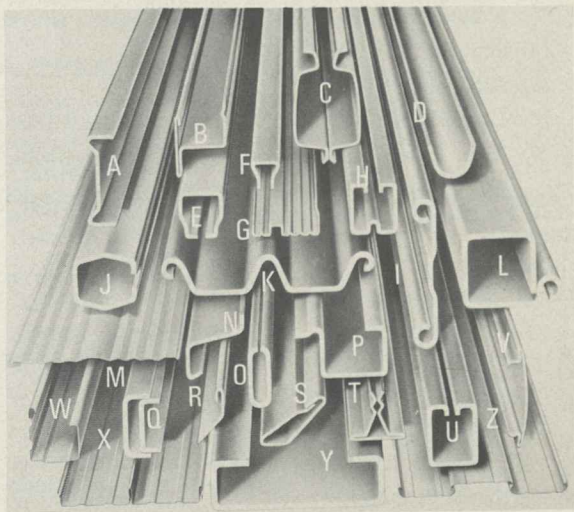
Regardless of the nature of the feed, thicknesses between 0.40 mm and 10 mm and widths up to 760 mm may be formed.

Typical sections currently being produced are shown in the following illustration.

A — Truck bumper bar	H — Partition upright
B — Automotive glass channel	I — Stock crate siding
C — Mono-rail (composite section)	J — Conveyor track
D — Bed frame bow	K — Sheet piling
E — Conveyor track	L — Shutter door bottom rail
F — Construction key	M — Caravan cladding
G — Lift door threshold	N — Farm machinery component
	O — Electrode plate stiffener

LYSAGHT REFEREE

P — Shipping container top rail	U — Industrial sliding door track
Q — Truck chassis and mating reinforcement	V — Venetian blind component
R — Farm machinery component	W — Gutter
S — Louvre for heating register	X — Roof decking
T — Acoustic ceiling suspension clip	Y — Electrical trunking and structural section
	Z — Precipitator electrode



Not to scale

EXPANDED METAL

Expanded Metal is used in almost every branch of engineering and building. It is made from sheet metal which, by slitting and expanding, without any waste of material, is converted into a network of diamond or other special shaped openings.

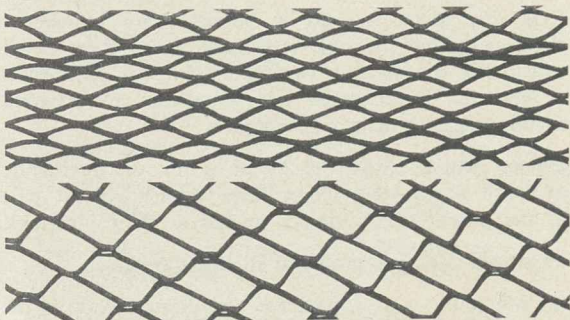
Unlike netting, Expanded Metal is not an interlacing of loose or separate pieces. The strands are all part of the parent metal, rigidly unified at their junctions.

Expanded Metal is produced in five types:—

- (a) Metalath — as a base for wet plaster work in the building trade.
- (b) Ornameash — for industrial, decorative and general use where a high degree of accuracy and finish is required.
- (c) Balustrade Mesh — for balcony and stair railings, screen doors, room dividers and security partitions.
- (d) Louvre Mesh — for sun screens, wind breaks and privacy screens, infill panels, facades and soffits.
- (e) Gridmesh — produced from heavy steel plate for use on catwalks, work platforms, stair treads, etc.

Many ductile materials such as steel, aluminium, copper, brass and other alloys, can be expanded, but the chief material for Expanded Metal is high-grade low carbon steel sheet.

METALATH



Metalath is a galvanized steel lathing mesh used extensively in the building industry, particularly as a base for plaster ceilings, ceramic wall tiles on timber frames, soffits and other architectural effects. Metalath is widely used also to support fire proofing sprays on steel columns and beams in fire rated construction and for cement rendering. The product is complemented with a range of corner beads and plaster partition accessories.

Metalath is produced in two steel thicknesses and two styles.

Catalogue No and thickness	Application
PL25, FL25 0.50 mm	For general plastering and wall tiling
PL34, FL34 0.60 mm	For low mass fireproof construction

All available in sheets 700 mm wide x 2400 or 2700 mm long. PL25 is also produced in 60 metre coils; longer subject to inquiry.

Accessories.— A complete range of accessories for walls, ceilings and partitions is available for use with Metalath.

ORNAMESH

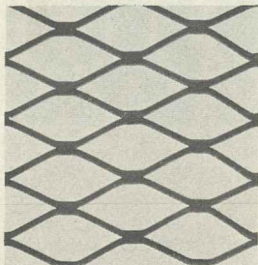
Whether it is for machinery guards in heavy industry, speaker grilles in transistor radios, room dividers or anti-dazzle screens on an express-way, there is a style and mesh size in the Ornameash range to suit the purpose.

Ornameash admits light and air and permits easy vision, yet it forms an effective barrier against entry, helps prevent accidents and has numerous other uses.

Ornameash is not limited to any one field. It is used extensively in industry for machinery guards, shelving pallets and racking. It is used in manufactured products and equipment of all kinds, and in the building industry for concrete formwork, partitions, room dividers and the like.

Ornameash is available in both low carbon steel and aluminium. Ornameash can also be produced in copper, brass, stainless steel and other ductile metals to order.

In some applications of Ornameash — such as machinery guards, ironing boards, functional furniture and storage bins — a particularly smooth and flat surface is desirable. In these cases, Flattened Steel Ornameash is the best choice.



Flattened Ornameash



Ornameash

PATTERNED ORNAMESH

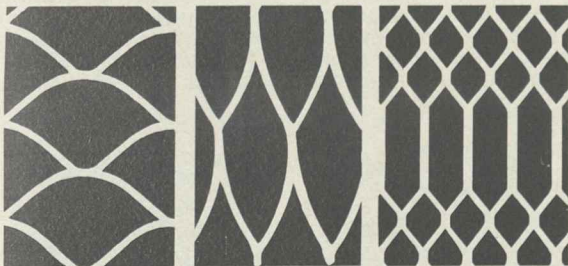
Used in decorative screens and panelling, Patterned Steel Ornamesh provides an attractive high-quality finish, yet it does not restrict the natural flow of air.

Three patterns are available in a wide range of sheet and mesh sizes. It can be supplied in aluminium if desired. A large range of special patterns can also be produced.

In addition to its many uses in industry, Patterned Ornamesh provides new, stimulating ideas for modern interior decoration.



BALUSTRADE MESH



Balustrade Mesh is an ornamental expanded metal with a high percentage of open area giving the appearance of delicate wrought iron.

Intended for internal and external balustrades, grilles and dividers, window and door protectors, security partitions and stair railings. Three standard patterns are available in steel, galvanized steel and aluminium.

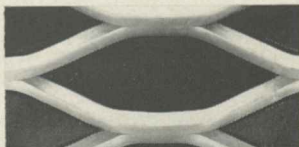
LOUVRE MESH

Louvre Mesh is primarily a sun screen mesh. Because of the unique mesh formation, which occupies only 20% of the total area, it forms an effective shield from the sun's rays, yet it permits free passage of air. Durability is assured by the heavily galvanized base steel.

In addition to being used for sun screens, Louvre Mesh is also suitable for infill panels, facades, and soffits. When installed with the mesh openings running vertically, it may be used effectively for wind breaks and outdoor screens.



Louvre Mesh



Gridmesh

GRIDMESH

Gridmesh is a metal mesh — designed for use in walkways and platforms. It is strong and light, much lighter than steel plate of similar load bearing capacity and an important advantage for industrial use is its self-cleaning properties.

Available in two series — “GR” is comparatively open for general use and “GM” recommended for heavy-duty applications and where a smaller mesh opening is desirable.

Gridmesh is available in steel, hot-dipped galvanized finish and aluminium.

LYSAGHT STEEL FRAMING SYSTEMS FOR FLOORS, WALLS AND ROOFS

The Lysaght integrated steel framing system comprises three elements — **Floor Framing, Wall Framing, Roof Framing.** Elements are fabricated with strong, lightweight, galvanized, formed steel components. Each element can be used independently with other materials or all three combined for maximum effectiveness.

The Lysaght framing system has undergone an extensive program of design and physical testing to ensure the practical and economical use of material consistent with sound engineering practice.

Assembly of the frame is carried out by fabricators to whom Lysaght supplies technical data and assistance to ensure that frames are structurally sound and acceptable to lending authorities and local councils. Lysaght also provides training and advice on production methods, techniques and equipment.

The combination of the three framing system elements allows an overall design approach. Incorporation of steel trusses permits the use of non-load-bearing internal walls. This simplifies the floor frame system by removing the need for bearers and piers to be placed immediately below internal walls. Together, the three elements form an integrated domestic structural system of importance to both builder and consumer.

Steel frames will not warp, twist, shrink or deteriorate due to natural causes. Frame component surfaces are flat and accurately aligned. Other features include:

High strength with economy, long life and reliable performance.

Rapid construction. Factory-fabricated frames are delivered to the building site ready to erect.

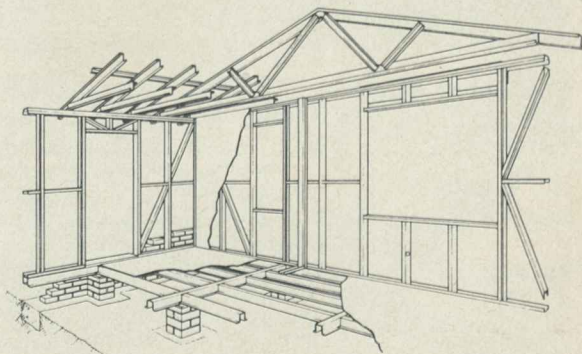
Problems of rot, white ants and borers are eliminated.

Rigid and stable frame eliminates wall cracking and fastener popping, door and window jamming, etc.

Steel framing combines readily with other materials currently used in home construction, such as bricks, timber and plaster-board. Provision is made for the installation of plumbing and electrical wiring.

Lysaght steel framing will perform as specified if design, fabrication and fixing are in accordance with Lysaght recommendations.

Comprehensive literature on steel framing, and details of approved Steel Framing Fabricators are available from Lysaght Offices listed on pages 8 to 12.



LB I SHEET PILING

LB I Sheet Pilings are high strength structural materials roll-formed from 4.8 mm steel strip. They are designed for the efficient construction of virtually earth and watertight permanent or temporary walls, either straight or contoured (free form).

Four profiles are manufactured; Slimlock, Deeplock, Slimlap and Deeplap. Two driving helmets are also available — Deepcap (for Deeplock and Deeplap), Slimcap (for Slimlock and Slimlap).

LB I Sheet Piling is light and easily handled (approximately 15 kg/m).

Can be driven with light hammers.

Requires only simple rigs and tooling.

Extractable for re-use.

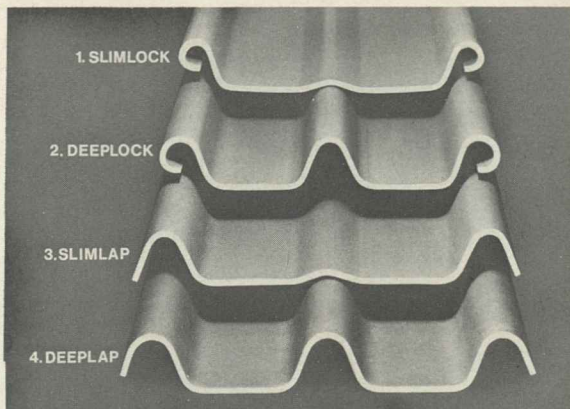
Long lasting, either as permanent installations or when re-used for temporary requirements.

Extremely resistant to scouring forces.

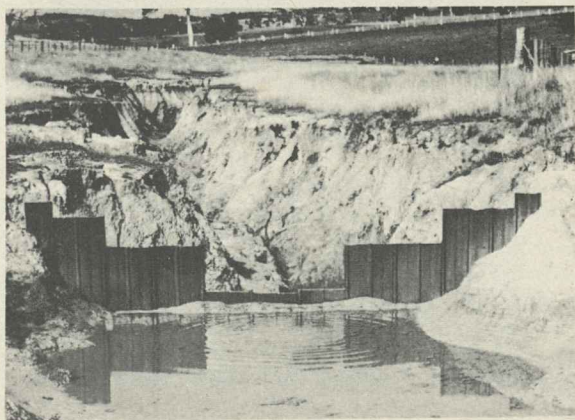
Typical applications include:

Trenching:	Pipe laying and similar operations.
Water Conservation:	Dams, dam cores, well housings, coffer dams.
Waterways:	Canal, lakeside or dock walls, bulkheading, development of recreational areas.
Erosion Control:	Check dams, beach groynes, cliff protection, dyke walls.
Structural:	Excavation walls, underpinning, formwork, machine well linings, bridge decks, bridge piers, footings, retaining walls, jetties, docks, causeways.

Sheet Piling is available in stock lengths. Custom cut lengths available on a forward ordering basis.



LBI Sheet Piling



LBI Sheet Piling silt-trap combats erosion

Brownbuilt

**STEEL OFFICE FURNITURE AND
STORAGE EQUIPMENT
RACK**

"MAXTOR" AUTOMATIC CAR PARKER

(Pages 113 to 120)

OFFICES: See pages 8 to 12 for addresses

Brownbuilt Limited

Brownbuilt Steel Equipment

Victoria

New South Wales

Queensland

South Australia

Australian Capital Territory

Tasmania

Northern Territory

Brownbuilt Metalux Industries Limited

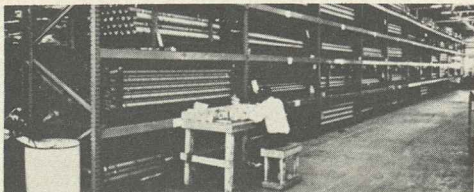
Western Australia

Brownbuilt (PNG) Pty Limited

Papua New Guinea

Lysaght Brownbuilt Industries (Fiji) Limited Fiji

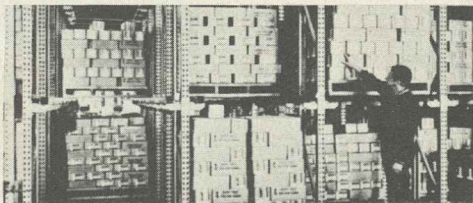
BROWNBUILT RACK



1. Selective Storage Rack for palletized loads. Many standard accessories such as Drum & Coil Beds, Fork Clearance Bars, etc.



2. Versa-QA. A versatile and quick assembly wide span shelf system using same uprights as Selective Storage Rack.



3. Drive-in/Drive-thru Rack. High density storage system for palletized loads and with a minimum of aisles.

“MAXTOR” AUTOMATIC CAR PARKER

Mobile platforms, on which cars park, are moved by a pneumatic ram set into floor beneath them.



1. System in closed position with cars on mobiles.



2. Driver enters car park and presses “OPEN” button corresponding to his parking position.



3. Mobiles move apart to create an access aisle to his parking position.



4. Car is driven along access aisle onto mobile.



5. Car is parked on mobile. When leaving area, driver presses "CLOSE" button and system closes ready for next user.

STEEL OFFICE FURNITURE AND STORAGE EQUIPMENT

BROWNBUILT OFFICE FURNITURE

"Fliteline 700" Series

Desks — executive, clerical, secretarial

Credenzas

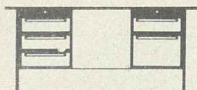
Tables

Wardrobes

Filing Cabinets — 2, 3 and 4 drawer and Personal

Executive with lockable cupboard

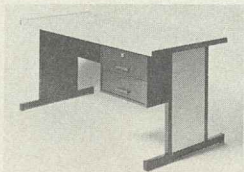
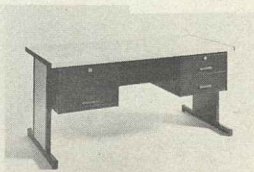
Cupboards — full length and counter high



Series 600 Desks

Single, double pedestal desks, also wing unit.

Desk top and side panels in Marviplate.



BROWNBUILT OFFICE EQUIPMENT

Vertical Filing Cabinets

2, 3 and 4 drawer.

All cabinets hold A4 or foolscap sheets.

Drawer inside dimensions, mm

A4	—	265 H	335 W	570 D
Foolscap	—	265 H	385 W	570 D

Telephone Cabinets

Overall dimensions — 760 mm H x 455 mm W x 455 mm D.

Plan File Cabinets

Horizontal. Either 6 or 10 drawer cabinets.

International Paper Sizes with internal drawer dimensions — 1270 mm W x 50 mm H x 900 mm D.

Cupboards

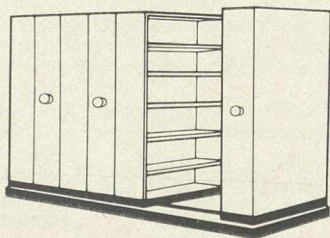
Steel cupboards with 25 mm adjustable shelves and 3-point locking.

“Compactus” Office File

A complete unit on self-levelling base. Three configurations to select. Configuration “B” is equal to ten 4 drawer filing cabinets. Storage cabinets roll apart to reveal required aisle. All cabinets lock together from a single point to give fire and dust protection.

Overall dimensions — 2020 mm H x 2440 mm W x 940 mm D.

Configuration “B”



Visible Record Cabinets

For quick, easy visual reference to stock sheets, purchase records, invoices, ledger cards, etc.

Flat File Cabinets

12 removable flat filing trays or shallow box drawers.

Outside cabinet dimensions — 1135 mm H x 340 mm W x 470 mm D.

Inside box drawer dimensions — 80 mm H x 280 mm W x 415 mm D.

Card Index Cabinets

For card filing systems. 1 or 2 drawer units to take cards measuring from 125 mm x 75 mm
to 210 mm x 150 mm

Posting Mobiles

For ledger card mobility. Holds up to 2000 cards vertically with maximum card size — 305 mm x 305 mm.

Also available with transfer drawer below card tray, both lockable.

Other Office Equipment

Stationery Cabinets — “Smokers” Trays

Letter Racks — Waste Paper Bins

Filing Systems — Lateral Filing, Box Filing, etc

Office Mobiles — for typewriters, accounting machines, etc

Chairs — executive, clerical, secretarial and typist.

Lockers

For sports clubs and factories. Full length, 2, 4 and 5 tier models.

Height — 1830 mm

Widths — 305 mm and 380 mm

Depth — 455 mm

BROWNBUILT STORAGE EQUIPMENT

Static Storage

Six types to choose from dependent upon load capacity and adjustability:

- (a) Rolled Upright Shelving. Shelves adjustable at 25 mm centres and for evenly distributed loads up to 100 kg per shelf.

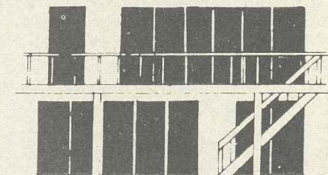


- (b) General Purpose Shelving. Shelves adjustable at 25 mm centres and for evenly distributed loads up to 225 kg per shelf.
- (c) Channel Upright Shelving. Shelves adjustable to 50 mm centres. Evenly distributed loads up to one tonne per shelf can be obtained using standard reinforcing and supports.
- (d) Angle Type Shelving. Used where quick adjustability not necessary. Evenly distributed loads up to 675 kg per shelf can be obtained using standard reinforcing and supports.
- (e) Library Shelving. Free Standing Types FS 1 and FS 5. Cantilever shelving for libraries.
- (f) Slotted Angle. Storage and Structural systems. Shelving — light duty bulk storage — shelving.

Mobile Storage

One "movable" aisle serves complete unit. Storage cabinets or racking are placed on mobiles running on rails set into the floor.

Mobiles roll apart either manually, mechanically or automatically.



- (a) "Compactus" Office Storage Unit. For bulk storage of stationery, light machinery parts, etc.
- (b) "Compactus" hand operated system, maximum load 2 tonnes per mobile.
- (c) Brownbuilt Mechanically Operated. Handle-to-sprocket operation. For loads up to 17 tonnes per movement/system.
- (d) "Compactus" Semi-Automatic. Electrically powered. 20 tonnes per block.
- (e) "Compactus" Semi-Automatic for heavier loads, electrically powered. 80 tonnes per system.
- (f) "Maxtor" Heavy Duty Automatic for heavy to extremely heavy loads. Electric remote control pneumatic and/or hydraulic power. Capacity up to 500 tonnes per system.

Other Products

- (a) Industrial Desks for foremen, supervisors, etc.
- (b) Paint Storage Cabinets. Ventilated and double-walled for fire protection. Capacity, up to 228 litres.

Overall dimensions — 1590 mm H x 1300 mm W x 500 mm D.

AUSTRALIAN STANDARDS

(Metric Units)

Implementation of the metric (SI) system of units is being substantially assisted by the revision of existing National Standards in metric terms and the preparation of new standards where there is a need. This has made it increasingly important for the manufacturer, the buyer and the user of products to be familiar with the Australian Standards and Codes.

Preparation of this edition of the Referee was undertaken during a period when many industries had not become fully metricated. In addition, some sections of industry were obliged to "soft" convert due to difficulties peculiar to some types of product. A number of Australian Standards had not been completed and the compilers of the Referee were sometimes faced with the decision of whether it would be more helpful if certain data were or were not included. Such instances fortunately were few and a precautionary apology is offered should a reader be inconvenienced due to changes made subsequent to printing.

Some Australian Standards referred to would not have been published at time of printing, and indeed, some commodities would not have been immediately available; the planned phasing-in of certain fasteners (screws, bolts, etc) over a period of time would be a typical example. However, in the fullness of time these anomalies will have disappeared and as a matter of policy all Lysaght Referee editions are produced in a manner such that they will hopefully remain a useful reference for many years after publication.

The following list, while not comprehensive, shows the more important Australian Standards relevant to products appearing in the Referee, the dimensions and property descriptions of which, have undergone change in the adoption of metric units.

**AUSTRALIAN STANDARDS RELEVANT TO
JOHN LYSAGHT (AUSTRALIA) LIMITED
PRODUCTS**

Standard Number	Title
AS 1123 — 1972	Preferred Metric Sizes of Wrought Ferrous and Non-Ferrous Sheet and Strip.
AS 1365 — 1973	Tolerances for Hot-Rolled or Cold-Rolled Low Carbon Unalloyed Steel (Coils or Cut Lengths).
AS 1594 — 1974	Hot-Rolled Unalloyed Low Carbon Steel (Coil or Cut Lengths).
AS 1595 Part 1 — 1974	Cold-Rolled Unalloyed Low Carbon Steel (Coil or Cut Lengths).
AS 1397 — 1973 (under revision issued as Public Review Document DR 76017)	Hot-Dipped Zinc-Coated Coil or Cut Lengths.
AS 1445 — 1973	76 mm Pitch Corrugated Hot-Dipped Zinc-Coated Steel Sheet.
AS 1170 Part 1 — 1971 Part 2	SAA Loading Code. Dead and Live Loads. Wind Forces.
AS 1562 — 1973	Design and Installation of Self-Supporting Metal Roofing Without Transverse Laps.
AS 1538 — 1974	Cold Formed Steel Structures.

**AUSTRALIAN STANDARDS RELEVANT TO
OTHER PRODUCTS APPEARING IN REFEREE**

A. Ferrous & Non-Ferrous Metal Products

(i) Structural Steels

AS 1204 — 1972	Structural Steels — Ordinary Weldable Grades.
AS 1205 — 1972	Structural Steels — Weather Resistant Weldable Grades.

**AUSTRALIAN STANDARDS RELEVANT TO
OTHER PRODUCTS APPEARING IN REFEREE
(Continued)**

A. Ferrous & Non-Ferrous Metal Products (Cont)

(ii) Plate

AS 1184 — 1972 Preferred Metric Sizes of Ferrous and Non-Ferrous Plate.

AS 1227 General Requirements for Supply of Hot-Rolled Steel Plates, Sections, Piling and Bars for Structural Purposes.

(iii) Bar and Rod

AS 1027 — 1971 Preferred Metric Sizes of Wrought Ferrous and Non-Ferrous Round, Square and Hexagonal Bar and Rod for General Engineering Purposes.

Supplement No 1 (1972) to AS 1027 Preferred Metric Feed Sizes of Hot-Rolled Steel Rod, Bar and Coiled Rounds for Drawing and Forming.

AS 1256 — 1973 Preferred Metric Sizes of Hot-Rolled Flat Steel Bars and Wrought Non-Ferrous Rectangular Bar.

(iv) Wire

AS 1153 — 1972 Preferred Metric Sizes of Ferrous and Non-Ferrous Round Wire for General Engineering Purposes.

(v) Pipes and Tubes

AS 1074 — 1971 Steel Tubes and Tubulars Suitable for Screwing to AS B53 Pipe Threads.

**AUSTRALIAN STANDARDS RELEVANT TO
OTHER PRODUCTS APPEARING IN REFEREE
(Continued)**

A. Ferrous & Non-Ferrous Metal Products (Cont)

AS 1238 — 1973 Preferred Metric Sizes of Steel Pipes.

(vi) Structural Sections

AS 1131 — 1973 Dimensions of Hot-Rolled Structural Steel Sections.

AS 1163 Sizes of Rectangular (including Square) Steel Hollow Sections for Structural Purposes.

(vii) Fasteners & Screw Threads

AS 1110 — 1972 ISO Metric Hexagon Precision Bolts and Screws.

AS 1111 — 1972 ISO Metric Hexagon Commercial Bolts and Screws.

AS 1112 — 1972 ISO Metric Hexagon Nuts Including Thin Nuts, Slotted Nuts and Castle Nuts.

AS 1252 General Grade High Strength Steel Bolts With Associated Nuts and Washers for Structural Engineering — ISO Metric Series.

AS 1390 Metric Cup Head Screws.

AS 1393 Coach Screws — With ISO Hexagon Heads.

AS 1420 ISO Metric Hexagon Head Cap Screws.

AS 1421 — 1973 ISO Metric Hexagon Socket Set Screws.

AS 1427 ISO Metric Machine Screws.

**AUSTRALIAN STANDARDS RELEVANT TO
OTHER PRODUCTS APPEARING IN REFEREE
(Continued)**

(vii) Fasteners & Screw Threads (Continued)

AS 1473	ISO Metric Hexagon and Square Machine Screw Nuts Pressed Type.
AS 1476	Wood Screws.
AS 1275 — 1972	Metric Screw Threads for Fasteners (based on ISO recommendations).

B. Building Materials

(i) Cement

AS 1315 — 1973	Portland Cement.
AS 1316 — 1972	Masonry Cement.
AS 1317 — 1973	Blended Cements.
AS 1379 — 1973	Ready-Mixed Concrete.

(ii) Bricks & Concrete Blocks

AS 1225	Burnt Clay and Shale Building Bricks.
AS 1346	Concrete Building Bricks.
AS 1500	Concrete Building Blocks.

(iii) Reinforcement

AS 1302 — 1973	Steel Reinforcing Bars for Concrete.
AS 1303	Hard-Drawn Steel Wire for Reinforced Concrete.
AS 1304 — 1973	Hard-Drawn Steel Wire Reinforcing Fabric for Concrete.

PREFERRED METRIC SIZES OF WROUGHT FERROUS AND NON-FERROUS SHEET AND STRIP

Australian Standard 1123-1972 specifies preferred metric sizes of hot rolled and cold rolled sheet and strip in steel, copper, copper alloys, aluminium, aluminium alloys, zinc and lead.

Reading of the whole of AS 1123-1972 is recommended but some extracts of interest appear on pages 126 to 129.

THICKNESSES FOR SHEET AND STRIP

THICKNESS, mm			
Choice		Choice	
First (R''10)	Second (R''20)	First (R''10)	Second (R''20)
0.10	0.10	1.0	1.0
	0.11		1.1
0.12	0.12	1.2	1.2
	0.14		1.4
0.16	0.16	1.6	1.6
	0.18		1.8
0.20	0.20	2.0	2.0
	0.22		2.2
0.25	0.25	2.5	2.5
	0.28		2.8
0.30	0.30	3.0	3.0
	0.35		3.5
0.40	0.40	4.0	4.0
	0.45		4.5
0.50	0.50	5.0	5.0
	0.55		5.5
0.60	0.60	6.0	6.0
	0.70		7.0
0.80	0.80	8.0	8.0
	0.90		9.0
1.00	1.00	10.0	10.0

Thickness: Recommended thicknesses given are in accordance with the R''10 and R''20 series standardized in SAA MP19, Report on Preferred Numbers and Their Use, except that, as recommended in that document, the size 1.5 is replaced by 1.6.

Note.— R''10 and R''20 denote the second rounding of the R10 and R20 series of preferred numbers (refer to SAA MP19).

Width:

First preference. Multiples of 100 mm.

Second preference. Multiples of 5 mm.

Width multiples less than 5 mm. Subject to special negotiation.

Length:

First preference. Multiples of 100 mm.

Second preference. Multiples of 10 mm.

Length multiples less than 10 mm. Subject to special negotiation.

PREFERRED SIZES*

Range of Sizes.— When different sizes of any article have to be manufactured, the problem of covering the range with the optimum number of sizes is bound to be encountered. The demand of consumers for a comprehensive coverage has to be balanced against any increase in the cost of production, stocking and distribution, which may result from the production of many sizes and types. An appropriate procedure would be to determine first what are the smallest and largest sizes required and how many intermediate steps are needed, then by a simple calculation set out a table of sizes, each being approximately a uniform percentage larger than its predecessor.

Experience has shown that a consumer's requirements for a range of sizes are frequently satisfied by sizes which progress geometrically rather than arithmetically, whereby small size increments occur in the lower end of the range and larger intervals in the upper end. In order to secure some measure of uniformity of practice, a rounded-off series of numbers known as 'preferred numbers' or 'Renard (R) numbers' has been adopted internationally, since they offer the most logical means of uninterrupted coverage of the complete range of requirements in a given field.

Preferred Numbers.— Preferred numbers are defined as the conventionally rounded-off term values of geometrical series, including the integral powers of 10, and having as ratios the following factors —

$$\sqrt[5]{10} \quad \sqrt[10]{10} \quad \sqrt[20]{10} \quad \sqrt[40]{10} \quad \sqrt[80]{10}$$

These ratios are approximately equal to:

1.58 1.26 1.12 1.06 and 1.03 respectively.

Thus, successive terms in the respective series increase by approximately 58, 26, 12, 6, or 3 per cent.

*Refer to SAA MP19, Report on Preferred Numbers and Their Use.

This series of preferred numbers is designated respectively R5, R10, R20, R40 and R80, in which the 'R' stands for Renard, while the number indicates the particular root of 10 on which the series is based.

It should be noted that any series can be extended indefinitely upwards or downwards by multiplying or dividing repeatedly by 10. The basic series of preferred numbers covers the range 1.0 to 10.0, and the number of values (excluding 10.0) in each series is as follows:

R5—5 R10—10 R20—20 R40—40 R80—80

The values of the R5 series are common to all series; the R10 series values common to R20, R40, R80; the R20 series values common to R40, R80; and the R40 series values common to R80.

Choice.— Wherever possible, the values of the R5 series are to be given preference over those of the R10 series, and these latter over the values of the R20 series and finally these last over those of the R40 series. The values of the R80 series are intended for use only in exceptional cases. In selecting a scale of numerical values, the first choice should be that series having the highest ratio consistent with the technical, economic or other considerations to be satisfied, in the order of R5, R10, etc.

RELATIONSHIP BETWEEN METRIC THICKNESSES OF SHEET (AND STRIP) AND BIRMINGHAM GAUGE (BG)

Thickness, mm		Inch equiv to mm	Thickness as inch fraction (nearest)	f — t	BG No (near- est)	Inch equiv to Gauge No	g — t	
Choice							t	f
First (R"10)	Second (R"20)							
10.0	10.0	0.3937	3/8	—0.0187	0	0.3964	+0.0027	+0.7
	9.0	0.3543			1	0.3532	—0.0011	—0.3
8.0	8.0	0.3150	5/16	—0.0025	2	0.3147	—0.0003	—0.1
	7.0	0.2756			3	0.2804	+0.0048	+1.7
6.0	6.0	0.2362	1/4	+0.0138	4	0.2500	+0.0138	+5.8
	5.5	0.2165			5	0.2225	+0.0060	+2.8
5.0	5.0	0.1969	3/16	—0.0094	6	0.1981	+0.0012	+0.6
	4.5	0.1772			7	0.1764	—0.0008	—0.5
4.0	4.0	0.1575	5/32	—0.0012	8	0.1570	—0.0005	—0.3
	3.5	0.1378			9	0.1398	+0.0020	+1.5
3.0	3.0	0.1181	1/8	+0.0069	10	0.1250	+0.0069	+5.8
	2.8	0.1102			11	0.1113	+0.0011	+1.0
2.5	2.5	0.0984	3/32	—0.0046	12	0.0991	+0.0007	+0.7
	2.2	0.0866			13	0.0882	+0.0016	+1.8
2.0	2.0	0.0787	5/64	—0.0006	14	0.0785	—0.0002	—0.3
	1.8	0.0709			15	0.0699	—0.0010	—1.4
1.6	1.6	0.0630	1/16	—0.0005	16	0.0625	—0.0005	—0.8
	1.4	0.0551			17	0.0556	+0.0005	+0.9
1.2	1.2	0.0472	3/64	—0.0003	18	0.0495	+0.0023	+4.9
	1.1	0.0433			19	0.0440	+0.0007	+1.6
1.0	1.0	0.0394			20	0.0392	—0.0002	—0.5
	0.90	0.0354			21	0.0349	—0.0005	—1.4
0.80	0.80	0.0315	1/32	—0.0002	22	0.0313	—0.0002	—0.6
	0.70	0.0276			23	0.0278	+0.0002	+0.7
0.60	0.60	0.0236			24	0.0248	+0.0012	+5.1
	0.55	0.0217			25	0.0220	+0.0003	+1.4
0.50	0.50	0.0197			26	0.0196	—0.0001	—0.5
	0.45	0.0177			27	0.0175	—0.0002	—1.1
0.40	0.40	0.0157	1/64	—0.0001	28	0.0156	—0.0001	—0.6
	0.35	0.0138			29	0.0139	+0.0001	+0.7
0.30	0.30	0.0118			30	0.0123	+0.0005	+4.2
	0.28	0.0110			31	0.0110	0.0000	0
0.25	0.25	0.0098			32	0.0098	0.0000	0
	0.22	0.0087			33	0.0087	0.0000	0
0.20	0.20	0.0079			34	0.0077	—0.0002	—2.5
	0.18	0.0071			35	0.0069	—0.0002	—2.8
0.16	0.16	0.0063			36	0.0061	—0.0002	—3.2
	0.14	0.0055			37	0.0054	—0.0001	—1.8
0.12	0.12	0.0047			38	0.0048	+0.0001	+2.1
	0.11	0.0043			39	0.0043	0.0000	
0.10	0.10	0.0039			40	0.0039	0.0000	



GKN MILLS
Building Services Company

A DIVISION OF GUEST KEEN & NETTLEFOLDS (AUST) LIMITED

EXISTING REPRESENTATION:

MILLS SCAFFOLDING DIVISION:

SCAFFOLDING EQUIPMENT: Tubular Scaffolding, Easyfix, Milframe, Milfast, Castor Wheels, Perimeter Handrail Posts, Seating Stands, Communication Towers.

SUSPENDED ACCESS: Light Duty Travelling and Fixed Cradles, Heavy Duty Suspended Scaffold, Power Operated Scaffolds.

BUILDERS PLANT: Mills Adjustable Trestles, Crowd Control Barriers.

SELF-LOCK: Mills 9 Metre Access Tower, Standard Self-Lock, Bantam Self-Lock.

SHORING: Milprops, Milcentres, Beam Clamps, Column Clamps, Shore X System.

FORMWORK DIVISION:

Multi-Form Wall System, Multi-Form Deck

System, 'M' Moulds, 'T' Forms.

MILLS STRUT DIVISION:

UNISTRUT for: Racking, Partitioning, Displays and Exhibits, Mechanical Supports, Electrical Supports, Lighting Supports and Electrical Trunking, Bench Framing, Concrete Inserts, Cavity Wall Brackets, Pipe Clamps and Roller Guides, Saf-T-Trolley, Saf-T-Climb.

OTHER PRODUCTS INCLUDE - Cable Trays and Ladders, Cable Clamps and Clips, Cable Straps and Ties, Thru-Way Rigid PVC Skirting Duct Systems and GKN Access Floor Systems for Computer Rooms and Commercial Building Construction.

BRANCH OFFICES:

SYDNEY, Percy Street, Auburn.

NEWCASTLE: Lot 14, Nth. Greenleaf Road, Walsh Point, Kooragang Island.

PORT KEMBLA, CRM Works, Port Kembla.

CANBERRA, 169-171 Newcastle Street, Fyshwick.

MELBOURNE, Tullamarine Park Road, Tullamarine.

GEELONG, Station Street, Norlane.

ALBURY/WODONGA: 393 Townsend Road, Albury.

BRISBANE, 10-14 Graham Street, Milton.

TOWNSVILLE, Ingham Road, Garbutt.

MOUNT ISA, Duchess Road, Mount Isa.

GLADSTONE, Bruce Highway, Gladstone.

GOLD COAST: Burleigh Garden Industrial Estate, Reedy Creek Road, Burleigh Heads.

ADELAIDE, Cnr. Adam & Manton Streets, Hindmarsh.

DARWIN, Cnr. Bombing & Coonawarra Roads, Winnellie.

PERTH, 35 Forbes Road, Perth.

PORT HEDLAND, Lot 1032 Murreena St., Port Hedland.

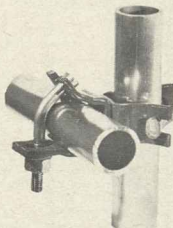
HOBART, Brewsters, 156 Campbell Street, Hobart.

And agents in major
country centres.

GKN MILLS
Building Services Company (Cont.)

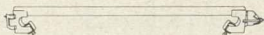
TUBULAR SCAFFOLDING

Steel, or aluminium with over 20 fittings. Used for independent bricklayers' scaffolds and special applications including temporary seating stands, cantilever scaffolds and the like. Tubular Scaffolds can be bought or hired. Design, erection and dismantling services available.



EASYFIX SYSTEM SCAFFOLDING

An extension of tube and fittings, Easyfix consists of one fitting welded to each end of the transom that couples standards and ledgers and a board bearer that has a single bolt fitting welded to one end.



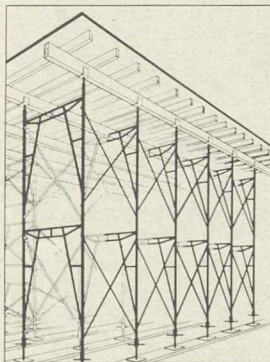
EASYFIX INDEPENDENT TRANSOM



EASYFIX INDEPENDENT BOARD BEARER

MILFRAME FRAME SCAFFOLDING

Can be used as an independent scaffold to provide safe access to workmen in multi-storey building operations. Milframe is also widely used for medium duty shoring applications.



GKN MILLS
Building Services Company (Cont.)

SELF-LOCK

A frame system comprising four frames and accessories. Used for independent scaffolds and where access is required in building maintenance for a variety of trades including electricians, painters, etc. For the larger applications, the Mills 9 Metre Access Tower is ideal. Mobile or static, provides safety and simplicity of erection.

BANTAM SELF-LOCK

A lightweight working platform that comes in three kits. Popular Kit 600 x 600 x 1800 mm high. Household 1300 x 600 x 2400 mm high and Tradesman's Kit 1300 x 1300 x 3600 mm high. These kits provide working platforms for home decorators, painters, plasterers, builders and renovators and consist of frames, diagonal braces, foot ties, rubber feet and scaffold boards.

POWER OPERATED SCAFFOLDS

A push button electric power winch is used in conjunction with aluminium 5500 mm, 3650 mm and 2400 mm stages, 900 x 900 mm two man working platforms or a fibreglass steel reinforced bosuns chair, providing workmen with powered access to points above the ground.

ADJUSTABLE TRESTLES

LARGE TRESTLE:

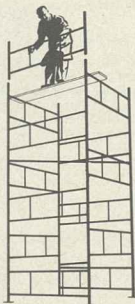
Height (fully extended), 2400 mm
Height (fully collapsed), 1500 mm
Extension every 150 mm

Mass 40 kg

SMALL TRESTLE:

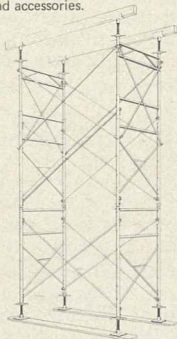
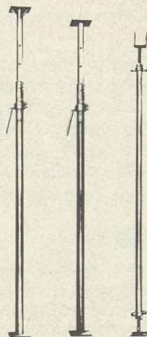
Height (fully extended), 1750 mm
Height (fully collapsed), 840 mm
Extension every 150 mm

Mass 35 kg



MILLS SHORING EQUIPMENT SHORE X:

A two frame adjustable shoring system used for the support of heavy concrete slabs in bridge soffits, floor slabs in multi-storey buildings, heavy industrial installations and for trench and tunnel work. System comprises one base and one extension frame and accessories.



MILPROPS



MILCENTRE

FORMWORK

MULTI-FORM

GKN Multi-form is a quick to assemble wall and deck forming system. It is particularly economical on the larger projects where there is high repetitive usage. Multi-form is ideal in forming decks utilising panels, waffle moulds, trough forms or plywood sheeting.

'M' MOULDS

GKN Mills 'M' Moulds for lightweight economical waffle floors, spanning in two directions. Moulds are available in depths of 200 mm 300 mm and 400 mm. Propping remains undisturbed while stripping takes place.

'T' MOULDS

GKN polypropylene 'T' Forms have been developed for the construction of trough floors spanning in one direction. Trough floors offer all the advantages of in-situ construction together with savings in concrete of up to 60% compared with solid floors.



GKN MILLS
Building Services Company (Cont.)

UNISTRUT All-purpose metal framing



Channels

Fittings

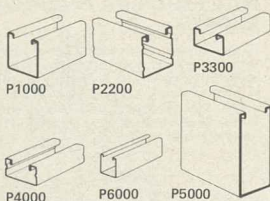
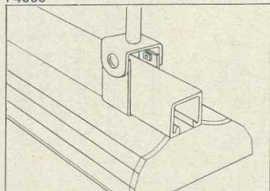
Nuts



Screws

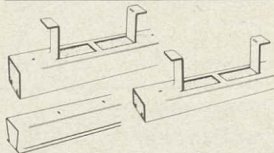
UNISTRUT ELECTRICAL TRUNKING

Consists of continuous channels. Accepts all types of incandescent and fluorescent lighting. Spacing can be intermittent or continuous. System can be adjusted to suit changes in layout and preassembled and wired on the ground.



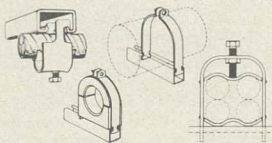
CONCRETE INSERTS

Unistrut Concrete Inserts provide a fixing of known strength. The continuous opening in the channel enables exact location of mechanical and electrical fixings. Full range of Unistrut accessories covers installation of all mechanical services in any position.



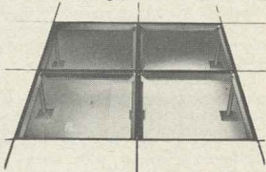
UNISTRUT PIPE AND CABLE SUPPORTS

A range for all service installation requirements, horizontal, vertical cable ducts or risers. These include: Unirod end threaded rod, one and two piece pipe or tubing clamps, etc.



GKN ACCESS FLOOR SYSTEMS

Access Floors in grid or gridless designs are modular panels supported by adjustable pedestals providing infinite access to building services in the under-floor area. Panel finishes include - Melamine Laminates, Vinyl Asbestos, Perma-Kleen, Carpet, etc. Air-conditioning duct grilles can be placed anywhere in the floor surface.



PAINTING OF GALVANIZED OR ZINCALUME SHEET

The painting of zinc-coated or Zincalume steel sheet for either decoration or added protection may be easily and effectively carried out, providing certain basic requirements are observed. Ordinary techniques combined with readily available appropriate paints should be used, but care must be taken in the choice of paint to ensure its suitability for application

in the factory; (see Section 1)

or in the field. (see Section 2)

Painting in the factory, normally on a line designed specifically for the purpose, usually requires **oven drying** paints, while painting in the field — with less elaborate cleaning and pretreatment — requires **air drying** paints. Table 2 summarizes the general approach to the field painting of galvanized steel sheet.

Selection of paint for factory use . . . is again dictated by the final use and exposure and should be chosen in consultation with a reputable manufacturer. Interior exposure tends to be less severe than exterior but many corrosive interior conditions are encountered eg, in washing machine cabinets.

Selection of paint for field use . . . should take into account the severity of the environment to which the paint will be exposed eg, in rural, marine, industrial or other special conditions. A number of proprietary paints which have been found suitable for use in a wide range of conditions have been set out in Table 3. Omission from this Table does not necessarily indicate unsuitability, only that in many instances the paint system has not yet been evaluated by John Lysaght (Australia) Limited.

SECTION 1 — FACTORY PAINTING

Pretreatment with a phosphate coating system or with a two pack etch primer is commonly used in the factory before painting. This confers a valuable combination of paint adhesion and increased corrosion resistance under the type of paints — generally stoving varieties —

normally used. Pretreatment is particularly important if the products are for outdoor use, and for many indoor applications where the product is exposed to humid conditions or to the risk of mechanical damage.

Cleaning, phosphating and post-treatment systems are available from companies dealing in metal pretreatment and known to the trade. Two suppliers whose systems have been found satisfactory are Oxy Metal Industries Australia Pty Ltd, and Dulux Australia Ltd. Where phosphating facilities are not available, two pack etch primers may be used.

If Galvabond is to be phosphated, it should be ordered unchromated and oiled since the chromate film, usually applied to the surface during production, may interfere with the phosphating reaction resulting in unsatisfactory coatings. The light mineral oil used on unchromated strip for protection during transit does not provide the same resistance to corrosion as the chromate treatment. Particular care should be taken to keep packages waterproof prior to use. Water staining, usually a white corrosion product, should be removed by light abrasion before or during the normal cleaning and phosphating process.

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 to the selection of finish coats. The technique should be considered only in close consultation with a paint manufacturer experienced in this field.

A variety of basic paint types is available for factory finishing, but the importance of selecting the correct paint for any particular application is again stressed. A summary of paint finishes and typical applications, together with cleaning and pretreatment notes has been compiled in Table 1.

Acrylics are very popular in the appliance and building industries because of their mar resistance and general resistance to heat and household chemicals. Alkyds are

less expensive coatings, widely used where their properties are applicable to the end product.

SECTION 2 — FIELD PAINTING

For satisfactory priming, the surface to be painted must be clean and dry. Dirt should be removed by washing with water, greasy deposits should be wiped with paint thinners and any loose corrosion product removed by wire brushing.

Weathering was formerly considered to improve long term paint adhesion, but 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 to be withstood; reference to the information listed in detail in Table 3 is strongly advised.

Use of the recommended brands should produce a satisfactory result provided care is taken to follow the manufacturers' mixing and application instructions closely. 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 except for zinc dust — zinc oxide paints where a total of two is sufficient. Spray painting can be used to cover larger areas at lower cost providing the paint is suitable for this method of application.

Lysaght Colorbond

In many instances, it is possible — and desirable — to avoid either field or factory painting. John Lysaght (Australia) Limited produces Colorbond, a prepainted zinc-coated or Zinalume quality, on Australia's largest fully integrated coil coating lines. Colorbond is available in a wide range of roofing and cladding profiles or as coil for fabrication.

TABLE 1 **FACTORY PAINTING OF GALVANIZED OR ZINCALUME STEEL SHEET**

QUALITY	COATING TYPE		CLEANING	PRE-TREATMENT	PAINT FINISH
	Type	Comment			
GALVABOND ZINCFORM ZINC-HI-TEN ZINCMATTE	Zinc	For phosphating ensure that "unchromated & oiled" is specified on the order.	Alkaline, usually part of pretreatment.	Phosphates, chromates, or two pack etch primers.	Stoving appliance or outdoor finishes, eg, acrylics, alkyds, vinyls, epoxies.
ZINCSEAL	Zinc	Provided with sophisticated phosphate coating.	Solvent wiping. Trichlorethylene vapour degrease.	None required. Two pack etch primers for damaged phosphate coating.	Stoving appliance finishes, eg, acrylics, alkyds.
ZINCANNEAL	Zinc-iron alloy	Provided with simple phosphate coating.	Solvent wiping. Trichlorethylene vapour degrease.	None normally. Performance can be upgraded by two pack etch priming.	Stoving appliance or outdoor finishes, eg, acrylics, alkyds, epoxies.
ZINCALUME	Zinc/Aluminium	Phosphating not applicable.	Alkaline, usually part of pretreatment.	Chromates or two pack etch primers.	Stoving, outdoor finishes, eg, silicone polyester.

TABLE 2

**GENERAL APPROACH TO THE FIELD
PAINTING OF GALVANIZED OR
ZINCALUME STEEL SHEET**

CLEANING

- (1) Remove dirt by washing with water.
- (2) Wipe off greasy deposits with paint thinners.
- (3) Remove any corrosion product by wire brushing.

PRIMING & FINISHING

- (1) Select paint system from Table 3 with due regard to environmental requirements.
- (2) Follow the paint manufacturers' instructions explicitly.
- (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 where two coats in total is usually sufficient.
- (5) Finishing coats may be applied directly to Zincanneal without priming, but when a two pack type etch primer is used, the overall protection given by the paint system is very much improved.

TABLE 3 FIELD PAINTING OF GALVANIZED OR ZINCALUME STEEL SHEET

Recommendations for rural, urban, moderate industrial and moderate marine conditions; approximately 800 metres and further from surf, depending on terrain and prevailing winds.

Primer Type	Application	Brand	Finish Type	Application	Brand
Two pack etch primer	Brush or spray Spray preferred	Dulux Wash Primer Taubmans Met-L-Etch	Alkyd	Brush or spray	Dulux Hi-Gloss Taubmans Butex
Zinc dust/zinc oxide	Brush or spray	Berger Galvanized Iron Primer Grey Taubmans Galva Kote	Oleoresinous/micaceous iron oxide	Brush or spray	Dulux Ferroclor Taubmans Mironite
Note: Before use, 3 kg zinc dust must be added per 5 litres of zinc dust/zinc oxide paint.					
Oil based calcium plumbate primer	Brush Spray not permitted	Dulux Calcium Plumbate Primer	Alkyd	Brush or spray	Berger Roofmaster Taubmans Butex
Note: Calcium plumbate primer contains lead and must not be used on water catchments.					
			Oleoresinous/micaceous iron oxide	Brush or spray	Berger Hemacote Taubmans Mironite
			Alkyd	Brush or spray	Dulux Hi-Gloss Taubmans Butex

Recommendations for rural, urban and moderate industrial conditions.

Primer Type	Application	Brand	Finish Type	Application	Brand
Low gloss water borne acrylic	Brush	Taubmans Primer for Galvanized Iron Berger Galvaprime Dulux Galvanized Iron Primer British Paints Latex Primer	High gloss water borne acrylic	Brush	Taubmans Big A Dulux Spruce Berger Brisk British Paints Four Seasons

High gloss water borne acrylic	Brush	Dulux Galvaciad	Brush	Dulux Galvaciad
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Note: As some acrylic paints may contain chromium compounds, their use on water catchments is not advisable.

Note: For acrylics, overpainting with oil based paints can reduce adhesion of total system; white is suitable for mild conditions only, colours contain anti-corrosive pigments.

Recommendations for severe industrial and severe marine conditions; approximately within 800 metres of open surf, depending on terrain and prevailing winds. The paint types listed are the most appropriate for these severe conditions, and maintenance frequency will vary with the degree of severity. The alternative use of Exterior Marvplate will generally solve such maintenance problems.

Primer Type	Application	Brand	Finish Type	Application	Brand
Two pack etch primer	Brush or spray Spray preferred	Dulux Wash Primer Taubmans Met-L-Etch	High build vinyl	Spray preferred	Dulux VR3 Vinyl Taubmans Valchem Vinyl Enamel
Note: Suppliers' recommendations should be followed explicitly in regard to film builds and appropriate undercoats.			Two pack polyurethane	Brush or spray	Dulux Durethane PGH Alumidise Taubmans Interthane
			Chlorinated rubber	Brush or spray	Dulux Thik-Clor Taubmans Valchem Chlorinated Rubber
			Two pack coal tar epoxy	Brush or spray	Dulux Duretar Taubmans Bitoxy

Recommendations for severe marine and buried or immersion conditions, eg, tanks storing ground waters.

Primer Type	Application	Brand	Finish Type	Application	Brand
Two pack etch primer	Brush or spray Spray preferred	Dulux Wash Primer Taubmans Met-L-Etch	Two pack coal tar epoxy	Brush or spray	Dulux Duretar Taubmans Bitoxy

The proprietary products referred to for guidance in the above tablets are among those which have been evaluated by John Lysaght (Australia) Limited and found satisfactory. The performance of a system is influenced by the quality of preparation and application. The paint manufacturers' instructions should be followed explicitly.

Contact the nearest John Lysaght (Australia) Limited Sales Office listed on pages 8 to 12 for further information.

SOLDERING GALVANIZED STEEL SHEETS

All qualities of Lysaght zinc-coated steel sheets may be soldered quickly and effectively if the simple procedures given below are followed.

Common Soldering Problems

The most common causes of problems in soldering are:

	Refer to Comments
1. Dirty soldering iron	Under Cleanliness
2. Overheated soldering iron and abrasion	Applying the Solder
3. Dirty and poor quality flux	Cleanliness; Fluxing
4. Poor quality solder	Solder
5. Use of percussion tools	Forming
6. Resistance to wetting by flux	Fluxing
7. Covering spangle cracks	Fluxing
8. Soldering Zincanneal	Fluxing

Storage of Sheets

Sheets or products for soldering should be stored appropriately to avoid water damage or oxidation of the surface as it is necessary to remove any surface deposit with abrasive paper before soldering.

Forming

The manner in which the material is formed before soldering has an important bearing on its soldering properties. It is important to ensure correct tailoring of seams and to avoid mechanical bruising in either:

(a) Hand Seaming.

Use a wooden dresser or mallet in preference to a steel hammer. A groover of the correct size should be used.

(b) Machine Seaming.

The size of the seam should be carefully tailored to suit the grooving machine. Care should be taken to ensure that machines are correctly set.

Cleanliness in Forming and Soldering

Forming tools and working surfaces should be thoroughly clean, as grit ground into the surface during forming can not be readily removed. Before seaming, sheets which are obviously dirty should be cleaned and, where applicable, surface deposits should be removed from the area to be soldered by the use of abrasive paper. Before fluxing, the job should be thoroughly cleaned to remove dirt, grease or oil picked up from the forming tools.

Flux pots and flux brushes must be clean, and flux which has become contaminated through excessive use should be discarded. It is most important that the soldering iron be clean and well tinned and that the solder be free from contamination.

Keep the Zinc on the Sheet

The technique of soldering — as described in both Fluxing and Applying the Solder — is built around the maxim “keep the zinc on the sheet”. This is particularly important with the thin coating of electro-galvanized sheet.

Fluxing

Three types of flux are recommended; the conventional spirits flux and two proprietary fluxes, Kemtex Pinnacle Soldering Fluid and Baker's No 47 Soldering Fluid, with the latter two being preferred. A spirits flux is not recommended for Zincanneal but this sheet may be readily soldered if Kemtex Pinnacle or Baker's No 47 Soldering Fluid is used.

1. Spirits Flux.

A spirits flux is normally a mixture of killed spirits and raw spirits in equal proportions, but good results can be obtained with killed spirits alone or with raw spirits alone. Excessive use of raw spirits can effectively remove significant amounts of the zinc coating and this may lead to soldering problems or corrosion of adjacent areas.

Raw spirits, spirits of salts and muriatic acid are popular names for hydrochloric acid. Killed spirits (or zinc chloride) is hydrochloric acid to which

zinc has been added until gas bubbles stop rising from the solution. These materials are normally obtainable from plumbing supply houses.

2. Proprietary Soldering Fluids.

Kemtex Pinnacle and Baker's No 47 soldering fluids are the preferred choice for soldering and are highly recommended. Kemtex Pinnacle is manufactured by O. T. Lempriere and Co Ltd, and Baker's No 47 by Aston and Fendley Pty Ltd. Both products are available through normal supply sources in all capital cities as well as from many hardware and plumbing supply houses in both city and country areas. These fluxes instantly wet and superficially etch the zinc surface. They are easier to control than a spirits flux, fluxing time is reduced and, normally, greater speed and ease of soldering results with better joint penetration. The slightly higher cost tends to be offset by the smaller quantity required for effective fluxing. For best results the time between fluxing and soldering should be minimised by fluxing small areas.

As a flux is corrosive, only the portions of the work to be covered with solder should be fluxed. This should be observed with particular care when using a high proportion of raw spirits, which is very reactive with zinc.

The flux should be applied until it has uniformly covered the whole of the joint and has penetrated into the joint. With a spirits flux it is essential to ensure that the area to be soldered has been thoroughly wetted with flux; a second application may be necessary.

The wetting action and joint penetration of a spirits flux is improved by the use of a wetting agent in the proportion of one drop per cup of flux. This approach may be used with Pinnacle or Baker's flux for ensuring joint penetration, although generally penetration of both lapped and grooved seams is complete if sufficient flux is used.

The wetting agent may be an industrial surface active agent such as Nonidet P40, which is available from Shell Chemical (Australia) Pty Ltd. Alternatively, many

of the readily available household detergents, preferably nonionic, are satisfactory and a simple trial will establish suitability. Some cloudiness may occur following the addition of the detergent but this will not affect the fluxing operation.

When forming or seaming operations involve severe stretching of the coating relative to the base, minute surface fissures, or spangle cracks, may result. Spangle cracking does not normally interfere with the penetration of solder into a seam; but when appearance is important and smooth coverage of these areas is necessary, careful attention must be given to cleanliness and fluxing technique, and the speed of soldering must be reduced, particularly when a spirits flux is used. This problem can normally be overcome by the use of Pinnacle or Baker's flux.

At regular intervals the flux pot should be cleaned and filled with fresh flux. Constant use of the same flux, or adding to used flux, will result in contamination and ineffective fluxing action.

Solder

A good quality 50:50 solder with a maximum antimony content of 0.5 per cent should be used. Australian Standard Specification No H.1 — 1931 gives full details of a suitable composition. Solder sticks should be clean and the use of badly oxidized sticks should be avoided.

Applying the Solder

To obtain best results the required heat should be applied in the shortest possible time at a minimum working temperature. Overheating may result in local buckling and it causes an excessive solution of the zinc coating, giving a rough sandy finish. The seam must, however, be adequately heated if good penetration is to be obtained. To achieve these objectives the following points should be observed:

1. Avoid heat conduction away from the joint. This will occur when the work is in contact with a heat conductor, such as a steel block, and inadequate heating may result.

2. Avoid soldering in draughty conditions. Inadequate heating may result.
3. Use a soldering iron with a high rate of heat transfer. It is desirable to dress the bit face to provide a large surface area in contact with the work.
4. The soldering iron should be clean and well tinned.
5. Do not overheat the soldering iron. An overheated iron, indicated by a predominance of green coloration in the heating flame, will cause overheating of the work.
6. Avoid applying a direct flame to the work. Overheating may result.
7. Solder the joint in one run wherever possible. A second run serves little purpose if the first run has been properly applied.
8. Avoid undue abrasion of the zinc surface with the soldering iron.
9. The soldering iron should always be drawn along the seam towards the operator, because the iron preheats the seam, and should be drawn in a straight line with no movement from side to side.

After Soldering

It is most important that the job be wiped with clean cloths dampened in clean water to remove excess flux and so prevent corrosion.

Sealants

As a substitute for soldering, zinc-coated sheets may be joined by use of mechanical fasteners such as "Pop" rivets in conjunction with a sealant. Four sealants suitable for use with all Lysaght coated sheet steels are GE Silglaze silicone rubber, Selleys Silicone Rubber 790, Perennator V23-4 and GE Silpuf. Refer to pages 90 and 91.

Zincalume

Zinc/aluminium alloy coatings are impractical to solder in the field, therefore soldering is not recommended for Zincalume. Sealants as mentioned in the paragraph above are suitable for use with Zincalume roofing and walling. Literature on current, economical, easy-to-use sealing and joining systems is available from Lysaght State Offices listed on pages 8 to 12.

ADHESIVES FOR FIXING AND FASTENING ZINC-COATED STEEL

There are many circumstances where adhesive bonding is the most suitable method for joining and sealing all types of zinc-coated steel. Assemblies of moderate strength can be produced.

Types and Selection of Adhesives

A wide variety of adhesives is available for use with zinc-coated steel. Basically these fall into two groups; rubber base adhesives and resin base adhesives.

Specific recommendations for adhesives for bonding building materials, including wall panellings, cladding, insulation materials, rubber and plastics to zinc-coated steel members should be made with the assistance of an adhesive manufacturer.

Joint Design for Adhesive Bonding

Advantages with adhesives can only be obtained by correct design. Joints should be designed specifically for adhesive bonding, not merely converted from former soldered or mechanically fastened joints.

Basic design rules for adhesive bonded joints are:

1. Utilize maximum joint contact area;
2. Put the maximum possible bonded area to work;
3. Design for the major working stresses to be in shear or tension;
4. Minimize or eliminate cleavage or peel stress if possible.

Surface Preparation for Adhesive Bonding

Cleaning Requirements

Surface contaminants such as oil, paint and oxide films must be removed from the surface of the zinc-coated steel. The extent of surface preparation necessary will be determined by the bond strength requirements and practical and economic considerations.

Non-structural adhesives, such as rubber base cements will perform satisfactorily when the surface is free from

dust, dirt, oil, grease and loosely bonded corrosion products. High strength adhesives naturally require more thorough surface preparation. The degree of preparation for particular adhesives and applications should be discussed with the adhesive manufacturer.

Hot melt and epoxy type adhesives can give adequate bond strength in non-critical applications after only minimal surface preparation such as wiping with a solvent.

Smooth zinc-coated steel sheet surfaces such as Zinc-anneal and electro-zinc-coated steel sheet such as Zincseal, have surfaces ideally suited for bonding without the need for further prepretreatment. Oil contaminated surfaces should be cleaned by solvent degreasing.

Cleaning Techniques

Degreasing, mild abrasive cleaning or chemical cleaning may be used to clean zinc-coated surfaces prior to application of adhesives.

Degreasing

When the zinc-coated surface is free of dirt, dust and paint and where maximum adhesive strength is not required, degreasing with a chemical solvent is satisfactory. Trichlorethylene is recommended for use in well ventilated areas. Inhalation of vapours should be avoided.

Abrasive Cleaning

Light abrasive cleaning should be used when the surface must be roughened and loosely adhering oxides removed. Wire brushing or rubbing with Scotchbrite, sandpaper or emery paper are recommended. Severe abrasion will remove too much of the protective zinc coating reducing corrosion resistance. After abrasive cleaning, the surface should be degreased prior to application of the adhesive.

Chemical Cleaning

Surface preparation for maximum cleanliness and optimum adhesion may be carried out using proprietary pretreatment solutions and etch primers. Because of their corrosive nature excess materials must be completely removed from the work surface prior to the bonding operation.

Application of Adhesives

Application may be by brush, spray, flow, roll coated, knife coat or curtain coat. The selection of the most suitable method should be as recommended by the adhesive manufacturer.

HANDLING & STORAGE OF COATED STEEL SHEETS

Provided they are kept dry, coated steel sheet products may be satisfactorily stored without deterioration in quality.

It must be stressed that should water become trapped between adjacent surfaces of coated sheet or coil, the resulting corrosive reactions are far more aggressive than those encountered in normal service. In extreme cases and with Colorbond or lighter zinc coating class qualities such as Zincanneal or Zincseal this may lead to early failure of the coating.

Both sheet and coil should be transported and stored so that water is unable to penetrate between adjacent sheet or wrap surfaces. Coated qualities must be kept dry in transit and stored in weatherproof buildings. Under conditions of high humidity, condensation must be prevented by adequate ventilation and air circulation.

If, inadvertently, a stack or pack of any sheet product should become wet, the suggested remedial action would depend greatly upon the nature of the product, its finish coating, the length of time any water is present and the condition of the sheets on examination. In all cases excess water should be wiped off with a clean cloth without delay and the separated sheets stacked so that air circulation completes the drying process. Obviously, this procedure is not applicable to coil, emphasising the need for initial precautions.

In prolonged storage, especially under humid conditions, some staining of the surface may occur.

To preserve the surface, handling should only be carried out using clean dry gloves. Precautions against mechanical damage should be observed.

The above precautions and remarks include and apply generally to storage of prepainted steel.

CORRUGATED GALVANIZED STEEL TANKS

Recommendations

INTRODUCTION

Where piped water supplies are not available, common practice is to install storage tanks of corrugated galvanized steel, varying in size from 4 to 5 kilolitre for small cottages to the large 90 to 135 kilolitre tanks for sheep and cattle stations. Galvanized steel tanks are relatively inexpensive to buy and transport, and erection on the site is not difficult.

Australia is a naturally dry country and every endeavour should be made to conserve all available water, particularly rain-water. A galvanized or Zincalume steel roof forms a suitable catchment and circular tanks of corrugated galvanized steel are a most efficient and economical method of storing water. Any desired size tank can be built by the choice of the appropriate lengths and thicknesses of LBI Custom Blue Orb.

TANK INSTALLATION

The life of a tank is dependent upon many factors and a little care in the choice of the location of the tank can often mean a difference of many years in its life. Whenever possible, tanks should be installed in a shady position, preferably on the southern side of the building but away from trees from which falling leaves might clog up the strainer or contaminate the water. Direct sunlight falling on a tank for long periods on hot days creates temperature differentials in the water which tend to promote corrosion.

Tanks should be fitted with a top, since this will not only help to prevent contamination of the water but will also prevent the growth of harmful algae. Most algae are not at all harmful but a few evolve acids during their normal process of growth and as a consequence are

detrimental to galvanized steel. Green algae are usually quite harmless and may grow to an appreciable length.

Inlet filling pipes should extend well into the tank in order to ensure that water does not run down the tank wall, because this creates conditions which can promote corrosion.

No metals such as copper, brass or bare steel should be in contact with the zinc coating on the sheets nor be in the water which is in contact with the zinc. Solder, although electro-positive to zinc, does not show any tendency to corrode in water and therefore no zinc is required for the sacrificial protection of this metal. When brass fittings are used in tanks, they should be thoroughly tinned before fixing otherwise severe corrosion may result in their immediate vicinity.

USES OF GALVANIZED STEEL TANKS

Galvanized steel tanks are used for the storage of rain, bore, dam and river waters, and in all cases the conditions of first filling are of the utmost importance in determining the ultimate life of the tank.

Zinc is not inherently a corrosion resistant metal, but if the initial corrosion of its surface takes place under suitable conditions, a thin, tightly adherent film can form, which reduces any further corrosion to a very low level. In a tank containing water of high purity or waters of high chloride and low magnesium and calcium content, conditions are not suitable for film formation, with the result that corrosion of the zinc is not inhibited. To overcome this problem, pretreatment of the water tank is highly desirable and the following recommendations should be followed.

RECOMMENDATIONS FOR TANK PROTECTION

Rain-Water Storage.— Zinc will not form a protective film when exposed to very pure water, and the corrosion that takes place under these conditions produces a non-adherent, flocculent deposit which affords no protection, and through which corrosion will proceed unchecked.

During the course of an extended period of rainfall, the nature of the water falling gradually changes. At the start, the composition of the rain-water may be such that it will readily form a protective film. At the beginning of the shower, the raindrops will collect dust and other impurities from the air and from the catchment, and these impurities will generally contribute to rapid film formation. With continued rainfall the purity of the water increases and what enters the tank is no longer capable of forming a protective film. If a tank is gradually filled by a succession of showers over an extended period, each run-off will contribute its share of impurities and a protective film may be formed which is then able to perform well even when high purity water enters at a later stage. If, however, the first filling of the tank occurs during continuous rain, the water in the tank will be relatively pure and, as a consequence, the initial protective film may not be formed.

To overcome this uncertainty, Lysaght Tect-A-Tank was developed for use in new tanks to ensure satisfactory film formation. Tect-A-Tank must be placed in the tank prior to the entry of any water at all, and protection is automatically afforded as the tank fills.

Tect-A-Tank contains two compounds, one a readily soluble zinc metaphosphate, and the other a less soluble zinc-calcium metaphosphate, which are mixed and packed in sections in a long, perforated plastic tube. On partial or total filling, the contents of the submerged sections of tube dissolve. Traces of zinc and calcium phosphates pass into solution but these are not sufficient to affect the taste of the water, nor to have any detrimental effect on the health of those using the water.

Tect-A-Tank is not effective in a header tank where the large volume of water circulating will prevent the formation of a passivating film on the tank walls, nor is it effective if it is placed in a tank which already has, or has had, water in it.

Rain-water tanks may run dry during a drought and be refilled with ground water. If this should become necessary, it must be realised that any protective film

that has formed on the tank walls can be destroyed and the life of the tank may be seriously shortened. To avoid this, the recommendation made in the following paragraphs regarding painting, should be observed.

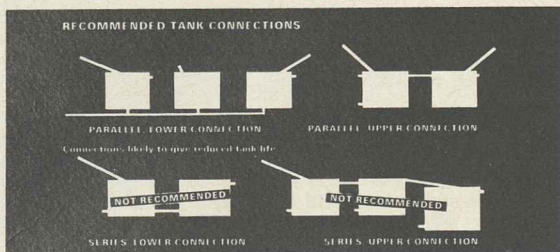
Ground Water Storage.— Bore, well, dam and river waters can vary widely in composition; many are aggressive to galvanized steel, some are protective. The behaviour of water from any one source may fluctuate from one extreme to the other as a result of floods or droughts. Waters from different locations vary considerably, dependent upon the nature of the terrain over, or through which the water has passed.

If in the initial stages of filling, a protective film or crust is formed, either by reaction of the water with the zinc or by the deposition of solids from the water, a long tank life is assured. However, the variability of ground waters is such that it must be considered unwise to be unduly optimistic in this regard, and the safest practice is to paint the inside of ground water tanks before their first filling. (Refer to Painting notes on pages 135 to 141). Bituminous paints are not recommended for painting galvanized steel tanks. The performance of these paints has been found to be variable and whilst some are quite satisfactory, others actually cause corrosion.

SERIES CONNECTIONS

Where two or more tanks are in use in the one location, each should have a separate inlet and outlet, since it has been found in many cases that the second or subsequent tanks in an inter-connected series have very short lives. The reason for the early failures in series connected tanks appears to be associated with differences in water purity and siltation between the first and subsequent tanks.

See illustration overleaf.



CATCHMENT AREAS

The nature of the catchment areas from which rain-water tanks are filled is of importance in determining the conditions in the tank, because the composition of the water may be influenced by both the size of the catchment and the material used.

Large catchment areas, over 16 square metres per kilolitre of water storage capacity, have been found to be associated with shorter tank lives. This is only of importance where very heavy rains are usual, and is considered to be due to the fact that rapid filling occurs, overflowing the tank and washing away any silt and leaving behind high purity water.

The material used for the roof catchment can have a considerable bearing on the nature of the water collected in the tank and, therefore, on the life of the tank. LBI zinc-coated or Zinalume roofing sheets are suitable catchments. However, Tect-A-Tank should always be used to offset possible effects of environmental and installation variables, particularly with inert catchments, eg, glazed terracotta tiles, aluminium or aluminium paint.

Capacity of Tanks — Calculations

Square or Rectangular Section.— All dimensions in metres:

length x breadth x depth = capacity in kilolitres.

Circular.— Capacity in kilolitres given by either of the following rules:

A. Capacity = $\frac{\pi}{4}$ x (diameter)² x height

B. Capacity = Multiply the circumference by itself
and by $\frac{8}{100}$ times the height — $C^2 \times \frac{8h}{100}$

C. Capacity = Multiply the diameter by itself and
by $\frac{4}{5}$ times the height — $D^2 \times \frac{4h}{5}$

Example using Rule C.— Diameter 2 metres, height 2 metres.

$$2 \times 2 \times \frac{4}{5} \times 2 = \frac{32}{5} = 6.4 \text{ kilolitres approximately.}$$

$$20 \times 20 \times 5$$



GAS CYLINDERS, GASES & WELDING ITEMS



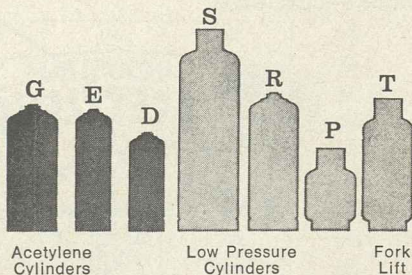
GAS IN CYLINDERS

High Pressure Gas Cylinders
(sizes C, B, A for medical gases only)

ORDER
BY THIS
LETTER CODE

		G	E	D	C	B	A
Gases	Con- tents Unit	(Volume at 15°C and 100 kPa)					
Oxygen & carbogen	m ³	7*	3.5*	1.4	0.4		
Air & nitrogen	m ³	6.4	3.2	1.3			
Argon	m ³	7	3.5				
Argon mixtures	m ³	6.9					
Carbon dioxide & Fumigas 10	kg	31*	15	6	1.8	0.9	
Ethylene	m ³	10		1.8			
Helium & mixtures	m ³	7.3*	3*	1.2*			
Hydrogen	m ³	6	3	1.2			
Nitrous oxide	m ³	17	8		0.95	0.45	
Entonox	m ³	8	4		0.5		
Cyclopropane	litre					350	150

GAS IN CYLINDERS



ORDER
BY THIS
LETTER CODE

		G	E	D	S	R	P	T
Gases	Con- tents Unit	(Volume at 15°C and 100 kPa)						
Acetylene	m ³	7*	3.2*	1.8*				
Handigas	kg				45.5	29	9.1	18.2
Fumigas 80 & Fumigas 90	kg				70	45	15	
Sterigas 27	kg				90		21	
Ethylene oxide	kg				80	53	16	
F11 & F12	kg					75	25	
F22, F502 & F500	kg					65	22	

*In a few locations more than one size of cylinder may be available under the general letter code designation, eg, there are three cylinder sizes for acetylene; 'G', 'GM' and 'GS'. The cylinders with a double letter code contain slightly less gas; however, if one is received (shown by letter code on cylinder label) invoice will be ONLY for the actual contents of the cylinder. In these cases still use only the single letter code, eg 'G', when reordering.

TYPICAL GAS CYLINDER LABEL

Background Colour

Red—Flammable Gases

White—Poisonous Gases

Yellow—Oxidising Agents

Green—Inert Gases

Grade of Gas



Gas Code Number

Cylinder Size Letter Code

GAS VOLUME

Cubic metres gas at 15°C and 100 kPa

GAS	1 kilogram	1 tonne	1 litre of liquid*
Oxygen	0.748	748	0.853
Nitrogen	0.855	855	0.691
Handigas (C3)	0.532	532	0.275*
Acetylene	0.913	913	—
Argon	0.599	599	0.833
Hydrogen ..	11.89	11 890	0.842
Carbon dioxide	0.542	542	—
Nitrous oxide ..	0.541	541	0.699
Helium	5.99	5 990	0.747
Air	0.827	827	—
Methane ...	1.490	1 490	0.543

* Handigas at 15°C. Others at 100 kPa

MACHINE AND HAND CUTTING NOZZLES

Plate Thickness, mm	Nozzle Size	Pressure		Speed
		Oxygen, kPa	Acet & LPG, kPa	Acet & LPG, mm/min

Standard Nozzle

6	8	180	100	370
12	12	200	100	320
20	12	250	100	300
25	15	250	100	250
40	15	280	100	240
50	15	400	100	180
75	15	500	100	150
100	20	500	100	130
125	20	550	100	120
150	24	520	100	110
200	24	630	100	100
250	32	630	100	75
300	32	700	100	75

HI Speed Nozzle

6	6HS	700	100	650
12	8HS	630	100	580
20	8HS	700	100	480
25	12HS	550	100	450
40	12HS	630	100	420
50	12HS	700	100	320
75	15HS	630	100	300
100	15HS	630	100	250
125	15HS	700	100	200
150	20HS	600	100	170
200	20HS	700	100	150

GAS WELDING RODS

Rod Diameters, mm

1.6	3.2	6.3
2.4	5.0	8.0

Rod Lengths, mm

1000	For mild steel and high test
550	For cast iron
315 & 500	For hardfacing rods
750	For alloy steels
750	For silver brazing alloys
750	For bronze
750	For aluminium

Rod Mass per packet, kg

0.125	0.5	5.0
0.250	2.5	25.0

MANUAL ARC ELECTRODES

Diameter, mm

1.6	3.25	6.0
2.0	4.0	6.3
2.6	5.0	8.0

Sold in packs of approximately 4.5 to 5.5 kg



AJAX NETTLEFOLDS PTY LIMITED

SELEFAST STEEL ROOFING AND WALLING FASTENERS

WITH METAL AND NEOPRENE WASHER ATTACHED

ARTICLE No 9201

**FOR CREST FIXING INTO
HARD OR SOFT TIMBER**



Hexagon Head
8 mm A/F
No 12 screw
complete with
Galvabond steel
washer 15 mm
diameter and
neoprene
sealing washer.
Bright Zinc
Plated.
(Fe/Zn12c)

Size

No 12 x 45 mm
No 12 x 60 mm

Pack

250
250

ARTICLE No 9202

**FOR CREST FIXING INTO
HARD OR SOFT TIMBER**



Slotted Pan
Head No 12
screw complete
with Galvabond
steel washer
15 mm diameter
and neoprene
sealing washer.
Bright Zinc
Plated.
(Fe/Zn12c)

Size

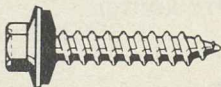
No 12 x 45 mm
No 12 x 60 mm

Pack

250
250

LYSAGHT REFEREE

ARTICLE No 9200
FOR CREST OR VALLEY
FIXING INTO STEEL



Hexagon Head
8 mm A/F
No 12 self-
tapping screw
Type AB,
complete with
Galvabond steel
washer 15 mm
diameter and
neoprene
sealing washer.
Bright Zinc
Plated.
(Fe/Zn12c)

Size	Pack
No 12 x 20 mm	500
No 12 x 40 mm	250

ARTICLE No 9204
FOR SIDE LAPS AND
V-CRIMP WALL VALLEY
FIXING TO STEEL AND
HARD OR SOFT TIMBER



Slotted Pan
Head No 8
self-tapping
screw Type AB,
complete with
Galvabond steel
washer 9 mm
diameter and
neoprene
sealing washer.
Bright Zinc
Plated.
(Fe/Zn12c)

Size	Pack
No 8 x 13 mm	500
No 8 x 25 mm	500

ARTICLE No 9203
FOR SPANDEK AND
TRIMDEK WALL VALLEY
FIXING TO HARD OR
SOFT TIMBER



Slotted Pan
Head No 10
self-tapping
screw Type AB,
complete with
Galvabond steel
washer 15 mm
diameter and
neoprene
sealing washer.
Bright Zinc
Plated.
(Fe/Zn12c)

Size	Pack
No 10 x 25 mm	500

COLOURED ROOFING AND WALLING FASTENERS — FOR USE WITH LYSAGHT COLORBOND SHEETS

The range of fasteners shown on pages 161-162 are available in colours to match standard Colorbond roofing and walling.

OFF WHITE

GOLD

BEIGE

BRONZE OLIVE

WEATHERED COPPER

MT OLGA ORANGE

HOLE SIZES

HOLE SIZES FOR SELEFAST STEEL ROOFING AND WALLING FASTENERS

Article No	Screw Type	Material Thickness, mm (Sum of all thicknesses driven)	Drill Size, mm
9200	No 12 Type AB, self-tapping screw	1.6	4.5
		2.0	4.6
		2.5	4.7
		3.0	5.0
		4.0 — 9.0	5.1
9203	No 10 Type AB, self-tapping screw	0.6 — 0.9	3.7
		1.2 — 1.5	3.8
		2.0 — 2.5	4.0
		3.0 — 3.5	4.3
		4.0	4.4
9204	No 8 Type AB, self-tapping screw	0.6 — 0.9	3.2
		1.2	3.3
		1.5	3.4
		2.0	3.5
		2.5 — 3.2	3.8
		3.5	3.9

ISO METRIC MACHINE SCREWS TO AS 1247

These metric machine screws conform with the standards of ISO (International Standards Organization), with ISO metric threads of the coarse pitch series to AS 1275 Class 6g.

Physical property grades:

Steel 4.8 — 400 MPa tensile strength

Brass — 320 MPa tensile strength

Aluminium Alloy — 320 MPa tensile strength

STANDARD HEAD STYLES, DRIVES AND DIAMETERS

Head Style	Drive	Diameter Range
Countersunk	Slotted	M1.6 to M20
	Pozidriv	M2 to M12
Raised Countersunk	Slotted	M1.6 to M10
	Pozidriv	M2 to M10
Pan	Slotted	M2.5 to M10
	Pozidriv	M2.5 to M10
Cheese	Slotted	M1.6 to M10
Mushroom	Slotted	M3 to M8
Hexagon	Hexagon	M3 to M10
Hexagon Washer	Hexagon	M3 to M10

STANDARD DIAMETERS AND PITCHES

Diameter	M1.6	M2	M2.5	M3	M3.5	M4	M5
Pitch, mm	0.35	0.4	0.45	0.5	0.6	0.7	0.8

Diameter	M6	M8	M10	M12	M16	M20
Pitch, mm	1.0	1.25	1.5	1.75	2.0	2.5

Standard Lengths, mm— 4, 5, 6, 8, 10, 12, 16, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75

CLEARANCE & TAPPING HOLE SIZES

The recommended clearance hole and drilled tapping hole sizes are defined below:—

Machine Screw Diameter	M1.6	M2	M2.5	M3	M3.5	M4	M5
Fine clearance hole diameter, mm	1.7	2.2	2.7	3.2	3.7	4.3	5.3
Medium clearance hole diameter, mm	1.8	2.4	2.9	3.4	3.9	4.5	5.5
Tapping hole drill diameter, mm	1.25	1.60	2.05	2.50	2.9	3.30	4.20

Machine Screw Diameter	M6	M8	M10	M12	M16	M20
Fine clearance hole diameter, mm	6.4	8.4	10.5	13	17	21
Medium clearance hole diameter, mm	6.6	9	11	14	18	22
Tapping hole drill diameter, mm	5.00	6.80	8.50	10.20	14.00	17.50

ISO METRIC PRESSED NUTS

HEXAGON & SQUARE TO AS 1474

The Pressed Nuts are for use in combination with Machine Screws AS 1247.

RANGE OF SIZES, ACROSS FLATS AND THICKNESSES FOR BOTH HEXAGON AND SQUARE

Nominal Diameter	M1.6	M2	M2.5	M3	M4	M5	M6	M8	M10
Width A/F max, mm	3.2	4.0	5.0	5.5	7.0	8.0	10.0	13.0	17.0
Thickness max, mm	1.16	1.36	1.78	1.78	2.20	2.70	3.22	4.24	5.26

METRIC TAPPING AND DRIVE SCREWS

There is agreement at ISO on International Standards for spaced thread types, ie, types AB and B which adopts a soft conversion of imperial inch dimensions and properties, maintaining interchangeability with imperial inch products.

There is no agreement in respect of Type C and its derivatives which employ machine screw type threads, and Australia supports the adoption of hard conversion to metric thread forms.

Australia is reluctant to decide on a National Standard before agreement is reached at the International level and, on this account, the metric conversion dates are not predictable with accuracy. Estimated dates are: Australian Standard publication date September, 1974. Product availability January, 1975.

METRIC WOODSCREWS TO AS 1476

In the absence of an ISO Standard at time of publication, industry has proposed a soft conversion with hard conversion of lengths and slot dimensions only.

STANDARD LENGTHS TO AS 1476

mm	mm	mm	mm
6	20	45	100
8	25	50	120
10	30	60	
12	35	70	
16	40	80	

Head styles and sizes remain unaltered from imperial designation.

Diameters and threads are also unaltered and are identified as a Number series.

A typical designation would be:—

“Steel Woodscrew No 6 x 16 Slotted Countersunk Head”.

ISO METRIC HEXAGON COMMERCIAL BOLTS & SCREWS TO AS 1111-1972

Hexagon bolts and screws replacing the BSW inch Black Bolt products and conforming with the ISO Standards; coarse pitch series threads to AS 1275 Class 8g. Physical properties are to strength grade 4.6 with a minimum tensile strength of 400 MPa.

STANDARD DIAMETERS, THREAD PITCHES AND HEXAGON HEAD SIZES — in millimetres

Standard Nominal Diameters	M5	M6	M8	M10	M12	M16
Thread Pitch	0.8	1.0	1.25	1.5	1.75	2.0
Hexagon A/F, max	8	10	13	17	19	24
Head Height, max	3.88	4.38	5.88	7.45	8.45	10.45

Standard Nominal Diameters	M20	M24	M30	M36	M42	M48
Thread Pitch	2.5	3.0	3.5	4.0	4.5	5.0
Hexagon A/F, max	30	36	46	55	65	75
Head Height, max	13.9	15.9	20.05	24.05	27.05	31.05

STANDARD MINIMUM LENGTH OF THREADS FOR ALL DIAMETERS

For Lengths up to and including 125 mm	For Lengths Over 125 & up to and including 200 mm	For Lengths Over 200 mm
2D + 6 mm	2D + 12 mm	2D + 25 mm

Standard Lengths, mm— 8, 10, 12, 14, 16, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 220, 240, 260, 280, 300, 325, 350, 375, 400, 425, 450, 475, 500.

ISO METRIC HEXAGON PRECISION BOLTS & SCREWS TO AS 1110-1972

Hexagon bolts and screws replacing unified high tensile products and conforming with ISO Standards with coarse pitch series threads to AS 1275 Class 6g.

Physical Properties

AS 1110-1972 provides four strength grades 4.6, 5.8, 8.8 and 10.9 having minimum tensile strengths of 400, 500, 800 and 1000 MPa respectively.

Strength Grade 8.8 is equivalent in strength to the popular Grade 5 High Tensile unified inch bolt which it replaces.

STANDARD DIAMETERS, THREAD PITCHES AND HEXAGON HEAD SIZES — in millimetres

Standard Nominal Diameter	M1.6	M2	M2.5	M3	M4	M5	M6	M8
Thread Pitch	0.35	0.4	0.45	0.5	0.7	0.8	1.0	1.25
Hexagon A/F, max	3.2	4.0	5.0	5.5	7.0	8.0	10.0	13.0
Head Height, max	1.22	1.52	1.82	2.12	2.92	3.65	4.15	5.65

Standard Nominal Diameter	M10	M12	M16	M20	M24	M30	M36
Thread Pitch	1.5	1.75	2.0	2.5	3.0	3.5	4.0
Hexagon A/F, max	17.0	19.0	24.0	30.0	36.0	46.0	55.0
Head Height, max	7.18	8.18	10.18	13.22	15.22	19.26	23.26

Standard lengths and thread lengths are as specified for Commercial Grade to AS 1111-1972 on page 167.

ISO METRIC HEXAGON NUTS TO AS 1112-1972

These nuts replace with a single class, the inch BSW and unified nuts formerly supplied in precision and black.

Threads are to AS 1275 Class 6H.

Strength Grades are 5, 8 and 10, and provide for proof load stresses of 500, 800 and 1000 MPa respectively, and are designated for application to bolt strength grades as indicated below:—

Strength Grade of bolt	4.6	5.8	8.8	10.9
Required strength grade of nut	5	5	8	10

Two thin nut property grades 04 and 06 provide for proof load stresses of 400 and 600 MPa respectively.

STANDARD DIAMETERS, THREAD PITCHES AND DIMENSIONS — in millimetres

Standard Nominal Diameter	M1.6	M2	M2.5	M3	M4	M5	M6	M8	M10
Thread Pitch	0.35	0.4	0.45	0.5	0.7	0.8	1.0	1.25	1.5
Hexagon A/F, max	3.2	4.0	5.0	5.5	7.0	8.0	10.0	13.0	17.0
Thickness Normal	1.3	1.6	2.0	2.4	3.2	4.0	5.0	6.5	8.0
Nuts, max Thickness	1.3	1.6	2.0	2.4	3.2	4.0	5.0	6.5	8.0
Thin Nuts, max	—	—	1.6	1.6	2.0	2.5	3.0	4.0	5.0

Standard Nominal Diameter	M12	M16	M20	M24	M30	M36	M42	M48
Thread Pitch	1.75	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Hexagon A/F, max	19.0	24.0	30.0	36.0	46.0	55.0	65.0	75.0
Thickness Normal	10.0	13.4	16.4	19.7	24.7	29.7	34.8	38.8
Nuts, max Thickness	10.0	13.4	16.4	19.7	24.7	29.7	34.8	38.8
Thin Nuts, max	6.0	8.0	10.0	12.0	15.0	18.0	21.0	24.0

ISO METRIC SPLIT COTTER PINS TO AS 1236-1973

Australian Standard 1236 provides a range of standard coter pins with diameters and tolerance with recommended hole sizes and combinations with bolt sizes as listed below:—

Nominal Diameter, mm	1	1.2	1.6	2	2.5	3.2
Shank Dia, max, mm	0.9	1.0	1.4	1.8	2.3	2.9
Shank Dia, min, mm	0.8	0.9	1.3	1.7	2.1	2.7
Recommended Hole Size, min, mm	1.0	1.2	1.6	2.0	2.5	3.2
Recommended combinations with bolt size.						
min	M4	M5	M6	M8	M10	M12
max	—	—	—	—	—	M14

LYSAGHT REFEREE

Nominal Diameter, mm	4	5	6.3	8	10	13
Shank Dia, max, mm	3.7	4.6	5.9	7.5	9.3	12.4
Shank Dia, min, mm	3.5	4.4	5.7	7.3	9.3	12.1
Recommended Hole Size, min, mm	4.0	5.0	6.3	8.0	10.0	13.0
Recommended combinations with bolt size.						
Min	M16	M22	M30	M42	M64	over
Max	M20	M24	M36	M56	M80	M80

STANDARD LENGTHS

The standard lengths nominated below are measured from the end of the short leg to the underside of the eye.

Standard Nominal Lengths, mm— 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 112, 125.

All popular combinations of diameter and length are stock sizes.

METRIC COACH SCREWS TO AS 1393

Hexagon head dimensions and physical properties of metric coach screws are identical with those nominated for Metric Hexagon Commercial Bolts and Screws to AS 1111-1972 on page 167.

Standard Nominal Diameters, mm— 6, 8, 10, 12, 16, 20.

Standard Nominal Lengths, mm— 20, 30, 35, 40, 50, 55, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 180, 200.

METRIC CUP HEAD SQUARE NECK BOLTS TO AS 1390

The metric cup head square neck bolt replaces the cup square bolt with BSW threads, and is sold with hexagon nut strength Grade 5, to AS 1112-1972.

Threads are to AS 1275 Class 8g.

The strength grade is 4.6 with a minimum tensile strength of 400 MPa.

STANDARD DIAMETERS, HEAD DIAMETERS AND HEAD THICKNESSES — in millimetres

Nominal Diameter Thread Size	M5	M6	M8	M10	M12	M16	M20	M24
Head Dia, max	12.0	14.2	18.7	23.3	27.8	37.0	46.0	55.1
Head Thickness and Length of Square Neck, max	3.1	3.6	4.8	5.8	6.8	8.9	10.9	13.1

Standard Lengths are as specified for Hexagon Commercial Bolts to AS 1111-1972 on page 167.

METRIC HIGH STRENGTH BOLTS FOR STRUCTURAL ENGINEERING TO AS 1252

High strength structural bolts replacing the unified inch products and conforming generally with ISO bolt Standards. Threads are to AS 1275 Class 6g coarse pitch series.

Physical Properties.— The Standard provides one strength grade 8.8 with a minimum tensile strength of 800 MPa.

BOLT AND NUT — STANDARD DIAMETERS, THREAD PITCHES AND HEXAGON HEAD SIZES — in millimetres

Standard Nominal Diameter	M12	M16	M20	M24	M30	M36
Thread Pitch	1.75	2.0	2.5	3.0	3.5	4.0
Bolt & Nut Hexagon A/F, max	22	27	32	41	50	60
Bolt Head Height, max	8.45	10.45	13.9	15.9	20.05	24.05
Nut Thickness, max	11.0	15.4	18.4	22.7	26.7	31.8

Standard Lengths

Lengths 40 up to and including 100 mm	Increments of 5 mm
Lengths over 100 up to and including 200 mm	Increments of 10 mm
Lengths over 200 up to and including 240 mm	Increments of 20 mm

Flat Round Washers — Hardened — in millimetres

Standard Bolt Diameter	M12	M16	M20	M24	M30	M36
Inside Dia, min	14.0	18.0	22.0	26.0	33.0	39.0
Outside Dia, max	28.0	34.0	39.0	50.0	60.0	72.0
Thickness, max	4.25	4.25	4.25	4.25	4.25	4.25
min	2.77	2.77	3.75	3.75	3.75	3.75

Square Taper Washers — in millimetres

Standard Bolt Diameter	M12	M16	M20	M24	M30	M36
Inside Dia, min	14.0	18.0	22.0	26.0	33.0	39.0
Width Across Flats, nom	31.75	31.75	44.45	44.45	57.15	57.1
Mean Thickness 5° Taper	4.76	4.76	4.76	4.76	4.76	4.76
Mean Thickness 8° Taper	6.35	6.35	6.35	6.35	6.35	6.35

METRIC FLAT METAL WASHERS FOR GENERAL ENGINEERING PURPOSES TO AS 1237-1973

The metric standard product range covers four varieties of washers defined below with appropriate applications.

Bright Metal Washers — Small Series

— for Machine Screws and Socket Head Cap Screws.

Bright Metal Washers — Normal Series

— for Hexagon Head Precision Bolts and Screws.

Black Washers — Normal Series

— for Hexagon Head Commercial Bolts and Screws.

Black Washers — Large Series

— for Hexagon Head Commercial Bolts and
Screws requiring larger bearing areas.

WASHER DIMENSIONS

Nominal Washer Size (Thread Dia), mm	Bright Metal Washers						
	Small Series Steel			Normal Series Steel and Brass			
	I D min, mm	O D max, mm	Thick- ness Steel nom, mm	I D min, mm	O D max, mm	Thickness	
						Steel nom, mm	Brass nom, mm
1	1.1	2.5	0.3	—	—	—	—
1.2	1.3	3	0.3	—	—	—	—
1.6	1.7	3.5	0.3	1.7	4	0.3	0.3
2	2.2	4.5	0.3	2.2	5	0.3	0.3
2.5	2.7	5	0.5	2.7	6.5	0.5	0.5
3	3.2	6	0.5	3.2	7	0.5	0.5
4	4.3	8	0.8	4.3	9	0.8	0.8
5	5.3	9.5	1	5.3	10	1.0	0.8
6	6.4	11	1.2	6.4	12.5	1.2	1
8	8.4	14	1.2	8.4	17	1.2	1.2
10	10.5	18	1.6	10.5	21	1.6	1.2
12	—	—	—	13	24	1.6	1.6
16	—	—	—	17	30	2.0	2
20	—	—	—	21	37	2.0	2
24	—	—	—	25	44	2.0	2
30	—	—	—	31	56	2.5	2
36	—	—	—	37	66	2.5	2
42	—	—	—	—	—	—	—
48	—	—	—	—	—	—	—
56	—	—	—	—	—	—	—
64	—	—	—	—	—	—	—

LYSAGHT REFEREE

Nominal Washer Size (Thread Dia), mm	Black Washers					
	Normal Series Steel			Large Series Steel		
	I D min, mm	O D max, mm	Thick-ness Steel nom, mm	I D min, mm	O D max, mm	Thick-ness Steel nom, mm
1	—	—	—	—	—	—
1.2	—	—	—	—	—	—
1.6	—	—	—	—	—	—
2	—	—	—	—	—	—
2.5	—	—	—	—	—	—
3	—	—	—	—	—	—
4	—	—	—	—	—	—
5	5.5	10.0	1	—	—	—
6	6.6	12.5	1.6	—	—	—
8	9.0	17.0	1.6	9.0	21.0	2
10	11.0	21.0	2	11.0	24.0	2
12	14.0	24.0	2.5	14.0	28.0	2.5
16	18.0	30.0	3	18.0	34.0	3
20	22.0	37.0	3	22.0	39.0	3
24	26.0	44.0	4	26.0	50.0	4
30	33.0	56.0	4	33.0	60.0	5
36	39.0	66.0	5	39.0	72.0	6
42	45.0	78.0	7	45.0	84.0	7
48	52.0	92.0	8	52.0	96.0	8
56	62.0	105.0	9	62.0	112.0	9
64	70.0	115.0	9	70.0	128.0	9

deutsher

STEEL ROOFING AND WALLING FASTENERS

Cadmium plated and yellow dichromate passivated

Teks self-drilling self-tapping screws

Type 23 thread-cutting screws

Type 17 self-drilling wood screws

Type S Point self-drilling self-tapping screws

TYPE 17
FOR CREST FIXING
INTO HARD OR SOFT
TIMBER

Hex Washer Head
self-drilling wood
screw pre-assembled
with neoprene
washer.

Size

No 12 x 45 mm
No 12 x 55 mm

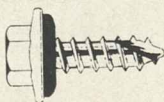


TYPE 17
FOR SPANDEK AND
TRIMDEK VALLEY WALL
FIXING INTO HARD OR
SOFT TIMBER

Hex Washer Head
self-drilling wood
screw pre-assembled
with neoprene
washer.

Size

No 12 x 25 mm



TYPE 17
FOR V-CRIMP VALLEY
WALL FIXING INTO
HARD OR SOFT TIMBER

Pan Head self-
drilling wood screw
pre-assembled
with neoprene
washer.

Size

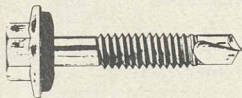
No 8 x 25 mm

LYSAGHT REFEREE

TEKS
FOR CREST OR VALLEY
FIXING INTO STEEL
UP TO 4.5 mm THICK

Hex Washer Head
self-drilling self-
tapping screw pre-
assembled with
neoprene washer.

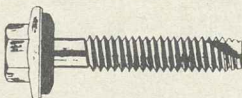
Size
No 12 x 20 mm
No 12 x 35 mm
No 12 x 45 mm



TYPE 23
FOR CREST OR VALLEY
FIXING INTO STEEL
5 mm AND THICKER

Hex Washer Head
thread-cutting
screw pre-assembled
with neoprene
washer.

Size
No 12 x 20 mm
No 12 x 35 mm
No 12 x 45 mm
Drill size 4.5 mm



TEKS
FOR V-CRIMP VALLEY
WALL FIXING INTO
STEEL UP TO 4.5 mm
THICK

Pan Head self-
drilling self-tapping
screw pre-assembled
with neoprene
washer.

Size
No 8 x 13 mm

TYPE 23
FOR V-CRIMP VALLEY
WALL FIXING INTO
STEEL 5 mm AND
THICKER

Pan Head thread-
cutting screw
pre-assembled with
neoprene washer.

Size
No 8 x 13 mm
Drill size 3.5 mm

TYPE S POINT
FOR SIDE LAP
STITCHING

Hex Washer Head or
Pan Head self-
drilling self-tapping
screw pre-assembled
with neoprene
washer.

Size
No 8 x 13 mm

LYSAGHT REFEREE

For fastening concealed clips or straps for Klip-Lok type roof and wall decks —

To hard or soft timber

Type 17 Wafer Head
self-drilling wood screw
No 10 x 25 mm

To steel up to 4.5 mm thick



Teks Wafer Head
self-drilling self-tapping
screw
No 10 x 16 mm
No 10 x 22 mm if
insulating blanket used.

To steel 5 mm and thicker

Type 23 Wafer Head
thread-cutting screw
No 10 x 16 mm
No 10 x 22 mm if
insulating blanket used.
Drill size 4.0 mm

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. In 1970 the total area treated was 4 156 000 hectares.

AIRSTRIP REQUIREMENTS

The development and maintenance of good airstrips on your own property can be highly advantageous to you in the following ways:—

1. Greater safety for the pilot and aircraft while operating on your property.
2. Fast and efficient operation of aircraft.
3. Airstrip facilities add to the capital value of your property.
4. Good operating conditions mean fuller utilization of contractor's equipment, which affects the cost to you.

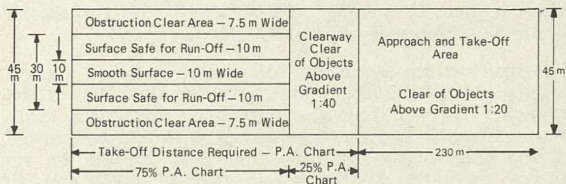
The minimum requirements for an airstrip are set out below but it is stressed that much depends upon particular aircraft that would be using the airstrip. A property owner contemplating construction of an airstrip on his property should consult the aircraft operator to ensure that the area complies with the approved standards specified in the operator's Operations Manual as being applicable to the type of aircraft and class of operation. It will be appreciated that it will also be necessary to provide a good access road and dump site for the storage of fertilizers, etc. Selection of the dump site in relation to the airstrip should be made in conjunction with the aircraft operator.

Full details are, of course, available from the Department of Civil Aviation, but below are the authorized landing area dimensional and other specifications for day operations.

The strip width and the dimensions of the clearway and approach and take-off areas shall not be less than those shown in the diagram.

The clearway and approach and take-off gradients shall not be steeper than those shown in the diagram.

The term "objects" used in the diagram includes any suspended object such as wires.



It is necessary to ensure that objects immediately beyond the approach and take-off area are not hazardous to the normal manoeuvring of an aircraft prior to landing or after taking-off.

The effective length of strip available must not be less than that prescribed in the relevant Performance of Aircraft (PA) chart for the prevailing conditions. In determining the effective length it shall be acceptable for the final 25% of the take-off distance required as prescribed in the relevant PA chart to be "clearway". Clearway is an area in which there are no obstructions above a plane of 1:40 measured from the end of the prepared surface over a width of 45 metres.

The maximum overall longitudinal gradient shall be 1:8. Where the overall longitudinal gradient exceeds 1:50, one way operations only are permitted (ie, down-hill take-off and up-hill landing).

The maximum transverse grade in the centre 10 metres of the strip shall be 1:33; in the 10 metres either side of the central 10 metres it shall be 1:20 and over the remainder of the strip it shall be 1:8.

The central 10 metres of the strip over its length shall be smooth, the 10 metres on each side of the central 10 metres shall be such that an aircraft running over it following a swing on take-off or landing would not

suffer damage. There shall be no obstructions above ground level over the whole area and in connection with this requirement, obstructions shall be deemed to include suspended objects such as wires. A reasonable test for smoothness of the central section would be to drive a heavily sprung vehicle over the surface at 50 km/h without discomfort to the occupants.

The strip surface should be well graded and then grassed so that it can stand up to maximum work and resist erosion. This will reduce maintenance costs to a minimum. When it becomes overgrown it should be mowed to the full length and the loose grass should be removed from the approach and take-off area, and all around the loading area. Long grass will retard aircraft acceleration and, if wet, can reduce brake control to a serious extent.

The reason for removing the cut grass as suggested is that it could otherwise be drawn into the intake of the aircraft with serious results, and there is always the possibility of dry loose grass being set alight by the aircraft exhaust.

It is recommended that airstrip boundaries be indicated by frangible type markers.

AERIAL AGRICULTURE, 1963-64 TO 1969-70

Year ended 31 March 1970—	Area top- dressed and seeded, ha x 10 ⁶	Area sprayed, ha x 10 ⁻⁵	Total area treated (b), ha x 10 ⁻⁵	Materials used		Total flying time, hours
				Super- phosphate, tonnes	Seed, kg x 10 ⁻⁵	
New South Wales (c)	(a)	(a)	(a)		(a)	
Victoria	24.59	6.16	33.01	298 451	9.50	48 823
Queensland (e)	7.26	1.96	9.46	117 988	0.45	20 893
South Australia	1.18	2.38	4.55	(d)	1.69	(d)
Western Australia	2.46	1.14	3.65	40 233	(d)	6 065
Tasmania	(d)	(d)	(d)	66 357	0.66	13 219
Australia	(d)	(d)	(d)	(d)	(d)	(d)
1969	41.56	15.07	60.17	559 793	12.95	102 619
1968	38.34	18.53	58.34	443 595	18.71	99 639
1967	42.47	(d)	58.06	532 789	14.74	102 112
1966	47.13	12.92	61.66	606 202	10.92	108 688
1965	45.79	14.04	60.74	597 481	7.17	108 850
1964	57.25	9.78	67.34	666 622	15.73	108 753
	43.16	8.26	51.75	513 928	9.06	84 827

(a) To obtain the original figure multiply the given figure by 100 000 (10⁵). (b) Includes other types of treatment (rabbit baiting etc.). (c) Includes details for the Australian Capital Territory. (d) Not available for publication. (e) Includes details for the Northern Territory.

AREA FERTILISED AND QUANTITY OF ARTIFICIAL FERTILISERS USED, 1965-1970

SEASON	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Aust	
AREA (hectares x 10 ⁻⁶) (a)										
1965-66		6.515	6.634	0.410	4.031	7.481	0.692	0.005	0.028	25.796
1966-67		6.713	6.991	0.490	4.192	8.148	0.736	0.006	0.027	27.301
1967-68		6.982	6.604	0.608	4.113	8.687	0.730	0.024	0.020	27.768
1968-69		6.811	6.025	0.681	4.159	9.104	0.701	0.023	0.017	27.520
1969-70		6.613	6.213	0.726	4.146	9.690	0.685	0.040	0.020	28.133
QUANTITY USED (tonnes)										
1965-66		853 434	1 071 313	217 929	570 980	988 037	166 556	683	3 838	3 872 768
1966-67		878 443	1 131 259	246 508	608 417	1 114 151	172 480	692	3 447	4 155 398
1967-68		907 806	1 085 753	267 688	609 503	1 239 545	174 958	4 703	2 738	4 292 695
1968-69		912 301	970 129	269 225	590 075	1 344 528	163 037	5 199	2 230	4 256 725
1969-70		917 830	1 023 379	297 068	599 733	1 439 674	156 115	5 501	2 835	4 442 133

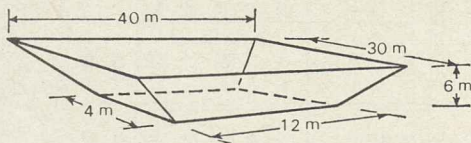
(a) To obtain the original figure multiply the given figure by 1 000 000 (10%).

AREA OF LAND IRRIGATED^(a) (hectares)

CROP (1969-70)	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Cotton	22 930		4 201		2 918			
Hops		(b)			(c)	583		
Orchards	(d) 22 290	21 649	(d) 4 473	13 643	5 316	3 101	28	5
Rice	39 258		905				(c)	
Sugar Cane	(b)		61 212					
Tobacco	1 108	(b)	5 046					
Vegetables	14 018	18 921	18 481	6 164	4 209	6 963	139	44
Vineyards	(e)	18 801	(e)	14 163	500			
Other Crops (incl fodder and fallow land)	182 678	33 483	60 350	13 560	2 814	3 315	218	202
Total Crops	282 282	92 854	154 668	47 530	15 757	13 962	384	252
Pastures	294 579	501 211	19 553	27 725	15 245	10 291	34	119

- (a) Compiled from annual agricultural census.
 (b) Not available separately, included in "Other Crops".
 (c) Not available for publication, included in "Other Crops".
 (d) Includes Vineyards.
 (e) Included with Orchards.

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) $= 3016$

(d) (a) + (b) + (c) multiplied by the depth and divided by 6 $= \frac{3016 \times 6}{6} = 3016 \text{ m}^3$

1 cubic metre is equal to 1 kilolitre.

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:—

1. Multiply length at base in metres by breadth at base in metres.
2. Multiply together length and breadth at eaves in metres.
3. 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 (1), (2) and (3) together and multiply by the height in metres of the eaves above ground level. Divide this product by 6, and the result is the volume of the body of the stack in cubic metres.

For the top portion:—

4. Multiply together the length and breadth in metres at the eaves.
5. 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 (4) and (5) together, multiply by the height of the ridge above the eaves in metres and divide by 6. 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: 12 m by 6 m at base; 15 m by 7 m at eaves; 9 m long at the ridge; eaves 3 m above the ground; ridge 3 m vertically above the eaves. Applying the formula:—

Volume of base or body =

$$\begin{aligned}
 1. \quad 12 \times 6 &= 72 \\
 2. \quad 15 \times 7 &= 105 \\
 3. \quad (12 + 15) \times (6 + 7) &= 27 \times 13 = 351 \\
 (1) + (2) + (3) &= 528 \\
 528 \times 3 & \\
 \hline
 6 &= 264 \text{ cubic metres}
 \end{aligned}$$

Volume of portion above eaves =

$$\begin{aligned}
 4. \quad 15 \times 7 &= 105 \\
 5. \quad 7 \times (15 + 9) &= 7 \times 24 = 168 \\
 (4) + (5) &= 273 \\
 273 \times 3 & \\
 \hline
 6 &= 136.5 \text{ cubic metres}
 \end{aligned}$$

Total volume of stack = 400.5 cubic metres

Cubic Contents of a Circular Stack

To determine the volume of a circular stack:—

1. Measure the circumference at both the base and eaves in metres.
2. Add these together and multiply this figure by itself (ie, "square" it).
3. Multiply the circumference at the base by the circumference at the eaves and deduct this from the result of (2).

4. Multiply the result of (3) by the height in metres of the eaves above the base and divide the result by 38. The figure obtained is the volume of the body of the stack in cubic metres.

For the top conical position of the stack, square the circumference in metres at the eaves and multiply by the height in metres of the top or peak above the eaves. Divide by 38 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.

Example.— Consider a circular stack with circumference at ground level 18 m, at the eaves 21 m and 3 m high at the eaves and 2 m at the top from the eaves. Applying the formula:—

Volume of body of stack

$$\begin{aligned}
 &= [(18 + 21) \times (18 + 21) - (18 \times 21)] \times \frac{3}{38} \\
 &= (1521 - 378) \times \frac{3}{38} \\
 &= 1143 \times \frac{3}{38} \\
 &= 90.2 \text{ cubic metres}
 \end{aligned}$$

Volume of conical top

$$\begin{aligned}
 &= \frac{21 \times 21 \times 2}{38} \\
 &= \frac{882}{38} \\
 &= 23 \text{ cubic metres}
 \end{aligned}$$

Total volume of stack = 113.2 cubic 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, metres	Average Length, metres	Height to Eaves, metres	Height of Ridge, metres	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 ³
	Sheaf, m ³	Loose, m ³	Sheaf, m ³	Loose, m ³	
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

FARM FENCING CONSTRUCTION AND HANDLING OF FENCING MATERIALS

Few, if any, capital items on a farm or grazing block improve the general appearance of the property more than sturdy, well constructed boundary and sub-divisional fences. The following notes are not designed to describe the exact method of erecting a farm fence, as this will vary from area to area and contractor to contractor, but rather to act as a guide when considering certain features of construction.

The class of fence to be erected depends mainly upon the site and material available, and whether the fence is to be rabbit- or dog-proof or merely stock-proof.

Fence Posts.— Fence posts used in Australia are typically:

- Local timber (hardwood)
- Chemically impregnated pine
- Precast concrete
- Star steel posts
- Used material, such as old railway line

If timber is available close to the fence line, it may be economical to use this, but the easy to handle and light Star steel post is usually used. The method of driving Star posts is by a manually operated tubular driver. There is no need to bore a hole in the ground prior to driving the post. Chemically treated posts are usually round, and about 100 to 150 mm in diameter. They are driven with a tubular driver into a pilot hole bored prior to driving.

Other posts are set in the ground manually, with shovel and soil rammer, after the hole has been dug.

On flat ground, posts would be spaced evenly apart (eg, each 7 metres) but in undulating or hilly country, post spacings need not be regular. A nominal distance apart should be settled upon (eg, 7 metres) but this would be varied to allow for ground undulation. Whether or not posts are driven at right angles to the ground or perpendicular, will depend on the fencing conditions, but a perpendicular position is usually chosen because it is much easier to keep the line tidy in appearance.

Strainer Assemblies.— The corner post is the anchor for the fence and, as such, should not be able to be moved. Considerable loss of tension is experienced for a small amount of movement in a corner. An AWI steel strainer assembly suitable for either a single strain or with the addition of an extra stay can be used as a corner post. Another type of strainer assembly can be constructed from treated timber posts or solid local timbers, using two posts and a horizontal strut.

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5	9	3.5	3	6
6	15	4	3	15

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Strainer Assemblies.— The corner post is the anchor for the fence and, as such, should not be able to be moved. Considerable loss of tension is experienced for a small amount of movement in a corner. An AWI steel strainer assembly suitable for either a single strain or with the addition of an extra stay can be used as a corner post. Another type of strainer assembly can be constructed from treated timber posts or solid local timbers, using two posts and a horizontal strut.

Where the ground has poor holding properties, a double end assembly with three posts can be used. A diagonal brace is made of wire of the thickness being used in the fence, and is run around four times prior to straining up and tying off. End posts should not be bored as this allows moisture into the interior of the post and also where the wire passes through the post, it will corrode away more quickly. Boring of holes also increases the possibility of wooden posts burning.

Wire Components in Fencing.— The choice of wire thickness is influenced by the accessibility of the fence line, cost per kilometre, length of strain, type of stock run and so on. High tensile wires, eg, Tyeasy, are slightly cheaper per kilometre and have less mass per kilometre to carry to the site. They can be strained over long distances without fear of too much stretch in the wire. Their disadvantages are mainly the difficulty in handling and tying of knots, possibility of snapping if overstrained and relatively small diameter (less metal present to corrode away over the years). The “softer” fencing wires are easier to handle and have more metal present. They can also be restrained many times without fear of breaking. Disadvantages of soft wires are that they are heavier and more difficult to get to the fence line, and have a greater tendency to stretch in service. This makes it necessary to have strainer posts closer together; four every 1500 metres on flat country areas compared with two every 1500 metres for high tensile wires.

The running-out procedure is the same for all types of wire. To run out a wire, it is suggested that certain procedures be observed in order to avoid tangles. A wire spinner makes the running-out of a coil easy. The coil is placed on the spinner, with the “top” of the coil facing upwards. The four wire ties are then cut off and the starting end is pulled out in the same plane as the coil. A few metres are run slowly to avoid snags and then the coil is ready to run out by pulling on the free end. If the coil is a “two-piece” coil, the outside ties are removed and the first piece run out. The tie on the second piece should not be removed

until the first piece is run out or tangles may occur with the loose ends.

The wire can be either run through the Star steel post holes or tied on with clips or tie wire after the line has been run and strained.

Fabricated Fencing and Its Erection.— Fabricated fencing has the advantage of being the easiest fence to erect. Because all fences are erected from top to bottom, it is necessary to position posts and any wires run over the top of fabricated fencing first. Then one end of a roll is fixed to the corner post and the balance of the roll is run out as near as possible to the line of fencing. It is then tied loosely in position prior to straining-up.

For many years, farmers have been straining fabricated fence by pulling it up with a tractor or four-wheel-drive vehicle. Whilst this is a quick method, it generally results in the material being over strained.

The Waratah Field Fence Strainer comprises three sections:

- (a) **Clamp Section.**— Clamps onto all wires in one simple operation and has a series of holes on the hauling side for attaching the straining mechanism.
- (b) **Tension Indicator.**— Heavy duty spring type indicator which can take loadings to 9 kilonewtons. It can be utilised with the clamp described above or with any existing clamp. It can also be used in conjunction with a hand straining mechanism or a tractor where preferred.
- (c) **Hand Straining Mechanism.**— Enlarged version of a normal chain strainer with all components designed to take in excess of the loadings required; the action is simple and can be safely and efficiently operated by one man.

Not all line wires will coincide with the holes in Star steel posts. However, with fabricated fencing, it is only necessary to tie every second wire to the post and this can be readily done with the hole spacings available. Tie wire (1.60 mm or 1.25 mm) is used to tie the fence to the posts.

Wire Netting.— Wire netting is erected in a similar manner to fabricated fencing except that the trench in

which the netting is buried is dug prior to running-out. Netting does not have to be strained as tightly as other wires as it may distort under the strain. It is fixed to the fence by means of tie wire or special fasteners. The final step in erecting a netting fence is to replace the soil in the trench. This can help to tighten the netting on the fence.

An alternative method of fixing netting is to lay the bottom 150 to 200 mm flat on the ground and secure with rocks every 300 to 500 mm. After 2 to 3 months, vegetation will grow through the netting and bind it to the ground. Rabbit netting should be placed in the ground at a depth of 150 mm, and this can most easily be accomplished by cutting a furrow with a small plough. Rabbit netting should be supported by three plain wires. A wire should run 150 mm above the ground to secure the netting, the portion below this being held by being buried in the ground. Another wire should be run along the top edge of the netting, the third being midway between the other two. Fasten the netting to the top wire with strong tie wire or clips at intervals of 1200 mm, but there should be a tie 300 mm on each side of every post. Also fasten the netting to the centre wire.

WARNING

Attention is drawn to the absolute necessity of removing every trace of old netting and the earth in which it was buried when renewing rabbit netting. The trench should be thoroughly cleared out of all old soil, clean virgin soil being used to bury the new netting. It has been found that fragments of old wire or rust spots in the soil will rapidly destroy any new netting.

Barbed Wire.— To position barbed wire, first fix one end to the corner post, then either run a bar through the reel and walk alongside it as it unwinds, or place it on a special spinner.

After straining, barbed wire is tied to fence posts, or in the barb slot of Star steel posts with either tie wires or clips. Strains not longer than 500 metres are recommended, as longer strains become difficult to handle.

Steel Fence Post Clips and Fastening Tool.— The firm attachment of all fence wire (including plain fence wire) to the outside of the steel post rather than running the wire through the holes is faster and results in less damage to the zinc coating of galvanized wire.

Fence post clips hold the wire firmly to the post after straining and fixing is performed by use of a small fastening tool.

Waratah clips are available in packets of 300, including a fastening tool, or in cartons of 3000 containing ten plastic packs.

Strains in Fencing Products.— The tension exerted on end assemblies by very long strains tends to limit their use. As a general rule, the maximum realistic strains are:

4.00, 3.55 & 3.15 mm Fencing Wire	—	750 m
2.50 & 2.80 mm HT Wire	—	1500 m
Barbed Wire	—	500 m
Fabricated Fencing	—	500 m
Wire Netting	—	500 m

Tension in Wires.— When overstrained, wire does not return to its original state but continues to stretch until it breaks. No wires should be strained to more than the following maximum loadings:

4.00, 3.55 & 3.15 mm Fencing Wire	—	1.5-2.5 kN
2.50 mm Flexabel	—	1.5 kN
2.50 mm Tyeasy	—	2.0 kN
2.80 mm HT Fencing Wire	—	3.0 kN
2.50 mm Iowa pattern and 1.60 mm HT Barbed Wire	—	1.5 kN
Fabricated Fencing	—	1.0 kN (per wire)
Wire Netting	—	Only until tight

A wire strainer should always incorporate a tension gauge. The jaws of the strainer must be smooth or the wire will be damaged, causing a weakness at that point.

WARATAH FENCE DROPPERS

These fence droppers are made from high tensile galvanized steel so that they are fire- and rust-resistant. They are attached after the fence posts have been erected and line wires run and strained. They may be used on all fencing wire between 4.00 mm and 2.50 mm diameter, and barbed wire.

A suggested fence construction would be posts spaced at up to 20 metres apart with droppers clipped at intervals of 2 to 4 metres depending on the number of line wires and site conditions.

The dropper dimensions are as follows:—

Thickness — 0.98 mm (nominal)

Length, cm — 63, 78, 96, 116, 122

Hole spacing — holes are at 25 mm centres

Approximate mass per bundle:—

Complete bundle of 50 — 96 cm droppers with clips
and fixing tools — 21 kg

Complete bundle of 50 — 116 cm droppers with clips
and fixing tools — 23.5 kg

WARATAH STEEL FENCE POSTS

Lengths, cm	Hole Spacings (from top), mm
135	25, 130, 100, 100, 100, 60, 120, 75, 75, 80, 75
165	25, 130, 100, 100, 100, 60, 120, 75, 75, 80, 70, 75, 60, 95
180	25, 130, 100, 100, 100, 60, 120, 75, 75, 80, 70, 75, 60, 95
270	25, 280, 300, 300, 300, 300, 300

1 Post per 40 m = 25 per km

1 Post per 20 m = 50 per km

1 Post per 15 m = 64 per km

1 Post per 10 m = 100 per km

1 Post per 7 m = 143 per km

1 Post per 5 m = 200 per km

1 Post per 3 m = 333 per km

WARATAH BARBED WIRE

Specification	Reel Type	Wire per Reel, m	Gross Mass per Reel, kg	Recommended Tension, kN
2.50 mm S/Galv Iowa Pattern	Wood	400	40	3
2.50 mm H/Galv Iowa Pattern Red Reel	Wood	400	40	3
1.60 mm H/Galv HT Red Reel	Wood	500	23	3
1.60 mm H/Galv HT Red Reel	Wood	500	22	3
1.60 mm H/Galv HT Red Reel	Wood	1000	44	3

GALVANIZED HT STEEL FENCE DROPPERS

Specification	Length, cm	Mass per Bundle, kg	Fastening Clips — included in bundles sufficient for fences of
HT galvanized	63	12	5 wires
steel fence droppers	78	15	6 wires
punched at 25 mm centres	96	21	7 wires
complete with fixing	116	24	9 wires
tool, instruction sheet & clips	122	26	9 wires

GALVANIZED FENCE WIRE

Diameter, mm	Type	Length per Coil, m	Recommended Tension, kN
4.00	Standard	500	2.5
3.55	Standard	600	2.0
3.15	Standard	750	1.5
2.80	HT Heavy Galv	1000	3.0
2.50	HT Flexabel	1500	1.5
2.50	HT Tyeasy	1500	2.0

The above represents standard thicknesses regularly produced for fencing purposes.

WIRE NETTING

The main sizes regularly produced are:

Type	Mesh, mm	Wire Diameter, mm	Width, cm
Rabbit-proof	30 & 40	1.4	30, 90, 105
Sheep	75	1.6, 1.4	60, 75, 90
Sheep	100	1.8, 1.6, 1.4	60, 75, 90
Dingo 3 ply 3 twist	75	1.8, 1.6	150, 180
Poultry	100	1.8, 1.6	150, 180
Poultry	25	0.9	90
Poultry	50	1.0	90, 180
Fish Trap	50	1.6, 1.4	90, 120, 150, 180
Oyster	25	1.4	105, 120
Dried Fruit Racks	50	1.4	105, 120

STEEL STRAINER ASSEMBLIES

Description	Mass, kg
Strainer Assembly (single stay)	45
Corner Assembly (two stays)	73
Additional stay, base plate and bolts	27
Vertical Post only	18
Waratah Post Driver	28

FENCE SPECIFICATIONS

1500 m Length of Fence	No of Strainer Assemblies	Additional Stay and Base Plates (if required)
100 m strain	17	15
200 m strain	9	7
400 m strain	5	3
800 m strain	3	1
1500 m strain	2	—

WARATAH HINGED JOINT FENCING

Type	Length per Roll, m	Mass per Roll, kg	Mass per kilometre, kg	Height of Roll, nominal, cm	Line Wire Spacings from top, nominal, mm	Picket Spacing, nominal, cm
5/26	200	65	325	67	200, 180, 150, 130	30
6/26	200	75	375	70	180, 150, 140, 130, 115	30
6/36	200	80	400	90	230, 200, 180, 150, 150	30
7/36	200	86	430	90	200, 180, 150, 140, 130, 115	30
8/32	100	64	320	80	165, 140, 130, 115, 100, 90, 75	15
8/45	200	105	525	115	230, 200, 180, 150, 140, 130, 115	30

NAILS: Approximate number per kilogram

Size, mm	No per kg	Size, mm	No per kg	Size, mm	No per kg
25 x 1.6	2270	50 x 2.80	380	75 x 3.75	145
25 x 1.8	1800	65 x 2.50	370	90 x 3.75	120
25 x 2.0	1360	65 x 2.80	300	100 x 3.75	105
40 x 2.0	920	50 x 3.15	290	90 x 4.50	80
50 x 2.0	780	65 x 3.15	230	100 x 5.00	60
40 x 2.5	600	70 x 3.15	200	125 x 5.00	50
50 x 2.5	490	65 x 3.75	170	125 x 5.60	40
50 x 2.8	380	100 x 4.50	75	150 x 5.60	35

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)*
1 Jan	7 Dec	11 Oct	31 May	28 May	27 Apr	5 Mar
8 "	14 "	18 "	7 June	4 June	4 May	12 "
15 "	21 "	25 "	14 "	11 "	11 "	19 "
22 "	28 "	1 Nov	21 "	18 "	18 "	26 "
29 "	4 Jan	8 "	28 "	25 "	25 "	2 Apr
5 Feb	11 "	15 "	5 July	2 July	1 June	9 "
12 "	18 "	22 "	12 "	9 "	8 "	16 "
19 "	25 "	29 "	19 "	16 "	15 "	23 "
26 Feb	1 Feb	6 Dec	26 July	23 July	22 June	30 Apr
5 Mar	8 "	13 "	2 Aug	30 "	29 "	7 May
12 "	15 "	20 "	9 "	6 Aug	6 July	14 "
19 "	22 "	27 "	16 "	13 "	13 "	21 "
26 "	1 Mar	3 Jan	23 "	20 "	20 "	28 "
2 Apr	8 "	10 "	30 "	27 "	27 "	4 June
9 "	15 "	17 "	6 Sep	3 Sep	3 Aug	11 "
16 "	22 "	24 "	13 "	10 "	10 "	18 "
23 "	29 "	31 "	20 "	17 "	17 "	25 "
30 "	5 Apr	7 Feb	27 "	24 "	24 "	2 July
7 May	12 "	14 "	4 Oct	1 Oct	31 "	9 "
14 "	19 "	21 "	11 "	8 "	7 Sep	16 "
21 "	26 "	28 "	18 "	15 "	14 "	23 "
28 "	3 May	7 Mar	25 "	22 "	21 "	30 "
4 June	10 "	14 "	1 Nov	29 "	28 "	6 Aug
11 "	17 "	21 "	8 "	5 Nov	5 Oct	13 "
18 "	24 "	28 "	15 "	12 "	12 "	20 "
25 "	31 "	4 Apr	22 "	19 "	19 "	27 "
2 July	7 June	11 "	29 "	26 "	26 "	3 Sep
9 "	14 "	18 "	6 Dec	3 Dec	2 Nov	10 "
16 "	21 "	25 "	13 "	10 "	9 "	17 "
23 "	28 "	2 May	20 "	17 "	16 "	24 "
30 "	5 July	9 "	27 "	24 "	23 "	1 Oct
6 Aug	12 "	16 "	3 Jan	31 "	30 "	8 "
13 "	19 "	23 "	10 "	7 Jan	7 Dec	15 "
20 "	26 "	30 "	17 "	14 "	14 "	22 "
27 "	2 Aug	6 June	24 "	21 "	21 "	29 "
3 Sep	9 "	13 "	31 "	28 "	28 "	5 Nov
10 "	16 "	20 "	7 Feb	4 Feb	4 Jan	12 "
17 "	23 "	27 "	14 "	11 "	11 "	19 "
24 "	30 "	4 July	21 "	18 "	18 "	26 "
1 Oct	6 Sep	11 "	28 "	25 "	25 "	3 Dec
8 "	13 "	18 "	7 Mar	4 Mar	1 Feb	10 "
15 "	20 "	25 "	14 "	11 "	8 "	17 "
22 "	27 "	1 Aug	21 "	18 "	15 "	24 "
29 "	4 Oct	8 "	28 "	25 "	22 "	31 "
5 Nov	11 "	15 "	4 Apr	1 Apr	1 Mar	7 Jan
12 "	18 "	22 "	11 "	8 "	8 "	14 "
19 "	25 "	29 "	18 "	15 "	15 "	21 "
26 "	1 Nov	5 Sep	25 "	22 "	22 "	28 "
3 Dec	8 "	12 "	2 May	29 "	29 "	4 Feb
10 "	15 "	19 "	9 "	6 May	5 Apr	11 "
17 "	22 "	26 "	16 "	13 "	12 "	18 "
24 "	29 "	3 Oct	23 "	20 "	19 "	25 "
31 "	6 Dec	10 "	30 "	27 "	26 "	4 Mar

* Average length of gestation period, which, however, may be subject to slight variation in individual cases.

AVERAGE DISTRICT RAINFALL THROUGHOUT AUSTRALIA

	DISTRICT	Annual fall, mm	DISTRICT	Annual fall, mm
NSW	Western Far North West	211	Manning	1359
	Western Lower Darling	246	Hunter	880
	Western Upper Darling	326	Central Tablelands North	587
	Western SW Plains	327	Central Tablelands South	849
	Central Western Plains South	443	Central Western Slopes North	580
	Central Western Plains North	435	Central Western Slopes South	557
	North-west Plains East	554	Metropolitan East ...	1064
	North-west Plains West	467	Metropolitan West	763
	North-west Slopes North	662	Illawarra	1102
	North-west Slopes South	617	South Coast	922
	Northern Tablelands Western	773	Southern Tablelands, Goulburn, Monaro .	634
	Northern Tablelands Eastern	954	Southern Tablelands, Snowy Mountains .	848
	North Coast Upper .	1408	South-west Slopes South	849
	North Coast Lower .	1413	South-west Slopes North	598
			Riverina East	469
			Riverina West	348
VIC	Mallee North	285	East Gippsland	767
	Mallee South	339	West Gippsland	907
	North Wimmera	401	East Central	882
	South Wimmera	481	West Central	598
	Lower North	420	North Central	715
	Upper North	496	Western Plains	618
	Lower North-east ...	772	West Coast	744
	Upper North-east ..	1109		

AVERAGE DISTRICT RAINFALL THROUGHOUT AUSTRALIA

	DISTRICT	Annual fall, mm	DISTRICT	Annual fall, mm
TAS	Northern	959	Central Plateau	1284
	East Coast	792	West Coast	2445
	Midland	577	King Island	846
	South-east	704	Flinders Island	765
	Derwent Valley	717		
SA	North-west Interior .	188	Central West	429
	Far North Interior .	156	Central East	594
	Western	331	Murray Valley	310
	Upper North	317	Murray Mallee	300
	North-east	196	Upper South-east ...	421
	Lower North	423	Lower South-east	648
WA	North Kimberley	791	North Coastal	404
	East Kimberley	379	Central Coastal	901
	West Kimberley	510	South Coastal	933
	De Grey	300	Central North	352
	Fortescue	253	Central South	434
	West Gascoyne	215	Eucla	188
	East Gascoyne	242	South-east	263
	Murchison	221	North-east	234
NT	Northern Rivers	1083	Northern Plateau ...	313
QLD	Peninsula North	1416	Upper West	363
	Peninsula South	916	Lower West	231
	Carpentaria Lower .	615	South Coast, Port Curtis	925
	Carpentaria Upper .	611	South Coast, Moreton	1056
	North Coast, Barron	1589	Darling Downs East	660
	North Coast, Herbert	2137	Darling Downs West	541
	Central Coast East .	938	Maranoa	525
	Central Coast West	573	Warrego	412
	Central Highlands ...	589	Far South West	285
	Central Lowlands ...	446		

AREA DISTRIBUTION OF AVERAGE ANNUAL RAINFALL: STATES AND TERRITORIES (Per cent)

Average annual rainfall (a)

	WA	NT	SA	Qld	NSW (b)	Vic	Tas	Total
Under 255 mm	58.0	24.7	82.8	13.0	19.7	Nil	Nil	39.0
255 mm and under	22.4	32.4	9.4	14.4	23.5	22.4	Nil	20.6
380 " "	6.8	9.7	4.5	19.7	17.5	15.2	0.7	11.2
510 " "	3.7	6.6	2.2	18.8	14.2	17.9	11.0	9.0
635 " "	3.7	9.3	0.8	11.6	9.1	18.0	11.4	7.2
760 " "	3.3	4.7	0.3	11.1	9.9	16.1	20.4	6.1
1020 " "	2.1	12.6	Nil	11.4	6.1	10.4	56.5	6.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(a) Hard conversion from inches

(b) Includes Australian Capital Territory

AREAS OF STATES AND TERRITORIES

State or Territory	Area km ²	State or Territory	Area km ²
New South Wales	801 428	Northern Territory	1 347 519
Victoria	227 619	Australian Capital Territory	2 432
Queensland	1 727 522	Mainland	7 618 517
South Australia	984 377	Tasmania	68 332
Western Australia	2 527 621	Australia	7 686 849

The coastline of Australia is approximately 19 320 km long — New South Wales 1130 km; Victoria 1130 km; Queensland 5150 km; South Australia 2410 km; Western Australia 6440 km; Northern Territory 1610 km; Australian Capital Territory, Jervis Bay area included in New South Wales; Tasmania 1450 km. These measurements are broadly on a 'direct' basis, but even so they must be regarded as approximate only.

POPULATION

AUSTRALIAN CENSUSES, STATES AND TERRITORIES 1881 to 1971

Census	NSW	Vic	Qld	SA	WA	Tas	NT	ACT (a)	Aust
PERSONS									
3 April 1881 ...	749 825	861 566	213 525	276 414	29 708	115 705	3 451	...	2 250 194
5 April 1891 ...	1 127 137	1 140 088	393 718	315 533	49 782	146 667	4 898	...	3 177 823
31 March 1901 ..	1 354 846	1 201 070	498 129	358 346	184 124	172 475	4 811	...	3 773 801
3 April 1911 ...	1 646 734	1 315 551	605 813	408 558	282 114	191 211	3 310	1 714	4 455 005
4 April 1921 ...	2 100 371	1 531 280	755 972	495 160	332 732	213 780	3 867	2 572	5 435 734
30 June 1933 ...	2 600 847	1 820 261	947 534	580 949	438 852	227 599	4 850	8 947	6 629 839
30 June 1947 ...	2 984 838	2 054 701	1 106 415	646 073	502 480	257 078	10 868	16 905	7 579 358
30 June 1954 ...	3 423 529	2 452 341	1 318 259	797 094	639 771	308 752	16 469	30 315	8 986 530
30 June 1961 (b)	3 918 501	2 930 366	1 527 514	971 487	746 750	350 340	44 481	58 828	10 548 267
30 June 1966 (b)	4 237 901	3 220 217	1 674 324	1 094 984	848 100	371 436	56 504	96 032	11 599 498
30 June 1971 (b)	4 601 180	3 502 351	1 827 065	1 173 707	1 030 469	390 413	86 390	144 063	12 755 638

(a) Part of New South Wales before 1911.

(b) Includes Aborigines.

POPULATION^(a) OF PRINCIPAL URBAN CENTRES: CENSUS 30 JUNE 1971

Urban Centre	State or Territory	Population
Sydney	NSW	2 717 069
Melbourne	Vic	2 388 941
Brisbane(b)	Qld	816 987
Adelaide	SA	809 466
Perth	WA	639 622
Newcastle	NSW	249 962
Wollongong	NSW	185 890
Canberra (National Capital) ..	ACT	140 966
Hobart	Tas	129 808
Geelong	Vic	115 047
Gold Coast (c)	Qld	74 121
Townsville	Qld	68 442
Launceston	Tas	62 181
Ballarat	Vic	58 434
Toowoomba	Qld	57 543
Rockhampton ..	Qld	48 188
Bendigo	Vic	45 860
Gosford-Woy Woy ..	NSW	38 093
Albury-Wodonga(d)	NSW	37 916
Darwin	NT	35 281
Cairns	Qld	32 570
Broken Hill	NSW	29 743
Mackay	Qld	28 416
Wagga Wagga ..	NSW	27 636
Bundaberg	Qld	26 570
Mount Isa	Qld	25 240
Tamworth	NSW	24 649
Maitland	NSW	24 530
Orange	NSW	24 154
Goulburn ..	NSW	21 568
Lismore	NSW	20 901
Kalgoorlie-Boulder	WA	20 784
Moe-Yallourn	Vic	20 764
Burnie-Somerset	Tas	20 088

(a) Preliminary figures. (b) Includes urban Ipswich, 60 017 persons.

(c) Includes part of urban centre (5147 persons) in NSW.

(d) Includes part of urban centre (10 533 persons) in Victoria.

NOTE: Figures for urban centres refer to population within areas based on new criteria for the delineation of urban boundaries introduced for the 1966 population census.

POPULATION, DENSITY, AND RATE OF INCREASE FOR THE WORLD AND CONTINENTS — SELECTED YEARS

(Source: United Nations Demographic Yearbook, 1971)

Continent and region	Population							Density (per- sons per square kilo- metre) 1971	
	Estimates of mid-year population (millions)								
	1950	1955	1960	1963	1965	1970	1971		
World Total	2486	2713	2982	3162	3289	3632	3706	2.0	27
Africa ..	217	241	270	289	303	344	354	2.6	12
Western Africa	64	71	80	85	90	101	104	2.5	17
Eastern Africa	62	69	77	82	86	98	100	2.5	16
Northern Africa	51	58	65	71	75	87	89	3.1	10
Middle Africa	25	27	29	31	32	36	37	2.1	6
Southern Africa	14	16	18	19	20	23	23	2.4	9
America	328	368	412	441	460	511	522	2.1	12
Northern America	166	182	199	208	214	228	230	1.2	11
Latin America	162	186	213	232	246	283	291	2.9	14
Tropical South America	84	96	112	122	130	151	155	3.0	11
Middle America	35	41	48	53	57	67	70	3.4	28
Temperate South America ..	27	30	33	35	36	39	40	1.8	10

	17	18	21	22	23	26	26	2.2	111
Caribbean									
Asia	1355	1487	1645	1754	1838	2056	2104	2.3	76
East Asia	657	715	780	822	852	930	946	1.8	80
Mainland region	536	586	640	675	700	765	779	1.8	70
Japan	83	89	93	96	98	103	105	1.1	283
Other East Asia	38	40	47	51	54	61	63	2.5	242
South Asia	698	772	865	931	981	1126	1158	2.8	73
Middle South Asia ..	481	528	588	632	665	762	783	2.8	116
South East Asia	173	193	219	236	249	287	295	2.9	66
South West Asia	44	51	58	63	67	77	79	2.9	18
Europe	392	408	425	437	445	462	466	0.8	94
Western Europe	122	128	135	140	143	149	150	0.7	150
Southern Europe	109	113	118	120	123	128	130	0.9	99
Eastern Europe	89	93	97	99	100	104	105	0.8	106
Northern Europe	72	74	76	78	79	81	81	0.6	50
Oceania	12.6	14.1	15.8	16.8	17.5	19.4	19.8	2.0	2
Australia and New Zealand	10.1	11.4	12.7	13.5	14.0	15.4	15.7	1.9	2
Melanesia	1.8	1.9	2.2	2.3	2.5	2.8	2.8	2.5	5
Polynesia and Micronesia	0.7	0.8	0.9	1.0	1.1	1.2	1.3	3.1	42
Union of Soviet Socialist Republics	180	196	214	225	231	243	245	1.0	11

Reference should be made to the detailed comments contained in the United Nations Demographic Yearbook, 1971, regarding geographical units used, boundaries of areas, reliability of estimates, etc.

OVERSEAS TRADE: AUSTRALIA, 1901 TO 1970-71 (fob)

LYSAGHT REFEREE

Period	Exports	Imports	Excess of exports (+) or imports (—)	Value per head of population	
	Exports	Imports		Exports	Imports
Annual average —	\$m	\$m	\$m	\$	\$
1901 to 1905	102	71	+	26.2	18.2
1906 to 1910	139	94	+	32.6	22.0
1911 to 1915-16	149	133	+	30.8	27.6
1916-17 to 1920-21	230	183	+	43.8	34.8
1921-22 to 1925-26	269	249	+	45.8	42.2
1926-27 to 1930-31	263	239	+	41.0	37.2
1931-32 to 1935-36	242	148	+	36.2	22.2
1936-37 to 1940-41	315	247	+	45.4	35.6
1941-42 to 1945-46	328	423	—	44.8	58.2
1946-47 to 1950-51	1143	899	+	145.4	114.3
1951-52 to 1955-56	1572	1566	+	176.4	175.6
1956-57 to 1960-61	1811	1729	+	182.0	173.7
Year —					
1958-59	1623	1593	+	163.1	160.1
1959-60	1875	1854	+	184.5	182.4
1960-61	1938	2175	—	186.5	209.3
1961-62	2155	1769	+	202.4	166.2
1962-63	2152	2163	—	198.5	199.4
1963-64	2782	2373	+	251.6	214.5
1964-65	2651	2905	—	235.1	257.5
1965-66	2721	2939	—	236.6	255.6
1966-67	3024	3045	—	258.3	260.1
1967-68	3045	3264	—	255.3	273.7
1968-69	3374	3469	—	277.2	285.0
1969-70	4135	3881	+	332.3	312.1
1970-71	4375	4150	+	343.7	326.0

GOVERNMENT RAILWAYS: ROUTE-DISTANCE OPEN, STATES AND TERRITORIES, 1855 TO 1970 (kilometres)

30 June —	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
1855(a)	23	3		11					37
1861(a)	117	183		90					391
1871(a)	576	444	351	214		72			1 658
1881(a)	1 603	2 007	1 287	1 339	148	72			6 457
1891	3 512	4 447	3 533	2 681	319	565	233		15 289
1901	4 580	5 209	4 508	2 794	2 181	735	233		20 241
1911	6 054	5 670	6 225	3 114	3 824	756	233		25 877
1921	8 116	6 867	9 257	5 485	6 425	1 014	320	8	37 491
1931	10 054	7 265	10 507	5 995	7 458	1 070	510	8	42 866
1941	10 248	7 271	10 569	6 130	7 781	1 033	789	8	43 829
1951	10 226	7 154	10 557	6 124	7 535	987	789	8	43 378
1961	10 144	6 518	10 177	6 173	7 366	832	789	8	42 007
1966	10 073	6 412	9 310	6 085	6 761	805	789	8	40 242
1967	10 073	6 481	9 222	6 082	6 870	805	789	8	40 329
1968	10 083	6 457	9 374	6 083	6 870	805	789	8	40 469
1969	10 083	6 392	9 373	6 050	6 888	805	789	8	40 386
1970	10 083	6 376	9 355	6 024	6 891	805	789	8	40 330

(a) At 31 December.

ROADS NORMALLY OPEN FOR GENERAL TRAFFIC 30 JUNE 1970 (kilometres)

STATE OR TERRITORY	CLASSIFIED ROADS	UNCLASSIFIED ROADS	TOTAL ROADS
New South Wales (a)	41 067	167 737	208 804
Victoria	23 550	139 078	162 627
Queensland	39 933	151 941	191 874
South Australia	13 126	108 043	121 169
Western Australia (b)	20 011	136 656	156 666
Tasmania	3 716	18 467	22 183
Northern Territory	(c)	19 584	19 584
Australian Capital Territory	(c)	1 387	1 387
Australia	141 402	742 894	884 296

(a) As at 30 June 1969.

(b) Revised classification by Main Roads Department as at 30 June 1969.

(c) See NOTE.

NOTE: 'Classified roads' refer to roads proclaimed or declared by Act for which the central road authority concerned assumed responsibility for part or the whole of the cost of construction and/or maintenance. Included under this heading are State highways, trunk roads and ordinary main roads, comprising about 73 per cent of the total classified road distances for Australia, and secondary developmental, tourist, etc, roads, comprising about 87 per cent. These classifications do not apply to the two Commonwealth territories.

'Total roads' are estimates of all roads and tracks normally open for general traffic, about 46 per cent of which are constructed, the remainder being formed or natural surface only. The sources for this information are, in the main, local government authorities.

ROADS NORMALLY OPEN FOR GENERAL TRAFFIC, BY SURFACE OF ROADS, 30 JUNE 1970 (kilometres)

LYSAGHT REFEREE

State or Territory	Bitumen or concrete	Gravel, crushed stone and other	Formed only	Cleared only	Total
NSW (a)	53 903	67 044	45 334	42 524	208 804
Vic	50 567	46 280	33 320	32 460	162 627
Qld	32 385	30 203	64 644	64 643	191 874
SA	15 263	30 100	12 291	63 516	121 169
WA (b)	25 717	24 056	43 948	62 941	156 666
Tas	6 265	13 771	2 147		22 183
NT	3 734	1 957	2 940	10 953	19 584
ACT	946	399	42		1 387
Aust	188 781	213 809	481 702		884 296

(a) As at 30 June 1969.

(b) Revised classification by Main Roads Department as at 30 June 1969.

MAJOR DAMS AND RESERVOIRS IN AUSTRALIA

EXISTING DAMS AND RESERVOIRS

Name (Year of completion)	Location	Gross capacity, million cubic metres	Height of wall, metres	Remarks
Ord (Lake Argyle) (1972)	Ord River near Wyndham, WA	5679	99	For irrigation and flood mitigation (flood storage above spillway level 30 800 million cubic metres) and hydro-electric power generation at later stage.
Eucumbene (1958)	Eucumbene River, NSW	4798	116	Part of Snowy Mountains Hydro-electric Scheme.
Eildon (1927, raised 1955)	Upper Goulburn River, Vic	3392	79	Storage for irrigation and hydro-electric power generation.
Hume (1936, raised 1961)	Murray River near Albury, NSW	3084	51	Part of Murray River Scheme: storage for domestic, stock and irrigation purposes. Hydro-electric power station.
Menindee Lakes (1960)	Darling River near Menindee, NSW	2467	18	Part of Darling River Water Conservation Scheme.
Miena (1967)	Great Lake, Tas	2309	18	Storage for Poatina hydro-electric power station.
Warragamba (Burragorang Res) (1960)	Warragamba River, NSW	2092	137	For Sydney water supply and flood mitigation. Hydro-electric power station.
Burrundong (1967)	Macquarie River near Wellington, NSW	1680	76	For conservation and flood mitigation.

Blowering (1968)	..	...	...	Tumut River, NSW	...	1628	112	Regulates discharges from Snowy Mountains Hydro-electric Scheme stations for irrigation. Hydro-electric power station.
Fairbairn (1972)	...	...	...	Nogoa River, Central Qld	...	1444	49	Storage for Emerald Irrigation Area.
Wyangala (1936, raised 1971)	...	...	...	Lachlan River, NSW	...	1220	85	Storage for domestic, stock and irrigation purposes. Hydro-electric power station.
Burrinjuck (1927, raised 1956)	...	...	...	Murrumbidgee River, NSW	...	1032	79	Storage for irrigation. Hydro-electric power station.
Talbingo (1971)	...	...	...	Tumut River, NSW	...	921	162	Part of Snowy Mountains Hydro-electric Scheme.
Somerset (1959)	...	...	...	Stanley River, Qld	...	893	50	Brisbane-Ipswich water supply and flood mitigation. Hydro-electric power station.
Jindabyne (1967)	..	...	...	Snowy River, NSW	...	688	72	Part of Snowy Mountains Hydro-electric Scheme.
Lake Victoria (1928)	...	...	...	Murray River near South Australian border in NSW	...	680	—	Improved natural off-river storage; conserves supplies for South Australia.
Lake Echo (1956)	...	...	...	Lake Echo, Tas	...	545	19	Storage for Lake Echo, Tungatinah, Liapootah, Wayatinah and Lower Derwent hydro-electric power stations.
Clark (Lake King William) (1949, raised 1966)	...	...	...	Derwent River, Tas	...	540	73	Storage for Tarraleah, Liapootah, Wayatinah and Lower Derwent hydro-electric power stations.
Keepit (1960)	...	...	...	Namoi River near Gunnedah, NSW	...	426	55	For conservation. Hydro-electric power station.
Arthur Lakes (1965)	...	...	...	Source of Lake River near Great Lake, Tas	...	423	17	Part of Great Lake hydro-electric power development.

MAJOR DAMS AND RESERVOIRS IN AUSTRALIA (Cont)

EXISTING DAMS AND RESERVOIRS

Name (Year of completion)	Location	Gross capacity, million cubic metres	Height of wall, metres	Remarks
Waranga (1910)	Swamp near Rushworth, Vic	411	12	Off-river storage in Goul- burn Valley for irrigation.
Tinaroo Falls (1958)	Barron River, Nth Qld	407	47	Storage for Mareeba-Dim- bulah irrigation area.
Mokoan (1971)	Winton Swamp near Benalla, Vic	365	10	Storage for irrigation.
Glenbawn (1958)	Hunter River near Scone, NSW	361	78	For conservation and flood mitigation.
Rocklands (1953)	Glenelg River, Vic ...	336	28	Part of Wimmera-Mallee domestic and stock water supply system.
Eppalock (1964)	Campaspe River near Heathcote, Vic	312	45	For irrigation and to supple- ment supply to Bendigo.
Cardinia (1973)	Cardinia Creek near Emerald, Vic	291	79	Part of Melbourne water supply storage.
Darwin River (1972)	Darwin River, NT ...	259	31	Darwin water supply aug- mentation.
Tantangara (1960)	Murrumbidgee River, NSW	254	45	Part of Snowy Mountains Hydro-electric Scheme.
Devils Gate (Lake Barrington) (1969)	Forth River near Dev- onport, Tas	235	84	Mersey-Forth power devel- opment.
Avon (1927)	Avon River, NSW ...	214	72	Part of Sydney water supply storage.

Upper Yarra (1957)	Yarra River, Vic	207	89	Part of Melbourne water supply storage.
Wuruma (1968)	Nogo River near Eidsvold, Qld	194	46	Storage for irrigation.
Glenmaggie (1927, raised 1958)	Macalister River, Gippsland, Vic	190	37	Storage for irrigation.
Lake St Clair (1938)	Central Plateau, Tas	190	3	Improved natural storage for eight Derwent River hydro-electric power stations.
Wellington (1933, raised 1944 and 1960)	Collie River, WA	185	37	For irrigation and water supply.
Koombooloomba (1961)	Tully River, Nth Qld	180	52	For hydro-electric and irrigation purposes.
Serpentine (1961)	Serpentine River, WA	178	55	For Perth water supply.
Lake Brewster (1951)	Lachlan River near Hillston, NSW	153	—	Conservation for Lower Lachlan Valley.
Grahamstown (1969)	Grahamstown River near Newcastle, NSW	153	12	Part of storage system for Newcastle and district water supply.
Cairn Curran (1956)	Loddon River, Vic	149	44	Storage for irrigation.
Liddell (1968)	Gardiners Creek, Muswellbrook, NSW	148	43	Cooling water for Liddell power station.
Eungella (1968)	Broken River, Nth Qld	131	49	For power station cooling water and water supply at Collinsville, and irrigation.
Rowallan (1967)	Mersey River, Nth Tas	130	43	Mersey-Forth hydro-electric power development.
Yarrowonga Weir (1939)	Murray River at Yarrowonga, Vic	117	22	Diversion weir for irrigation.

MAJOR DAMS AND RESERVOIRS IN AUSTRALIA (Cont)

EXISTING DAMS AND RESERVOIRS

Name (Year of completion)	Location	Gross capacity, million cubic metres	Height of wall, metres	Remarks
Cethana (1971)	Forth River near Dev- onport, Tas	108	110	Mersey-Forth power devel- opment.
Beardmore (1972)	Balonne River near St George, Qld	101	15	Storage for irrigation.

DAMS AND RESERVOIRS UNDER CONSTRUCTION

Name	Location	Gross capacity, million cubic metres	Height of wall, metres	Remarks
Lakes Gordon and Pedder	South-west Tas, Gor- don River, Serpentine River, Upper Huon River, (Scotts Peak), Lake Edgar	11 728 2 963	140 38 43 17	Storage for Gordon River hydro-electric power develop- ment.
Dartmouth	Mitta Mitta River, N-E Vic	3 700	180	Additional regulation under River Murray Agreement. Hydro-electric power station.
Copeton	Gwydir River, NSW	1 358	113	Storage for irrigation.

Monduran				586	52	Storage for irrigation.
Kolan River near Gin Gin, Qld						
Glenlyon				261	46	Storage of irrigation for Border Rivers Scheme.
South Dandalup River						
Pike Creek near Stanthorpe, Qld						
Near Mandurah, WA				207	41	Storage for Perth water supply.
North Pine ..				205	44	To supplement supply to north Brisbane area.
Tallowa (Lake Yarrunga)				123	43	Sydney water supply and pumped storage power development.
Shoalhaven River and Kangaroo River Junction, NSW						

DAMS AND RESERVOIRS PROJECTED

Lake Mackintosh				900	77 25	Storage for Pieman hydro-electric power development.
Mackintosh River Tullibardine River near Queenstown, Tas						
Lake Pieman				655	122	Storage for Pieman hydro-electric power development.
Windamere ..				346	69	Storage for irrigation.
Cudgegong River near Mudgee, NSW						
Rosebery				125	75	Storage for Pieman hydro-electric power development.
Googong				119	59	For Canberra water supply.
Queanbeyan River near Canberra, NSW						

DISTANCES BETWEEN AIRPORTS (in kilometres)

Distances converted to kilometres from air miles* actually flown by aircraft following the prescribed airline routes

PERTH

602 KALGOORLIE

1282 617 FORREST

1958 1254 637 CEDUNA

2509 1833 1219 483 ADELAIDE

2897 2221 1604 870 385 MILDURA

3487 2602 1985 1252 769 532 MELBOURNE

4002 3117 2502 1769 1283 1046 517 LAUNCESTON

4173 3289 2672 1939 1454 1219 687 172 HOBART

4063 3178 2561 1828 1343 1107 576 1093 1282 CANBERRA

3845 3169 2552 1819 1335 1576 900 1561 1732 280 SYDNEY

4263 2308 1691 957 474 294 826 1341 1511 1359 1080 BROKEN HILL

4706 4030 3415 2680 2196 2437 1761 2422 2593 1141 861 1941 BRISBANE

5308 4632 4015 3282 2798 3041 2363 3024 3195 1743 1463 2543 602 ROCKHAMPTON

6010 5334 4717 3984 3500 3743 3065 3726 3897 2445 2165 3243 1304 702 TOWNSVILLE

6351 5669 5052 4319 3834 4078 3398 4060 4232 2778 2500 3578 1637 1037 335 CAIRNS

6936 6252 5636 4902 4419 4661 3984 4645 4815 3363 3084 4163 2222 1621 919 585 NORMANTON

*(Table in air miles originally provided by courtesy of the Department of Civil Aviation)

BRICKS AND BRICKWORK

METRIC BRICK TYPE

Standard

Modular

Modulated

Modulated

BRICK SIZE, mm

230 x 110 x 76

290 x 90 x 90

290 x 90 x 76

290 x 90 x 65

FORMAT: All metric bricks fulfil the dimensional co-ordination requirement to fit a 600 mm grid in all directions.

METRIC BRICKWORK DIMENSIONS

METRIC STANDARD BRICK

Size: 230 x 110 x 76 mm

No of Bricks per course	Wall, mm	Pier, mm	Opening, mm	No of Courses	Height of Bkwb, mm
1	240	230	250	1	86
1-1/2	360	350	370	2	172
2	480	470	490	3	257
2-1/2	600	590	610	4	343
3	720	710	730	5	429
3-1/2	840	830	850	6	514
4	960	950	970	7	600
4-1/2	1080	1070	1090	8	686
5	1200	1190	1210	9	772
5-1/2	1320	1310	1330	10	857
6	1440	1430	1450	11	943
6-1/2	1560	1550	1570	12	1029
7	1680	1670	1690	13	1114
7-1/2	1800	1790	1810	14	1200
8	1920	1910	1930	15	1286
8-1/2	2040	2030	2050	16	1372
9	2160	2150	2170	17	1457
9-1/2	2280	2270	2290	18	1543
10	2400	2390	2410	19	1629
10-1/2	2520	2510	2530	20	1714
11	2640	2630	2650	21	1800
11-1/2	2760	2750	2770	22	1886
12	2880	2870	2890	23	1972
12-1/2	3000	2990	3010	24	2057
13	3120	3110	3130	25	2143
13-1/2	3240	3230	3250	26	2229
14	3360	3350	3370	27	2314
14-1/2	3480	3470	3490	28	2400
15	3600	3590	3610	29	2486
15-1/2	3720	3710	3730	30	2572
16	3840	3830	3850	31	2657
16-1/2	3960	3950	3970	32	2743
17	4080	4070	4090	33	2829
17-1/2	4200	4190	4210	34	2914
18	4320	4310	4330	35	3000
18-1/2	4440	4430	4450	36	3086
19	4560	4550	4570	37	3172
19-1/2	4680	4670	4690	38	3257
20	4800	4790	4810	39	3343
				40	3429

METRIC BRICKWORK DIMENSIONS (Cont)

METRIC MODULAR BRICK

Size: 290 x 90 x 90 mm

No of Bricks per course	Wall, mm	Pier, mm	Opening, mm	No of Courses	Height of Bkww, mm
1	300	290	310	1	100
1-1/3	400	390	410	2	200
1-2/3	500	490	510	3	300
2	600	590	610	4	400
2-1/3	700	690	710	5	500
2-2/3	800	790	810	6	600
3	900	890	910	7	700
3-1/3	1000	990	1010	8	800
3-2/3	1100	1090	1110	9	900
4	1200	1190	1210	10	1000
4-1/3	1300	1290	1310	11	1100
4-2/3	1400	1390	1410	12	1200
5	1500	1490	1510	13	1300
5-1/3	1600	1590	1610	14	1400
5-2/3	1700	1690	1710	15	1500
6	1800	1790	1810	16	1600
6-1/3	1900	1890	1910	17	1700
6-2/3	2000	1990	2010	18	1800
7	2100	2090	2110	19	1900
7-1/3	2200	2190	2210	20	2000
7-2/3	2300	2290	2310	21	2100
8	2400	2390	2410	22	2200
8-1/3	2500	2490	2510	23	2300
8-2/3	2600	2590	2610	24	2400
9	2700	2690	2710	25	2500
9-1/3	2800	2790	2810	26	2600
9-2/3	2900	2890	2910	27	2700
10	3000	2990	3010	28	2800
10-1/3	3100	3090	3110	29	2900
10-2/3	3200	3190	3210	30	3000
11	3300	3290	3310	31	3100
11-1/3	3400	3390	3410	32	3200
11-2/3	3500	3490	3510	33	3300
12	3600	3590	3610	34	3400
12-1/3	3700	3690	3710	35	3500
12-2/3	3800	3790	3810	36	3600
13	3900	3890	3910	37	3700
13-1/3	4000	3990	4010	38	3800
13-2/3	4100	4090	4110	39	3900
14	4200	4190	4210	40	4000

METRIC BRICKWORK DIMENSIONS (Cont)

METRIC MODULATED BRICK

Size: 290 x 90 x 76 mm

No of Bricks per course	Wall, mm	Pier, mm	Opening, mm	No of Courses	Height of Bkwk, mm
1	300	290	310	1	86
1-1/3	400	390	410	2	172
1-2/3	500	490	510	3	257
2	600	590	610	4	343
2-1/3	700	690	710	5	429
2-2/3	800	790	810	6	514
3	900	890	910	7	600
3-1/3	1000	990	1010	8	686
3-2/3	1100	1090	1110	9	772
4	1200	1190	1210	10	857
4-1/3	1300	1290	1310	11	943
4-2/3	1400	1390	1410	12	1029
5	1500	1490	1510	13	1114
5-1/3	1600	1590	1610	14	1200
5-2/3	1700	1690	1710	15	1286
6	1800	1790	1810	16	1372
6-1/3	1900	1890	1910	17	1457
6-2/3	2000	1990	2010	18	1543
7	2100	2090	2110	19	1629
7-1/3	2200	2190	2210	20	1714
7-2/3	2300	2290	2310	21	1800
8	2400	2390	2410	22	1886
8-1/3	2500	2490	2510	23	1972
8-2/3	2600	2590	2610	24	2057
9	2700	2690	2710	25	2143
9-1/3	2800	2790	2810	26	2229
9-2/3	2900	2890	2910	27	2314
10	3000	2990	3010	28	2400
10-1/3	3100	3090	3110	29	2486
10-2/3	3200	3190	3210	30	2572
11	3300	3290	3310	31	2657
11-1/3	3400	3390	3410	32	2743
11-2/3	3500	3490	3510	33	2829
12	3600	3590	3610	34	2914
12-1/3	3700	3690	3710	35	3000
12-2/3	3800	3790	3810	36	3086
13	3900	3890	3910	37	3172
13-1/3	4000	3990	4010	38	3257
13-2/3	4100	4090	4110	39	3343
14	4200	4190	4210	40	3429
14-1/3	4300	4290	4310	41	3514
14-2/3	4400	4390	4410	42	3600
15	4500	4490	4510		

METRIC BRICKWORK DIMENSIONS (Cont)

METRIC MODULATED BRICK

Size: 290 x 90 x 65 mm

No of Bricks per course	Wall, mm	Pier, mm	Opening, mm	No of Courses	Height of Bkwk, mm
1	300	290	310	1	75
1-1/3	400	390	410	2	150
1-2/3	500	490	510	3	225
2	600	590	610	4	300
2-1/3	700	690	710	5	375
2-2/3	800	790	810	6	450
3	900	890	910	7	525
3-1/3	1000	990	1010	8	600
3-2/3	1100	1090	1110	9	675
4	1200	1190	1210	10	750
4-1/3	1300	1290	1310	11	825
4-2/3	1400	1390	1410	12	900
5	1500	1490	1510	13	975
5-1/3	1600	1590	1610	14	1050
5-2/3	1700	1690	1710	15	1125
6	1800	1790	1810	16	1200
6-1/3	1900	1890	1910	17	1275
6-2/3	2000	1990	2010	18	1350
7	2100	2090	2110	19	1425
7-1/3	2200	2190	2210	20	1500
7-2/3	2300	2290	2310	21	1575
8	2400	2390	2410	22	1650
8-1/3	2500	2490	2510	23	1725
8-2/3	2600	2590	2610	24	1800
9	2700	2690	2710	25	1875
9-1/3	2800	2790	2810	26	1950
9-2/3	2900	2890	2910	27	2025
10	3000	2990	3010	28	2100
10-1/3	3100	3090	3110	29	2175
10-2/3	3200	3190	3210	30	2250
11	3300	3290	3310	31	2325
11-1/3	3400	3390	3410	32	2400
11-2/3	3500	3490	3510	33	2475
12	3600	3590	3610	34	2550
12-1/3	3700	3690	3710	35	2625
12-2/3	3800	3790	3810	36	2700
13	3900	3890	3910	37	2775
13-1/3	4000	3990	4010	38	2850
13-2/3	4100	4090	4110	39	2925
14	4200	4190	4210	40	3000
14-1/3	4300	4290	4310		
14-2/3	4400	4390	4410		
15	4500	4490	4510		

- NOTES: 1. Length of wall:
 $\text{No of bricks (n)} \times (\text{Brick (B)} + \text{Joint (J)})$
 2. Width of openings: $n \times (\text{B} + \text{J}) + 10 \text{ mm}$
 3. Height of brickwork: $n \times (\text{B} + \text{J})$
 4. Brick joints are 10 mm nominal

WALL TIES FOR CAVITY WALLS TO SAA BRICKWORK CODE

Table 1. Recommended Spacing and Type of Wall Ties

MODULAR METRIC BRICK
90 mm THICK LEAF x 100 mm COURSE HEIGHT

Cavity Width	Vertical Spacing			Type of Tie*
	Every 3rd Course (300 mm)	Every 4th Course (400 mm)	Every 6th Course (600 mm)	
	Horizontal Spacing—mm			
60 mm	1200	900	600	1
95 mm	1200	900	600	2
110 mm	600	500	300	2

STANDARD METRIC BRICK
110 mm THICK LEAF x 86 mm COURSE HEIGHT

Cavity Width	Vertical Spacing			Type of Tie*
	Every 4th Course (343 mm)	Every 5th Course (429 mm)	Every 7th Course (600 mm)	
	Horizontal Spacing—mm			
55 mm & 70 mm	1200	900	600	1

Notes on Table 1

- The SAA Brickwork Code, AS CA47-1969, permits the spacing of brick-ties to be varied provided that the number of ties per unit area is maintained, and the spacing is as uniform as practicable. Table 2 assists in the calculation of tie spacings.
- Additional ties to the extent of one for each 300 mm of opening height shall be provided near the sides of openings and at discontinuities in the brickwork.
- The minimum embedment of a tie in the mortar joint shall be 50 mm in each leaf.

Table 2. Variations in Wall Tie Spacings

Least Leaf Thickness, mm	Cavity Width, mm	Maximum Area per Tie = Horizontal Spacing × Vertical Spacing	Type of Tie*
90 or more	75 or less	417 000 mm ²	1
90 or more	75 to 100	348 000 mm ²	2
90 or more	100 to 165	208 000 mm ²	2
76	50 or less	208 000 mm ²	1

Example in the Use of Table 2.

Calculate the spacing of ties in a cavity brick wall consisting of modular metric brick external skin with a modulated metric faced brick (Format 300 x 100 x 86) internal skin. Cavity width is 110 mm.

Choose vertical tie spacings at 600 mm because this is common to both forms of brickwork.

$$\text{Horizontal spacing} = \frac{208\,000}{600} = 347 \text{ mm}$$

$$\text{Rounding off} = 350 \text{ or } 300 \text{ mm}$$

Use 6.3 mm dia galvanized mild steel ties or vertical twist type to BS 1243. Minimum tie length 210 mm.

***Type of Tie**

1. 3.15 mm galvanized wire tie in accordance with SAA Int 324 (Fig 2)
2. 6.3 mm dia galvanized mild steel tie, or vertical twist type wall ties to BS 1243

3.15 mm and 6.3 mm diameter wire sizes are recommended preferred metric wire sizes (based on the ISO R10 Series of preferred numbers) in Australian Standard 1153—1972.

MORTAR FOR BRICKWORK:

- (a) Cement mortar should be used where a high degree of impermeability is required, as in walls and piers below damp-proof course, or where high strength is required, as in piers or walls carrying heavy loads. Usual proportions are 1 part cement to 3 parts sand, or 1 part cement to 4 parts sand by volume.
- (b) Lime mortar is frequently used where strength is of less importance; it is more workable than cement mortar, resulting in a higher rate of bricklaying. Usual proportions are 3 to 4 parts of sand to 1 part of hydrated lime or lime putty by volume.
- (c) Composition mortars consist of cement, hydrated lime, and sand, and are intermediate between cement and lime mortars in regard to strength and workability. Proportions used vary from a cement mortar with added lime equal to 10% of cement volume (to improve workability) to a lime mortar gauged with 10% cement immediately before use to improve robustness of the job; satisfactory proportions for normal brickwork are included in the following table:

COMPOSITION MORTAR MIX PROPORTIONS

Class of Work	Nominal Mix Proportions by Volume (cement : lime : sand)	Materials for one cubic metre of mortar			Added Water per bag of cement, litre
		Cement, bags	Lime, bags	Sand, m ³	
Brickwork and Blockwork	1 : 1 : 6	7	4	1.2	30
Render and Plaster	1 : 0 : 3	13	—	1.2	15
	or 1 : 0.1 : 3	12	1	1.2	15

Note: Where masonry cement is used in mortar, mix proportions may be different—check with supplier.

CONCRETE MASONRY

Concrete masonry walls, in addition to the more routine uses, offer special properties such as high sound absorption coefficients, high sound transmission loss, and good thermal insulation and fire resistance.

DESIGN

The design of concrete masonry structures is regulated by Australian Codes and Standards and Building Regulations of State Government. 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.

ESTIMATING DATA

1250 No 400 mm x 200 mm (face area) units occupy 100 m² wall face area.

100 m² of wall face area requires 1.5 m³ of mortar. This is for face shell bedding, with no allowance for wastage or variation in joint size. This quantity applies to 100, 150 and 200 mm wide hollow units.

SPECIFICATION FOR BUILDING MASONRY WALLS

Modular Planning.— To achieve economy in construction, concrete masonry walls should be dimensioned to take full advantage of full, quarter, half and three-quarter length units.

Dimensions of Blocks.— All manufacturing dimensions of blocks are 10 mm less than nominal dimensions, to allow for a standard 10 mm mortar joint. The nominal length and height of standard blocks are 400 mm and 200 mm respectively. Nominal length and height dimensions of other blocks are multiples of 100 mm. Standard nominal block widths are 100, 150 and

200 mm. For standard blocks, joint spacings both vertically and horizontally will be 200 mm or multiples thereof. Wall length measurements will be multiples of 100 mm minus 10 mm and openings will be multiples of 100 mm plus 10 mm to allow for one joint.

Laying.— Dry units are essential. They should never be wetted to control suction prior to application of mortar. Keep blocks as dry as possible on the site. Moreover, at the stoppage of work the tops of the walls should be covered to prevent moisture entering the cores of the blocks.

In single leaf construction the first bed joints on the footings and at damp-proof courses shall be fully bedded. Thereafter, vertical and horizontal joints shall be face shell bedded only, care being taken not to allow mortar to spread over the webs or drop into cavities to create bridging. Full bedding should be used in columns and piers intended to carry heavy loads.

Mortar Mix.— The function of mortar is to provide an even bedding for the block, adequate compressive strength, resistance to shear and tension, adhesion between mortar and block, durability and weather resistance.

Tests have shown that to get the most satisfactory balance between strength shrinkage and adhesion for general purpose block laying, the following recommendations should be followed:

Above damp-proof course level —

- 1 part Portland cement
- 1 part hydrated lime
- 6 parts clean pit sand

Below damp-proof course level —

Lime and cement lime mortars are unsuitable for use in retaining walls and in structures below damp-proof course level. The following mix is recommended:—

- 1 part Portland cement
- 3 parts clean pit sand

To make approximately 1 cubic metre of mortar, the following materials are required:—

1:1:6 mortar	cement	7 bags
	lime	4 bags
	sand	1.2 cubic metres*
	water	210 litres

1:3 mortar	cement	13 bags
	sand	1.2 cubic metres*
	water	195 litres

For a 1 bag mix:—

1:1:6 mortar	cement	1 bag
	lime	0.6 bag
	sand	0.18 cubic metres*
	water	30 litres
	yield —	approx 0.15 cubic metres

1:3 mortar	cement	1 bag
	sand	0.09 cubic metres*
	water	15 litres
	yield —	approx 0.08 cubic metres

* Including allowance made for bulking of damp sand.

Note that cement is sold in 40 kg bags (25 per tonne) containing approximately 0.03 m^3 , and lime is sold in 25 kg bags (40 per tonne) containing approximately 0.045 m^3 .

Tooling Joints.— The mortar squeezed from the joints should be struck off flush with the wall as each block is laid. When the mortar has stiffened somewhat, it is firmly compacted with a jointing tool. This compaction is important since mortar, when hardening, has a tendency to shrink slightly.

Support of walls during Construction.— Concrete masonry walls must be braced during construction against lateral loads, including 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 SAA Code for Concrete Block Masonry.

Sills.— Where standard sill blocks are shown to window openings no flashing is necessary. Where paving slab or other sill construction is shown, flashing is necessary. Flashing should be detailed by the designer.

Top Plates.— These should be fixed by means of bolts grouted into the block core holes to sufficient depth to prevent roof structure failure resulting from wind loads. This should be detailed by the designer.

External Finish.— The use of single leaf external walls is not recommended where weather resistance is required unless walls are protected by wide eave overhang. Properly flashed and drained cavity walls are preferable. Where single leaf exterior walls are used, and they are required to be weather resistant, the external surfaces should be sealed with a durable water resistant exterior coating. Portland cement base paint is satisfactory and should be applied in two coats to the manufacturer's recommendations.

The degree of weather resistance of a wall depends to a large extent on the wall movement control characteristics incorporated in its design, the proper flashing and drainage of wall openings and penetrations, and the standard of block laying and mortar joints. If these items have not been performed correctly, painting will prove at best a temporary expedient.

Damp-proof Courses.— Damp-proof courses should be provided in accordance with recognized practice.

CONCRETE MASONRY — DIMENSIONS

Note that wall panels are 10 mm shorter and openings 10 mm longer than figures below.

No of Blocks	LENGTH, mm (based on 400 mm long units)				HEIGHT, mm (based on 200 mm high units)	
	Full Blocks	+ Fractional Blocks			No of Courses	Height
		¼	½	¾		
1	400	500	600	700	1	200
2	800	900	1000	1100	2	400
3	1200	1300	1400	1500	3	600
4	1600	1700	1800	1900	4	800
5	2000	2100	2200	2300	5	1000
6	2400	2500	2600	2700	6	1200
7	2800	2900	3000	3100	7	1400
8	3200	3300	3400	3500	8	1600
9	3600	3700	3800	3900	9	1800
10	4000	4100	4200	4300	10	2000
11	4400	4500	4600	4700	11	2200
12	4800	4900	5000	5100	12	2400
13	5200	5300	5400	5500	13	2600
14	5600	5700	5800	5900	14	2800
15	6000	6100	6200	6300	15	3000
16	6400	6500	6600	6700	16	3200
17	6800	6900	7000	7100	17	3400
18	7200	7300	7400	7500	18	3600
19	7600	7700	7800	7900	19	3800
20	8000	8100	8200	8300	20	4000

HOW TO MAKE GOOD CONCRETE

Proportions.— Correct proportions of cement, aggregate and water depend on nature of work for which concrete is intended, and character and condition of aggregate. Masonry cement must not be used in concrete. Table of quantities for various classes of work is given below.

CONCRETE MIX PROPORTIONS

Class of Work	Nominal Mix Proportions by Volume (cement:sand:stone)	Materials Required for one cubic metre of concrete			Added water per bag of cement, litre
		Cement, bags	Sand, m ³	Stone, m ³	
Structural Concrete Reinforced walls, columns, elevated slabs	1:2:3	10	0.6*	0.9 (1.3 tonne)	20
Wearing Surfaces Heavy duty paths, roads, slabs. Watertight Concrete					
Unreinforced Concrete Mass footings, light duty paths and drives	1:2:4	8	0.5*	1.0 (1.4 tonne)	20

* NOTE: When ordering sand, allow extra to the above figure for losses plus "bulking" due to wet sand i.e. order 0.7 — 0.8 cubic metres (about 1 tonne) of sand for each cubic metre of concrete.

Job proportioning may be by volume or mass; volumetric method is usual for small jobs. Water should be kept to a minimum, adding only sufficient for a workable mix.

MATERIALS

Portland Cement.— Normal type suited to all normal work; High-Early Strength and Low-Heat for special applications only.

Packing.— Paper bags hold 40 kilograms
ie, 25 bags = 1 tonne.

Storage.— Must be dry; stack off the ground and away from exterior walls, and in a manner so that only limited air circulation through stack is possible. At time of use, cement should be free-flowing and free from lumps.

Sand or Fine Aggregate.— Must be clean and free from earth, clay, humus, etc; a coarse sand is best for concrete making, but particles should preferably be graded from coarse to fine. A sand containing silt and/or clay should be washed before use.

Coarse Aggregate.— May be gravel or crushed stone, graded from the largest particles down to the size of the largest sand grains to be used. Particles should be clean, hard, impervious and free from organic matter.

Other Aggregate.— (1) Crushed blast furnace slag may be an economic and satisfactory material. (2) Cinders and coke-breeze should be used only for unimportant work unless previous experience has shown material from the same source to be satisfactory. (3) Low mass aggregate of the bloated clay or shale type is suitable for structural concretes with strengths up to 30 MPa. The concrete density varies from 1.6 to 2.0 t/m³. (4) Exceptionally low mass aggregate — vermiculite or perlite — can be used for concretes where no structural strength is required. It has excellent sound-absorbing and heat-resisting properties. It is suitable for use as a fire-proofing medium.

Water.— Should be drinkable.

Uses of Concrete.— Information relating to concrete problems will be given upon request to the Cement and Concrete Association of Australia, 147 Walker Street, North Sydney, New South Wales 2060.

MIXING

Concrete should preferably be mixed in a concrete mixer, hand or power operated or may be hand mixed. Mixers, when used, should revolve at speeds recommended by makers, and a minimum mixing time of one and one-half to two minutes after addition of all ingredients is recommended.

HAND MIXING is carried out as follows:—

Equipment.— Shovel, mixing board, watering can, measuring box.

Method.— (1) Sand measured and spread on mixing board.

(2) Cement spread over sand.

(3) Sand and cement turned over with shovels until thoroughly mixed and uniform colour throughout.

(4) Coarse aggregate measured, spread on top, and mixing process repeated until colour again uniform.

(5) Water added slowly in depression in centre and mixed as added until whole has a quaky, jelly-like consistency.

PLACING

(1) When concrete is thoroughly mixed, place without delay; concrete made with ordinary Portland cement should be placed within half an hour of mixing in summer and three-quarters of an hour in winter.

(2) Place with care, avoiding chuting and dumping, which causes segregation of coarse from fine material.

(3) Place as near as possible to final position; working concrete along in forms causes segregation.

(4) Work thoroughly in mass of concrete against forms to ensure good packing.

(5) When placing against hardened concrete thoroughly wire-brush surface and wash to remove all loose particles.

Curing.— As soon as placed, protect concrete against drying out by shading. When hard enough to resist finger impressions, cover, and keep moist for at least one week.

Watertight Concrete.— Essential requirements for watertight concrete are as follows:—

- (1) Suitable design (to prevent cracking).
- (2) Sound, well-graded aggregates of low porosity.
- (3) Limited amount of mixing water.
- (4) Plastic, workable mixes.
- (5) Thorough mixing.
- (6) Proper placing and compacting.
- (7) Favourable curing conditions.

Coloured Concrete.— Colour pigments for use with cement must be —

- (1) Proof against lime, alkali, and action of direct sunlight.
- (2) Very finely ground, insoluble in water, and uniform in shade and quality.

The most suitable pigments are metallic oxides of a high degree of purity; low-grade pigments must be used in larger quantities, thereby reducing strength and quality of the concrete or mortar. A pure white is obtained only by use of white Portland cement with white sand, crushed marble, etc.

For economy, pigment and cement should be ground together; or, failing this, sieved together to a uniform colour throughout. A steel floating trowel gives a darker colour than a wooden float. Concrete cured in sunlight will be given a lighter colour than if cured in shade.

Coloured concrete is darker when wet than when dry. Trowelling on partly hardened surfaces causes colour blotches.

Amount of pigment depends on a number of factors, and may vary from about 2 to 5 kg per bag of cement.

Use of the following pigments is recommended:—

Colour	Pigment
Red	Iron oxide.
Yellow	Iron oxide or hydroxide.
Brown	Iron oxide.
Black	Iron oxide or manganese dioxide. (Lamp black should NOT be used.)
Green	Chromium oxide.
Blue	Cobalt oxide.

Pigments may be mixed to give other effects as desired. Coloured cements with white cement as a base are available.

Formwork.— The following points must be observed if a good concrete job is to be obtained at lowest cost.

- (1) Shuttering must be strong and rigid.
- (2) It must be designed for removal without excessive damage to concrete or timber.
- (3) It must be carefully made and erected to avoid gaps between boards, panels, etc, which may require filling with clay, putty, or other suitable material.
- (4) It must be treated to prevent concrete from adhering to it.
- (5) It must not be removed until concrete has sufficient strength; this period will be longer in cold than in warm weather.

Reinforced Concrete.— Concrete is strong in compression, weak in tension; hence, when tensile stresses are to be carried, steel bars are used to reinforce the concrete. Determination of the amount and placing of the steel require expert knowledge, and are not matters for the layman; once determined, the steel must be accurately placed on the job.

Paving and Rendering.— Materials required for 100 m² of surface:—

Paving Thickness, mm	Concrete Mix (by volume)					
	1:2:3			1:2:4		
	Cement, bags	Sand, m ³	Stone, m ³	Cement, bags	Sand, m ³	Stone, m ³
50 (light traffic)	50	3	4.5	40	2.5	5
75 (normal path)	75	4.5	7	60	4	7.5
100 (car drive)	100	6	9	80	5	10
150 (heavy truck)	150	9	14	120	7.5	15

Render Thickness, mm	Render Proportions (by volume)							
	1:3		1 : 0.1 : 3			1:1:6		
	Cement, bags	Sand, m ³	Cement, bags	Lime, bags	Sand, m ³	Cement, bags	Lime, bags	Sand, m ³
10	13	1.2	12	1	1.2	7	4	1.2
15	20	1.8	18	1.5	1.8	11	6	1.8
20	26	2.4	24	2	2.4	14	8	2.4

- Note: 1. Allow extra for waste
eg, plus 20% for sand and plus 10% for stone.
2. The mass of one cubic metre of sand or stone is approximately 1.4 tonnes.

REINFORCING FABRIC

RECTANGULAR MESHES

Standard Sheets — 6 m x 2.4 m = 14.4 m²

AS 1304 Ref No	Standard Unit	Longitudinal Wires		Cross Wires		Mass per Sheet, kg
		Size, mm	Pitch, mm	Size, mm	Pitch, mm	
F 1218	Sheet	12.5	@ 100	8	@ 200	173
F 1118	Sheet	11.2	@ 100	8	@ 200	144
F 1018	Sheet	10	@ 100	8	@ 200	121
F 918	Sheet	9	@ 100	8	@ 200	103
F 818	Sheet	8	@ 100	8	@ 200	88
F 718	Sheet	7.1	@ 100	8	@ 200	75
F 928	Sheet	9	@ 200	8	@ 250	62
F 828	Sheet	8	@ 200	8	@ 250	54

SQUARE MESHES

Standard Sheets — 6 m x 2.4 m = 14.4 m²

Standard Rolls — 60 m x 2.4 m = 144.0 m²

AS 1304 Ref No	Standard Unit	Longitudinal Wires		Cross Wires		Mass per Sheet or Roll, kg
		Size, mm	Pitch, mm	Size, mm	Pitch, mm	
F 81	Sheet	8	@ 100	8	@ 100	116
F 102	Sheet	10	@ 200	10	@ 200	92
F 92	Sheet	9	@ 200	9	@ 200	75
F 82	Sheet	8	@ 200	8	@ 200	59
F 72	Sheet	7.1	@ 200	7.1	@ 200	47
F 62	Sheet	6.3	@ 200	6.3	@ 200	37
F 52	Sheet	5	@ 200	5	@ 200	23
F 52	Roll	5	@ 200	5	@ 200	231
F 42	Sheet	4	@ 200	4	@ 200	15
F 42	Roll	4	@ 200	4	@ 200	148

STEEL REINFORCING BARS FOR CONCRETE

All details for Steel Reinforcing Bars for Concrete are contained in Australian Standard 1302-1973.

STANDARD REINFORCING BAR DIMENSION AND MASS PER UNIT LENGTH

Bar Size, mm	Calculated Mass per Unit Length, kg/m	Nominal Area, mm ²	Theoretical Area, mm ²	Nominal Perimeter, mm
10	0.616	80	78.5	—
12	0.888	110	113.1	37.7
16	1.579	200	201.1	50.3
20	2.466	310	314.2	62.8
24	3.551	450	452.4	75.4
28	4.834	620	615.8	88.0
32	6.313	800	804.2	100.5
36	7.991	1020	1017.9	113.1
40	9.864	1260	1256.6	125.7
50	15.413	1960	1963.5	157.1

ELECTRICITY

FUNDAMENTAL UNITS:

Ampere is the unit in which electric current flow is measured.

Ohm is the unit in which resistance to the flow 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.

$$\text{watts} = \text{volts} \times \text{amperes}$$

Kilowatt hour.— For commercial purposes electrical energy is charged for in units of 1000 watt hours, and is called the Board of Trade unit or kilowatt hour.

$$\text{kW.h} = \frac{\text{volts} \times \text{amperes} \times \text{hours}}{1000} \quad \text{or} \quad \frac{\text{watts} \times \text{hours}}{1000}$$

Example: To find the cost of burning five 60-watt lamps for ten hours, assuming the cost per unit to be 3 cents —

$$\text{Cost} = \frac{60 \times 5 \times 10 \times 3\text{c}}{1000} = \$0.09$$

$$\text{kilowatts} = \frac{\text{watts}}{1000}$$

The normal voltage for household appliances is 240; for 3-phase motors, etc, 415.

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. The colours red and black have been used to identify the current-carrying conductors.

Recently, in conformity with overseas practice, the Statutory Electrical Authorities throughout Australia, agreed to accept an alternative system of colour coding.

The existing colours and alternative colours are:—

Existing Colour	Alternative Colour
Red	Brown
Black	Blue
Green	Green/Yellow*

* Striped conductor. Stripes may be either straight or helical.

It is permissible for a green/yellow earthing conductor to be used in conjunction with current-carrying conductors having existing colours.

It is essential for the earthing conductor to be correctly identified and correctly connected to the earth terminal marked "E" or "EARTH" on the fitting or appliance.

HINTS:

Do NOT take risks with electricity.

Do NOT use frayed or damaged cords or flexibles on portable appliances — THEY ARE DANGEROUS.

WATER is injurious to most electrical equipment.

DO NOT handle wet or damp metal-clad switchgear unless it is effectively EARTHED. If in doubt, have it inspected by a competent electrician, or cover the hand with a rubber glove, several thicknesses of dry cloth, or similar material before attempting to touch.

Portable appliances, unless double insulated, should be earthed by means of the appropriate type of flexible cord and plug to an earth plug socket.

A cable carrying electric current (amperes) greater than its capacity will develop excessive heat. This is injurious to insulation (except in special applications) and uneconomical.

The fuse is there for protection. ALWAYS use the correct wire sizes and material (usually copper) when replacing fuses. Oversize fuse wire is dangerous. Frequent blowing of a fuse justifies a check being made.

In all cases of electric shock, remove person from danger zone and apply artificial respiration until medical aid arrives.

STEEL WIRE ROPES

A wire rope is made up of a number of strands, each comprised of a combination of wires or wires and fibres laid over a core. This may be made of fibre or an independent wire rope core (IWRC).

FACTORS OF SAFETY

Factors of safety are outlined in Australian Standard CB2 known as the SAA Crane and Hoist Code. Some of the more commonly used factors are shown below but these may vary slightly in various Australian States. Reference to CB2 should always be made for such important detail.

Cranes (Hook Hoist, Grab Hoist), Derrick Fall and Boom Lines	6
Service Winch or Block Ropes	6
Shovels and Excavating Equipment	5 to 6 min
Derrick Crane Guys	5
Logging Skylines, Main Cableways	4
Logging Spar Tree Guys and Stack Guys	3½ to 4
Incline Haulages	6 to 8

THE CHIEF COMPONENT PARTS OF A STEEL WIRE ROPE ARE:

- (1) The wires which are used to form the strands.
- (2) The strands which are laid together to form the rope.
- (3) The core which provides the foundation on which the rope strands are laid.

To describe a wire rope fully the following characteristics should be specified:

Description of Item	Example
(a) Dimensions:	
Length	1000 mm
Diameter	26 mm
(b) Construction:	
Number of strands	6
Number of wires per strand ..	x 36

Arrangement of wires in strands	14/7 & 7/7/1
Lay: Direction and type	RHOL
Core	IWRC
Whether preformed or not preformed	Preformed
(c) Steel Grade:*	1770
(d) Lubrication:	
Petroleum jelly, Mytilus, Crater, Corbula, etc	Corbula

* Steel Grade is designated by a number which is equal to the rope tensile strength in megapascals. If a galvanized rope is required the prefix "G" is added to the number; example G1770.

POINTS OF WIRE ROPE USAGE

EQUIPMENT:

It is important for maximum economical, efficient and safe rope life that the equipment on which it operates be maintained in good working condition.

Before making or altering recommendations for new ropes, close inspection of the equipment and the working conditions should be made. All steps should be taken to correct such items as:

- (1) Worn drum and sheave grooves which pinch and distort the rope — especially Langs Lay rope.
- (2) Worn sheave bearings and faulty alignment between sheaves and drum which can lead to heavy abrasion of the rope between it and the sides of the sheave grooves.
- (3) Undue vibration or whipping of the rope which can lead to fatigue failures of the rope wires.
- (4) Obstructions in the path of the rope against which it may rub and cause excessive wear on the rope.
- (5) Lack of suitable lubrication of the rope and its core to prevent corrosion and reduce internal friction and wear between the wires and strands.

Contrary to the belief of many users, the lubricant applied during the manufacture of the rope is seldom

sufficient to last out the life of the rope, and the rope lubricant should be replenished regularly right from the time of the rope's installation.

THE STORAGE, HANDLING AND FITTING:

The storage, handling and fitting of the rope prior to its installation should be checked to see that:

- (1) The rope is stored under dry conditions off the ground and free from corrosive fumes or moisture.
- (2) The rope is coiled on to or off the reel coil so that all tendency to form loops or kinks in the rope is avoided.
- (3) Where rope is stored for long periods under hot conditions the reel or coil is turned at intervals to prevent the lubricant from draining to the bottom of the reel or coil.
- (4) The rope is suitably seized with a marline, annealed wire or strand seizing before cutting the rope to prevent distortion of the lay and strands.
- (5) All end fittings and attachments are suitable for the work, properly fitted and maintained in good safe working order during the life of the rope.

TINPLATE (INCLUDING TIN SHEET AND BLACKPLATE)

For tinplate ordering, pricing and calculations the international term or unit "sita" is preferred. Sita is derived from the initial letters of "System International Tinplate Area". One sita is equal to 100 square metres. Tinplate is sometimes ordered by the package or by the tonne. One package contains 100 sheets irrespective of thickness.

Thicknesses available are (millimetres):

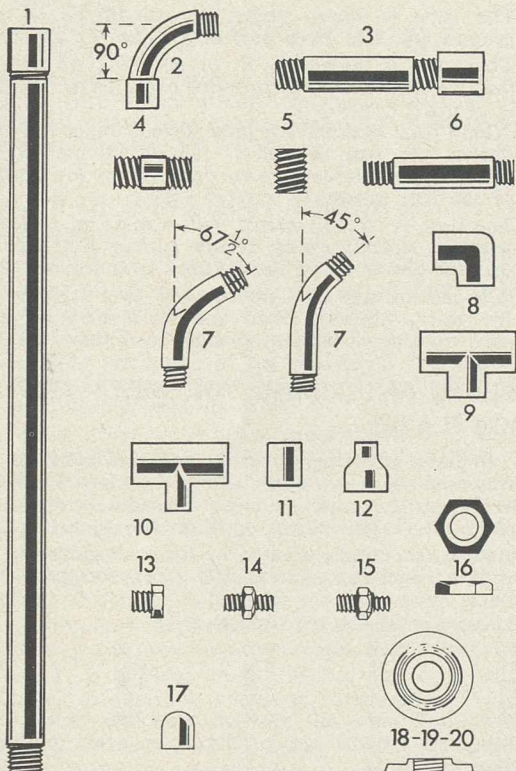
0.20	0.26	0.33	0.43	0.60
0.21	0.28	0.35	0.45	0.65
0.22	0.30	0.36	0.50	0.70
0.24	0.31	0.38	0.55	0.80
0.25	0.32	0.40	0.58	0.90

Widths and lengths are produced in even millimetre increments only.



**TUBEMAKERS OF AUSTRALIA LIMITED,
STEWARTS & LLOYDS DIVISION**

**S & L SCREWED AND SOCKETED
STEEL TUBES AND FITTINGS**



[illegible]



PIPE CHARACTERISTICS

Plain End and Screwed and Socketed Steel Tubes

Pipe Size Designa- tion	Outside Dia, mm	Quality	Wall Thick- ness, mm	metres per tonne		Pipe Size Designa- tion	Outside Dia, mm	Quality	Wall Thick- ness, mm	metres per tonne		
				P/E	S & S					P/E	S & S	
8 NB	13.5	Medium	2.3	1538	1529	40 NB	48.3	Medium	3.2	277	274	
		Med Galv	2.3	1466	1458			Med Galv	3.2	268	265	
		Heavy	2.9	1300	1294			Heavy	4.0	226	224	
		Hvy Galv	2.9	1253	1247			Hvy Galv	4.0	220	218	
10 NB	17.2	Refrigerant	2.9	1295	—	50 NB	60.3	Refrigerant	5.4	175	—	
		Medium	2.3	1174	1166			Medium	3.6	196	193	
		Med Galv	2.3	1119	1111			Med Galv	3.6	191	188	
		Heavy	2.9	980	971			Heavy	4.5	162	160	
15 NB	21.3	Hvy Galv	2.9	943	935	65 NB	76.1	Hvy Galv	4.5	159	157	
		Refrigerant	3.2	901	—			Refrigerant	5.4	137	—	
		Medium	2.6	820	813			Medium	3.6	154	151	
		Med Galv	2.6	787	781			Med Galv	3.6	149	147	
20 NB	26.9	Heavy	3.2	690	685	80 NB	88.9	Heavy	4.5	127	125	
		Hvy Galv	3.2	667	662			Hvy Galv	4.5	124	122	
		Refrigerant	3.6	625	—			Refrigerant	5.9	98	—	
		Medium	2.6	633	629			Medium	4.0	118	116	
25 NB	33.7	Med Galv	2.6	606	602	100 NB	114.3	Med Galv	4.0	115	113	
		Heavy	3.2	526	524			Heavy	4.88	99	97	
		Hvy Galv	3.2	510	508			Hvy Galv	4.88	97	95	
		Refrigerant	4.0	437	—			Refrigerant	5.9	83	—	
32 NB	42.4	Medium	3.2	410	407	125 NB	139.7	Medium	4.5	83	81	
		Med Galv	3.2	397	394			Med Galv	4.5	81	79	
		Heavy	4.0	337	334			Heavy	5.4	69	68	
		Hvy Galv	4.0	329	327			Hvy Galv	5.4	68	67	
32 NB	42.4	Refrigerant	4.5	310	—	150 NB	165.1	Medium	4.88	62	60	
		Medium	3.2	318	315			Med Galv	4.88	61	59	
		Med Galv	3.2	309	306			Heavy	5.4	56	55	
		Heavy	4.0	260	258			Hvy Galv	5.4	55	54	
		Hvy Galv	4.0	254	253			Medium	4.88	52	51	
		Refrigerant	4.88	221	—			Med Galv	4.88	51	50	
										5.4	47	46
										5.4	46	45

Mass per metre of screwed and socketed tubing is based on the overall length of tube plus socket, screwed to basic engagement



MALLEABLE PIPE FITTINGS

Manufactured Range

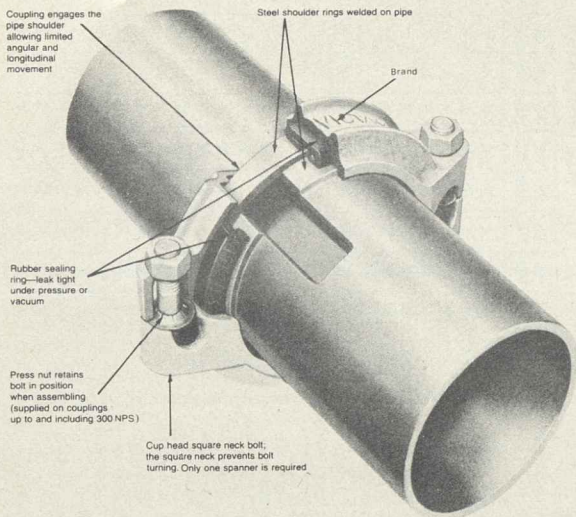
FITTING	PIPE SIZE DESIGNATION													
	8 NB	10 NB	15 NB	20 NB	25 NB	32 NB	40 NB	50 NB	65 NB	80 NB	90 NB	100 NB	125 NB	150 NB
Backnuts	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bends, M & F	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bends, F & F	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bends, M & F 45°	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bushes	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Caps	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Crosses	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Elbows, F & F	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Elbows, M & F	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Elbows, Three-way	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Elbows, 45°	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Elbows, Reducing	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Flanges	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Flanges, Oval	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hexagon Nipples	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hex Nipples, Red	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Plugs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sockets	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sockets, Reducing	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tees	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tees, Reducing	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tees, Four-way	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Unions, FS	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Unions, BS	X	X	X	X	X	X	X	X	X	X	X	X	X	X



THE VICTAULIC PIPING SYSTEM with Shouldered Steel Pipe

- Dredging, fire protection, sewage disposal/treatment, water services, mining — compressed air lines, construction site services, plant processing, oil field and petroleum piping, shipbuilding.

For full details and data sheets, contact nearest S & L office.



THE SYSTEM

The Victaulic system is simple in design. It consists of a self-sealing rubber ring embracing two pipe ends and a coupling which encloses the ring while engaging shoulders on the pipe ends.

The coupling accurately centralises the self-sealing ring and keeps it firmly in position to prevent leaks and protect it from external damage. It engages the pipes positively and prevents separation; a small amount of end play is provided between the coupling and the pipe ends.

The Victaulic joint is leakproof under pressure or vacuum even when the pipeline is only partly full or under vibration.

The small space occupied by the joint, the ease with which it can be fitted into confined spaces, together with the quick and easy coupling of pipe lengths make the system uniquely versatile.

The system provides for limited expansion and contraction and accommodates some longitudinal and angular movement.

For irrigation, dewatering of construction sites, and temporary installations, the Victaulic piping system in most instances does not require the design and supervision of a piping engineer or inspection by a statutory authority provided the working pressures shown on the couplings are not exceeded.

Because of the high stored energy in compressed gases, any gas or air system over 1030 kPa should be designed by a piping engineer.

VICTAULIC PIPE

Specification

Steel pipe for most pressure applications where the Victaulic system is employed will be manufactured to AS 1074 for sizes up to and including 165.1 mm outside diameter and to AS B221 or AP15L, 5LX for sizes over 165.1 mm outside diameter.

The pipe end diameters permitted in these specifications may necessitate rounding and/or sizing to make the pipe ends suitable for the Victaulic steel shoulder rings. For Victaulic piping, the pipe end mean diameter measured with a circumferential tape (or other effective averaging device) should be ± 1 mm of the nominal outside diameter.

Length Range

Victaulic pipe is normally supplied in random lengths ranging from single randoms (6.5 m) for small diameter pipe to triple randoms (18 m) for large diameter pipe.

Random Length Detail

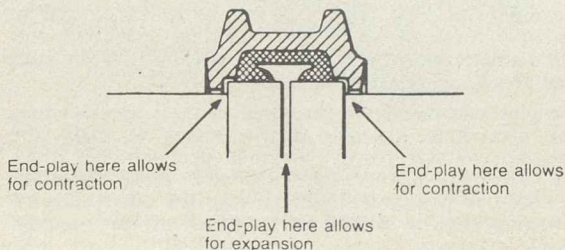
	Single Rand- oms, m	9 m Rand- oms, m	Double Rand- oms, m	15 m Rand- oms, m	Triple Rand- oms, m
Maximum Length	*6.5	9	13	15	18
Minimum Average Length	5.5	8	10.5	13.5	16
Shortest Length	3	4	4	5.5	6.5
Shortest Length in 90% of Lengths	4	6	8	10	12
No of Joints per kilometre	182	124	93	74	62

*In a limited number of instances single random lengths could be supplied up to 7.3 m.

UTILISING END PLAY

1. Longitudinal Movement

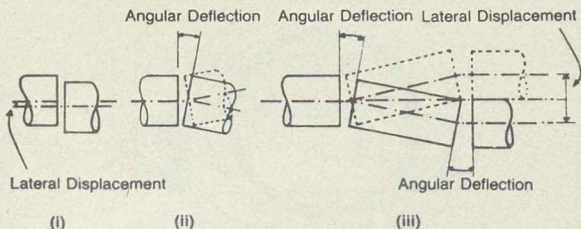
The normal end play in a properly laid anchored Victaulic pipeline, using 6.5 m lengths, allows for expansion and contraction within a temperature change of 45°C.



2. Angular Deflection

The Victaulic joint will also allow for angular deflections within the pipeline relative to the pipe diameter.

3. Lateral Movement Incorporating both Longitudinal and Angular Movement



The use of Victaulic joints has become recognized as an effective and simple means of making provision for lateral movement.

(i) Lateral Displacement

This is the pipe movement for which provision has to be made. A single joint will not allow such movement.

(ii) Angular Deflection

This is the natural pipe movement allowed to a limited extent in any direction by joints.

(iii) Lateral Displacement — Correct Application

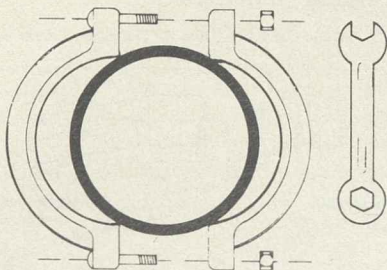
Two couplings should be used with a short pipe between. This arrangement allows:

- A lateral movement as at (i) between the end pipes
- An angular deflection as at (ii) produced at the joints between the end pipes and the intermediate pipe

OPERATING FEATURES

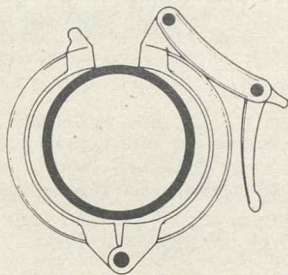
Speed and Efficiency

Victaulic shouldered joints have two basic parts — two shouldered ends on pipes (or fittings) and a complete coupling.



The complete standard coupling has three components

- a rubber ring
- two (or four) coupling parts
- two (or four) bolts and nuts



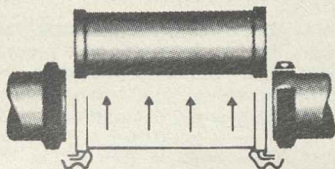
The toggle coupling is hinged and requires no bolts. It has two components

- a rubber ring
- the hinged coupling

After suitably lubricating the ring, the complete unit can be installed in seconds with only an ordinary spanner; the couplings are entirely self centring over the pipe ends.

System Simplicity

Just as Victaulic joints are easy to connect so they are easy to disconnect.



Dismantle two Victaulic joints in a Victaulic line and any individual pipe length fitting or valve requiring maintenance, cleaning or repair can be quickly removed or replaced. Adjoining sections are undisturbed; pipe ends and joints are unharmed.

A Locked Joint

Victaulic joints mechanically lock the shouldered pipe ends together securely and safely. The joints cannot blow off under pressure nor can they pull out under vibration or sag, because the shoulder sections of the couplings engage the circumference of the pipe shoulders.





RECTANGULAR HOLLOW SECTION TUBES

RHS TUBES are a comprehensive range of rectangular and square steel sections. They enable every fabricator to enjoy the advantages associated with hollow section construction without the necessity of installing new plant and equipment.

They are now widely used in the structural, architectural, mechanical handling, agricultural and general engineering fields with their established advantages — minimum maintenance, high load/mass ratios, immense torsional stiffness and aesthetic qualities.

In many cases RHS Tube is now being used in conjunction with traditional sections and for this reason it is manufactured to dimensions which match with conventional rolled steel sections.

SIZE RANGE:

The sizes for square profiles range from serial size designation 13 x 13 to 356 x 356 and for rectangular profiles from 51 x 25 to 457 x 254.

SPECIFICATION:

Australian Standard 1163.

“Structural Steel Hollow Sections”

“Welded and Seamless Steel Hollow Sections for General Structural Purposes”

All tubes produced to above specification are manufactured from weldable quality steel.

NOTE: Tubemakers manufacture the following RHS serial sizes to Australian Standard G32 — “Circular and Non-Circular Carbon Steel Tubes for Mechanical and General Engineering Purposes”: These sizes are stocked in grade 270. 13 x 13 16 x 16 19 x 19 25 x 25 32 x 32 Refer Tubemakers Data Sheet 3/02 for further details.

APPLICATION CODE:

In Australia use of Structural Hollow Section (SHS) is governed primarily by:

- Australian Standard 1250 — Steel Structure Code
- Australian Standard 1170 — SAA Loading Code (metric units)
 - Part 1. Dead and Live Loads
 - Part 2. Wind Forces
- Australian Standard CB2 — Crane and Hoist Code
- Australian Standard CA8 — SAA Code for Welding in Building
- Australian Institute of Steel Construction/Standards Association of Australia — Steel Structures Manual.

STANDARD LENGTH RANGE:

RHS — Serial sizes up to and including

32 x 32 6.5 metres

Serial sizes over 32 x 32 up to and including

64 x 64 76 x 51 89 x 38 7 metres

Serial sizes over

64 x 64 76 x 51 89 x 38 8 metres

Other lengths available on request.

FINISH:

RHS

(i) Mild Steel — Grade 250

(a) supplied with a red identifying paint.

(b) supplied not oiled or painted.

(c) galvanized.

(ii) High Tensile Steel — Grade 350

(a) supplied with a blue identifying paint.

(b) supplied not oiled or painted.

(c) galvanized.

Grade Designation

MINIMUM YIELD

STRESS

MPa

GRADE
DESIGNATION

210

250

360

200

250

350

LYSAGHT REFEREE

RHS is normally stocked only in Grade 250.

Grades 350 and Austen 50 are available ex mill rolling against specific orders.

Material

Grade Designation	CHEMICAL COMPOSITION							
	Ladle Check Analysis							
	Composition (max) Per Cent							
	C	Mn $C + \frac{Mn}{6}$	Mn	P	S	Si	Cr	Mn+Cr
200	0.20	0.40	—	0.05	0.05	—	—	—
	0.24	—	—	0.06	0.06	—	—	—
250	0.25	0.42	—	0.05	0.05	—	—	—
	0.29	—	—	0.06	0.06	—	—	—
350	0.22	—	1.50	0.04	0.04	0.50	0.50	1.60
	0.26	—	1.60	0.05	0.05	0.55	0.55	1.70

MECHANICAL PROPERTIES			
Grade Designation	Yield Stress, MPa, (min)	Tensile Strength, MPa, (min)	% min elong as a proportion of gauge length of 5.65 So*
200	210	340	24
250	250	420	22
350	360	480	20

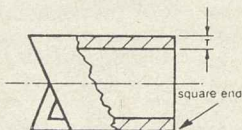
* So is the area of cross-section of the test piece.

TESTING

All material is tested to AS 1163 to ensure quality control and if required, a test certificate will be supplied covering the material on order. Where the purchaser desires to receive such a certificate, this should be stated at the time the order is placed.

END CONDITION

Usually supplied square ends (as shown). Serial sizes up to and including 64 x 64 and 76 x 51 are cut direct off the mill and further have their ends trimmed separately within the works finishing department.



Serial sizes 76 x 76 and 102 x 51 and above are cut as an individual operation on a cold saw and no further end preparation is carried out.

TOLERANCES

Cross-Section

Serial Size Dimension (Actual Size Dimension), mm	Maximum Permissible Variation from Specified Outside Dimension of Side, mm	Maximum Permissible Out-of-Square at Corners
51 and under	0.5	1°
Over 51	0.01 times the specified dimension	

Mass

The length mass of hollow section shall not be less than 0.96 of the specified mass.

Exact Length

The maximum exact length Tubemakers can offer ex mill rollings is dependent on mill capacity; however the following exact length tolerance will apply. Lengths up to and including 14 m, +6 mm, -0.

Lengths over 14 m as agreed between client and Tubemakers.

Straightness

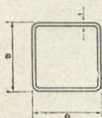
The maximum permissible variation from straightness in a length of RHS shall not exceed

$$\frac{\text{specified length}}{600}$$

Radii of Corners

Process of Manufacture	Maximum		Minimum		
	Outside Radius	Inside Radius	Outside Radius		Inside Radius
			$t \leq 6.3$ mm	$t > 6.3$ mm	
Initially hot formed	2t	t	$\frac{t}{2}$	t	$\frac{t}{10}$
Initially cold formed	3t	2t			

Where t = Specified wall thickness of section.



RECTANGULAR HOLLOW SECTION TUBES SQUARES

BUNDLING SCHEDULE



Serial Size Designation	Depth of Section "D", mm	Wall Thick- ness "t", mm	Mass		No of Lengths per Bundle	Arrange- ment of Tubes	Overall Bundle Dimensions, mm	Approx Total Length, Mass, m t	
			kg/m	m/t				6.5 m Lengths	7 m Lengths
13 x 13	12.7 x 12.7	1.8	0.556	1800	64	8 x 8	101 x 101	416	504
16 x 16	15.9 x 15.9	1.8	0.738	1350	64	8 x 8	127 x 127	416	448
19 x 19	19.1 x 19.1	1.8	0.920	1090	64	8 x 8	152 x 152	416	448
25 x 25	25.4 x 25.4	2.0	1.00	1000	64	8 x 8	152 x 152	416	336
		2.0	1.41	711	64	8 x 8	203 x 203	416	252
		2.6	1.75	573	64	8 x 8	203 x 203	416	210
		3.2	2.05	489	64	8 x 8	203 x 203	416	252
32 x 32	31.8 x 31.8	2.6	2.27	440	64	8 x 8	254 x 254	416	175
38 x 38	38.1 x 38.1	2.6	2.80	357	72	9 x 8	343 x 305	504	112
		3.2	3.34	299	64	8 x 8	305 x 305	448	1411
		4.0	4.01	250	49	7 x 7	267 x 267	343	1496
51 x 51	50.8 x 50.8	3.2	4.64	216	48	8 x 6	406 x 305	336	1375
		4.0	5.62	178	36	6 x 6	305 x 305	252	1559
		4.9	6.55	153	30	6 x 5	305 x 254	210	1416
64 x 64	63.5 x 63.5	3.2	5.93	169	36	6 x 6	381 x 381	252	1376
		4.0	7.24	138	30	6 x 5	381 x 318	210	1494
		4.9	8.49	118	25	5 x 5	318 x 318	175	1520
		6.3	10.6	94.6	16	4 x 4	254 x 254	112	1486
76 x 76	76.2 x 76.2	3.2	7.23	138	30	6 x 5	457 x 381	240	1187
		4.0	8.86	113	25	5 x 5	381 x 381	200	1735
		4.9	10.4	95.9	20	5 x 4	381 x 305	160	1772
		6.3	13.1	76.3	16	4 x 4	305 x 305	128	1664
89 x 89	88.9 x 88.9	3.6	9.51	105	20	5 x 4	445 x 356	160	1677
		4.9	12.4	80.8	16	4 x 4	356 x 356	128	1522
									1587

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RECTANGULAR HOLLOW SECTION TUBES **RECTANGLES**



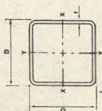
Serial Size Designation	Depth & Breadth of Section "D" and "B", mm	Wall Thick- ness "t", mm	Mass		No of Lengths per Bundle	Arrange- ment of Tubes	Overall Bundle Dimensions, mm	Approx Total	
			kg/m	m/t				Length, Mass, m t	
								7 m Lengths	8 m Lengths
51 x 25	50.8 x 25.4	2.6	2.80	357	36	4 x 9	203 x 229	252	0.706
		3.2	3.34	299	32	4 x 8	203 x 203	224	0.748
		3.2	4.64	216	42	6 x 7	381 x 267	294	1.364
		4.0	5.62	178	35	5 x 7	318 x 267	245	1.377
76 x 38	76.2 x 38.1	3.2	5.28	189	40	5 x 8	381 x 305	280	1.478
		4.0	6.43	155	32	4 x 8	305 x 305	224	1.440
76 x 51	76.2 x 50.8	3.2	5.93	169	35	5 x 7	381 x 356	245	1.453
		4.0	7.24	138	28	4 x 7	305 x 356	196	1.419
		4.9	8.49	118	24	4 x 6	305 x 305	168	1.426
		6.3	10.6	94.6	20	4 x 5	305 x 254	140	1.484
89 x 38	88.9 x 38.1	3.2	5.93	169	32	4 x 8	356 x 305	224	1.328
		4.0	7.24	138	27	3 x 9	267 x 343	189	1.368
102 x 51	101.6 x 50.8	3.2	7.23	138	28	4 x 7	406 x 356	224	1.620
		4.0	8.86	113	24	4 x 6	406 x 305	192	1.701
		4.9	10.4	95.9	21	3 x 7	305 x 356	168	1.747
		6.3	13.1	76.3	15	3 x 5	305 x 254	120	1.572
102 x 76	101.6 x 76.2	3.6	9.51	105	20	4 x 5	406 x 381	160	1.522
		4.9	12.4	80.8	16	4 x 4	406 x 305	128	1.587
127 x 51	127.0 x 50.8	6.3	15.6	64.0	12	3 x 4	305 x 305	96	1.498
		3.6	9.51	105	21	3 x 7	381 x 356	168	1.598
		4.9	12.4	80.8	18	3 x 6	381 x 305	144	1.786
		6.3	15.6	64.0	14	2 x 7	254 x 356	112	1.747
127 x 64	127.0 x 63.5	4.0	11.3	88.6	18	3 x 6	381 x 381	144	1.627

LYSAGHT REFEREE

[illegible]



RECTANGULAR HOLLOW SECTION TUBES SQUARES STANDARD SIZES AND PROPERTIES



Serial Size Designation	Depth of Section "D", mm	Wall Thick- ness "t", mm	Surface Area, mm ² /m	Area of Section, mm ²	Moment of Inertia mm ⁴ x 10 ⁶	Radius of Gyration, mm	Elastic Modulus, mm ³ x 10 ³	Plastic Modulus, mm ³ x 10 ³
13 x 13	12.7 x 12.7	1.8	0.045	70.9	0.00130	4.29	0.205	0.276
16 x 16	15.9 x 15.9	1.8	0.057	94.1	0.00294	5.59	0.371	0.479
19 x 19	19.1 x 19.1	1.8	0.070	117	0.00557	6.89	0.585	0.738
		2.0	0.069	128	0.00589	6.79	0.618	0.790
25 x 25	25.4 x 25.4	2.0	0.095	179	0.0158	9.39	1.24	1.54
		2.6	0.093	223	0.0184	9.09	1.45	1.84
		3.2	0.090	261	0.0201	8.78	1.58	2.08
32 x 32	31.8 x 31.8	2.6	0.118	290	0.0396	11.7	2.49	3.09
38 x 38	38.1 x 38.1	2.6	0.143	357	0.0728	14.3	3.82	4.66
		3.2	0.141	426	0.0833	14.0	4.37	5.44
		4.0	0.138	511	0.0942	13.6	4.94	6.32
51 x 51	50.8 x 50.8	3.2	0.192	591	0.217	19.2	8.56	10.4
		4.0	0.189	717	0.253	18.8	9.96	12.3
		4.9	0.186	835	0.282	18.4	11.1	14.0
64 x 64	63.5 x 63.5	3.2	0.243	756	0.449	24.4	14.1	16.9
		4.0	0.240	924	0.531	24.0	16.7	20.3
		4.9	0.237	1080	0.601	23.6	18.9	23.3
		6.3	0.232	1350	0.703	22.8	22.2	28.1
76 x 76	76.2 x 76.2	3.2	0.294	921	0.805	29.6	21.1	24.9
		4.0	0.291	1130	0.961	29.2	25.2	30.2
		4.9	0.288	1330	1.10	28.8	28.9	35.0
		6.3	0.283	1670	1.31	28.0	34.5	42.8
89 x 89	88.9 x 88.9	3.6	0.343	1210	1.45	34.5	32.6	38.4
		4.9	0.339	1580	1.82	34.0	40.9	49.0
		6.3	0.334	1990	2.20	33.2	49.5	60.5
102 x 102	101.6 x 101.6	4.0	0.392	1540	2.41	39.5	47.5	55.9

LYSAGHT REFEREE

114 x 114	4.9	0.390	1830	2.80	39.1	55.1	65.4
	6.3	0.385	2320	3.42	38.4	67.3	81.4
	9.5	0.386	3460	4.85	37.4	95.4	119
114.3 x 114.3	4.9	0.447	2120	4.22	44.6	73.9	86.9
	6.3	0.444	2720	5.26	44.0	92.1	110
	9.5	0.437	3950	7.16	42.6	125	154
127 x 127	4.9	0.498	2370	5.88	49.8	92.5	108
	6.3	0.494	3050	7.36	49.2	116	137
	9.5	0.488	4430	10.1	47.8	159	194
152.4 x 152.4	4.9	0.599	2870	10.4	60.2	136	158
	6.3	0.596	3690	13.1	59.5	172	202
	9.5	0.589	5400	18.3	58.2	240	288
	12.5	0.582	7020	22.6	56.8	297	365
	16.0	0.576	8550	26.2	55.4	344	434
178 x 178	5.9	0.699	4040	19.8	70.1	223	260
	6.3	0.698	4340	21.2	69.9	238	278
	7.1	0.696	4850	23.5	69.6	264	310
	9.5	0.691	6370	29.9	68.5	337	401
	12.5	0.684	8310	37.5	67.2	422	512
	16.0	0.677	10200	44.0	65.8	495	613
203 x 203	5.9	0.800	4630	30.0	80.5	295	342
	6.3	0.799	4980	32.1	80.3	316	367
	7.1	0.797	5580	35.6	79.9	351	409
	9.5	0.792	7340	45.7	78.9	450	531
	12.5	0.786	9600	57.7	77.6	568	683
	16.0	0.779	11800	68.3	76.2	673	823
254 x 254	6.3	1.00	6270	64.0	101	504	582
	9.5	0.996	9270	92.1	99.7	725	848
	12.5	0.989	12200	118	98.3	927	1099
	16.0	0.982	15000	141	96.9	1110	1334
305 x 305	9.5	1.20	11200	162	120	1066	1239
	12.5	1.19	14800	209	119	1373	1613
	16.0	1.19	18200	252	118	1657	1969
356 x 356	9.5	1.40	13100	262	141	1473	1703
	12.5	1.40	17300	339	140	1906	2226
	16.0	1.39	21500	411	138	2312	2726



RECTANGULAR HOLLOW SECTION TUBES RECTANGLES STANDARD SIZES AND PROPERTIES



LYSAGHT REFEREE

Serial Size Design- nation	Depth & Breadth of Section "D", and "B", mm	Wall Thick- ness "t", mm	Sur- face Area, m ² /m	Area of Sec- tion, mm ²	Moment of Inertia,		Radius of Gyration		Elastic Modulus,		Plastic Modulus,	
					X-X mm ² x10 ⁶	Y-Y mm ⁴ x10 ⁶	X-X mm	Y-Y mm	X-X mm ³ x10 ³	Y-Y mm ³ x10 ³	X-X mm ³ x10 ³	Y-Y mm ³ x10 ³
51 x 25	50.8 x 25.4	2.6	0.143	357	0.108	0.0358	17.4	10.0	4.26	2.82	5.52	3.37
		3.2	0.141	426	0.124	0.0405	17.1	9.75	4.88	3.19	6.44	3.91
64 x 38	63.5 x 38.1	3.2	0.192	591	0.299	0.134	22.5	15.0	9.42	7.01	11.9	8.32
		4.0	0.189	717	0.348	0.154	22.0	14.7	11.0	8.10	14.1	9.83
76 x 38	76.2 x 38.1	3.2	0.217	674	0.475	0.159	26.6	15.3	12.5	8.33	15.9	9.75
		4.0	0.215	820	0.558	0.184	26.1	15.0	14.6	9.67	19.0	11.6
76 x 51	76.2 x 50.8	3.2	0.243	756	0.585	0.311	27.8	20.3	15.4	12.2	18.9	14.3
		4.0	0.240	924	0.692	0.366	27.4	19.9	18.2	14.4	22.7	17.1
		4.9	0.237	1 080	0.785	0.413	26.9	19.5	20.6	16.3	26.2	19.7
		6.3	0.232	1 350	0.919	0.479	26.1	18.9	24.1	18.9	31.5	23.6
89 x 38	88.9 x 38.1	3.2	0.243	756	0.705	0.184	30.5	15.6	15.9	9.65	20.5	11.2
		4.0	0.240	924	0.833	0.214	30.0	15.2	18.8	11.3	24.5	13.3
102 x 51	101.6 x 50.8	3.2	0.294	921	1.20	0.404	36.0	20.9	23.6	15.9	29.6	18.2
		4.0	0.291	1 130	1.43	0.479	35.6	20.6	28.1	18.9	35.8	21.9
		4.9	0.288	1 330	1.64	0.544	35.1	20.2	32.2	21.4	41.5	25.4
		6.3	0.283	1 670	1.95	0.640	34.2	19.6	38.5	25.2	50.7	30.8
102 x 76	101.6 x 76.2	3.6	0.343	1 210	1.76	1.13	38.1	30.5	34.7	29.7	41.8	34.3
		4.9	0.339	1 580	2.22	1.42	37.5	30.0	43.6	37.2	53.5	43.8
		6.3	0.334	1 990	2.69	1.71	36.7	29.3	52.9	44.8	66.0	54.0
127 x 51	127.0 x 50.8	3.6	0.343	1 210	2.32	0.546	43.8	21.2	36.6	21.5	47.0	24.5
		4.9	0.339	1 580	2.92	0.675	43.0	20.7	46.0	26.6	59.9	31.1
		6.3	0.334	1 990	3.53	0.800	42.1	20.0	55.6	31.5	73.9	37.9
127 x 64	127.0 x 63.5	4.0	0.367	1 440	2.92	0.987	45.0	26.2	46.0	31.1	57.8	35.6
		4.9	0.364	1 700	3.38	1.13	44.6	25.8	53.2	35.7	67.5	41.5
		6.3	0.367	2 240	4.42	1.43	44.4	25.3	69.6	45.1	88.7	53.5

LYSAGHT REFEREE

127 x 76	127.0 x 76.2	4.9	0.396	1 880	4.03	1.79	46.3	30.9	63.4	47.1	78.1	54.4
		6.3	0.393	2 400	5.01	2.20	45.7	29.3	78.8	57.9	98.4	68.2
		9.5	0.386	3 460	6.77	2.90	44.2	30.0	107	76.2	137	94.0
152 x 76	152.4 x 76.2	4.9	0.447	2 120	6.33	2.11	54.6	31.5	83.0	55.4	103	63.3
		6.3	0.444	2 720	7.91	2.60	53.9	30.9	104	68.2	131	79.5
		9.5	0.437	3 950	10.8	3.45	52.4	29.5	142	90.4	184	110
152 x 102	152.4 x 101.6	4.9	0.498	2 370	7.68	4.07	56.9	41.4	101	80.2	122	91.8
		6.3	0.494	3 050	9.63	5.07	56.2	40.8	126	99.9	155	116
		9.5	0.488	4 430	13.3	6.91	54.8	39.5	175	136	219	163
203 x 102	203.2 x 101.6	4.9	0.599	2 870	15.5	5.23	73.5	42.7	153	103	188	116
		6.3	0.596	3 690	19.6	6.54	72.9	42.1	193	129	240	147
		9.5	0.589	5 400	27.5	8.96	71.4	40.7	271	176	344	208
		12.5	0.582	7 020	34.3	10.9	69.9	39.4	338	214	437	261
		16.0	0.576	8 550	40.0	12.4	68.4	38.0	393	244	520	306
203 x 152	203.2 x 152.4	5.9	0.699	4 040	24.2	15.5	77.4	61.9	238	203	283	232
		6.3	0.698	4 340	25.8	16.5	77.2	61.7	254	217	304	249
		7.1	0.696	4 850	28.7	18.3	76.9	61.4	282	240	338	277
		9.5	0.691	6 370	36.6	23.2	75.8	60.4	360	305	438	357
		12.5	0.684	8 310	46.0	29.0	74.4	59.0	453	380	560	456
		16.0	0.677	10 200	54.2	33.8	73.0	57.7	533	444	671	544
254 x 152	254.0 x 152.4	5.9	0.800	4 630	41.3	18.7	94.4	63.5	325	245	393	276
		6.3	0.799	4 980	44.2	20.0	94.2	63.3	348	262	422	296
		7.1	0.797	5 580	49.1	22.1	93.9	63.0	387	290	471	330
		9.5	0.792	7 340	63.1	28.2	92.8	62.0	497	370	612	426
		12.5	0.786	9 600	80.1	35.3	91.4	60.6	631	463	788	546
		16.0	0.779	11 800	95.2	41.3	89.9	59.3	749	543	950	654
305 x 203	304.8 x 203.2	6.3	1.00	6 270	83.4	44.6	115	84.3	547	439	653	494
		9.5	0.996	9 270	120	63.8	114	83.0	789	628	953	719
		12.5	0.989	12 200	154	81.2	112	81.6	1011	799	1236	929
		16.0	0.982	15 000	185	96.7	111	80.3	1214	952	1503	1125
406 x 203	406.4 x 203.2	9.5	1.20	11 200	243	82.0	147	85.5	1194	807	1473	906
		12.5	1.19	14 800	313	105	146	84.2	1542	1030	1921	1175
		16.0	1.19	18 200	379	125	144	82.8	1866	1231	2346	1427
457 x 254	457.2 x 254.0	9.5	1.40	13 100	373	150	169	107	1634	1181	1987	1321
		12.5	1.40	17 300	485	193	167	105	2120	1519	2599	1722
		16.0	1.39	21 500	589	233	166	104	2577	1831	3186	2102



**TUBEMAKERS OF AUSTRALIA LIMITED,
BTM DIVISION**

PRECISION STEEL TUBING

Production Range

(A) COLD DRAWN SEAMLESS (CDS), ELECTRIC RESISTANCE WELDED (ERW) AND DRAWN WELDED (DW) TUBING

CIRCULAR TUBE

Outside Diameter, mm

- (i) **Standard Production Range.**
CDS, ERW and DW
12.7, 16, 19, 22.2, 25.4, 28.6, 31.8, 35, 38, 41.3, 44.5, 47.6, 51, 54, 57, 60.3, 63.5, 66.7, 70, 76.1, 82.5, 88.9.
- (ii) **CDS and DW also produced in the following sizes**
6.4, 9.5, 73, 79.4, 85.7, 92, 95, 98.4, 101.6, 105, 108, 114.3, 117.5, 120.6, 127, 130.
- (iii) **CDS also produced in the following sizes**
133, 139.7, 143, 146, 152.4, 155.6, 159, 165.1, 168.3, 171.4.

Wall Thickness, mm

- (i) **Standard Production Range.**
CDS, ERW and DW
0.7, 0.9, 1.2, 1.4, 1.6, 2.0, 2.6, 3.2.
- (ii) **The following thicknesses are also available in CDS, ERW and DW**
1.0, 1.8, 2.3, 2.9, 3.6, 4.0, 4.5, 4.9, 5.4 (5.4 CDS and ERW only).
- (iii) **CDS also produced in the following thicknesses**
5.9, 6.4, 7.0, 7.6, 8.0, 8.2, 8.8, 9.5, 10.0.

NON-CIRCULAR TUBE

BTM Non-Circular Section Tube is described by Section Numbers which also describe the section dimensions in millimetres. The full description includes the following suffixes and should be used for all inquiries and orders.

R denotes rounded corners, S denotes sharp corners (radius = 1x thickness), N denotes standard corners (radius = 2x thickness).

SQUARES

RECTANGLES

BTM Section No	Dimen- sion, mm	BTM Section No	Dimen- sion, mm	BTM Section No	Dimen- sion, mm
1515S	15 x 15	2525N	25 x 25	3519N	35 x 19
1616N	16 x 16	3030R	30 x 30	4020S	40 x 20
1919N	19 x 19	3535S	35 x 35	5010S	50 x 10
1919R	19 x 19	3838S	38 x 38	5020S	50 x 20
1919S	19 x 19	4040S	40 x 40	5116N	51 x 16
2020S	20 x 20	5050N	50 x 50	5735R	57 x 35
2222S	22 x 22	6060N	60 x 60	7019N	70 x 19
				7051N	70 x 51

The Section Numbers describing sections which were designed in imperial dimensions are as follows. Quote the Section Number **not** the dimensions.

OVALS

SQUARES

RECTANGLES

BTM Section No	Dimen- sion, mm	BTM Section No	Dimen- sion, mm	BTM Section No	Dimen- sion, mm
118	31.8 x 17.5	312	22.2 x 22.2	417	44.5 x 34.9
125	19 x 12.7	313	12.7 x 12.7	419	44.5 x 25.4
134	57.5 x 31.6	327	31.8 x 31.8	434	51 x 41.3
223	51 x 16	342	44.5 x 44.5	436	76.1 x 44.5
228	20.6 x 8.7	346	31.8 x 31.8	440	31.8 x 22.2
		351	25.4 x 25.4	443	47.6 x 23.8
		357	41.0 x 41.0	444	51 x 31.8
		372	51 x 51	446	38 x 25.4
				454	54 x 25.4
				456	25.4 x 12.7
				465	31.8 x 12.7

The standard range of thicknesses for ERW Non-Circular Section Tube is: 0.9, 1.2, 1.4, 1.6, 2.0, 2.6 mm

(B) STAINLESS STEEL TUBES

Standard Range

CIRCULAR TUBE

Outside Diameter, mm

4.8, 6.4, 7.9, 9.5, 11.1, 12.7, 16, 19, 22.2, 25.4, 28.6, 31.8, 35, 38, 41.3, 44.5, 47.6, 51, 54, 57, 60.3, 63.5.

Wall Thickness, mm

0.45, 0.5, 0.7, 0.9, 1.2, 1.4, 1.6, 2.0, 2.6, 3.2.

NON-CIRCULAR TUBE

Quote the BTM Section Number **not** the dimensions. Some typical examples of the more popular stainless steel non-circular section tubes are —

BTM Section No	Dimension, mm	BTM Section No	Dimension, mm
2500	38 x 38	2509	19 x 19
2503	51 x 51	2512	12.7 x 12.7
2505	25.4 x 25.4	2513	22.2 x 22.2

(C) STEEL CONDUIT

Conduit is supplied to AS C66, Part 1 — 1955, but will have the following designations. It is necessary to quote the required classification either Class A — Plain, or Class B — Screwed, as described in AS C66 and the BTM Electrical Conduit Products Compendium.

Designations, mm

16, 19, 25.4, 31.8, 38, 51, 63.5.

(D) BUNDYWELD TUBING

Standard Range

OUTSIDE DIAMETER, mm	THICKNESS, mm
4.75	{ 0.51 0.71
6	0.71
6.35 } 7.94 } 9.53 } 12.7 }	0.71 0.89

Intermediate tube sizes can be produced by cold drawing. Tooling for the following diameters is available.

Outside Diameter, mm

3.18, 3.5, 3.97, 4, 5.5, 5.56, 7.14, 10, 11.11

Bundyweld tubing complies with the following specifications —

AS B289, ASTM A254, SAE J527.

Bundyweld is supplied for Diesel Fuel Injection Tubing as follows —

OUTSIDE DIAMETER, mm	INSIDE DIAMETER, mm
5.5	1.5
6	1.5 to 2
8	3



TUBEMAKERS OF AUSTRALIA LIMITED, CAST IRON PIPE DIVISION

SPUN CAST IRON PIPES TYTON FLEXIBLE JOINT

DIMENSIONS AND MASS — UNLINED

Nominal Internal Diameter, mm	Class	Wall Thickness, mm	Barrel Mass, kg/m	Pipe Mass per 5.5 m Length, kg	Pipes per tonne
80	B	7.4	14.5	83	12.05
	C	7.4	14.5	83	12.05
	D	7.6	14.9	85	11.76
100	B	7.6	19.4	113	8.85
	C	7.9	20.1	117	8.55
	D	8.9	22.5	130	7.69
150	B	8.4	31.5	183	5.46
	C	9.4	35.1	203	4.93
	D	10.9	40.4	232	4.31
200	B	9.1	45.5	268	3.73
	C	10.9	53.7	313	3.19
	D	12.4	60.8	352	2.84
225	B	9.4	52.3	308	3.25
	C	11.4	63.0	367	2.72
	D	13.2	72.3	418	2.39
250	B	9.9	60.8	357	2.80
	C	11.9	72.9	423	2.36
	D	14.0	84.7	488	2.05
300	B	10.9	81.4	474	2.11
	C	13.2	97.6	563	1.78
	D	15.2	112.0	642	1.56
375	B	11.9	110.2	654	1.53
	C	14.7	135.0	790	1.27
	D	17.0	155.0	900	1.11
450	B	13.2	145.1	858	1.17
	C	16.3	177.5	1036	0.97
	D	18.8	204.1	1182	0.85
500	B	14.0	169.8	1006	0.99
	C	17.0	205.7	1203	0.83
	D	19.6	235.2	1365	0.73
600	B	15.2	221.2	1308	0.76
	C	18.8	271.2	1583	0.63
	D	21.6	310.0	1796	0.56
750	B	20.3	364.1	2107	0.47
	C	21.8	390.7	2253	0.44
	D	23.4	417.3	2399	0.42

Pipe barrels meet the requirements of AS A145



VINIDEX TUBEMAKERS PTY LIMITED

Rigid PVC Pipes and Fittings

Further information
and supplies from:

Vinidex Tubemakers
Pty Limited,

Tubemakers of Australia
Limited

—Stewarts and Lloyds
Division Warehouses,
or major hardware
and plumbers supply
houses



PRESSURE PIPES:

Standard Length — 6 metres

Solvent Cement Joint — Nominal Size 15 to 200

“Polydex” Rubber Ring Joint —
Nominal Size 50 to 200

Pipes — Manufactured to AS K138-1969

Rubber Rings — Manufactured to AS A139-1973

Fittings — Manufactured to AS A159-1971

STORMWATER & DRAINAGE PIPES & FITTINGS:

Sizes Available:—

Nominal sizes — 80; 90 mm*; 100; 150

* 90 mm manufactured to AS 1254-1973.

Fittings available include —

Elbows, Tees, Reducers, Y Junctions and
Downpipe Adaptors

SEWER PIPES AND FITTINGS:

Metric Sizes Available:— 100 and 150 mm

Pipe and Fittings manufactured to AS 1260

RIGID PVC PRESSURE PIPE SIZES, CLASSES AND PRESSURE RATINGS AT 20°C

NOM PIPE SIZE	MEAN OD, mm	CLASS 4.5			CLASS 6			CLASS 9		
		PRESSURE RATING 45 metre head/0.45 MPa			PRESSURE RATING 60 metre head/0.6 MPa			PRESSURE RATING 90 metre head/0.9 MPa		
		ID, mm	Wall thick- ness, mm	Mass, kg/m	ID, mm	Wall thick- ness, mm	Mass, kg/m	ID, mm	Wall thick- ness, mm	Mass, kg/m
15	21.4									
20	26.8							30.6	1.47	0.220
25	33.5							38.6	1.83	0.344
32	42.2							44.2	2.06	0.443
40	48.3				45.4	1.42	0.313	55.2	2.57	0.692
50	60.4				56.8	1.78	0.484	69.0	3.20	1.07
65	75.4				70.9	2.21	0.746	81.4	3.76	1.49
80	88.9	85.0	1.96	0.796	83.8	2.57	1.04	104.7	4.80	2.46
100	114.3	109.3	2.49	1.31	107.7	3.30	1.71	128.4	5.89	3.71
125	140.2	134.2	3.02	1.95	132.2	4.01	2.57	154.2	7.04	5.32
150	168.3	161.0	3.63	2.81	158.6	4.80	3.68	200.9	9.12	9.01
200	219.1	209.7	4.70	4.76	206.7	6.20	6.23			

RIGID PVC PRESSURE PIPE **SIZES, CLASSES AND PRESSURE RATINGS AT 20°C**

NOM PIPE SIZE	MEAN OD, mm	CLASS 12				CLASS 15				CLASS 18			
		PRESSURE RATING 120 metre head/1.2 MPa				PRESSURE RATING 150 metre head/1.5 MPa				PRESSURE RATING 180 metre head/1.8 MPa			
		ID, mm	Wall thick- ness, mm	Mass, kg/m		ID, mm	Wall thick- ness, mm	Mass, kg/m		ID, mm	Wall thick- ness, mm	Mass, kg/m	
15	21.4					18.3	1.55	0.140		17.9	1.75	0.162	
20	26.8	23.7	1.52	0.18		23.0	1.88	0.219		22.3	2.21	0.252	
25	33.5	29.7	1.93	0.284		28.9	2.34	0.338		28.1	2.74	0.391	
32	42.2	37.5	2.39	0.442		36.4	2.92	0.534		35.4	3.43	0.618	
40	48.3	42.8	2.72	0.574		41.6	3.33	0.693		40.4	3.91	0.804	
50	60.4	53.6	3.4	0.89		52.1	4.11	1.08		50.6	4.88	1.26	
65	75.4	67.0	4.17	1.38		65.1	5.13	1.68		63.2	6.07	1.95	
80	88.9	79.1	4.90	1.92		76.8	6.05	2.33		74.6	7.14	2.71	
100	114.3	101.8	6.27	3.17		98.8	7.75	3.86		96.0	9.17	4.50	
125	140.2	124.9	7.67	4.77		121.3	9.47	5.81		117.5	11.2	6.79	
150	168.3	149.9	9.19	6.857		145.5	11.4	8.37		141.4	13.4	9.75	
200	219.1	195.3	11.9	11.64		189.5	14.8	14.23		184.2	17.5	16.58	

COPPER—SHEET AND STRIP

- GENERAL —**
1. Common grades: Commercial, High Conductivity, De-oxidized.
 2. Finishes: Cold Rolled (Sheet and Strip), Hot Rolled (Plate over 12 mm thick).
 3. Common Tempers: Half Hard, Soft.
 4. Specification: To AS 1566 — 1973.
 5. Preferred Dimensions: To AS 1123 — 1972.

TRADE SIZES —

Sheet, all preferred thicknesses		Strip	
Width, mm	Length, mm	Preferred thickness, mm	Width, mm
600	1800	0.025 to 0.15	up to 300
900	1800	0.15 to 0.40	up to 600
1200	1800	0.40 to 0.50	up to 900
1200	2400	0.50 to 2.0	up to 1200

MASS PER UNIT AREA —

Calculated on the mean density of copper taken as 8940 kg/m³.

Preferred Thickness, mm	Mass per square metre, kg	Preferred Thickness, mm	Mass per square metre, kg
0.10	0.894	1.2	10.73
0.12	1.073	1.6	14.30
0.16	1.430	2.0	17.88
0.20	1.788	2.5	22.35
0.25	2.235	3.0	26.82
0.30	2.682	4.0	35.76
0.40	3.576	5.0	44.70
0.50	4.47	6.0	53.64
0.60	5.36	8.0	71.52
0.80	7.15	10.0	89.40
1.00	8.94		

DRAWN COPPER BARS

Standard Rectangular Sizes

MASS PER UNIT LENGTH

Calculated on the mean density of copper taken as 8940 kg/m³

Dimension, mm	Mass per linear metre, kg	Dimension, mm	Mass per linear metre, kg
12.5	0.279	25	1.41
16	0.358	31.5	1.77
20	0.447	40	2.25
2.5 x 25	0.559	50	2.82
31.5	0.704	6.3 x 63	3.55
40	0.894	80	4.51
50	1.12	100	5.63
63	1.41	125	7.04
		160	9.01
16	0.572	50	4.47
20	0.715	63	5.63
25	0.894	10 x 80	7.15
31.5	1.13	100	8.94
4 x 40	1.43	125	11.18
50	1.79	160	14.30
63	2.25	100	14.30
80	2.86	16 x 125	17.88
100	3.58	160	22.89

SOLID DRAWN ROUND TUBES

COPPER — 70/30 BRASS — 60/40 BRASS

Preferred Sizes and Mass per linear metre in kilograms

EXTERNAL DIAMETER, mm	WALL THICKNESS, mm												
	0.41	0.46	0.51	0.56	0.71	0.81	0.91	1.02	1.22	1.63	2.03	2.64	2.74
COPPER													
9.53	0.105	—	—	0.141	0.176	0.199	0.220	—	0.285	0.362	—	—	—
12.70	0.142	—	—	0.191	0.239	0.271	0.302	0.335	0.394	0.507	—	—	—
15.88	—	—	—	0.241	0.303	—	0.383	0.426	0.503	0.653	—	—	—
19.05	—	—	—	0.291	0.366	—	0.464	0.517	0.611	0.798	—	—	—
25.40	—	—	—	—	—	—	0.626	—	0.829	1.089	—	—	—
31.75	—	—	—	—	—	—	0.789	—	1.047	1.380	—	—	—
38.10	—	—	—	—	—	—	0.951	—	1.265	1.671	—	—	—
44.45	—	—	—	—	—	—	1.114	—	1.483	1.962	—	—	—
50.80	—	—	—	—	—	—	1.276	—	1.700	2.253	—	—	—
63.50	—	—	—	—	—	—	1.601	—	2.136	2.835	—	—	—
76.20	—	—	—	—	—	—	1.926	—	2.571	3.417	—	—	—
101.60	—	—	—	—	—	—	2.576	—	3.442	4.581	5.682	—	—
127.00	—	—	—	—	—	—	3.223	—	4.314	5.744	7.131	—	—
152.40	—	—	—	—	—	—	3.875	—	5.185	6.908	8.581	—	—
70/30 BRASS													
9.52	—	—	—	0.135	0.168	—	0.210	—	0.272	0.345	—	—	—
11.11	—	—	—	—	0.198	—	0.249	—	0.323	—	—	—	—

LYSAGHT REFEREE

12.70	—	—	—	—	0.228	—	0.288	—	0.375	0.484	—	—	—
14.29	—	—	—	—	—	—	0.326	—	—	—	—	—	—
15.88	—	—	—	—	0.230	—	0.365	—	0.479	0.622	—	—	—
19.05	—	—	—	0.253	—	—	0.442	—	0.583	0.761	—	—	—
22.22	—	—	—	—	—	—	—	—	0.687	0.899	—	—	—
25.40	—	—	—	0.340	—	—	0.597	—	0.791	1.038	—	—	—
31.75	—	—	—	—	—	—	0.752	—	0.998	1.316	—	—	—
38.10	—	—	—	—	—	—	0.907	—	1.206	1.593	—	—	—
44.45	—	—	—	—	—	—	1.062	—	—	—	—	—	—
50.80	—	—	—	—	—	—	1.217	—	1.621	2.148	—	—	—
63.50	—	—	—	—	—	—	1.526	—	2.036	2.703	—	—	—
76.20	—	—	—	—	—	—	—	—	2.451	3.258	—	—	—
101.60	—	—	—	—	—	—	—	—	3.282	4.367	5.417	—	—
127.00	—	—	—	—	—	—	—	—	—	5.477	6.799	—	—
152.40	—	—	—	—	—	—	—	—	—	6.586	8.181	10.596	—
60/40 BRASS	—	—	—	—	—	—	—	—	—	—	—	—	—
76.20	—	—	—	—	—	—	—	—	—	3.200	3.964	5.113	5.300
101.60	—	—	—	—	—	—	—	—	—	4.290	5.322	6.879	7.132
127.00	—	—	—	—	—	—	—	—	—	—	6.680	8.644	8.965
152.40	—	—	—	—	—	—	—	—	—	—	—	10.410	10.797

Mass (kg) per linear metre = (external diameter (mm) — wall thickness (mm)) × wall thickness (mm)

× $\begin{cases} 0.02811 & \text{for copper.} \\ 0.0268 & \text{for 70/30 brass.} \\ 0.02633 & \text{for 60/40 brass.} \end{cases}$

BRASS AND COPPER—RODS AND BARS

Standard Sizes — Round, Square, Hexagon

MASS PER UNIT LENGTH

Calculated on the mean density of copper taken as 8940 kg/m³ and brass as 8476 kg/m³

ROUND

Dia- meter, mm	Mass per linear metre, kg		Dia- meter, mm	Mass per linear metre, kg	
	Brass	Copper		Brass	Copper
3	0.060	0.063	27	4.85	5.12
4	0.107	0.112	30	5.99	6.32
5	0.166	0.176	33	7.25	7.65
6	0.240	0.253	36	8.63	9.10
7	0.326	0.344	39	10.13	10.68
8	0.426	0.449	42	11.74	12.39
9	0.539	0.569	45	13.48	14.22
10	0.666	0.702	48	15.34	16.18
12	0.959	1.01	50	16.64	17.55
14	1.30	1.38	55	20.14	21.24
16	1.70	1.80	60	23.97	25.28
18	2.16	2.28	65	28.13	29.67
20	2.66	2.81	70	32.62	34.41
22	3.22	3.40	75	37.45	39.50
24	3.83	4.04	80	42.61	44.94

SQUARE

Side, mm	Mass per linear metre, kg		Side, mm	Mass per linear metre, kg	
	Brass	Copper		Brass	Copper
6	0.305	0.322	20	3.39	3.58
8	0.542	0.572	25	5.30	5.59
10	0.848	0.894	32	8.68	9.15
12	1.22	1.29	35	10.38	10.95
14	1.66	1.75	40	13.56	14.30
16	2.17	2.29	45	17.16	18.10
18	2.75	2.89	50	21.19	22.35

HEXAGON

Across flats, mm	Mass per linear metre, kg		Across flats, mm	Mass per linear metre, kg	
	Brass	Copper		Brass	Copper
3.2	0.075	0.079	24	4.23	4.46
4	0.118	0.124	30	6.61	6.97
5	0.184	0.194	36	9.51	10.03
5.5	0.222	0.234	46	15.53	16.38
7	0.360	0.379	55	22.21	23.42
8	0.470	0.496	65	31.02	32.71
10	0.734	0.774	75	41.29	43.55
13	1.24	1.31	85	53.04	55.94
17	2.12	2.24	95	66.25	69.87
19	2.65	2.80			

BRASS—SHEET AND STRIP

- GENERAL** — 1. Common Grades: 63/37 (Basis Brass)
70/30 (Yellow or Cartridge Brass)
2. Common Tempers: Soft, Half Hard, Hard, Extra Hard.
3. Preferred Dimensions: To AS 1123 — 1972.

TRADE SIZES —

Sheet: All preferred thicknesses — 600 mm x 1800 mm
900 mm x 1800 mm

Strip: Subject to special inquiry.

MASS PER UNIT AREA —

Calculated on the mean density of rolled **63/37 Brass** taken as 8440 kg/m^3 . Slight variations correspond to the composition of different alloys.

Table can also be used for 70/30 Brass and other copper alloys if the values listed are multiplied by the factors appearing in the footnote.

Preferred Thickness, mm	Mass per square metre, kg	Preferred Thickness, mm	Mass per square metre, kg
0.10	0.844	1.2	10.1
0.12	1.01	1.6	13.5
0.16	1.35	2.0	16.9
0.20	1.69	2.5	21.1
0.25	2.11	3.0	25.3
0.30	2.53	4.0	33.8
0.40	3.58	5.0	42.2
0.50	4.22	6.0	50.6
0.60	5.06	8.0	67.5
0.80	6.75	10.0	84.4
1.00	8.44		

To obtain value for.	Multiply listed value by factor:
90/10 & 85/15 Gilding Metals	1.036
12% Nickel Silvers	1.018
18% Nickel Silvers	1.030
Engraving Brass	1.003
5% Phosphor Bronze	1.049
70/30 Brass	1.010

EXTRUDED FLAT BRASS SECTIONS

Standard Rectangular Sizes

MASS PER UNIT LENGTH

Calculated on the mean density of 63/37 brass taken as 8440 kg/m³

Dimension, mm	Mass per linear metre, kg	Dimension, mm	Mass per linear metre, kg	Dimension, mm	Mass per linear metre, kg
1.6 x	10 0.135	6 x	10 0.51	16 x	20 2.70
	12 0.162		12 0.61		25 3.38
	16 0.216		16 0.81		30 4.05
2 x	10 0.169		20 1.01		40 5.40
	12 0.203		25 1.27		60 8.10
	20 0.338		30 1.52		100 13.50
3 x	10 0.253		40 2.03	20 x	25 4.22
	12 0.304		50 2.53		30 5.06
	16 0.405		60 3.04		40 6.75
	20 0.506		80 4.05		50 8.44
	25 0.633		100 5.06		60 10.13
	30 0.760	8 x	10 0.68		80 13.50
	40 1.01		12 0.81	25 x	100 16.88
	50 1.27		16 1.08		30 6.33
4 x	10 0.338		25 1.69		40 8.44
	12 0.405		30 2.03		50 10.55
	16 0.540		40 2.70		60 12.66
	20 0.675		60 4.05		80 16.88
	25 0.844	10 x	12 1.01		100 21.10
	30 1.01		16 1.35	30 x	40 10.13
	40 1.35		20 1.69		50 12.66
	50 1.69		25 2.11		60 15.19
	60 2.03		30 2.53		80 20.26
	80 2.70		40 3.38		100 25.32
	100 3.38		50 4.22	40 x	50 16.88
5 x	10 0.422		60 5.06		60 20.26
	20 0.844		80 6.75		80 27.01
	25 1.06		100 8.44		100 33.76
	30 1.27	12 x	16 1.62	50 x	60 25.32
5 x	40 1.69		20 2.03		80 33.76
			25 2.53		100 42.20
			30 3.04	60 x	80 40.51
			40 4.05		100 50.64
			50 5.06		
			60 6.07	80 x	100 67.52
			80 8.10		
			100 10.13		

ZINC AND ZINC SHEET

Zinc is rolled in plates, sheet and strip, and is available in sheets up to a maximum width of 915 mm and maximum length of 2440 mm. Minimum thickness available in widths over 607 mm is 0.71 mm. Strip in coil is supplied to a maximum width of 607 mm in thicknesses from 0.15 mm to 1.22 mm. Standard coil thicknesses are 0.46 mm, 0.61 mm, 0.71 mm and 0.79 mm.

Zinc Sheet Mass

Thickness, mm	Mass per unit area, kg/m ²	Approximate mass per sheet, kg	
		915 x 1830 mm	915 x 2440 mm
0.46	3.29		
0.48	3.48		
0.51	3.66		
0.53	3.83		
0.56	4.02		
0.58	4.21		
0.61	4.38		
0.64	4.57		
0.66	4.78		
0.69	4.95		
0.71	5.13	8.55	11.40
0.74	5.32	8.85	11.83
0.76	5.50	9.16	12.23
0.79	5.78	9.48	12.65
0.81	5.97	9.78	13.04
0.84	6.05	10.08	13.45
0.92	6.58	11.01	14.70
1.04	7.51	12.52	16.71

Process Engravers' Zinc

Process engravers' sheets are supplied in 1015 mm x 507 mm plates polished on one side.

507 mm x 1015 mm x	4.07 mm	3.25 mm	2.59 mm	2.03 mm	1.63 mm
Mass per plate, kg	15	12	10	75	59

LEAD AND LEAD SHEET

Soft lead (up to 99.99% lead) and alloy lead is generally sold by the tonne in ingots weighing 25 kg. Lead and lead alloy plate, sheet and strip are also available.

STANDARD SIZES FOR LEAD SHEET

(Available as rolled or cast sheet)

ROLLED SHEET: Soft lead and lead alloy (Commercial and Chemical grades):—

Foils from 0.5 mm thick up to plate 25 mm thick.

Length in multiples of 10 mm up to 10 m.

Width in multiples of 5 mm up to 2700 mm.

CAST SHEET: Soft lead both plain and wire reinforced for greater creep resistance:—

Plain sheet 0.5, 0.7, 1.0, 1.2 and 1.8 mm thick. Wire reinforced 1.0, 1.2 and 1.8 mm thick.

Length in multiples of 10 mm up to 360 m.

Width in multiples of 5 mm up to 900 mm.

DAMP COURSE:

Bitumen Coated

Thickness 0.5 mm, 1.0 mm, 1.2 mm.

Plain (Uncoated)

Thickness 1.0, 1.2, 1.8, 2.2, 2.5 mm.

Length (for both) 6000 mm.

Widths (for both) 110, 150, 225, 300, 350, 450 mm.

THICKNESSES AND APPROXIMATE EQUIVALENT MASS

Thickness, mm	Mass per unit area, kg/m ²
0.5	5.67
0.7	7.94
1.0	11.34
1.2	13.61
1.8	20.41
2.2	24.95
2.5	28.35
3.0	34.02
3.5	39.69
4.0	45.36

Multiples of these sizes available up to 25 mm.

MONEL ALLOY 400 AND NICKEL*

Mass per Unit Length of Rounds, Squares and Hexagons

*The values shown are for Monel alloy 400 (density 8.83 kg/dm³). Nickel 200 density is 8.89 kg/dm³, therefore multiply value by factor 1.007 to obtain equivalent mass for nickel.

Size, mm	Round	Hexa- gon	Square	Size, mm	Round	Hexa- gon	Square
5.0	—	0.191	0.221	50	17.3	19.1	22.1
5.5	—	0.231	—	55	21.0	23.1	26.7
6.0	—	—	0.318	60	25.0	27.5	31.8
7.0	—	0.375	—	65	29.3	32.3	37.3
8.0	—	0.489	0.565	70	34.0	37.5	43.3
10	0.694	0.765	0.883	75	39.0	43.0	49.7
11	—	0.925	—	80	44.4	48.9	56.5
12	0.999	1.10	1.27	85	—	55.2	63.8
13	—	1.29	—	90	56.2	61.9	71.5
14	1.36	1.50	1.73	95	—	69.0	—
16	1.78	—	2.26	100	69.4	76.5	88.3
17	—	2.21	—	110	83.9	—	107
18	2.25	—	2.86	120	99.9	—	127
19	—	2.76	—	130	117	—	149
20	2.77	—	3.53	140	136	—	173
22	3.36	3.70	4.27	160	178	—	226
24	—	4.40	—	180	225	—	286
25	4.33	—	5.52	200	277	—	353
27	—	5.57	—	220	336	—	—
28	5.44	—	—	240	399	—	—
30	6.24	6.88	7.95	260	469	—	—
32	7.10	7.83	9.04	280	544	—	—
35	8.50	—	—	300	624	—	—
36	—	9.91	11.4	350	850	—	—
40	11.1	—	14.1	400	1110	—	—
41	—	12.9	—	450	1400	—	—
45	14.0	—	—	500	1730	—	—
46	—	16.2	18.7				

ALUMINIUM ALLOY SHEET

Mass per Unit Area

Values shown are theoretical and based on the density of commercially pure aluminium (2710 kg/m³). Actual values may differ slightly within the permissible manufacturing tolerances.

Thickness, mm	Mass per unit area, kg/m ²
0.16	0.434
0.18	0.488
0.20	0.542
0.22	0.596
0.25	0.678
0.28	0.759
0.30	0.813
0.35	0.949
0.40	1.084
0.45	1.220
0.50	1.355
0.55	1.491
0.60	1.626
0.70	1.897
0.80	2.168
0.90	2.439
1.00	2.710
1.1	2.981
1.2	3.252
1.4	3.794
1.6	4.336
1.8	4.878
2.0	5.420
2.2	5.962
2.5	6.775
2.8	7.588
3.0	8.130
3.5	9.485
4.0	10.840
4.5	12.195
5.0	13.550
5.5	14.905
6.0	16.260

ROUND AND SQUARE STEEL BAR AND ROD **Mass per metre and length per tonne**

Thickness or Dia, mm	Rounds		Squares	
	kg/m	m/t	kg/m	m/t
2	0.024 3	40 549	0.031 4	31 847
3	0.055 7	18 022	0.070 7	14 154
4	0.098 9	10 137	0.126	7 962
5	0.154	6 488	0.196	5 096
6	0.222	4 505	0.283	3 539
7	0.302	3 310	0.385	2 600
8	0.395	2 534	0.502	1 990
9	0.499	2 002	0.636	1 573
10	0.616	1 622	0.785	1 274
12	0.887	1 126	1.13	884.6
14	1.21	827.5	1.54	649.9
15	1.39	720.9	1.77	566.2
16	1.58	633.6	2.01	497.6
18	1.99	500.6	2.54	393.2
20	2.46	405.5	3.14	318.5
22	2.98	335.1	3.80	263.2
24	3.55	281.6	4.52	221.2
25	3.85	259.5	4.91	203.8
26	4.17	239.9	5.31	188.4
28	4.84	206.9	6.15	162.5
30	5.55	180.2	7.07	141.5
32	6.31	158.4	8.04	124.4
34	7.13	140.3	9.07	110.2
35	7.55	132.4	9.62	104.0
36	7.99	125.2	10.2	98.3
38	8.90	112.3	11.3	88.2
40	9.87	101.4	12.6	79.6
42	10.9	91.9	13.8	72.2
44	11.9	83.8	15.2	65.8
45	12.5	80.1	15.9	62.9
46	13.0	76.7	16.6	60.2
48	14.2	70.4	18.1	55.3
50	15.4	64.9	19.6	51.0
52	16.7	60.0	21.2	47.1
54	18.0	55.6	22.9	43.7
55	18.7	53.6	23.7	42.1
56	19.3	51.7	24.6	40.6

ROUND AND SQUARE STEEL BAR AND ROD **Mass per metre and length per tonne**

Thickness or Dia, mm	Rounds		Squares	
	kg/m	m/t	kg/m	m/t
58	20.7	48.2	26.4	37.9
60	22.2	45.1	28.3	35.4
62	23.7	42.2	30.2	33.1
64	25.3	39.6	32.2	31.1
65	26.0	38.4	33.2	30.2
66	26.9	37.2	34.2	29.2
68	28.5	37.1	36.3	27.5
70	30.2	33.1	38.5	26.0
72	32.0	31.3	40.7	24.6
74	33.8	29.6	43.0	23.3
75	34.7	28.8	44.2	22.6
76	35.6	28.1	45.3	22.1
78	37.5	26.7	47.8	20.9
80	39.5	25.3	50.2	19.9
82	41.5	24.1	52.8	18.9
84	43.5	23.0	55.4	18.1
85	44.5	22.4	56.7	17.6
86	45.6	21.9	58.1	17.2
88	47.7	20.9	60.8	16.4
90	49.9	20.0	63.6	15.7
92	52.2	19.2	66.4	15.1
94	54.5	18.4	69.4	14.4
95	55.6	18.0	70.8	14.1
96	56.8	17.6	72.3	13.8
98	59.2	16.9	75.4	13.3
100	61.7	16.2	78.5	12.7
105	68.0	14.7	86.5	11.6
110	74.6	13.4	95.0	10.5
115	81.5	12.3	104	9.63
120	88.8	11.3	113	8.85
125	96.3	10.4	123	8.15
130	104	9.60	133	7.54
135	112	8.90	143	6.99
140	121	8.27	154	6.50
145	130	7.71	165	6.06
150	139	7.21	177	5.66

Mass calculations are based on a density for steel of 7850 kg/m³.

STEEL RECTANGULAR SECTIONS —

Mass per Unit Length (kg/m) of Flat Rolled Plate, Sheet, Coil and Bar

Mass per unit length table (pages 286 and 287) is theoretical only. Calculations are based on a mass for carbon steel of 7850 kg/m^3 and are rounded off.

To obtain values for intermediate widths to 5 mm increments, select width combinations to equal the width required and sum their respective mass values.

eg, to obtain the mass per linear metre for a section
11 mm thick $\times$ 1275 mm wide

millimetres	kilograms per linear metre	
11 $\times$ 1000	weighs	86.4
11 $\times$ 200	weighs	17.3
11 $\times$ 75	weighs	6.48
<hr/>		
$\therefore$ 11 $\times$ 1275	weighs	110.18

The value for any thickness or width may be obtained from the following formula:

Mass (kg) per linear metre

$$= 7850 \times \text{thickness (m)} \times \text{width (m)}$$

STEEL RECTANGULAR SECTIONS — MASS PER UNIT LENGTH, kg/m

Width, mm		Thickness, mm													Width, mm	
1	2	3	4	5	6	7	8	9	10	11	12	13				
5	0.0393	0.0785	0.118	0.157	0.196	0.236	0.275	0.314	0.353	0.393	0.432	0.471	0.510	5		
10	0.0785	0.157	0.236	0.314	0.392	0.471	0.550	0.628	0.707	0.785	0.864	0.942	1.02	10		
15	0.118	0.236	0.353	0.471	0.589	0.707	0.824	0.942	1.06	1.18	1.30	1.41	1.53	15		
20	0.157	0.314	0.471	0.628	0.785	0.942	1.10	1.26	1.41	1.57	1.73	1.88	2.04	20		
25	0.196	0.393	0.589	0.785	0.981	1.18	1.37	1.57	1.77	1.96	2.16	2.36	2.55	25		
30	0.236	0.471	0.707	0.942	1.18	1.41	1.65	1.88	2.12	2.36	2.59	2.83	3.06	30		
35	0.275	0.550	0.824	1.10	1.37	1.65	1.92	2.20	2.47	2.75	3.02	3.30	3.57	35		
40	0.314	0.628	0.942	1.26	1.57	1.88	2.20	2.51	2.83	3.14	3.45	3.77	4.08	40		
45	0.353	0.707	1.06	1.41	1.77	2.12	2.47	2.83	3.18	3.53	3.89	4.24	4.59	45		
50	0.393	0.785	1.18	1.57	1.96	2.36	2.75	3.14	3.53	3.93	4.32	4.71	5.10	50		
55	0.432	0.864	1.30	1.73	2.16	2.59	3.02	3.45	3.89	4.32	4.75	5.18	5.61	55		
60	0.471	0.942	1.41	1.88	2.36	2.83	3.30	3.77	4.24	4.71	5.18	5.65	6.12	60		
65	0.510	1.02	1.53	2.04	2.55	3.06	3.57	4.08	4.59	5.10	5.61	6.12	6.63	65		
70	0.550	1.10	1.65	2.20	2.75	3.30	3.85	4.40	4.95	5.50	6.04	6.59	7.14	70		
75	0.589	1.18	1.77	2.36	2.94	3.53	4.12	4.71	5.30	5.89	6.48	7.07	7.65	75		
80	0.628	1.26	1.88	2.51	3.14	3.77	4.40	5.02	5.65	6.28	6.91	7.54	8.16	80		
85	0.667	1.33	2.00	2.67	3.34	4.00	4.67	5.34	6.01	6.67	7.34	8.01	8.67	85		
90	0.707	1.41	2.12	2.83	3.53	4.24	4.95	5.65	6.36	7.07	7.77	8.48	9.18	90		
95	0.746	1.49	2.24	2.98	3.73	4.47	5.22	5.97	6.71	7.46	8.20	8.95	9.69	95		
100	0.785	1.57	2.36	3.14	3.93	4.71	5.50	6.28	7.07	7.85	8.64	9.42	10.2	100		
200	1.57	3.14	4.71	6.28	7.85	9.42	11.0	12.6	14.1	15.7	17.3	18.8	20.4	200		
300	2.36	4.71	7.07	9.42	11.8	14.1	16.5	18.8	21.2	23.6	25.9	28.3	30.6	300		
400	3.14	6.28	9.42	12.6	15.7	18.8	22.0	25.1	28.3	31.4	34.5	37.7	40.8	400		
500	3.93	7.85	11.8	15.7	19.6	23.6	27.5	31.4	35.3	39.3	43.2	47.1	51.0	500		
600	4.71	9.42	14.1	18.8	23.6	28.3	33.0	37.7	42.4	47.1	51.8	56.5	61.2	600		
700	5.50	11.0	16.5	22.0	27.5	33.0	38.5	44.0	49.5	55.0	60.4	65.9	71.4	700		
800	6.28	12.6	18.8	25.1	31.4	37.7	44.0	50.2	56.5	62.8	69.1	75.4	81.6	800		
900	7.07	14.1	21.2	28.3	35.3	42.4	49.5	56.5	63.6	70.7	77.7	84.8	91.8	900		
1000	7.85	15.7	23.6	31.4	39.3	47.1	55.0	62.8	70.7	78.5	86.4	94.2	102	1000		
2000	15.7	31.4	47.1	62.8	78.5	94.2	110	126	141	157	173	188	204	2000		

LYSAGHT REFEREE

Width, mm	Thickness, mm													Width, mm
	14	15	16	17	18	19	20	21	22	23	24	25	26	
5	0.550	0.589	0.628	0.667	0.707	0.746	0.785	0.824	0.864	0.903	0.942	0.981	1.02	
10	1.10	1.18	1.26	1.33	1.41	1.49	1.57	1.65	1.73	1.81	1.88	1.96	2.04	
15	1.65	1.77	1.88	2.00	2.12	2.24	2.36	2.47	2.59	2.71	2.83	2.94	3.06	
20	2.20	2.36	2.51	2.67	2.82	2.98	3.14	3.30	3.45	3.61	3.77	3.93	4.08	
25	2.75	2.94	3.14	3.34	3.53	3.73	3.93	4.12	4.32	4.51	4.71	4.91	5.10	
30	3.30	3.53	3.77	4.00	4.24	4.47	4.71	4.95	5.18	5.42	5.65	5.89	6.12	
35	3.85	4.12	4.40	4.67	4.95	5.22	5.50	5.77	6.04	6.32	6.59	6.87	7.14	
40	4.40	4.71	5.02	5.34	5.65	5.97	6.28	6.59	6.91	7.22	7.54	7.85	8.16	
45	4.95	5.30	5.65	6.01	6.36	6.71	7.07	7.42	7.77	8.12	8.48	8.83	9.18	
50	5.50	5.89	6.28	6.67	7.06	7.46	7.85	8.24	8.64	9.03	9.42	9.81	10.2	
55	6.04	6.48	6.91	7.34	7.77	8.20	8.64	9.07	9.50	9.93	10.4	10.8	11.2	
60	6.59	7.07	7.54	8.01	8.48	8.95	9.42	9.89	10.4	10.8	11.3	11.8	12.2	
65	7.14	7.65	8.16	8.67	9.18	9.69	10.2	10.7	11.2	11.7	12.2	12.8	13.3	
70	7.69	8.24	8.79	9.34	9.89	10.4	11.0	11.5	12.1	12.6	13.2	13.7	14.3	
75	8.24	8.83	9.42	10.0	10.5	11.2	11.8	12.4	13.0	13.5	14.1	14.7	15.3	
80	8.79	9.42	10.0	10.7	11.3	11.9	12.6	13.2	13.8	14.4	15.1	15.7	16.3	
85	9.34	10.0	10.7	11.3	12.0	12.7	13.3	14.0	14.7	15.3	16.0	16.7	17.3	
90	9.89	10.6	11.3	12.0	12.7	13.4	14.1	14.8	15.5	16.2	17.0	17.7	18.4	
95	10.4	11.2	11.9	12.7	13.4	14.2	14.9	15.7	16.4	17.2	17.9	18.6	19.4	
100	11.0	11.8	12.6	13.3	14.1	14.9	15.7	16.5	17.3	18.1	18.8	19.6	20.4	
200	22.0	23.6	25.1	26.7	28.2	29.8	31.4	33.0	34.5	36.1	37.7	39.3	40.8	
300	33.0	35.3	37.7	40.0	42.4	44.7	47.1	49.5	51.8	54.2	56.5	58.9	61.2	
400	44.0	47.1	50.2	53.4	56.5	59.7	62.8	65.9	69.1	72.2	75.4	78.5	81.6	
500	55.0	58.9	62.8	66.7	70.7	74.6	78.5	82.4	86.4	90.3	94.2	98.1	102	
600	65.9	70.7	75.4	80.1	84.8	89.5	94.2	98.9	104	108	113	118	122	
700	76.9	82.4	87.9	93.4	98.9	104	110	115	121	126	132	137	143	
800	87.9	94.2	100	107	113	119	126	132	138	144	151	157	163	
900	98.9	106	113	120	127	134	141	148	155	162	170	177	184	
1000	110	118	126	133	141	149	157	165	173	181	188	196	204	
2000	220	236	251	267	283	298	314	330	345	361	377	393	408	

CONVERSION FACTORS

Factors listed are based on Australian Standard 1376 "Conversion Factors" and where not exact have been rounded to six significant figures. Exact values printed in bold type.

To convert from	to	multiply by
acre	hectare	0.404 686
acre foot	cubic metre	1 233.48
atmosphere	millibar	1 013.25
atmosphere	pascal	101 325
barrel	litre	159.113
barrel (US)	litre	158.987
barrel, dry (US)	cubic metre	0.115 627
British thermal unit	joule	1 055.06
British thermal unit	kilowatt. hour	0.000 293
British thermal unit	megajoule	0.001 055
Btu per cubic foot	kilojoule per cubic metre	37.258 9
Btu per gallon	kilojoule per litre	0.232 080
Btu per hour	watt	0.293 071
Btu per pound	kilojoule per kilogram	2.326
Btu per square foot hour °F	watt per square metre. kelvin	5.678 26
bushel	litre	36.368 7
bushel (US)	litre	35.239 1
cubic foot	cubic metre	0.028 317
cubic foot per second	cubic metre per second	0.028 317
cubic inch	cubic centimetre	16.387 064
cubic inch	cubic millimetre	16 387.1
cubic yard	cubic metre	0.764 555
fathom	metre	1.828 8
fluid ounce	millilitre	28.413 1
foot	metre	0.304 8
foot per minute	metre per minute	0.304 8

foot per minute	metre per second	0.005 08
foot per second	metre per second	0.304 8
foot pound force	joule	1.355 82
foot pound force per second	watt	1.355 82
furlong	metre	201.168
gallon	litre	4.546 09
gallon (US)	litre	3.785 41
gravity (standard)	metre per second per second	9.803 65
horse-power	kilowatt	0.745 700
hundredweight	kilogram	50.802 3
inch	metre	0.025 4
inch	micrometre	25 400.00
inch	millimetre	25.4
inch mercury	kilopascal	3.386 38
inch water gauge	kilopascal	0.248 642
kilowatt hour	megajoule	3.6
knot (international)	kilometre per hour	1.852
mile	kilometre	1.609 344
mile per gallon	litre per 100 kilometre	divide 282.481 by mile per gallon
mile per hour	kilometre per hour	1.609 344
millimetre mercury	kilopascal	0.133 322
millimetre water gauge	pascal	9.789 04
ounce	gram	28.349 5
ounce per square foot	gram per square metre	305.152
ounce per square yard	gram per square metre	33.905 7
pint	litre	0.568 261
pound	kilogram	0.453 592 37
pound force	newton	4.448 22
pound force foot	newton. metre	1.355 82
pound force inch	newton. metre	0.112 985
pound force per square inch	kilopascal	6.894 76
pound force per square inch	megapascal	0.006 895

CONVERSION FACTORS (Cont)

Factors listed are based on Australian Standard 1376 "Conversion Factors" and where not exact have been rounded to six significant figures. Exact values printed in bold type.

To convert from	to	multiply by
pound force per square inch	pascal	6 894.76
pound per acre	kilogram per hectare	1.120 85
pound per cubic foot	kilogram per cubic metre	16.018 5
pound per foot	kilogram per metre	1.488 16
pound per gallon	kilogram per litre	0.099 776
pound per square foot	kilogram per square metre	4.882 43
square foot	square metre	0.092 903
square foot per gallon	square metre per litre	0.020 436
square foot per ton	square metre per tonne	0.091 436
square inch	square centimetre	6.451 6
square inch	square millimetre	645.16
square mile	square kilometre	2.589 99
square yard	square metre	0.836 127
superficial foot	cubic metre	0.002 360
ton	tonne	1.016 05
ton, freight (40 ft³)	cubic metre	1.132 67
ton, register (100 ft³)	cubic metre	2.831 68
ton force foot	kilonewton. metre	3.037 03
ton force per square inch	megapascal	15.444 3
ton per cubic yard	tonne per cubic metre	1.328 94
yard	kilometre	0.000 914

GEOMETRY AND MENSURATION

CIRCLE.— Circumference = diameter $\times \frac{22}{7}$ (or 3.1416).

Area = diameter² $\times$ 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 = 0.8862 diameter of circle.

Diameter of circle equal in area to square = 1.1284 side of square.

SPHERE.— Surface area = 3.1416 $\times$ diameter².

Volume = 0.5236 diameter³.

AREAS generally.

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 $\times \frac{2}{3}$.

Ellipse = long axis $\times$ short axis $\times$ 0.7854.

SURFACES AND VOLUMES

CUBES.— a = length of one side, volume = a^3 , surface area = $6a^2$.

RECTANGULAR PRISM.— Volume = area of base $\times$ height = $bl \times h$. Total surface area = $2(bl + lh + bh)$.

REGULAR PRISM.— Volume = $\frac{1}{2}n \times r \times a \times h$, where n = number of sides, r = radius of inscribed circle, a = length of side.

CYLINDER (Right Circular).— Volume = 0.7854 $\times$ diameter² $\times$ height. Lateral surface area = 3.1416 $\times$ diameter $\times$ height. Total surface area = 3.1416 (diameter $\times$ height) + 1.5708 diameter².

ANY PRISM OR CYLINDER.— Volume = $h \times$ area of base. Lateral surface area = length of cylinder $\times$ perimeter of normal section.

REGULAR PYRAMID OR CONE.— Volume = $\frac{1}{3}$ (area of base $\times$ height). Lateral surface area of regular figure = $\frac{1}{2}$ (perimeter of base $\times$ slant height).

ANY PYRAMID OR CONE.— Volume = $\frac{1}{3}$ (area of base $\times$ distance from vertex to plane of base).

FRUSTUM OF ANY PYRAMID OR CONE.— Volume = $\frac{h}{3} (A_1 + A_2 + \sqrt{A_1 A_2})$, where A_1 and A_2 are the areas of bases made by parallel planes.

AREAS AND CIRCUMFERENCES OF CIRCLES

Dia- meter	Area	Circum- ference	Dia- meter	Area	Circum- ference
1	0.7854	3.1416	51	2042.8	160.22
2	3.1416	6.2832	52	2123.7	163.36
3	7.0686	9.4248	53	2206.2	166.50
4	12.566	12.566	54	2290.2	169.65
5	19.635	15.708	55	2375.8	172.79
6	28.274	18.850	56	2463.0	175.93
7	38.485	21.991	57	2551.8	179.07
8	50.266	25.133	58	2642.1	182.21
9	63.617	28.274	59	2734.0	185.35
10	78.540	31.416	60	2827.4	188.50
11	95.033	34.558	61	2922.5	191.64
12	113.10	37.699	62	3019.1	194.78
13	132.73	40.841	63	3117.3	197.92
14	153.94	43.982	64	3217.0	201.06
15	176.72	47.124	65	3318.3	204.20
16	201.06	50.266	66	3421.2	207.35
17	226.98	53.407	67	3525.7	210.49
18	254.47	56.549	68	3631.7	213.63
19	283.53	59.690	69	3739.3	216.77
20	314.16	62.832	70	3848.5	219.91
21	346.36	65.974	71	3959.2	223.05
22	380.13	69.115	72	4071.5	226.20
23	415.48	72.257	73	4185.4	229.34
24	452.39	75.398	74	4300.9	232.48
25	490.88	78.540	75	4417.9	235.62
26	530.93	81.682	76	4536.5	238.76
27	572.56	84.823	77	4656.6	241.90
28	615.75	87.965	78	4778.4	245.04
29	660.52	91.106	79	4901.7	248.19
30	706.86	94.248	80	5026.6	251.33
31	754.77	97.390	81	5153.0	254.47
32	804.25	100.53	82	5281.0	257.61
33	855.30	103.67	83	5410.6	260.75
34	907.92	106.81	84	5541.8	263.89
35	962.12	109.96	85	5674.5	267.04
36	1017.9	113.10	86	5808.8	270.18
37	1075.2	116.24	87	5944.7	273.32
38	1134.1	119.38	88	6082.1	276.46
39	1194.6	122.52	89	6221.2	279.60
40	1256.6	125.66	90	6361.7	282.74
41	1320.3	128.81	91	6503.9	285.89
42	1385.4	131.95	92	6647.6	289.03
43	1452.2	135.09	93	6792.9	292.17
44	1520.5	138.23	94	6939.8	295.31
45	1590.4	141.37	95	7088.2	298.45
46	1661.9	144.51	96	7238.2	301.59
47	1734.9	147.66	97	7389.8	304.74
48	1809.6	150.80	98	7543.0	307.88
49	1885.7	153.94	99	7697.7	311.02
50	1963.5	157.08	100	7854.0	314.16

SQUARES, CUBES, SQUARE ROOTS AND CUBE ROOTS

n	n ²	n ³	√n	³ √n	n	n ²	n ³	√n	³ √n
1	1	1	1.000	1.000	50	2 500	125 000	7.071	3.684
2	4	8	1.414	1.260	51	2 601	132 651	7.141	3.708
3	9	27	1.732	1.442	52	2 704	140 608	7.211	3.733
4	16	64	2.000	1.587	53	2 809	148 877	7.280	3.756
5	25	125	2.236	1.710	54	2 916	157 464	7.348	3.780
6	36	216	2.449	1.817	55	3 025	166 375	7.416	3.803
7	49	343	2.646	1.913	56	3 136	175 616	7.483	3.826
8	64	512	2.828	2.000	57	3 249	185 193	7.550	3.849
9	81	729	3.000	2.080	58	3 364	195 112	7.616	3.871
10	100	1 000	3.162	2.154	59	3 481	205 379	7.681	3.893
11	121	1 331	3.317	2.224	60	3 600	216 000	7.746	3.915
12	144	1 728	3.464	2.289	61	3 721	226 981	7.810	3.936
13	169	2 197	3.606	2.351	62	3 844	238 328	7.874	3.958
14	196	2 744	3.742	2.410	63	3 969	250 047	7.937	3.979
15	225	3 375	3.873	2.466	64	4 096	262 144	8.000	4.000
16	256	4 096	4.000	2.520	65	4 225	274 625	8.062	4.021
17	289	4 913	4.123	2.571	66	4 356	287 496	8.124	4.041
18	324	5 832	4.243	2.621	67	4 489	300 763	8.185	4.062
19	361	6 859	4.359	2.668	68	4 624	314 432	8.246	4.082
20	400	8 000	4.472	2.714	69	4 761	328 509	8.307	4.102
21	441	9 261	4.583	2.759	70	4 900	343 000	8.367	4.121
22	484	10 648	4.690	2.802	71	5 041	357 911	8.426	4.141
23	529	12 167	4.796	2.844	72	5 184	373 248	8.485	4.160
24	576	13 824	4.899	2.884	73	5 329	389 017	8.544	4.179
25	625	15 625	5.000	2.924	74	5 476	405 224	8.602	4.198
26	676	17 576	5.099	2.962	75	5 625	421 875	8.660	4.217
27	729	19 683	5.196	3.000	76	5 776	438 976	8.718	4.236
28	784	21 952	5.292	3.037	77	5 929	456 533	8.775	4.254
29	841	24 389	5.385	3.072	78	6 084	474 552	8.832	4.273
30	900	27 000	5.477	3.107	79	6 241	493 039	8.888	4.291
31	961	29 791	5.568	3.141	80	6 400	512 000	8.944	4.309
32	1 024	32 768	5.657	3.175	81	6 561	531 441	9.000	4.327
33	1 089	35 937	5.745	3.208	82	6 724	551 368	9.055	4.344
34	1 156	39 304	5.831	3.240	83	6 889	571 787	9.110	4.362
35	1 225	42 875	5.916	3.271	84	7 056	592 704	9.165	4.380
36	1 296	46 656	6.000	3.302	85	7 225	614 125	9.220	4.397
37	1 369	50 653	6.083	3.332	86	7 396	636 056	9.274	4.414
38	1 444	54 872	6.164	3.362	87	7 569	658 503	9.327	4.431
39	1 521	59 319	6.245	3.391	88	7 744	681 472	9.381	4.448
40	1 600	64 000	6.325	3.420	89	7 921	704 969	9.434	4.465
41	1 681	68 921	6.403	3.448	90	8 100	729 000	9.487	4.481
42	1 764	74 088	6.481	3.476	91	8 281	753 571	9.539	4.498
43	1 849	79 507	6.557	3.503	92	8 464	778 688	9.592	4.514
44	1 936	85 184	6.633	3.530	93	8 649	804 357	9.644	4.531
45	2 025	91 125	6.708	3.557	94	8 836	830 584	9.695	4.547
46	2 116	97 336	6.782	3.583	95	9 025	857 375	9.747	4.563
47	2 209	103 823	6.856	3.609	96	9 216	884 736	9.798	4.579
48	2 304	110 592	6.928	3.634	97	9 409	912 673	9.849	4.595
49	2 401	117 649	7.000	3.659	98	9 604	941 192	9.899	4.610
					99	9 801	970 299	9.950	4.626
					100	10 000	1 000 000	10.00	4.642

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	3	5	7	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	12	21	29	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	11	19	26	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	10	17	24	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	10	16	23	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	9	15	21	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	8	14	20	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	8	13	18	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	7	12	17	22
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	7	12	16	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	7	11	16	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	6	11	15	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	6	10	14	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	6	10	14	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	6	9	13	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	5	9	12	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	5	9	12	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	5	8	11	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	5	8	11	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	5	8	11	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	4	7	10	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	4	7	10	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	4	7	10	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	4	7	9	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	4	6	9	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	4	6	9	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	4	6	9	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	4	6	8	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	3	6	8	11
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	3	6	8	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	3	5	8	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	3	5	8	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	3	5	7	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	3	5	7	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	3	5	7	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	3	5	7	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	3	5	7	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	3	5	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	3	5	6	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	3	4	6	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	3	4	6	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	3	4	6	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	3	4	6	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	4	6	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	4	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	4	6	7

Difference 2 4 6 8 obtained by interpolation.

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	3	5	7	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	4	5	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	4	5	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	4	5	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	2	4	5	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	2	4	5	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	2	4	5	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	2	4	5	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	2	3	5	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	2	3	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	2	3	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	2	3	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	2	3	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	2	3	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	2	3	4	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	2	3	4	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	2	3	4	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	2	3	4	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	2	3	4	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	2	3	4	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	2	3	4	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	2	3	4	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	2	3	4	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	2	3	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	2	3	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	2	3	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	2	3	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	2	3	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	2	3	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	2	3	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	2	3	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	2	3	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	2	3	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	2	3	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	2	3	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	2	3	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	2	3	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	2	3	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	2	3	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	2	3	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	2	3	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	2	3	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	2	3	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	2	3	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	2	3	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	2	3	4

Common Logarithms = Hyperbolic Logarithms x 0.43429.

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	3	5	7	9
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	1	1	2	2
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	1	1	2	2
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	1	1	2	2
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	1	1	2	2
.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	2	2
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	2	2
.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	2	2
.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	2	2
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	2	3
.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	2	3
.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	2	3
.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	2	2	3
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	2	2	3
.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	2	2	3
.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	2	2	3
.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	2	2	3
.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	2	2	3
.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	2	2	3
.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	2	2	3
.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	2	3	3
.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	2	3	3
.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	2	3	3
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	2	3	3
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	2	3	4
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	2	3	4
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	2	3	4
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	2	3	4
.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	2	3	4
.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	2	3	4
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	2	3	4
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	2	3	4
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	2	3	4
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	2	3	4
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	2	3	4
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	2	3	4	5
.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	2	3	4	5
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	2	3	4	5
.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	2	3	4	5
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	2	3	4	5
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	2	3	4	5
.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	2	3	4	5
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	2	3	4	5
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	2	3	4	6
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	2	3	4	6
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	2	3	4	6
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	2	3	5	6
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	2	3	5	6
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	2	3	5	6
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	2	4	5	6
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	2	4	5	6

Difference 2 4 6 8 obtained by interpolation.

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	3	5	7	9
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	2	4	5	7
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	4	5	7
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	4	5	7
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	4	6	7
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	4	6	7
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	4	6	7
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	3	4	6	8
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	3	4	6	8
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	3	4	6	8
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	3	5	6	8
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	3	5	6	8
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	3	5	7	9
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	3	5	7	9
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	3	5	7	9
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	3	5	7	9
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	3	5	7	9
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	3	5	7	10
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	3	5	8	10
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	3	6	8	10
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	3	6	8	10
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	4	6	8	11
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	4	6	8	11
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	4	6	9	11
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	4	6	9	11
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	4	6	9	12
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	4	7	9	12
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	4	7	9	12
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	4	7	10	12
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	4	7	10	13
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	4	7	10	13
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	4	7	10	13
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	5	8	11	14
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	5	8	11	14
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	5	8	11	14
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	5	8	11	15
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	5	8	12	15
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	5	8	12	15
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	5	9	12	16
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	5	9	12	16
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	5	9	13	16
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	6	9	13	17
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	6	9	13	17
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	6	10	14	17
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	6	10	14	18
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	6	10	14	18
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	6	10	15	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	6	11	15	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	7	11	15	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	7	11	16	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	7	11	16	20

Difference 2 4 6 8 obtained by interpolation.

TRIGONOMETRICAL RATIOS

LYSAGHT REFEREE

Angle		Chord	Sine	Tangent	Co-tangent	Cosine			
De- grees	Radians								
0°	0	0	0	0	∞	1	1.414	1.5708	90°
1	.0175	.017	.0175	.0175	57.2900	.9998	1.402	1.5533	89
2	.0349	.035	.0349	.0349	28.6363	.9994	1.389	1.5359	88
3	.0524	.052	.0523	.0524	19.0811	.9986	1.377	1.5184	87
4	.0698	.070	.0698	.0699	14.3007	.9976	1.364	1.5010	86
5	.0873	.087	.0872	.0875	11.4301	.9962	1.351	1.4835	85
6	.1047	.105	.1045	.1051	9.5144	.9945	1.338	1.4661	84
7	.1222	.122	.1219	.1228	8.1443	.9925	1.325	1.4486	83
8	.1396	.140	.1392	.1405	7.1154	.9903	1.312	1.4312	82
9	.1571	.157	.1564	.1584	6.3138	.9877	1.299	1.4137	81
10	.1745	.174	.1736	.1763	5.6713	.9848	1.286	1.3963	80
11	.1920	.192	.1908	.1944	5.1446	.9816	1.272	1.3788	79
12	.2094	.209	.2079	.2126	4.7046	.9781	1.259	1.3614	78
13	.2269	.226	.2250	.2309	4.3315	.9744	1.245	1.3439	77
14	.2443	.244	.2419	.2493	4.0108	.9703	1.231	1.3265	76
15	.2618	.261	.2588	.2679	3.7321	.9659	1.218	1.3090	75
16	.2793	.278	.2756	.2867	3.4874	.9613	1.204	1.2915	74
17	.2967	.296	.2924	.3057	3.2709	.9563	1.190	1.2741	73
18	.3142	.313	.3090	.3249	3.0777	.9511	1.176	1.2566	72
19	.3316	.330	.3256	.3443	2.9042	.9455	1.161	1.2392	71
20	.3491	.347	.3420	.3640	2.7475	.9397	1.147	1.2217	70
21	.3665	.364	.3584	.3839	2.6051	.9336	1.133	1.2043	69

LYSAGHT REFEREE

[illegible]

TEMPERATURE CONVERSION TABLE

The numbers in **BROWN TYPE** refer to the temperature either in degrees Celsius or Fahrenheit which it is desired to convert into the other scale. If converting from Fahrenheit degrees to Celsius degrees the equivalent temperature will be found in the left column, while if converting from degrees Celsius to degrees Fahrenheit, the answer will be found in the column on the right.

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
-40	-40.0	90.6	195	383	640	1184	599	1110	2030	860	1580	2876					
-37.2	-31.0	93.3	200	392	650	1202	604	1120	2048	866	1590	2894					
-34.4	-30	96.1	205	401	660	1220	610	1130	2066	871	1600	2912					
-31.7	-25	98.9	210	410	670	1238	616	1140	2084	877	1610	2930					
-28.9	-20	100	212	413.6	680	1256	621	1150	2102	882	1620	2948					
-26.1	-15	104	220	428	690	1274	627	1160	2120	888	1630	2966					
-23.3	-10	110	230	446	700	1292	632	1170	2138	893	1640	2984					
-20.6	-5	116	240	464	710	1310	638	1180	2156	899	1650	3002					
-17.8	0	121	250	482	720	1328	643	1190	2174	904	1660	3020					
-15.0	5	127	260	500	730	1346	649	1200	2192	910	1670	3038					
-12.2	10	132	270	518	740	1364	654	1210	2210	916	1680	3056					
-9.4	15	138	280	536	750	1382	660	1220	2228	921	1690	3074					
-6.7	20	143	290	554	760	1400	666	1230	2246	927	1700	3092					
-3.9	25	149	300	572	770	1418	671	1240	2264	932	1710	3110					
-1.1	30	154	310	590	780	1436	677	1250	2282	938	1720	3128					
1.7	35	160	320	608	790	1454	682	1260	2300	943	1730	3146					
4.4	40	166	330	626	800	1472	688	1270	2318	949	1740	3164					
7.2	45	171	340	644	810	1490	693	1280	2336	954	1750	3182					
10.0	50	177	350	662	820	1508	699	1290	2354	960	1760	3200					
12.8	55	182	360	680	830	1526	704	1300	2372	966	1770	3218					
15.6	60	188	370	698	840	1544	710	1310	2390	971	1780	3236					

LYSAGHT REFEREE

18.3	65	149.0	193	380	716	454	850	1562	716	1320	2408	977	1790	3254
21.1	70	158.0	199	390	734	460	860	1580	721	1330	2426	982	1800	3272
23.9	75	167.0	204	400	752	466	870	1598	727	1340	2444	998	1810	3290
26.7	80	176.0	210	410	770	471	880	1616	732	1350	2462	993	1820	3308
29.4	85	185.0	216	420	788	477	890	1634	738	1360	2480	999	1830	3326
32.2	90	194.0	221	430	806	482	900	1652	743	1370	2498	1004	1840	3344
35.0	95	203.0	227	440	824	488	910	1670	749	1380	2516	1010	1850	3362
37.8	100	212.0	232	450	842	493	920	1688	754	1390	2534	1016	1860	3380
40.6	105	221.0	238	460	860	499	930	1706	760	1400	2552	1021	1870	3398
43.3	110	230.0	243	470	878	504	940	1724	766	1410	2570	1027	1880	3416
46.1	115	239.0	249	480	896	510	950	1742	771	1420	2588	1032	1890	3434
48.9	120	248.0	254	490	914	516	960	1760	777	1430	2606	1038	1900	3452
51.7	125	257.0	260	500	932	521	970	1778	782	1440	2624	1043	1910	3470
54.4	130	266.0	266	510	950	527	980	1796	788	1450	2642	1049	1920	3488
57.2	135	275.0	271	520	968	532	990	1814	793	1460	2660	1054	1930	3506
60.0	140	284.0	277	530	986	538	1000	1832	799	1470	2678	1060	1940	3524
62.8	145	293.0	282	540	1004	543	1010	1850	804	1480	2696	1066	1950	3542
65.6	150	302.0	288	550	1022	549	1020	1868	810	1490	2714	1071	1960	3560
68.3	155	311.0	293	560	1040	554	1030	1886	816	1500	2732	1077	1970	3578
71.1	160	320.0	299	570	1058	560	1040	1904	821	1510	2750	1082	1980	3596
73.9	165	329.0	304	580	1076	566	1050	1922	827	1520	2768	1088	1990	3614
76.7	170	338.0	310	590	1094	571	1060	1940	832	1530	2786	1093	2000	3632
79.4	175	347.0	316	600	1112	577	1070	1958	838	1540	2804			
82.2	180	356	321	610	1130	582	1080	1976	843	1550	2822			
85.0	185	365	327	620	1148	588	1090	1994	849	1560	2840			
87.8	190	374	332	630	1166	593	1100	2012	854	1570	2858			

$$^{\circ}\text{C} = \frac{5}{9} \left(^{\circ}\text{F} - 32 \right)$$

$$^{\circ}\text{F} = \frac{9}{5} ^{\circ}\text{C} + 32$$

CONVERSION FORMULAE

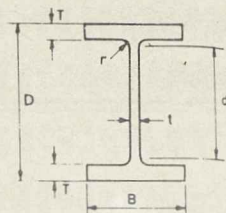
STRUCTURAL STEEL

Australian Standard 1204, 'Structural Steels — Ordinary Weldable Grades'. The regular 'normal strength' steel that is widely available from distributors and stockists is Grade 250.

It is produced in a range of shapes and sections, including Universal Sections, Taper Flange Beams, Channels, Equal and Unequal Angles.

The entire range is detailed in AS 1131, 'Dimensions of Hot-Rolled Structural Steel Sections', and includes large and heavy members mostly used only in fully-engineered structures. The tables here list the dimensions of some lighter sections.

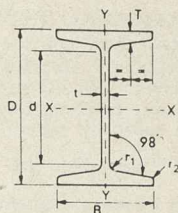
Universal Beams



Properties and Dimensions

Designation	Mass per metre, kg	Depth of Section D , mm	Flange		Web Thickness t , mm	Radius Root r , mm	Depth Between Fillets d , mm	Area of Section, mm ²
			Width B , mm	Thickness T , mm				
410 UB 54	53.6	403	178	10.9	7.6	10.2	361	6840
360 UB 45	44.6	352	171	9.7	6.9	10.2	312	5700
310 UB 40	40.2	304	165	10.2	6.1	8.9	266	5150
250 UB 31	31.3	251	146	8.6	6.1	7.6	219	4000
200 UB 25	25.3	203	133	7.8	5.8	7.6	172	3230

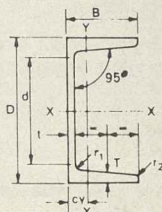
Taper Flange Beams



Properties and Dimensions

Nominal Size, mm	Mass per metre, kg	Depth of Section D, mm	Flange		Web Thickness t, mm	Radii		Depth Between Fillets d, mm	Area of Section, mm ²
			Width B, mm	Thickness T, mm		Root r ₁ mm	Toe r ₂ mm		
203 x 152	52	203	152	16.5	8.9	15.5	7.6	136	6650
203 x 102	27	203	102	10.1	7.1	11.4	5.6	156	3420
178 x 89	22	178	89	10.1	6.4	10.4	5.1	133	2850
152 x 127	37	152	127	14.2	8.4	13.5	6.6	94	4740
152 x 76	18	152	76	9.6	5.8	9.4	4.6	112	2280
127 x 64	13	127	64	8.8	5.1	8.4	4.1	91	1710
102 x 76	15	102	76	8.8	6.1	9.4	4.6	64	1900
102 x 45	7	102	45	6.1	4.3	6.9	3.3	73	948

Channels



Properties and Dimensions

Nominal Size D x B, mm	Mass per metre, kg	Thickness		Centre of Area Cy, mm	Area of Section, mm	Radii	
		Web t, mm	Flange T, mm			Root r ₁ mm	Toe r ₂ mm
203 x 76	24	7.1	11.2	21.3	3030	12	3
178 x 76	21	6.6	10.3	22.0	2650	12	3
152 x 76	18	6.4	9.0	22.1	2280	12	2
127 x 64	15	6.4	9.2	19.4	1900	11	2
102 x 51	10	6.1	7.6	15.1	1330	9	2
76 x 38	6.5	5.1	6.8	11.9	853	8	2

SAFE LOAD TABLES

The tables list the safe distributed load that can be carried by Universal Beams and Taper Flange Beams when used as simply-supported beams over various spans. In using these tables the following points should be carefully noted.

- (i) the tables are for Grade 250 steel.
- (ii) loads are given as safe distributed loads, ie spread evenly along the beam, and are expressed in kilonewtons. 1 kilogram imposes a load of 9.81 newtons; 1 tonne imposes a load of 9.81 kilonewtons.
- (iii) it is important that beams should be long enough to have adequate support or 'landing'. As a rule-of-thumb, the length of support at each end should be no less than the width of the flange, B.
- (iv) beams used as crane runways or for any hoisting purpose are subject to point loads and dynamic loading conditions. **These situations call for special design rules and the tables must NOT be used to select such members.**
- (v) the tables are intended to help in selecting beams to span openings in domestic and similar forms of construction where full engineering designs are not warranted. Where there are more complex conditions the services of a structural engineer should be sought.

Advice on the use of structural steel can be obtained from the Australian Institute of Steel Construction, PO Box 534, North Sydney, NSW 2060. AISC also publishes a number of useful books on steel and steel design.

Acknowledgement is made of the assistance given by the AISC in the preparation and updating of this section on structural steels, and for use of BHP tabular data.

SIMPLIFIED BEAM LOAD TABLES

(BY COURTESY AISI)

NORMAL STRENGTH STEEL (GRADE 250)

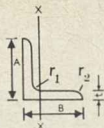
Designation	Mass per metre, kg	Safe Distributed Loads in kilonewtons Spans in metres										Maximum centres of lateral restraints, m*
		2	2.5	3	3.5	4	5	6	7	8	10	
UNIVERSAL BEAMS	410 UB 54	53.6	SEE NOTE					208	158	120	74	2.8
	360 UB 45	44.6						141	102	77	47	2.8
	310 UB 40	40.2				191	186	98	71	53	2.8	
	250 UB 31	31.3			137	117	74	50	36	2.5		
	200 UB 25	25.3	127	105	81	62	39	26	2.4			
TAPER FLANGE BEAMS	mm											
	203 x 152	52	SEE NOTE					53				3.9
	203 x 102	27						25			1.8	
	178 x 89	22				126	79				1.7	
	152 x 127	37				60	38	24			3.9	
	152 x 76	18	88	41	64	48			1.5			
	127 x 64	13	21	15	29	22			1.3			
	102 x 76	15	30	14	15				2.2			
102 x 45	7	34	21	7				0.9				

NOTE—For these short spans the load given to the right of the heavy line should not be exceeded without the advice of an Engineer.

* LATERAL RESTRAINT Beams that directly support floor systems (concrete or timber) and are firmly connected to them can be regarded as being fully laterally restrained. Other beams should have their top flanges restrained laterally at not more than the centres tabulated.

Equal Angles

Properties and Dimensions



Nominal Size A x B, mm	Thickness t		Radii		Mass per metre, kg	Area of Section, mm ²
	Nominal, mm	Actual, mm	Root r ₁ mm	Toe r ₂ mm		
203 x 203	25	25.3	15.2	4.8	75.9	9680
	22	22.1	15.2	4.8	67.0	8540
	18	19.1	15.2	4.8	57.9	7380
	16	15.8	15.2	4.8	48.7	6200
	12	12.7	15.2	4.8	39.6	5040
152 x 152	18	19.0	12.2	4.8	42.7	5450
	16	15.9	12.2	4.8	36.0	4600
	12	12.6	12.2	4.8	29.0	3700
	10	9.4	12.2	4.8	22.0	2810
127 x 127	16	15.8	10.7	4.8	29.6	3780
	12	12.6	10.7	4.8	24.0	3060
	10	9.5	10.7	4.8	18.3	2330
	8	8.0	10.7	4.8	15.5	1970
102 x 102	12	12.6	9.1	4.8	18.9	2410
	10	9.5	9.1	4.8	14.4	1840
	8	7.8	9.1	4.8	12.1	1540
	6.5	6.4	9.1	4.8	9.82	1260
89 x 89	10	9.4	8.4	4.8	12.5	1590
	8	7.9	8.4	4.8	10.6	1350
	6.5	6.3	8.4	4.8	8.48	1080
76 x 76	10	9.4	7.6	4.8	10.6	1350
	8	7.8	7.6	4.8	8.92	1140
	6.5	6.2	7.6	4.8	7.14	912
	5	4.8	7.6	4.8	5.51	708
64 x 64	10	9.5	6.9	2.4	8.78	1120
	8	7.9	6.9	2.4	7.44	948
	6.5	6.2	6.9	2.4	5.96	759
	5	4.8	6.9	2.4	4.61	591
57 x 57	8	7.8	6.6	2.4	6.55	835
	6.5	6.3	6.6	2.4	5.35	682
	5	4.6	6.6	2.4	4.01	511
51 x 51	8	7.8	6.1	2.4	5.80	739
	6.5	6.3	6.1	2.4	4.77	608
	5	4.7	6.1	2.4	3.58	456
	3	3.2	6.1	2.4	2.53	318
44 x 44	6.5	6.1	5.8	2.4	4.02	512
	5	4.7	5.8	2.4	3.13	399
	3	3.2	5.8	2.4	2.17	277
38 x 38	6.5	6.3	5.3	2.4	3.50	446
	5	4.7	5.3	2.4	2.68	341
	3	3.2	5.3	2.4	1.79	236

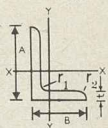
Equal Angles (Cont)

Properties and Dimensions

Nominal Size A x B, mm	Thickness t		Radii		Mass per metre, kg	Area of Section, mm ²
	Nominal, mm	Actual, mm	Root r_1 mm	Toe r_2 mm		
32 x 32	6.5	6.2	5.1	2.4	2.83	361
	5	4.6	5.1	2.4	2.16	275
	3	3.1	5.1	2.4	1.49	190
25 x 25	6.5	6.4	4.6	2.4	2.23	284
	5	4.7	4.6	2.4	1.72	219
	3	3.2	4.6	2.4	1.19	152
Bedstead	Angles					
44 x 44	3	3.2	1.6	2.4	2.11	271
38 x 38	3	3.2	1.6	2.4	1.80	232

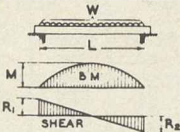
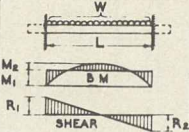
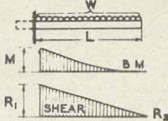
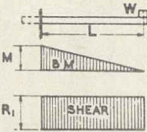
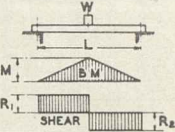
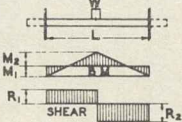
Unequal Angles

Properties and Dimensions



Nominal Size A x B, mm	Thickness t		Radii		Mass per metre, kg	Area of Section, mm ²
	Nominal, mm	Actual, mm	Root r_1 mm	Toe r_2 mm		
152 x 102	12	12.6	10.7	4.8	24.0	3060
	10	9.5	10.7	4.8	18.3	2330
152 x 89	16	15.8	10.4	4.8	28.0	3570
	12	12.6	10.4	4.8	22.8	2900
	10	9.4	10.4	4.8	17.3	2200
	8	7.8	10.4	4.8	14.4	1840
127 x 76	12	12.6	9.1	4.8	18.9	2410
	10	9.4	9.1	4.8	14.4	1840
	8	7.8	9.1	4.8	12.1	1540
	6.5	6.4	9.1	4.8	9.82	1260
102 x 76	10	9.4	8.4	4.8	12.5	1590
	8	7.9	8.4	4.8	10.6	1350
	6.5	6.4	8.4	4.8	8.63	1090
89 x 64	10	9.4	7.6	4.8	10.6	1350
	8	7.8	7.6	4.8	8.93	1140
	6.5	6.2	7.6	4.8	7.16	912
	5	4.8	7.6	4.8	5.51	707
76 x 51	8	7.9	6.9	2.3	7.45	949
	6.5	6.2	6.9	2.3	5.96	759
	5	4.7	6.9	2.3	4.62	589
64 x 51	8	7.8	6.6	2.3	6.55	835
	6.5	6.2	6.6	2.3	5.35	682
	5	4.6	6.6	2.3	4.01	511

BEAM LOADING

System of Loading	Max B M	Diagram	Shear Reactions	Max Deflection
Uniformly loaded, Ends supported.	$M = \frac{WL}{8}$		$R_1 = \frac{W}{2}$ $R_2 = \frac{W}{2}$	$\frac{WL^3}{76.8EI}$
Uniformly loaded, Ends fixed.	$M_1 = \frac{WL}{12}$ $M_2 = \frac{WL}{24}$		$R_1 = \frac{W}{2}$ $R_2 = \frac{W}{2}$	$\frac{WL^3}{384EI}$
Uniformly loaded, One end fixed, other free.	$M = \frac{WL}{2}$		$R_1 = W$ $R_2 = 0$	$\frac{WL^3}{8EI}$
Load concentrated at free end, One end fixed, Other free.	$M = WL$		$R_1 = W$	$\frac{WL^3}{3EI}$
Load concentrated at centre, Ends supported.	$M = \frac{WL}{4}$		$R_1 = \frac{W}{2}$ $R_2 = \frac{W}{2}$	$\frac{WL^3}{48EI}$
Load concentrated at centre, Ends fixed.	$M_1 = \frac{WL}{8}$ $M_2 = \frac{WL}{8}$		$R_1 = \frac{W}{2}$ $R_2 = \frac{W}{2}$	$\frac{WL^3}{192EI}$

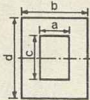
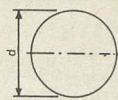
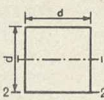
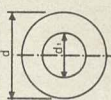
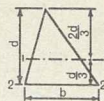
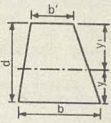
PROPERTIES OF SECTIONS

A = Area of Section.

r = Radius of Gyration.

I = Second Moment of Area.

Z = Modulus of Section.

 $A = bd - ac$ $I = \frac{bd^3 - ac^3}{12}$ $r = \sqrt{\frac{bd^3 - ac^3}{12(bd - ac)}}$	 $A = \frac{\pi d^2}{4} = 0.7854 d^2$ $I = \frac{\pi d^4}{64} = 0.0491 d^4$ $r = \frac{d}{4}$
 $A = d^2$ $I_1 = \frac{d^4}{12}$ $I_2 = \frac{d^4}{3}$ $r_1 = 0.2887 d$ $r_2 = 0.5774 d$	 $A = \frac{\pi(d^2 - d_1^2)}{4} = 0.7854(d^2 - d_1^2)$ $I = \frac{\pi(d^4 - d_1^4)}{64}$ $r = \frac{1}{4} \sqrt{d^2 + d_1^2}$
 $A = \frac{bd}{2}$ $I_1 = \frac{bd^3}{36}$ $I_2 = \frac{bd^3}{12}$ $r_1 = 0.236 d$ $r_2 = 0.408 d$	 $A = \frac{d}{2}(b + b')$ $y_1 = \frac{d(2b + b')}{3(b + b')}$ $y = \frac{d(b + 2b')}{3(b + b')}$ $I = \frac{d^3(b^2 + 4bb' + b'^2)}{36(b + b')}$ $r = \frac{d}{6(b + b')} \sqrt{2(b^2 + 4bb' + b'^2)}$

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NOTES



NON-CYCLONIC AREAS

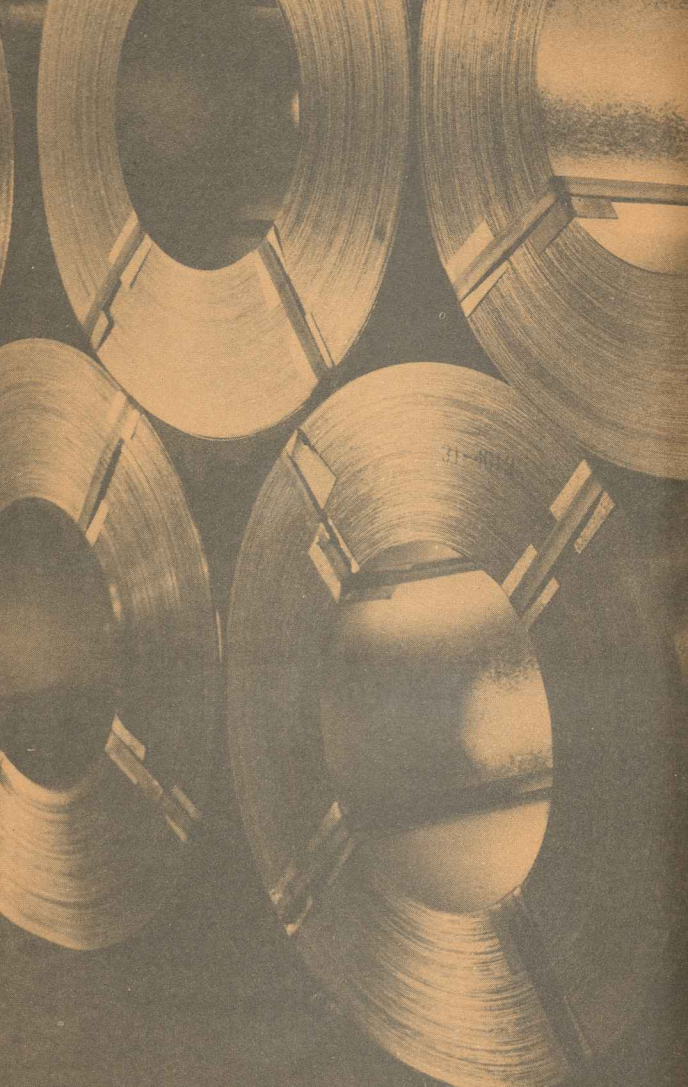
In Section 2 of the Lysaght Referee where information is provided for steel roofing and walling (pages 62 to 94), design and fixing recommendations apply for non-cyclonic areas.

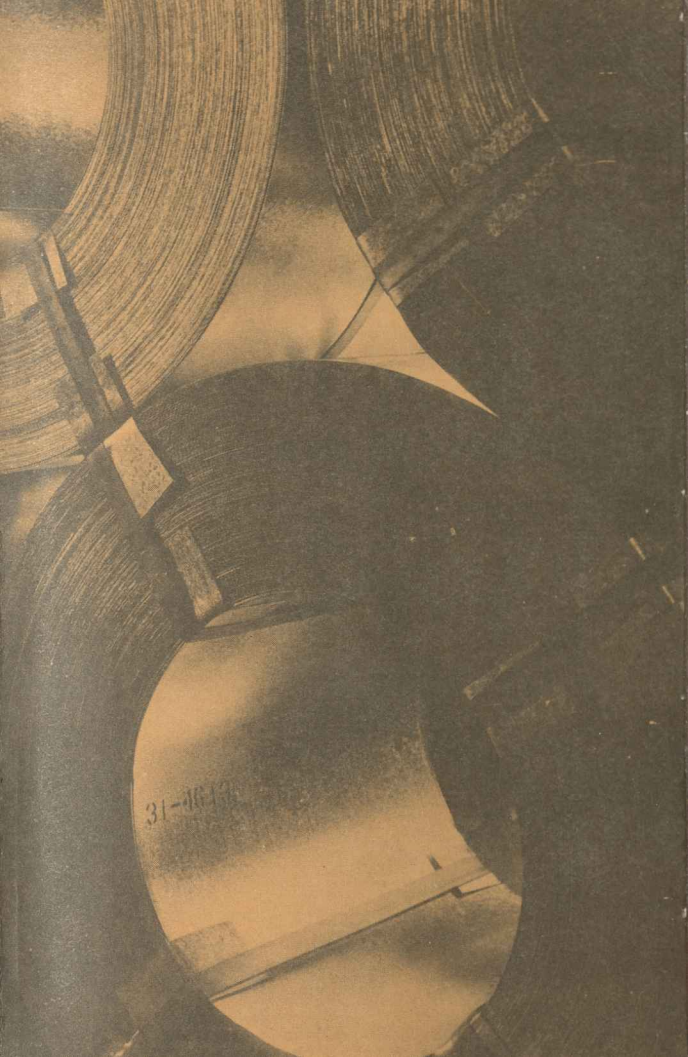
A non-cyclonic area is defined as one in which a tropical cyclone is unlikely to occur — ie, areas other than a 50 km coastal strip and offshore islands, north of latitude 27° south.

Design and fixing data for cyclonic areas are available from Lysaght State Offices listed on pages 8 to 10.

NOTES

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