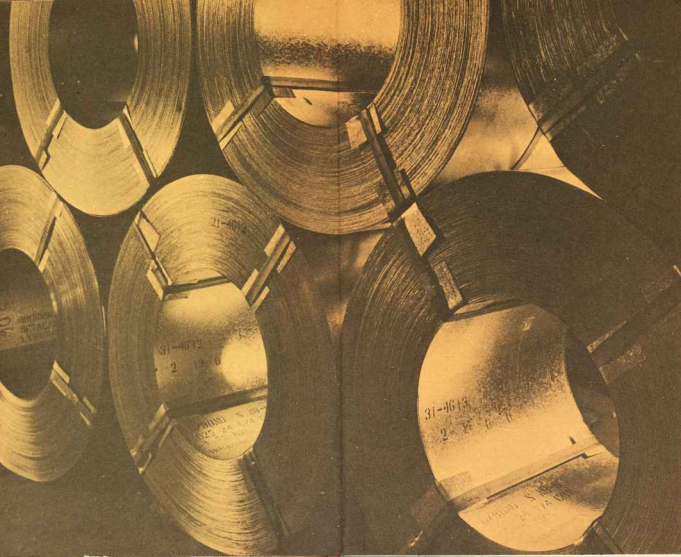




LYSAGHT REFERRÉ

23RD EDITION



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LYSAGHT REFEREE

23rd EDITION

HEAD OFFICE

50 Young Street, Sydney, N.S.W. 2000
Box 196, G.P.O. Sydney, N.S.W. 2001

EXPORT DEPARTMENT

Guardian Assurance Building—9th Floor
Cnr. Pitt and Hunter Streets, Sydney
N.S.W. 2000
Box 196, G.P.O. Sydney, N.S.W. 2001

LONDON

John Lysaght (Australia) Limited
G.K.N. House
22 Kingsway, London. W.C.2.

NEW ZEALAND

John Lysaght (New Zealand) Limited
Huddart Parker Building
Post Office Square
Wellington, New Zealand
Box 341, G.P.O. Wellington, New Zealand.

SINGAPORE

John Lysaght (South East Asia) Limited
350 Jalan Boon Lay. Jurong Industrial Estate
Window Delivery Service. Taman Jurong Post Office
Singapore 22.

MANUFACTURING PLANTS

SHEET MANUFACTURING DIVISION

Springhill Works
Springhill Road, Wollongong, N.S.W.
Box 77, P.O. Port Kembla, N.S.W. 2505

C.R.M. Works
Port Kembla Road, Port Kembla, N.S.W.
Box 77, P.O. Port Kembla, N.S.W. 2505

FABRICATED PRODUCTS DIVISION

Newcastle Works
Ingall Street, Mayfield, N.S.W.
Box 589, P.O. Newcastle 2300

STATE OFFICES

NEW SOUTH WALES

Anzac Street, Chullora
Box 2, P.O. Chullora Park 2190

Steel Service Centre
Service and Sales Division
Organic Finishes Division

49-51 Falcon Street, Crows Nest
Box 329, P.O. Crows Nest 2065

Fabricated Products Division
Structural Products
Sankey Division and Electrical Steel Products

767-773 Hunter Street, Newcastle West
Box 201, P.O. Newcastle West 2302

Service and Sales Division

VICTORIA

70-84 Clarendon Street, South Melbourne
Box 2776Y, P.O. Elizabeth Street 3001

Service and Sales Division
Fabricated Products Division
Organic Finishes Division

2 St. Albans Road, Sunshine
Box 21 Sunshine 3020

Steel Service Centre

SOUTH AUSTRALIA

99 South Terrace, Adelaide
Box 125B, P.O. Adelaide 5001

Fabricated Products Division

Wingfield Road, Wingfield
Box 50, P.O. Rosewater East 5013

Steel Service Centre
Service and Sales Division
Organic Finishes Division

QUEENSLAND

436-444 Ann Street, Brisbane
Box 251D, G.P.O. Brisbane 4001

Service and Sales Division
Fabricated Products Division
Organic Finishes Division

Nudgee Road, Nudgee
Box 25, P.O. Northgate 4013

Steel Service Centre

WESTERN AUSTRALIA

Cnr. Norma Road and McCoy Street, Myaree
Box 46, P.O. Applecross 6153

Steel Service Centre
Service and Sales Division
Fabricated Products Division
Organic Finishes Division

TASMANIA

97A Grove Road, Glenorchy
Box 769H, G.P.O. Hobart 7001

Steel Service Centre
Service and Sales Division
Fabricated Products Division
Organic Finishes Division

FOREWORD

For many years the Lysaght Referee has enjoyed the reputation of being one of the handiest and most useful reference books available to the architect, builder, farmer, plumber, student, and country store-keeper.

It is with special pride that John Lysaght (Australia) Limited presents this completely revised and up-to-date twenty-third edition.

Compiled by an expert staff and from recognised authoritative sources, the user will find it a mine of practical information, the greatest care having been taken throughout to ensure the accuracy of the data and tables supplied. At the same time, no responsibility can be accepted for any errors that may have escaped the attention of the editors, nor is any originality claimed for any information contained in its pages that may be readily obtainable elsewhere. The Company will be glad to receive suggestions for inclusion in later editions.

Each copy is, of course, issued entirely without cost and with the compliments of the Company.

JOHN LYSAGHT (Australia) LIMITED

50 YOUNG STREET, SYDNEY

September, 1967.

LYSAGHT — 1857-1967

A chronicle of events which mark the history of the Lysaght organisation is briefly summarised on this page. This diary traces the progress that has been made since galvanized sheets were first produced by the founder of this Company 110 years ago, and emphasises the continuous progress that John Lysaght has made in the past century.

- 1857 Commencement of manufacture of Galvanized Iron by John Lysaght in Bristol, England.
- 1879 Establishment of Selling Agency in Australia.
- 1880 Opening of Central Selling Agency in Australia.
- 1895 Export to Australia, 30,000 tons/year.
- 1899 Formation of Lysaght's Galvanized Iron Pty. Ltd.
- 1913 Export to Australia, 85,000 tons/year.
- 1917 Formation of John Lysaght (Australia) Pty. Ltd.
- 1918 Preparation of site for Lysaght's Newcastle Works.
- 1921 First sheets rolled at Newcastle Works.
- 1923 Production 13,000 tons/year.
- 1924 First major extension to Newcastle Works.
- 1925 Production 20,000 tons/year.
- 1927 Production 27,000 tons/year.
- 1928 Duplication of Newcastle Works began.
- 1930 Production 36,000 tons/year.
- 1932 Production 58,000 tons/year.
- 1937 Production 100,000 tons/year.
- 1938 Establishment of Lysaght's Springhill Works.
- 1939 Production 130,000 tons/year.
- 1941 Production 200,000 tons/year.
- 1946 Acquisition by John Lysaght (Australia) Pty. Ltd. of Commonwealth Rolling Mills Pty. Ltd.

- 1950 Production 250,000 tons/year.
- 1951 Four-high Cold-reduction Mill installed at Port Kembla.
- 1955 Installation of Four-stand Cold-reduction Mill at Port Kembla. Strip rolling commenced on both Four-stand and Reversing Cold-reduction Mills.
- 1956 Annual potential production 650,000 tons/year.
- 1961 Continuous Galvanizing Line commenced operations.
- 1964 Second Continuous Galvanizing Line commenced operations. Total production 813,000 tons/year.
- 1966 Coil Painting Line installed.
- 1966 Third Continuous Galvanizing Line completed and operating.
- 1966 Strand Annealing and Decarburizing Line commissioned.

The 46 years in which the Lysaght Works have been established in Australia have encompassed the period of the nation's greatest industrial development.

That the Company has been able to help substantially to meet the heavy demands of peace and war, and to move swiftly to prepare for the even heavier requirements of the future, reflects a part in its rapid growth as an industrial unit.

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GALVANIZED STEEL SHEET

Iron and steel, being susceptible to corrosion, must be protected from the action of air and water to prevent their deteriorating by rusting. The most satisfactory form of protection is that afforded by hot-dip galvanizing which provides the steel with an adherent coating of zinc to give an electro-chemical defence against the corrosive elements.

The LIFE of a GALVANIZED STEEL SHEET
is dependent
upon the WEIGHT and QUALITY of its zinc coating.

In the manufacture of Lysaght Galvanized Steel Sheets, strict control of coating weight and thickness together with zinc quality, assures adequate safeguards against corrosion whilst the steel base, likewise, has to conform to the rigid standards that have long been a feature of Lysaght practice.

One of the best known and most widely recommended building sheets in the world today is Lysaght Orb brand Corrugated Galvanized Steel Sheet. First introduced in England in 1857, and manufactured in Australia since 1921, Corrugated Galvanized Steel Sheet has proved itself unequalled for all types of roofing, walling and fencing projects, particularly where economy, ease of erection, high strength, long life and the ability to withstand the ravages of fire are important considerations. The recent introduction of the long-length Custom Orb sheets is an important forward step in providing for an even more economical means of roofing homes, factories or stores.

Equally well known to the plumber, fabricator and builder are Lysaght Galvabond and Queen's Head flat sheet and Galvabond coil. These have been used for many years for working-up applications such as gutter, downpipe, ridge capping and long-length roof decking.

Lysaght sheets conform to the requirements of the Standards published by the Australian Standards Association.

ZINC-COATED FLAT SHEETS

Galvabond is a zinc-coated steel sheet which is available in either cut lengths or coils. This sheet quality is produced by the continuous galvanizing process and is noted for its tightly adherent coating. The coating will not peel or flake during severe forming operations such as rollforming, deep drawing, spinning or Pittsburg lock-seaming.

Coating Weight.—The standard sheet has a nominal 1.25oz./sq.ft. zinc coating but heavier or lighter coatings can be provided for special applications.

Zincmatte is a continuously-coated sheet with similar forming characteristics to Galvabond but processed to give a smooth, minimized spangle surface for high finish applications. The standard coating weight is 1.00 oz./sq.ft.

Zincskin is a fully alloyed, non-spangle, low coating weight galvanized sheet produced to full finish standard. The coating is suitable for painting without prior preparation other than a normal degreasing operation and the sheets are suitable for severe forming and simple drawing operations.

Zincanneal sheets have a non-spangled coating consisting entirely of zinc-iron alloy. The coating, which possesses good adherence to the steel base provides a good corrosion resistant finish suitable for painting without any prior surface treatment other than a normal degreasing operation. The coating weight is 1.0 oz./sq.ft.

Queen's Head is a flat galvanized sheet with a ductile steel base which is suitable for applications requiring moderate formability. Neither the base ductility nor the coating adherence are at a sufficiently high level for these sheets to give consistent results in difficult forming applications such as lockseaming. The coating weight is 1.25 oz./sq.ft.

Leopard.—The Leopard brand is placed on sheets produced for Queen's Head or Galvabond qualities which, due to minor imperfections just fail to meet the standards for these two qualities. Leopard brand sheets are suitable for general forming operations but not for severe deformation.

ZINC-COATED SHEET IN COIL

Galvabond quality with similar coating and base characteristics to the sheet product is available in coil form in the following size range:—

THICKNESS	WIDTH
.1250"-.0640"	2"-48"
.0639"-.0160"	$\frac{1}{2}$ "-48"
.0159"-.0123"	$\frac{1}{2}$ "-36"

Zincmatte coils are available in the following size range:—

THICKNESS	WIDTH
.0495"-.0240"	$\frac{1}{2}$ "-48"
.0239"-.0196"	$\frac{1}{2}$ "-36"

Coil Thickness.—Zinc-coated coil is sold on a decimal thickness basis and when ordered to a decimal thickness or B.G. number this represents the base thickness prior to the application of the coating. The total coated thickness is the base thickness plus the thickness of the coating.

Dimensional Tolerances and Quality Standards.—All Lysaght flat and corrugated prime zinc-coated sheets in cut lengths or coils comply with the requirements of the appropriate Australian Standard Specification.

WEIGHT OF FLAT ZINC-COATED SHEETS

Galvabond and Queen's Head

	Gauge	APPROXIMATE WEIGHT PER SHEET IN LB.					COUNT OF SHEETS PER NOMINAL TON				
		Width					Width				
		24"	30"	36"	42"	48"	24"	30"	36"	42"	48"
72" SHEETS	10BG	62.14	77.67	93.21	108.74	124.28	36	29	24	21	18
	12BG	49.46	61.82	74.19	86.55	98.91	45	36	30	26	23
	14BG	39.37	49.21	59.06	68.90	78.74	57	46	38	33	28
	16BG	31.54	39.42	47.31	55.19	63.08	71	57	47	41	36
	18BG	25.17	31.47	37.76	44.05	50.35	89	71	59	51	44
	20BG	20.13	25.16	30.20	35.23	40.26	111	89	74	64	56
	22BG	16.21	20.27	24.32	28.37	32.43	138	111	92	79	69
	24BG	13.03	16.29	19.55	22.80	26.06	172	138	115	98	86
	26BG	10.53	13.17	15.80	18.43	21.07	213	170	142	122	106
	26Cml	8.92	11.15	13.38	15.61	17.84	251	201	167	143	126
	28BG	8.58	10.72	12.86	15.01	17.15	261	209	174	149	131
	30BG	6.96	8.70	10.44	12.18	13.92	322	257	215	184	161
96" SHEETS	10BG	82.85	103.56	124.28	144.99	165.70	27	22	18	15	14
	12BG	65.94	82.43	98.91	115.40	131.89	34	27	23	19	17
	14BG	52.50	65.62	78.74	91.87	104.99	43	34	28	24	21
	16BG	42.05	52.56	63.08	73.59	84.10	53	43	36	30	27
	18BG	33.56	41.96	50.35	58.74	67.13	67	53	44	38	33
	20BG	26.84	33.55	40.26	46.97	53.68	83	67	56	48	42
	22BG	21.62	27.02	32.43	37.83	43.24	104	83	69	59	52
	24BG	17.38	21.72	26.06	30.41	34.75	129	103	86	74	64
	26BG	14.05	17.56	21.07	24.58	28.09	159	128	106	91	80
	26Cml	11.89	14.86	17.84	20.81	23.78	188	151	126	108	94
	28BG	11.43	14.29	17.15	20.01	22.87	196	157	131	112	98
	30BG	9.28	11.60	13.92	16.24	18.56	241	193	161	138	121

NOTE:—Following long-established British practice, 26 Commercial Galvanized Steel Sheet, both corrugated and plain, manufactured in Australia, is lighter than 26BG.

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 normally within a range of 10-15%. 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, even if the fuel tank is severely dented, the coating will not flake or powder so that there is no risk of particles of the coating clogging fuel lines, etc.
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.

LYSAGHT UNCOATED STEEL SHEET

Whatever your need may be you will find that there is a Lysaght Uncoated Sheet Quality which will fulfil your requirements. Uncoated sheets may be either hot rolled or cold reduced, the latter are always used where a high degree of surface finish is required

whilst the former are used when the surface requirement is less exacting.

Hot rolled sheets are only available in the heavier gauges, from 0.060" upwards in Commercial Quality and from 0.075" upwards for Drawing Quality. Thicknesses of up to 0.125" are always available in all Hot Rolled Qualities. Thicker sheets may, under some circumstances, be provided. The sheet widths that can be produced vary with thickness, sheets 0.060" thick are available in 42" widths, sheets 0.075" thick can be rolled 48" wide whilst sheets 0.104" thick and over may be up to 60" wide. Hot rolled sheets are available in cut lengths or coils and for the latter, similar maximum width limitations apply as in the case of sheets.

Cold reduced sheets (or coils) are available in a wide range of thicknesses. These vary somewhat depending upon the particular sheet quality but overall the available gauge range extends from 0.010" up to 0.125". As in the case of hot rolled sheets, the widths of cold reduced sheets increase with increasing thickness but with rather less restriction. The actual variance is very dependent upon the sheet quality but the following table is applicable to Cold Reduced Commercial Quality and is indicative (although not accurate) for other qualities:—

THICKNESS	WIDTH
.015"-.016"	36" max.
.017"-.019"	38" „
.020"-.030"	48" „
.031"-.038"	52" „
.039"-.125"	60" „

Individual Qualities:

Lysaght produces a very wide range of uncoated qualities to meet all the diversified needs of the manufacturing industry. Customers are invited to discuss their particular requirements, which may even be

for products outside our current range. A visit, a telephone call or a letter to our nearest Branch Office will enable us to give you the information you require.

In the following section we give a brief, general description of each of the regularly produced hot rolled and cold reduced sheet qualities. However, it should be remembered that in addition to these, Lysaght produces many Special Qualities which have particular applications in certain manufacturing industries and it is possible that one of these may meet your own special need.

HOT ROLLED QUALITIES

HR.CQ. HOT ROLLED COMMERCIAL QUALITY sheets are heavy gauge hot rolled sheets suitable for the majority of simple drawing or forming operations but they are not recommended for severe working. The sheet surface carries an adherent oxide layer. HR.CQ. coil is all temper rolled and recoiled. Coils are supplied with "mill edge" unless ordered "slit edge" for which an extra applies. Sheets are available in lengths from 48" to 192".

HR.P.CQ. HOT ROLLED PICKLED COMMERCIAL QUALITY sheets and coils are hot rolled from the same grade of steel as HR.CQ. They are suitable for moderate forming operations but not for drawing or severe working. The surface is free from scale or oxide film and the sheets or coils are oiled to prevent rusting in transit. Sheet lengths range from 48" to 150".

HR.DQ. HOT ROLLED DRAWING QUALITY sheets or coils, supplied only in heavy gauges, are suitable for most drawing applications where appearance is not of primary importance. The sheets or coils are only supplied in the pickled condition and are normally oiled. Unoiled coil cannot be supplied. Available in lengths from 48" to 150".

COLD REDUCED QUALITIES

CR.CQ. COLD REDUCED COMMERCIAL QUALITY is a standard commercial quality sheet with a surface free from oxides or scale. The appearance is clean and bright and of a good standard. The physical properties are such that the sheet may be formed by folding or bending operations but not by drawing. CR.CQ. sheets and coils are supplied oiled unless otherwise specified. Optionally, Cold Reduced Commercial Quality sheets may be supplied with an oxidized surface, these are designated CR.BL.CQ.

CR.DQ. COLD REDUCED DRAWING QUALITY

sheets or coils are rimmed steel drawing quality, intended for pressings up to moderate severity. Some deterioration of properties is to be expected with the lapse of time after final processing. Reasonable freedom from stretcher strain can only be ensured if the sheets are flex-rolled immediately prior to pressing. CR.DQ. is produced to full finish standard and guaranteed to this standard on exposed panels. Some relaxation of surface standard is permissible for less critical applications. CR.DQ. sheets may be ordered to "Special Surface Inspection" standard when a guaranteed premium surface is required on every sheet.

CR.DQ.NT. COLD REDUCED DRAWING QUALITY—NOT TEMPER ROLLED. Rimmed drawing quality sheets and coils NOT temper rolled. Suitable for pressings of moderate severity but should only be used for hidden panels because of severe stretcher straining when pressed. This material is not subject to ageing until it is cold worked. The surface is only guaranteed to be free from defects likely to lead to difficulty in forming or pressing. Reasonable flatness may be anticipated, but with the omission of temper rolling, compliance with flatness tolerances cannot be assured.

CR.DD. COLD REDUCED DEEP DRAWING QUALITY. A rimmed steel deep drawing quality for applications more severe than can readily be produced from CR.DQ.

CR.DD sheets and coils are produced to full finish standard for external panels. These sheets are subject to ageing with the lapse of time after final processing but reasonable freedom from stretcher straining will be obtained by flex-rolling immediately before pressing.

CR.DD.NT. COLD REDUCED DEEP DRAWING QUALITY—NOT TEMPER ROLLED. Rimmed steel deep drawing quality sheets and coils NOT temper rolled but produced to closer and more uniform metallurgical limits, and intended for applications more severe than can readily be met by CR.DQ.NT.

Can only be used for non-exposed panels where stretcher straining can be tolerated. The surface is only guaranteed to be free from defects likely to cause difficulty in forming or pressing. Reasonable flatness may be expected, but with the omission of temper rolling, compliance with normal flatness tolerances cannot be assured.

CR.ST. COLD REDUCED STABILIZED sheets are special killed, non-ageing extra deep drawing quality produced to meet the extreme requirements of drawability. Because of their analysis and special processing, CR.ST sheets are guaranteed to be free from any ageing characteristics or stretcher straining, under normal conditions of storage.

This quality is produced to full-finish standard and guaranteed to this standard for all exposed panels.

Sheet Lengths.—Cold Reduced Commercial Qualities are available in lengths from 30"-180" and Cold Reduced Drawing Qualities in lengths for 30" to 192".

CARBON STEELS

Where there is a requirement for greater strength than is provided by Commercial Quality sheets, steels of

higher carbon contents can be used. In the system of nomenclature used for these qualities, the figures following the letter C indicate the approximate carbon content, thus CR.C20 is a cold reduced quality with a nominal 0.20% carbon content.

A range of qualities is available to meet specific requirements.

HR.C15 sheets are hot rolled heavy gauge suitable for moderate drawing applications. The steel is higher in carbon than is normal for drawing grades for the development of higher strength and hardness. This quality was initially produced for use in the manufacture of automobile wheel centres and this remains the main application.

HR.C20 sheets are hot rolled from steel ordered to the following analysis range:—

C 0.18-0.23%	P 0.05% max.
Mn 0.30-0.60%	S 0.05% max.

These sheets are normally slightly higher in strength than HR.CQ sheets but this is not guaranteed. The ductility of HR.C20 sheets will be lower than that of HR.CQ and as a consequence they are less formable.

CR.C20 sheets are cold reduced from steel of the same analysis as HR.C20. Although these sheets are normally higher in strength and hardness than CR.CQ sheets, their physical properties are not guaranteed and they are sold only on the basis of compliance with chemical specification.

HR.C30 sheets are hot rolled from steel of the following specified analysis:—

C 0.28-0.34%	P 0.05% max.
Mn 0.60-0.90%	S 0.05% max.

Sheets of this analysis have very limited cold formability and the physical properties are liable to show

a fair degree of variability depending on gauge and hot mill rolling conditions. Some increase in hardness can be obtained by quenching articles made from HR.C30 sheets, from a temperature of about 860°C, in water. Hardness results are not consistent because material of this analysis is at the lower end of the range of hardenable steels.

HR.C65 sheets are hot rolled from steel provided to the following specified analysis:—

C 0.63-0.73% S 0.05% max.

Mn 0.65-0.95% P 0.05% max.

This quality is primarily designed as an economical general purpose high carbon steel for use in applications where subsequent heat treatment is necessary. It is used principally for shovels, plough discs and miscellaneous hard-wearing and cutting edges.

Advisory Service Leaflet T2-1.1 covering details of recommended heat treatment procedures is available on request.

LY-TEN

Low-Alloy High-Tensile Steel Sheets

LY-TEN is one of the group of low-alloy high-tensile steels offered by the steel industry as an answer to the ever increasing demand for steel of improved physical properties, at relatively low prices. These steels, in general, are characterised by a carbon content of less than 0.12% and contain other alloying elements to obtain the desired physical properties. The chosen composition provides sheets which have:—

1. Higher strength.
2. Weldability, workability, dependability.
3. Greater impact resistance.
4. Higher endurance limits.
5. Improved resistance to atmospheric corrosion.

LY-TEN is especially suitable for applications in the transportation field, both railway and automotive. Larger pay loads, without increasing the overall weight has been the demand in freight service. By using high-tensile steel, and in many cases incorporating new design, such as using a drawn instead of a flat panel, lighter vehicles have been made possible.

Although emphasis has been placed on transportation, there are, however, a great many other applications in which low-alloy high-tensile steels have proven their worth whilst there are others where high strength steels have yet to be introduced and for which they would be ideally suited.

UNCOATED SHEET SECONDS AND MILL REJECTS

Rigid inspection standards are applied in the manufacture of Lysaght uncoated sheets to ensure the maintenance of the high qualities of prime sheets. Resulting from the application of these stringent standards, some material is produced which falls outside the acceptable limits for primes and is consequently classified as "Seconds" or "Mill Rejects".

SECONDS:

Seconds retain their quality name for which they were originally produced, e.g., CR.DD Seconds, HR.CQ Seconds, etc. The steel base and physical properties are as for Primes.

Thickness.—To be within commercial thickness tolerances.

Flatness.—To be commercially flat.

Surface.—Surface may be affected by various defects but will not include lamination, holes, severe pitting, laminated surface.

Rust.—To be relatively free from rust. However, light incipient rust spotting or light edge rusting may be present.

Size.—Sheet not to be less than nominal size but may slightly exceed maximum tolerances.

MILL REJECTS:

Mill Rejects are normally sold in two qualities only, cold reduced and hot rolled, and unless separately specified will only contain low carbon steel sheet.

Thickness.—Individual sheets may deviate from normal thickness tolerances by an additional $\pm .001$ " but the bulk of material will be within normal tolerances.

Flatness.—Sheets are not necessarily commercially flat and may include minor damage, kinks, small buckles, coil break and corrugated edge.

Surface Defects.—These sheets will include heavier surface defects than Seconds, such as severe pits, laminated surface, seams and one or more small holes with a maximum area of 1 sq. inch on a sheet up to 6 ft. x 3 ft. On larger size sheets, holes up to a total area of $1\frac{1}{2}$ sq. inches will be tolerated provided the holes are towards the edges of the sheet.

Rust.—Some sheets may be affected by light rust but heavily rusted sheets will not be included.

Size.—Sheets would approximate to normal size but edge defects such as splits, edge folds and cut-outs may be included.

UNCOATED STEEL SHEET

	Birmingham Gauge No.	APPROXIMATE WEIGHT PER SHEET LB.			THEORETICAL COUNT OF SHEETS PER TON		
		Width			Width		
		24"	36"	48"	24"	36"	48"
72" Sheets	10	61.20	91.80	122.40	37	24	18
	12	48.52	72.78	97.04	46	31	23
	14	38.43	57.65	76.87	58	39	29
	16	30.60	45.90	61.20	73	49	37
	18	24.24	36.35	48.47	92	62	46
	20	19.19	28.79	38.39	117	78	58
	22	15.28	22.91	30.55	147	98	73
	24	12.09	18.14	24.19	185	123	93
	26	9.60	14.39	19.19	233	156	117
	28	7.64	11.46	15.28	293	195	147
	30	6.02	9.03	12.04	372	248	186
84" Sheets	10	71.40	107.10	142.80	31	21	16
	12	56.61	84.91	113.21	40	26	20
	14	44.84	67.26	89.68	50	33	25
	16	35.70	53.55	71.40	63	42	31
	18	28.27	42.41	56.55	79	53	40
	20	22.39	33.59	44.78	100	67	50
	22	17.82	26.73	35.64	126	84	63
	24	14.11	21.16	28.22	159	106	79
	26	11.20	16.79	22.39	200	133	100
	28	8.91	13.37	17.82	252	168	126
	30	7.03	10.54	14.05	319	213	159
96" Sheets	10	81.60	122.40	163.20	27	18	14
	12	64.69	97.04	129.38	35	23	17
	14	51.24	76.87	102.49	44	29	22
	16	40.80	61.20	81.60	55	37	27
	18	32.31	48.47	64.63	69	46	35
	20	25.59	38.89	51.18	88	58	44
	22	20.37	30.55	40.73	110	73	55
	24	16.12	24.19	32.25	139	93	69
	26	12.79	19.19	25.59	175	117	88
	28	10.18	15.28	20.37	220	147	110
	30	8.03	12.04	16.06	279	186	139

BIRMINGHAM GAUGE

The standard gauge table used for Steel Sheets is known as the Birmingham Gauge, or BG. It must not be confused with either the Birmingham Wire Gauge (B.W.G.) or the Standard Wire Gauge (S.W.G.). Wherever the word gauge is used in these pages the Birmingham Gauge is implied.

It is useful to remember that—

10 BG. is 1/8" thick

16 BG. is 1/16" thick

and that for every increase of 6 in the number of the gauge the thickness of the sheet is reduced by a half.

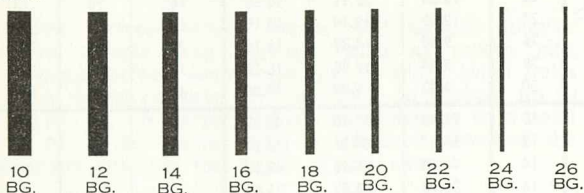


Illustration showing the approximate thickness of sheets according to the Birmingham Gauge.

Birmingham Gauge Table

Gauge No.	Thickness		lbs. per sq. ft.	Gauge No.	Thickness		lbs. per sq. ft.
	In.	Mm.			In.	Mm.	
8	.1570	3.988	6.406	20	.0392	0.996	1.599
9	.1398	3.551	5.704	21	.0349	0.886	1.424
10	.1250	3.175	5.100	22	.0312	0.792	1.273
11	.1113	2.827	4.541	23	.0278	0.706	1.134
12	.0991	2.517	4.043	24	.0247	0.627	1.008
13	.0882	2.240	3.600	25	.0220	0.559	0.898
14	.0785	1.994	3.203	26	.0196	0.498	0.800
15	.0699	1.775	2.852	27	.0174	0.442	0.710
16	.0625	1.588	2.550	28	.0156	0.396	0.636
17	.0556	1.412	2.268	29	.0139	0.353	0.567
18	.0495	1.257	2.020	30	.0123	0.312	0.502
19	.0440	1.118	1.795	31	.0110	0.279	0.449

STEEL SHEETS

Comparison of Sheet and Wire Gauges

Gauge Name	Birming- ham Gauge (B.G.)	U.S. Mnfrs. Standard Gauge	Birming- ham Wire Gauge (Stubs') (B.W.G.)	Standard Wire Gauge (British) (S.W.G.)	U.S. Steel Wire Gauge	Galv. Sheet Gauge (Japan- ese)
Principal Use	Steel Sheets, etc.	Steel Sheets, etc.	Steel Wire, Shts., etc.	Steel Wire, Shts., etc.	Steel Wire	Galv. Steel Sheets
Gge. No.	Thickness or Diameter in Inches					
4/0	.5416	—	.454	.400	.3938	
3/0	.5000	—	.425	.372	.3625	
2/0	.4452	—	.380	.348	.3310	
0	.3964	—	.340	.324	.3065	
1	.3532	—	.300	.300	.2830	.2812
2	.3147	—	.284	.276	.2625	.2656
3	.2804	.2391	.259	.252	.2437	.2500
4	.2500	.2242	.238	.232	.2253	.2344
5	.2225	.2092	.220	.212	.2070	.2187
6	.1981	.1943	.203	.192	.1920	.2031
7	.1764	.1793	.180	.176	.1770	.1875
8	.1570	.1644	.165	.160	.1620	.1719
9	.1398	.1495	.148	.144	.1483	.1562
10	.1250	.1345	.134	.128	.1350	.1406
11	.1113	.1196	.120	.116	.1205	.1250
12	.0991	.1046	.109	.104	.1055	.1094
13	.0882	.0897	.095	.092	.0915	.0937
14	.0785	.0747	.083	.080	.0800	.0781
15	.0699	.0673	.072	.072	.0720	.0703
16	.0625	.0598	.065	.064	.0625	.0625
17	.0556	.0538	.058	.056	.0540	.0562
18	.0495	.0478	.049	.048	.0475	.0500
19	.0440	.0418	.042	.040	.0410	.0437
20	.0392	.0359	.035	.036	.0348	.0375
21	.0349	.0329	.032	.032	.0317	.0344
22	.0312	.0299	.028	.028	.0286	.0312
23	.0278	.0269	.025	.024	.0258	.0281
24	.0247	.0239	.022	.022	.0230	.0250
25	.0220	.0209	.020	.020	.0204	.0219
26	.0196	.0179	.018	.018	.0181	.01875
27	.0174	.0164	.016	.0164	.0173	.01719
28	.0156	.0149	.014	.0148	.0162	.01562
29	.0139	.0135	.013	.0136	.0150	.01406
30	.0123	.0120	.012	.0124	.0140	.01250
31	.0110	.0105	.010	.0116	.0132	.01094
32	.0098	.0097	.009	.0108	.0128	.01016
33	.0087	.0090	.009	.0100	.0118	.00937
34	.0077	.0082	.007	.0092	.0104	.00859
35	.0069	.0075	.005	.0084	.0095	.00781
36	.0061	.0067	.004	.0076	.0090	.00703

ELECTRICAL STEELS

General.—The steel core components of motors, alternators and transformers are made up of high quality special sheet steel laminations. Stringent control of raw materials and steel processing is maintained and the sheets are produced by modern cold reduction and strand annealing techniques.

All qualities are available both as sheet and coiled strip. They are available both fully processed with the magnetic properties fully developed and semi-processed which requires a final anneal after punching the laminations in order to develop the magnetic properties. Fully processed grades have the prefix "L" prior to the grade number and semi-processed grades the prefix "SL".

A catalogue, "Lysaght Electrical Steels", is available and provides details of the magnetic and physical characteristics of the various grades produced. Briefly L63, L68, L75, SL63, SL68, and SL75 grades are used for transformer work and other applications where low electrical losses are essential. L100, L120, SL100 and SL120 are used for motors of all types, large motor generators, small transformers and reactors, while SL190 and L370 find use in applications where the magnetic properties of the core steel are less critical.

Electrical Steel Data

Quality	Gauge	Guaranteed Max. Core Loss in Watt/lb. at B 10,000 gaussess, 50 cycles
L63 and SL63	.020"	0.63
L68 and SL68	.020"	0.68
L75 and SL75	.020"	0.75
L100 and SL100	.020"	1.00
L100 and SL100	.025"	1.15
L120 and SL120	.020"	1.20
L120 and SL120	.025"	1.40
SL190	.020"	1.90
SL190	.025"	2.25
L370	.020"	3.70
L370	.025"	4.00

NOTE:—The SL (semi-processed) grades require a final anneal to develop the magnetic properties.

ELECTRICAL STAMPINGS

For All Requirements

SANKEY DIVISION OF

JOHN LYSAGHT (Australia) LIMITED

General.—Sankey Division is associated with a world-wide organisation which for many years has specialised in the manufacture of stampings for the electrical industry. The Newcastle plant is one of the largest in the Southern Hemisphere capable of producing a great variety of electrical steel cores and laminations.

Electrical laminations are produced from a comprehensive range of special Australian silicon steels rolled and processed by John Lysaght (Australia) Limited. Details of these steels are shown on page 26.

Electric Motors.—The essential core of an electric motor is built up of a large number of thin stampings or laminations to form a stator and a rotor. Sankeys manufacture laminations for the smallest personal appliances and the larger industrial motors (100 h.p. or more).

Most of these laminations are manufactured to customers' particular designs, but tools are also held in stock to produce a range of standard blank sizes, in which case slot details are supplied to the customer.

Radio and Television.—In every radio set there is at least one small transformer; in television sets there are several. These small transformers are relatively simple, consisting mainly of a stack of laminations in the form of E's and I's.

Sankey Division manufactures a large range of standard sizes of "E" and "I" laminations from $\frac{1}{2}$ " to 3" centre limb width.

Lighting.—Modern fluorescent lighting operates on a very low voltage, which necessitates the use of a special type of transformer called a ballast. The standard

E-shape lamination is produced by Sankeys for this purpose, as well as other special shapes to customers' designs.

Wound Cores.—In keeping with modern technological trends, Sankey Division offers a wide range of Wound Transformer Cores, mainly in the form of C Cores and Toroids. These are usually wound from grain-oriented silicon steel and, after being heat treated and impregnated, are cut and finished or lapped to provide two matched halves to fine limits or precision.

Enquiries are welcomed for the supply of small or large quantities of stampings, either from Sankey Division's standard range or to your own particular design. In the latter case, detailed and dimensioned drawings will facilitate quotation.

Please address your enquiries to John Lysaght (Australia) Limited, SANKEY DIVISION, Post Office, Newcastle, or to John Lysaght (Australia) Limited in all capital cities.

MARVIPLATE

Marviplate consists of an aluminium or steel sheet to which a vinyl film has permanently been bonded.

Marviplate films are stain resistant, permanent and washable. They are highly resistant to fading and discolouration and withstand effects of corrosive atmosphere and most common chemicals.

There is virtually no limit to the stylings possible—soft pastels or bold prints, fabric weaves, woodgrains—even custom stylings are available. The impact and abrasive resistance of Marviplate allows it to withstand any operation to which the base metal is usually subjected.

It can be formed or fabricated and assembled in as many ways as metal and its versatility is demonstrated by the thousands of applications ranging from T.V. sets to acoustic ceilings and even building cladding.

EXTERIOR MARVIPLATE BUILDING SHAPES:

Specially formulated vinyl films have made possible the development of Exterior Marviplate building shapes which will withstand the most severe outdoor conditions of sub-tropical sun, rain and temperature as well as providing against a wide range of industrial chemicals.

Three well-known Lysaght building shapes are produced in Exterior Marviplate—

E.M. Spandek for long span “square look” roofing and wall cladding.

E.M. V-Crimp “slim line” wall cladding.

E.M. Corrugated (10 x 3” corrugations).

The full range of accessories and fasteners are available and the flat sheet can also be provided for the manufacturer of a wide range of exterior uses including signs, letter boxes, garage doors, building cladding and rainwater goods.

COLORBOND PREPAINTED STRIP

A high-speed continuous strip coating line has been installed at Port Kembla to produce precoated wide metal strip and sheet. The line can pretreat, prime and coat one, or both, sides of strip 24 to 48 inches wide at up to 150 f.p.m.

The material to be coated may be uncoated or galvanized steel, stainless steel or non-ferrous substrates within the following dimensional limits:—

Width:	24”-48” max.
Thickness:	0.008”-0.050” max.
Coil Diameter:	20” I.D.-60” O.D. max.
Coil Weight:	22,000 lb. max.

TYPICAL COLORBOND COATING MATERIALS AND APPLICATIONS:

Generally speaking, the end product dictates what paint finish or type of coating is needed and the following briefly outlines the most frequently used coatings and their characteristics.

Alkyds.—Possibly the most widely used type of coating. The alkyds possess highly decorative properties, have good exterior durability and are economical, but are not suitable for severe forming operations. Applications include metal containers, indoor and outdoor furniture, picture frames and awnings.

Acrylics.—This paint system is especially developed for both the manufacturing and building fields. Acrylics have excellent stain, abrasion, and mar resistance coupled with excellent durability but their formability is limited. Typical uses include exterior siding, cabinets, light fittings, etc.

Epoxies.—Having excellent hardness, toughness, flexibility and abrasion resistance, epoxies are very good for primers under exterior topcoats. They lend themselves well to such applications as container linings, closures, simulated brass tubing and other industrial applications.

Vinyls.—Exhibit outstanding flexibility and consequently they can withstand very severe forming operations. The vinyls have particularly good exterior durability and are well suited for roof and wall cladding and other such building applications.

Organosol and Plastisol coatings are currently being developed to add to the present range of COLOR-BOND finishes.

GLOSSARY OF TERMS

Following are the definitions of a number of terms in common usage in the steel industry and particularly those related to steel sheet processing and fabrication.

Annealing.—Annealing is a heat treatment process primarily used for the purpose of reducing the hardness and increasing the ductility of steel. The operation involves heating to, and holding at a selected temperature, and then cooling at a suitable rate. Variations of the practice adopted, provide specific treatments which are referred to as:—

Blue Annealing

Bright Annealing

Spheroidizing

Stress Relief Annealing

Blueing.—Blueing is a carefully controlled oxidation process which causes the formation of an adherent iron oxide film over the whole surface of the sheet. The oxide is blue in colour and from this the process gets its name.

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

Cold Forming.—Cold forming is a broad term used to describe metal-forming operations which are carried out at either atmospheric or very slightly elevated temperature.

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.

Ductility.—Ductility is a property which enables metals to undergo plastic deformation. Ductile metals

can be deformed to a greater extent, prior to fracture, than non-ductile metals.

Drawability.—Drawability is a comparative term used to indicate the extent to which material is suitable for deep drawing operations.

Drawing.—Drawing or deep drawing are terms used to describe the formation of sheet metal shapes by the combined actions of a punch, a die and a blankholder. For the operation to be considered a “drawing”, the metal must flow under the blankholder and follow the punch into the die. If the metal is completely locked by the blankholder and no flow occurs, the shape is said to have been “stretch-formed”.

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

Flatness.—Flatness of sheet metal may best be 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.

Heat Treatment.—Heat treatment refers to any combination of heating and cooling operations which may be applied to a metal with the objective of obtaining altered, and usually enhanced, physical properties.

Normalizing.—In a normalizing operation, steel is heated to a temperature slightly above its upper critical temperature, held for a sufficient time to soak thoroughly, and is then withdrawn from the furnace and allowed to cool freely in still air. Normalizing is recommended in those cases where heat treatment is necessary to enable further cold forming operations to be carried out on already work-hardened sheet metal.

Pickle Finish.—Pickle finish describes the surface condition of hot rolled sheets after removal of the scale layer by pickling in acid.

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

Stretch Forming.—In a deep draw die, stretch formed panels may be produced by the use of locking beads on the blankholder. Alternatively, the blank may be gripped by the ends and tension applied as a punch of the desired shape rises and forms the required panel.

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.

Temper Rolling.—Temper rolling, sometimes referred to as “skin passing”, is a relatively light cold rolling pass given to sheets to overcome the tendency to stretcher-strain or to impart a desired amount of stiffness.

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.

Workability.—Workability is the characteristic or group of characteristics that determine the ease of forming a metal into desired shapes.

HINTS ON THE CARE OF GALVANIZED STEEL ROOFING AND SIDING SHEETS

WET STORAGE STAIN

Whilst it is recognized that galvanized steel will give long and satisfactory service under normal conditions of atmospheric exposure it is not always appreciated that, under certain circumstances, water can be corrosive to the zinc coating. The particular condition which can give rise to this trouble is when the sheets become wet whilst in a stack where air movement is restricted. The rate of corrosion will be dependent on the length of time that the material remains wet and the temperature of the stack. Material exposed to direct sunlight will heat up rapidly and retain the heat for a considerable period. Under these circumstances corrosion will progress at a rapid rate.

Penetration of rain into the stack is the most frequent cause of the trouble, but a drop in temperature after a warm, humid day, particularly in tropical regions, can lead to condensation of moisture throughout the stack. Because it is usual to put the sheets on the ground, or close to it, where the temperature is at its lowest during the night, the chance of condensation taking place is very great.

It should be understood that "wet storage stain" cannot occur if (a) the sheets remain dry or (b) they are not in close contact at any point if they do get wet. Precautions should therefore be taken to ensure that one of these conditions applies whilst the sheets are in storage or awaiting erection.

If the sheets cannot be stored in a dry shed, they should be stood on end, spaced out at the bottom and tied to their support to prevent them from being blown away.

SURFACE CONTAMINATION

Care should always be taken to ensure that none of the debris arising from the fixing of a galvanized steel

roof is allowed to remain on it after it is finished. Nails, particles of steel, etc., should be swept off and out of the guttering. Power saws are frequently used these days and if the swarf arising from their use is allowed to remain on the galvanized steel roof it will very soon produce unsightly rust spots. Initially these rust spots are merely stains from the rapidly rusting fine particles of steel but if this is allowed to continue, there is likely to be some loss of zinc coating in the stained areas. Low slope roofs are more liable to be affected than those with a steeper pitch but, in the latter case, if the particles are washed off by rain, it is only a transfer of the problem from the roof to the gutter and possibly to a tank.

To ensure that their appearance is not marred—Keep Galvanized Steel Sheets Dry Whilst They Are In a Stack—remove all metallic objects or scrap from roofs and gutters.

LYSAGHT ZINC-COATED STEEL ROOFING AND WALLING MATERIALS

General.—Zinc coated steel from Lysaght has a long history in Australian building and its advantages need no stressing. Their 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 plain corrugated sheet has been modernised.

Long Lengths.—Lysaght roofing and walling profiles can be 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. Sheets now "fall into place" without the need to turn over alternates.

Improved Weather and Corrosion Resistance.—The unequalled mechanical strength of steel is protected from corrosion by a new continuous zinc coating process. This applies a heavy ($1\frac{3}{4}$ oz. sq. ft. on roofing products) coating of high uniformity and adhesion. Anti-capillary side laps and a new screw-and-integral-washer fastening ensure weather-tightness. In some profiles fastenings are kept entirely below the unpierced sheeting.

Colour.—Colorbond sheets feature factory controlled application of organic (paint) or plastic systems so as to ensure maximum performance without risk of early breakdown as exists where roofing is painted on-site and in prevailing weather conditions. Higher cost of Colorbond sheets is off-set by on-site economies as well as maximum protection and life. A full range of colour matched accessories and fastenings is available.

Strength and Fire Resistance.—Of the many roofing and walling materials now available, zinc coated steel

remains the strongest. It will not flap, distort or blow off in winds of gale force. It offers high fire resistance: it will not crack or explode and being continuous prevents entry of flying sparks.

Thermal Insulation.—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 temperature in dwellings 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 C.E.B.S. Technical Study No. 34. "The Thermal Behaviour of Dwellings", from which the following 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".

Service.—Lysaght building profiles are now manufactured in every State, and are available through leading building materials merchants, either in stock sizes or on prompt delivery, factory cut to your own precise needs. A full range of accessories and fasteners is also available. Qualified design and installation services are available on request—please contact the Lysaght office in your State Capital.

Roofing Performance.—An Australian Standard Code of "Recommended practice for the design and fixing of self-supporting metal roofing" is in the course of preparation to stipulate the requirements of a roofing medium. These requirements include stringent proof tests to measure the ability of the roofing medium to withstand simulated wind uplift loads and superimposed concentrated loads.

Lysaght roofing products and recommended fixing methods are tested to ensure compliance with the requirements of the new Code. Details and test reports are available in all Lysaght sales offices.

LYSAGHT REFEREE

Profile	Gauge or Total Thickness	Coating Weight	Width of Coverage	Depth of Rib	Minimum Rec. Pitch	Maximum Rec. Spacing of Supports	
						(Roofs)	(Walls)
CUSTOM ORB for Roofing & Walling 	.020"	1.75 ozs. sq./ft.	30"	3/4"	5° (1" in 1' 0")	4' 0"	6' 0"
TRIMDEK for Roofing & Walling 	.020"	1.75 ozs. sq./ft.	30"	1-1/16"	3° (1" in 1' 6")	3' 0"	7' 6"
SPANDEK for Roofing & Walling 	* .023"	1.75 ozs. sq./ft.	30"	1"	3° (1" in 1' 6")	5' 6"	9' 0"
V-CRIMP for Walling 	.021"	Galvabond 1.25 ozs. sq./ft.	24"	5/8"	—	—	3' 6"
		Zincaneal 1.00 ozs. sq./ft.					

KLIP-LOK for Roofing & Walling



10 x 3" RED ORB for Roofing & Walling



25 x 1" RED ORB for Walling



8 x 3" BLUE ORB



.031"	16"	1-5/8"	1° (1" in 4' 9")	8' 0"	10' 0"
.027"	16"	1-5/8"	1° (1" in 4' 9")	6' 3"	9' 0"
.023"	16"	1-1/8"	2° (1" in 2' 5")	3' 0"	5' 0"
† 26G.	30"	3/4"	5° (1" in 1' 0")	3' 0"	5' 0"
26G.	25"	1/4"	—	—	3' 0"
22G. 24G.	24"	3/4"	Normally used only for applications requiring curving or in the manufacture of water tanks, see page 129.		
26G.					

*ALSO AVAILABLE IN .027" THICKNESS.

†ALSO AVAILABLE IN 24G.

ZINC-COATED STEEL ROOFING AND WALLING SELECTION GUIDE

New Homes.—For designs that dare to be different .027" Klip-Lok is the ideal roofing material. From an exciting skillion design to the lowline grace of a flat roof choose Klip-Lok, for all homes where prestige and added value are important considerations. If your budget requires a lower initial cost, choose Custom Orb Corrugated sheets for a traditional appearance, or Trimdek where a fresh, modern look is desired. In all home construction the use of low-pitch roofing permits considerable savings in the cost of structural framing, and the use of Lysaght steel roofing allows an amazing amount of design freedom because it is so versatile.

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 .023" or .027" Klip-Lok are the most suitable. Custom Orb and Trimdek are ideal where there is sufficient height to permit a slightly greater roof fall.

Carports, Garages, Roofed Outdoor Areas.—Where a flat roof pitch is desired, use .023" Klip-Lok or .027" Klip-Lok if long spans are necessary. Use Custom Orb or Trimdek where slightly more roof fall is possible. All of these products have an attractive underside which may be left exposed thus avoiding unnecessary additional cost where a ceiling is not required.

Fences, Privacy Screens.—Custom Orb, Trimdek and V-Crimp are all most suitable, and may be used either horizontally or vertically to achieve a variety of pleasing effects. Each of these products is easily attached to conventional timber or tubular framework.

Colour.—For most domestic applications colour is an important consideration, and Colorbond is the answer. Available in a range of architect-selected colours on all of the Lysaght roofing and walling shapes, Colorbond is the ultimate paint finish. As soon as Colorbond pre-painted steel sheet is fastened, the job is complete.

Farm Buildings.—The finest roofing and walling material for sheds, barns, and other farm outbuildings is Custom Orb, long-length, corrugated-steel sheet. No other cladding can match the strength and economy of steel and it will last for a lifetime. If you would prefer a change from the traditional corrugated appearance try Trimdek which, like Custom Orb, is equally suitable for both roofing and walling.

Shop Roofs.—All of the Lysaght roofing profiles are suitable for the roofing of shopping blocks. The final choice will be influenced largely by the particular design. Generally, .031" and .027" Klip-Lok is recommended for modern low-pitched construction, and either Spandek or Custom Orb for roofs of steeper pitch.

Shop Facades.—With no visible fixings .027" Klip-Lok is ideal for shop facades. Alternatively, both V-Crimp and Trimdek provide an attractive ribbed appearance. Facades need colour and Klip-Lok, V-Crimp or Trimdek in a pre-painted Colorbond colour would be the most economic and convenient way of finishing your job.

Shop Awning Soffits.—V-Crimp is the ideal cladding for awning soffits. It is available in both a galvanized finish or a zincanneal finish ready for painting—or pre-painted in a new Colorbond colour. V-Crimp may be run transversely or longitudinally, the long lengths mean that end lapping is virtually unnecessary. The traditional method of fixing V-Crimp is with the V-ribs protruding. Attached in the reverse manner a new visual effect is produced.

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 to 30 ft. and enables cladding to be carried out in a single run without end laps. The result is a saving in cladding time and a pleasing finish.

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

V-Crimp is a walling that is eminently suitable for factory cladding and has a distinctive uncluttered appearance. For prestige buildings, or for feature areas, use .031" or .027" Klip-Lok, the fixings for which are hidden from view. Where a painted finish is desired order the appropriate profile pre-painted in Colorbond.

Buildings such as Schools, Hospitals, Clubs and Churches are usually architect designed and the correct choice of roofing will normally be made from the individual design considerations.

Lysaght Red Orb.—Lysaght Red Orb 3" pitch corrugated roof sheeting has been in use for many years, although most users now prefer the more modern Custom Orb which has very many advantages, including availability in long lengths.

Although 3" pitch Red Orb sheet is being used less frequently, it is still widely seen on existing buildings.

Also available is Red Orb in a 1" pitch shallow corrugated profile. This product is not intended for roofing but is widely used for walling, decorative facades and other similar applications.

Our technical advisory service is available to assist architects and others in coming to a decision on material, and we would welcome the opportunity of handling your enquiry.

Where to Buy.—The products listed are available from all leading building materials merchants, either in stock sizes or on prompt delivery, factory cut to your own precise sizes.

A full range of accessories and fasteners is also available.

For further advice and information contact your merchant or the nearest office of John Lysaght (Australia Limited).

CARE AND STORAGE OF ZINC-COATED SHEETS

No building material which is neglected or damaged before use can do a satisfactory job. Most builders recognise this and exercise commonsense care in storage and handling as a matter of habit.

Zinc coated steel roofing sheets are, of course, designed to do a life-time job of protection against the elements. This is widely recognised in the Trade, but often causes builders to overlook the fact that these products, in common with all other metal roofing, need care in storage.

One of the commonest forms of abuse is water damage caused by bundles of sheets being left unprotected in the open. Damage can be caused either by rain or by condensation, which may occur even in relatively dry atmospheres. Corrugated and similar roofing profiles fit snugly together in a bundle, so that any moisture present is easily drawn in between the sheets by capillary action and, once inside, is unlikely to evaporate. After a very short time this moisture causes unsightly stains which cannot readily be removed and which can detract seriously from the finished appearance of the installation.

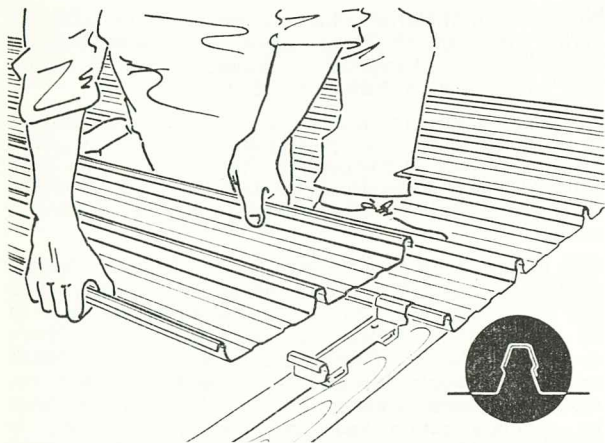
Although, where bundles have been in the weather only a short time, these stains are unlikely to have any significant effect on the service life of the sheeting, they do create misgivings in the minds of builders and building owners.

It is essential, therefore, that all concerned in the trade should be constantly reminded of the wisdom of keeping steel sheets dry before installation.

FASTENINGS FOR LYSAGHT STEEL SHEET ROOF AND WALL CLADDING

Klip-Lok is fixed to steel or timber purlins by means of a steel fixing strap. This fixing method ensures positive fixing without puncturing the deck in any way, thereby ensuring complete watertightness.

Alternatively, Klip-Lok may be bolted to steel or screwed to timber structures.



Nettlefolds' "Selefast" Fasteners have been specially designed for fixing Lysaght roofing and walling products to timber and steel and will provide secure fixing and trouble-free service when used as directed. They should be specified in all applications where a top-quality installation is required.

Fixing by conventional roofing screws or roofing nails will also be satisfactory in certain classes of work.

When nails are used, roof pitch should exceed 5° (1 in 12) and design and location should be such that severe wind uplift forces will not be encountered.

Where the appropriate product literature calls for side-lap fixing, this should be done preferably with "Selefast" No. 9032 screws. Alternatively, blind rivets may be used.

Other types of fixings, such as explosive powered fasteners, welded studs and hook bolts are also satisfactory. Recommendations concerning the use of these may be obtained on application.

Galvanized Roofing Nails.—Galvanized roofing nails are manufactured in lengths of 2" and 2¼". They are normally purchased by the cwt. from manufacturers, but may be purchased by the pound in small quantities. For estimating purposes it may be assumed that approx. 70 nails or 1 lb. of nails are required for one square of roofing.

Galvanized Twisted-shank Roofing Nails.—Galvanized twisted-shank roofing nails are similar to the standard roofing nail, with the exception that the shank has been twisted in order to obtain a better grip in the timber roof members. They are manufactured in lengths of 2" and 2¼", and are normally used where the roof timbers are oregon or cypress. These nails can be obtained from local hardware stores. Approximately 70 2¼" roofing nails weigh 1 lb.

Galvanized Roofing Screws.—Galvanized roofing screws are normally used in the softer roofing timbers such as oregon and cypress. Screws should be used in conjunction with lead or diamond galvanized sheet steel washers. For estimating purposes 70 screws and washers are required per 100 sq. ft. of roof area.

1½" screws can be used, though 2" are normal for 3" corrugations sheet.

Though lead washers may be used alone, it is preferable that they be accompanied by a steel washer.

An impregnated paper washer should be used in conjunction with diamond metal washers.

Lead washers are bought approximately 64 per lb.

Valley Fastening with Self Tapping Screws.—Zinc coated self tapping screws with an integral neoprene seal are now available for valley fixing (Nettlefolds Art. No. 9028) of roofing and walling to steel purlins and girts.

Where purlin spacing exceeds 3 ft., side lap fastenings should be employed (Nettlefolds Art. No. 9032) midway between supports.

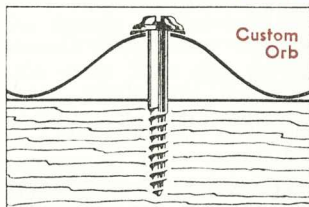
For estimating purposes an average of 40 valley screws and 18 lap screws per square are required.

SELF SEALING WASHER AND SCREW FASTENERS FOR STEEL SHEET ROOF AND WALL CLADDING

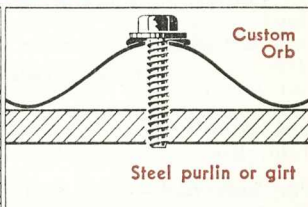
ITEM	DESCRIPTION
SIDE LAP FASTENERS (Nettlefolds Art. No. 9032) 	$\frac{3}{4}$ " x 12G. Slotted Pan Head Washer Collar Type 'A' Self Tapping Screw, complete with Neoprene washer attached. Zinc coated.
VALLEY AND CREST FASTENERS Steel Construction (Nettlefolds Art. No. 9028) 	Hexagon Head Washer Collar Type 'Z' Self Tapping Screw, complete with Neoprene washer attached. Zinc coated. Valley Fastener — $\frac{3}{4}$ " x $\frac{1}{4}$ " Crest Fastener — $1\frac{1}{2}$ " x $\frac{1}{4}$ "
CREST FASTENERS Timber Construction (Nettlefolds Art. No. 9033) 	Slotted Pan Head Washer Collar Roofing Screw complete with Neoprene washer attached. Zinc coated. — $1\frac{3}{4}$ " x 12G. — $2\frac{1}{4}$ " x 12G. — $2\frac{1}{2}$ " x 12G. — $2\frac{1}{2}$ " x 12G.

PACKING.—Packed in lots of 100 or 1,000 screws.

CREST FASTENING



Roofing screw with neoprene washer (Nettlefolds Art. No. 9033) to timber

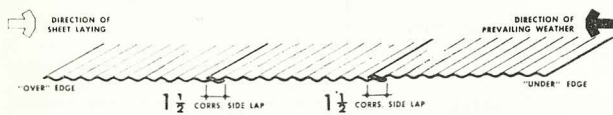


Type 'Z' Self Tapping screw with neoprene washer (Nettlefolds Art. No. 9028) to steel

LAYING AND FIXING PROCEDURES

CUSTOM ORB—DECK LAYING PROCEDURE

Roof Applications



Note.— Should it be necessary to use more than one sheet to provide full-length coverage, commence sheet laying at the gutter line and lay subsequent sheets over this sheet to the ridge or fascia, allowing a minimum end lap of 6".

WALLING

For walling applications follow the procedure outlined for roofing. The recommended minimum end lap for vertical wall cladding is 4".

Fixing Procedure—Conventional Crest Fixing

ENDS AND END LAPS.



INTERMEDIATE PURLINS AND GIRTS.



For Hardwood.— Use Nettlefolds "Selefast" $1\frac{1}{4}$ " x 12G. Roofing Screw No. 9033.

For Softwood.— Use Nettlefolds "Selefast" 2" x 12G. Roofing Screw No. 9033.

For Steel.— Use Nettlefolds "Selefast" $1\frac{1}{2}$ " x $\frac{1}{4}$ " "Z" type Self Tapping Screw No. 9028.

Fixing to Steel—Valley Fastenings

Use Nettlefolds "Selefast" $\frac{3}{4}$ " x $\frac{1}{4}$ " "Z" type Self Tapping Screw No. 9028.

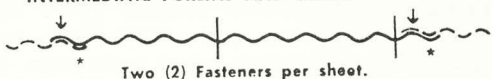
VALLEY FIXING. (Steel Construction only).

ENDS AND END LAPS.

↓ Location of Side Lap Fasteners.



INTERMEDIATE PURLINS AND GIRTS.



* Note : Sheets should not be fastened in the valley of the side lap.

Side Lap and Flashing Fasteners—Timber and Steel

Side lap fasteners are essential and the spacing between such fasteners should not exceed 3 ft.

Note.—A side lap fastener should always be placed alongside a valley fastener. (See illustrations).

Use Nettlefolds "Selefast" $\frac{3}{4}$ " x 12G. "A" type Self Tapping Screw No. 9032.

TRIMDEK—DECK LAYING PROCEDURE

Roof Applications.—Lay and fix the first sheet with the female rib towards the outside of the area being sheeted and, where possible, commence laying on the side away from the prevailing weather. Lay the next sheet, overlapping the first sheet by one rib and fix as indicated herein. Should it be necessary to use more than one sheet to provide full length coverage, commence sheet laying at the gutter line and lay subsequent sheets over this sheet to the ridge or fascia allowing a minimum end lap of 6". When roof pitches are less than 15°, deck flanges should be turned upwards at ridges or fascias and turned downwards at gutters with the Flange Bending Tool.

Hip Ridge Capping.—Hip Ridge Capping should be 18" ridge capping, notched on the job to suit the particular hip angle, and dressed down between the ribs. (See also Advisory Service Leaflet No. A3-1.1).

WALLING

For walling applications, follow the procedure outlined for roofing.

Fixing Procedure—Conventional Crest Fixing

For Hardwood.—Use Nettlefolds "Selefast" 2½" x 12G. Roofing Screw No. 9033.

For Softwood.—Use Nettlefolds "Selefast" 2½" x 12G. Roofing Screw No. 9033.

For Steel.—Use Nettlefolds "Selefast" 1½" x ¼" "Z" type Self Tapping Screw No. 9028.

Frequency of Fixing

Fix through every crest at each end and at all end laps, and through alternate crests at intermediate purlins or girts.

Fixing to Steel—Valley or Flange Fastenings

Use Nettlefolds "Selefast" ¾" x ¼" "Z" type Self Tapping Screw No. 9028.

Valley or flange fixing of Trimdek to steel purlins or girts is suitable only for decks up to 20 ft. in length.

Frequency of Fixing

Each deck should be fixed through every flange at the ends and end laps and two fasteners per sheet should be used at intermediate purlins or girts.

Note.—One flange fastener should always be placed alongside a side lap fastener.

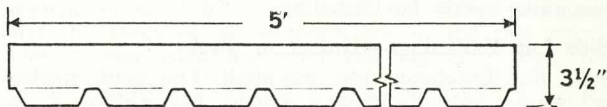
Side Lap and Flashing Fasteners—Timber and Steel

Side lap fasteners are essential and the spacing between such fasteners should not exceed 24".

Use Nettlefolds "Selefast" ¾" x 12G. "A" type Self Tapping Screw No. 9032.

Flashing

A Trimdek notched flashing, which is generally used in conjunction with ridge or apex flashings, closers, etc., can be supplied. Overall length is 5 ft.



SPANDEK—DECK LAYING PROCEDURE

Roof Applications.—Lay and fix the first sheet with the outer edges facing downwards and the female rib towards the outside of the area being sheeted. Where possible commence laying on the side away from the prevailing weather. Lay the next sheet in the same manner, overlapping the first sheet by one rib and fix as described herein. Continue in this manner until all sheets have been fixed. Should it be necessary to use more than one sheet to provide full length coverage commence sheet laying at the gutter line and lay subsequent sheets over this sheet to the ridge or fascia, allowing a minimum end lap of 6". When roof pitches are less than 15°, deck troughs should be turned upwards at ridges or fascias with the Flange Bending Tool.

WALLING

Installation of Spandek for walling applications is similar to that for roofing.

Fixing Procedure—Conventional Crest Fastenings

For Hardwood.—Use Nettlefolds "Selefast" 2½" x 12G. Roofing Screw No. 9033.

For Softwood.—Use Nettlefolds "Selefast" 2½" x 12G. Roofing Screw No. 9033.

For Steel.—Use Nettlefolds 1½" x ¼" "Z" type "Selefast" Fastener No. 9028.

Frequency of Fixing

Four (4) per sheet at ends or end laps.

Three (3) per sheet at intermediate purlins or girts.

Note.—One flange fastening should always be placed alongside a side lap fastening.

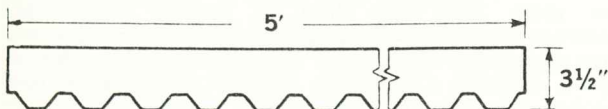
Side Lap Fastenings—Timber or Steel

Side lap fastenings are essential. For roof pitches below 5° such fastenings should not exceed 2 ft. centres. For pitches 5° and above, side lap fastenings should not exceed 3 ft.

Use Nettlefolds “Selefast” $\frac{3}{4}$ ” x 12G. “A” type self tapping screw No. 9032.

Flashing

A Spandek notched flashing, which is used in conjunction with the standard ridge or apex flashings is available. Overall length is 5 ft.



V-CRIMP

Fixing Procedure—Walling only

Spacing of Supports.—V-Crimp may be installed vertically or horizontally. In either case the recommended maximum spacing of supports for general application is 3' 6". Care should be taken to ensure that the faces of all supports are in the one plane. The recommended minimum end lap is 3" and for horizontal fixing, where practical, the lap should face away from the prevailing weather, or should be suitably weatherproofed by means of a mastic sealer.

Side Laps.—Side lap fastenings are essential and the pitch of such fastenings should not exceed 2 ft.

Use $\frac{1}{2}$ " x 8G. type "A" self tapping screws (Nettlefolds Art. No. 4003N), or blind rivets.

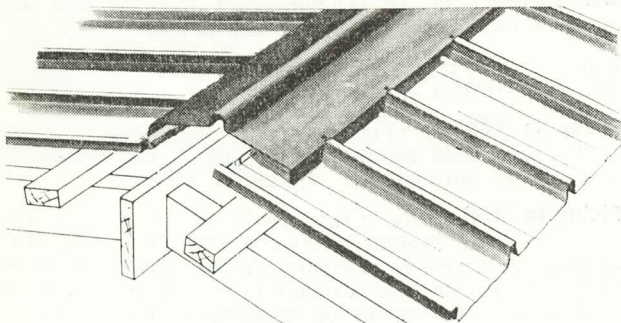
Fixing to Timber.—Fix to supports by means of 1" x 10G. round head wood screws or $1\frac{1}{2}$ " x 11G. threaded nails driven through the bottom of each "V".

Fixing to Steel.—Fix to supports by means of 1" x 8G. type "Z" self tapping screws (Nettlefolds Art. No. 4103N), or rivets driven through the bottom of each "V". On heavier steel structures, any of the standard stud attachment systems or hook bolts may be used.

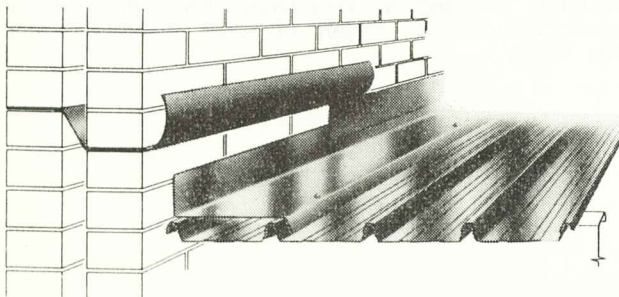
Fixing/General.—When screws are the fastening method, "Phillips" or "Pozi Drive" heads may also be used. This reduces chance of screw drivers marking the sheets.

ROOFING ACCESSORIES

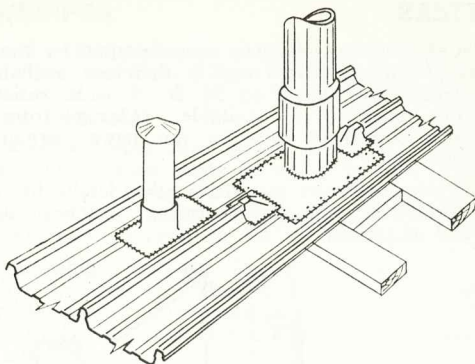
To ensure weather-tightness and to provide a neat finish, roofing accessories are required. These accessories take the form of cappings and flashings and are available from merchants, roofing contractors, or direct from Lysaght. Dimensions and details may vary from area to area although the basic function of these components is the same. It is not possible in the scope of this book to deal in detail with the very wide range available, but the following sketches illustrate the principles of roof flashing.



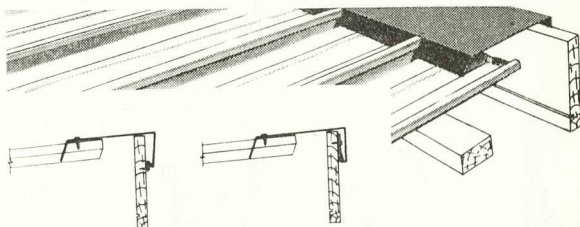
Typical Ridge



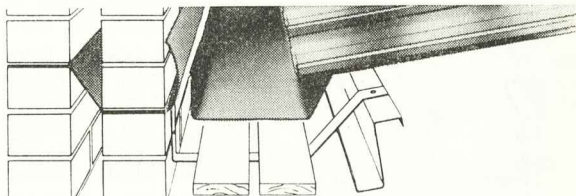
Typical Parapet Flashing



Typical Roof Projection



Typical Facia Flashing



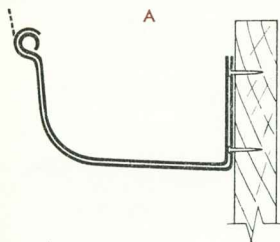
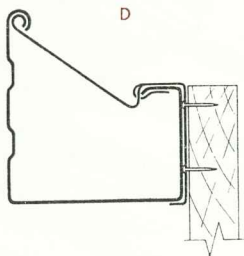
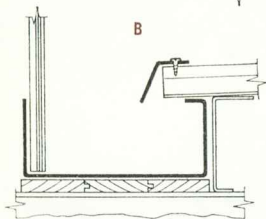
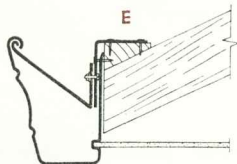
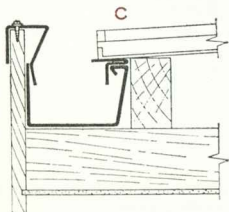
Typical Box Gutter

All flashings are shown for Klip-Lok. Similar flashing principles apply for all other steel roofing profiles.

GUTTERS

Nowadays most guttering is manufactured by the continuous forming process and is therefore available in long lengths—often up to 30 ft. A wide variety of guttering profiles is available, ranging from the traditional quadrant type to the newer ornamental fascia gutters.

Gutter manufacturers provide precise details for fixing their products, and the following sketches can be regarded as typical.



A. Standard Quadrant Gutter and Bracket bent over lip.

B. Box Gutter and Baffle Strip with Klip-Lok Decking.

C. Secret Eaves Gutter, Capping, and Eaves Closer Flashing with Klip-Lok Decking.

D. Fascia Gutter and General Purpose Clip.

E. Concealed Fascia Gutter with Long Rafter and Bead Brackets.

DOWNPIPES

General.—Downpipes are formed from 24BG. Galva-bond Sheet or Coil. The longitudinal joint may be formed with a $\frac{3}{8}$ " seamed joint, or alternatively lapped $\frac{1}{4}$ " and soldered.

Types.—Downpipes may be of round or rectangular section. The normal range of round downpipes is from 2"-6" dia., 3" being the usual size for cottage construction, 4" for farm sheds, while 5" and 6" sizes are generally confined to factory buildings.

The downpipes may be formed from tapered strips, so that one end is slightly larger than the other, to allow lengths of downpipes to be fitted together, or alternatively, one end of the pipe can be crimped.

ROUND				RECTANGULAR			
Dia.	Area sq. in.	Roof area drained sq. ft.	Area of building roofed sq. ft.	Size of Piping	Area sq. in.	Roof area drained sq. ft.	Area of building roofed sq. ft.
2"	3.14	314	304	3" x 2"	6	600	582
2½"	4.9	490	475	4" x 2"	8	800	775
3"	7.07	707	686	4" x 3"	12	1,200	1,165
4"	12.56	1,256	1,218	4" x 4"	16	1,600	1,555
5"	19.63	1,963	1,905	5" x 4"	20	2,000	1,940
6"	28.27	2,827	2,742	6" x 4"	24	2,400	2,315

Size of Downpipes.—For every 100 square feet of actual roof area drained, 1 square inch of downpipe is required, whether round or square. This calculation is based on the assumption that the maximum rainfall does not exceed 5 inches 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 40 feet centres.

Fixing of Downpipes.—Downpipes may be secured:—

1. To weatherboards with 16BG. galvanized straps.
2. To brickwork joints with galvanized steel wall hooks, one to each length of downpipe, or with

1/16" steel straps fixed to wall blocks with galvanized screws and washers.

For additional holding capacity 16BG. galvanized steel straps can be soldered to the downpipe and fixed with a self-tapping screw through the middle of the bracket.

3. To steel wall siding sheets with 16BG. galvanized straps bolted to the sheet with a pair of 3/16" galvanized gutter bolts and washers.

Downpipes should be blocked out 1" clear of all walls and painted prior to fixing.

When buildings are erected on the boundary of a street alignment, the lower length of downpipe should be of cast iron, and chased into the outside face of the building for a minimum length of six feet.

Soldering.—Downpipes are fitted so that the lower length fits outside the upper length some $1\frac{1}{2}$ "-2". Joints are sweated and soldered.

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 be not 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 Dimensions		Approx Area of Roof Drained sq. ft.	Approx. Gutter Dimensions		Approx Area of Roof Drained sq. ft.
	Nominal Size in.	Area of Cross Section sq. in.		Nominal Size in.	Area of Cross Section sq. in.	
Hobart	4	10	650	4½	8	550
Broken Hill	4	10	650	4½	8	550
Melbourne	4	10	500	4½	8	400
Adelaide	4½	11½	550	5	10	500
Perth	4½	11½	500	5	10	450
Canberra	4½	11½	550	5	10	500
Alice Springs	4½	11½	550	5	10	500
Sydney	4½	11½	450	5	10	400
Brisbane	5	13½	500	6	14	500
Port Moresby	5	13½	450	6	14	450
Darwin	6	19	350	7	19	350
Cairns	6	19	400	7	19	400

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 Dimensions		Approx Area of Roof sq. ft.	Gutter (2) Dimensions in.	Area of (3) Cross Section sq. in.	Approx Area of Roof Drained sq. ft.
	Nominal size in.	Area of Cross Section sq. in.				
Hobart	3 x 3	9	600	12 x 4	36	2400
Broken Hill	3 x 3	9	600	12 x 4	36	2400
Melbourne	3 x 3	9	450	12 x 4	36	2000
Adelaide	4 x 3	12	550	12 x 5	48	2400
Perth	4 x 3	12	500	12 x 5	48	2500
Canberra	4 x 3	12	550	12 x 5	48	2600
Alice Springs	4 x 3	12	550	12 x 5	48	2600
Sydney	4 x 3	12	450	12 x 5	48	2000
Brisbane	5 x 3	15	550	12 x 6	60	2400
Port Moresby	5 x 3	15	500	12 x 6	60	2300
Darwin	5 x 4	20	400	12 x 7	72	1500
Cairns	5 x 4	20	450	12 x 7	72	1600

NOTES—

- (1) Based on a risk of overflow of once in 100 years.
- (2) A minimum gutter width of 12 inches.
- (3) Does not include freeboard of 1 inch in gutter depth.

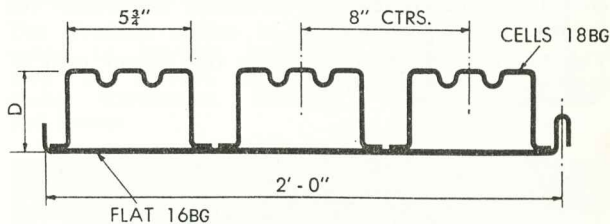
CELDEK

Celdek is a high strength, cellular type, galvanized steel floor deck which costs little more than formwork.

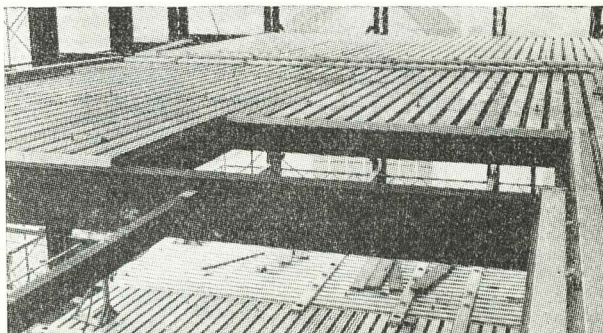
Widely used in multi-storey buildings where a high degree of electrical availability is required, it is fully structural, needs no props and provides immediate working platforms so that other trades can "walk in and work". Celdek features 100% electrical availability and allows variation of service wiring at any time.

Decks give an effective cover of 2ft. and are supplied to site in the required lengths—generally up to 25ft.

Two men can handle individual sections; "crane time" is significantly reduced.



Typical Celdek Profile



TRI-LOK

Tri-Lok is a system of strong, interlocking, galvanized steel structural panels.

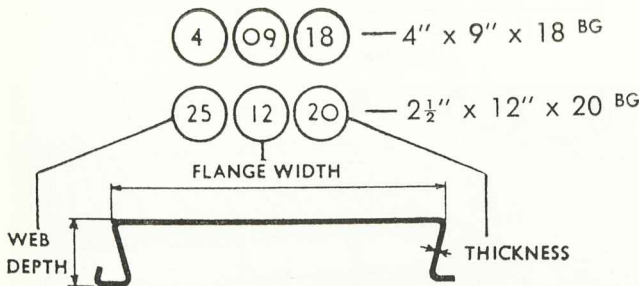
Seven standard panel sizes are produced in flange width of 9", 12" and 15", and web depths from 2" to 4".

Panels are supplied in custom cut lengths to 25ft.

The comprehensive range of panels, together with a range of special panels and accessories, are designed to cover a wide field of building requirements.

This versatile, all-purpose system is used for floor decking—particularly in domestic cottages, and similar applications—built-up roofing, wall cladding, ceilings, etc. 12" wide panels are available perforated for acoustic ceiling treatment.

The following diagram illustrates the system used in cataloguing Tri-Lok Panels.



TROFDEK

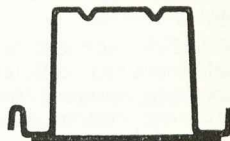
Trofdek is an economical, fully load-carrying galvanized steel floor system.

Seven standard decks are produced in depths from $2\frac{3}{4}$ " to 6"—allowing economical selection for a wide range of load and span conditions.

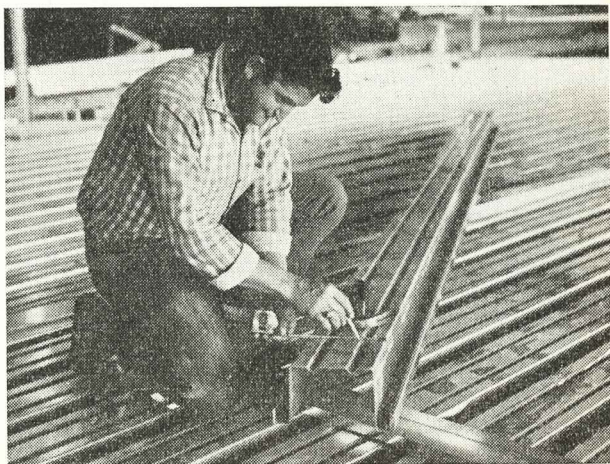
The panels give an effective cover of 10" and have full length overlapping ribs for button punching. They are supplied to the site in custom cut lengths to 25ft. Trofdek panels need no temporary supports, are quickly erected, and provide an early on-the-job working and safety platform.

Electrical availability may be provided exactly where required.

The Trofdek system is most suited to low-rise buildings such as schools, hospitals, clubs, warehouses, factories and homes.



Typical Trofdek Profile



LYSAGHT BONDEK

Lysaght Bondek is a high-strength galvanized steel decking which acts as both permanent framework and positive tensile reinforcement in one-way reinforced concrete slab construction.

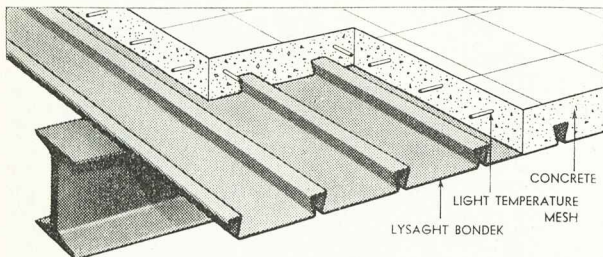
Panels are accurately rollformed in unit widths of 2' 0" with $2\frac{1}{8}$ " high wedge-shaped ribs at 8" centres.

They are supplied cut to the length required—long lengths in the order of 40ft. allow multiple spans and significantly reduce handling and installation time.

The assembled deck forms a safe working platform which supports construction loads and the weight of wet concrete.

Electrical services are readily accommodated by the self-contained cellular raceway system. Raceways are specially designed for simple, on-the-job installation—allowing custom spaced electrical availability in any selected location.

Lysaght Bondek is a utility deck which may be used wherever economy is the prime consideration. It is suitable for all types of construction—multi-storey, home units, hospitals, domestic cottages and bathroom floors—and for industrial buildings.



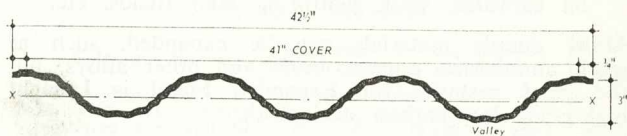
LYSAGHT-BEHLEN 3" PANEL

The Lysaght-Behlen galvanized steel building panel is manufactured in Australia by John Lysaght (Australia) Limited under licence from the Behlen Manufacturing Company, Columbus, Nebraska, U.S.A.

It is a heavy gauge, deeply corrugated, channel ridged panel, which makes maximum use of the high strength of steel. Because of the high structural strength inherent in the panel, it serves the unique purpose of a structural member as well as a covering sheet. Panels are available in lengths from 8' 0" to 25' 7½", cut to customer's order. Lysaght-Behlen panels can be used to form a complete frameless structure, as a roof for other types of wall construction, or as a combination of the two to gain the desired function and appearance.

In all cases long clear span roofs with no intermediate supporting structural members are possible.

Panels for use as walling can be supplied with a specially formed flange to facilitate attachment of roof panels. These flanged connections are suitable for 85° to 95° angle connections. They can be manually formed to suit 80° to 100° angle connections.



LYSAGHT 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.

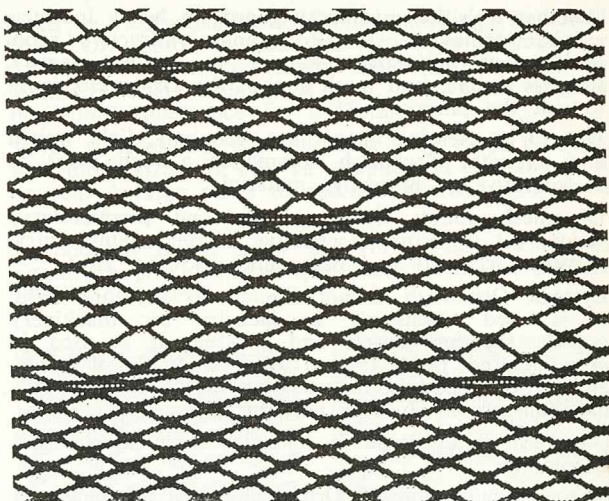
Unlike netting, Expanded Metal is not an interlacing of loose or separate pieces. The strands are all part of the parent metal, rigidly unified at their junctions.

Lysaght Expanded Metal is produced in five types:—

- (a) Metalath—for plastering 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 can be expanded, such as steel, aluminium, copper, brass and other alloys, but the chief material for Expanded Metal is Lysaght high-grade low carbon steel sheet.

METALATH



Self-Furring Metalath

LYSAGHT METALATH

Catalogue No.	Sheet sizes Width Length		No. Sheets per Bundle	Weight per Bundle
PL25, FL25 — For general plastering and wall til- ing (2.5 lb./sq. yd.) ..	27"	8'	10 (20 sq. yds.)	50 lb.
	27"	9'	10 (22½ sq. yds.)	56½ lb.
PL34, FL34 — For light- weight fireproof con- struction (3.4 lb./sq. yd.)	27"	8'	5 (10 sq. yds.)	34 lb.
	27"	9'	5 (11¼ sq. yds.)	38¼ lb.

Material.—Formed from galvanized steel strip.
PL25 is also available in 200ft. coils and can be supplied in larger coils subject to enquiry.

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, attractive room dividers or anti-dazzle screens on an express-way, there is a style and mesh size in the Ornamesh range to suit the purpose.

Due to its pleasing appearance, economy, light weight and strength, Ornamesh commands a high place as a decorative or protective material.

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

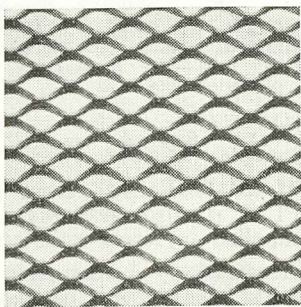
Lysaght Ornamesh is not limited to any one field. It is used extensively in industry for machinery guards, shelving pallets and racking. It is used in manufactured products and equipment of all kinds, and in the building industry for concrete formwork, partitions, room dividers and the like.

Ornamesh is available in both low carbon steel and aluminium.

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



Flattened Ornamesh



Ornamesh

PATTERNED ORNAMESH

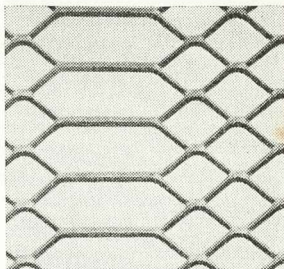
Used in decorative screens and panelling, Patterned Steel Ornamesh provides an attractive high-quality finish, yet it does not restrict the natural flow of air. With the innate strength of steel, it keeps its original handsome appearance for a lifetime.

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.



Patterned Ornamesh



Balustrade Mesh

BALUSTRADE MESH

Balustrade Mesh has a distinctive pattern with a high percentage of open area, giving the appearance of delicate wrought iron.

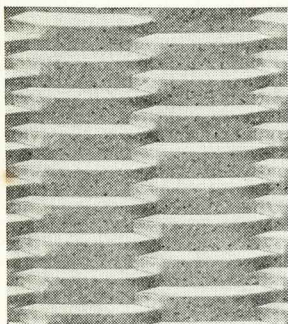
It is strong and durable and is available either uncoated or with a hot-dipped galvanized finish.

Balustrade Mesh is ideal for balcony and stair railings, screen doors, room dividers and security partitions.

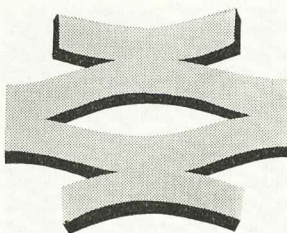
LOUVRE MESH

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 EXPANDED STEEL GRATING

Lysaght expanded steel Gridmesh is the ideal material for use in walkways and platforms. The non-skid surface of Gridmesh assures complete safety. Rigid enough to support heavy loads, it is still lighter than steel plate of similar load-bearing capacity.

Gridmesh is available in two series of meshes. The "GR" series is a comparatively open range of meshes suitable for general purpose use whilst the "GM" series is recommended for heavy-duty applications or where a smaller mesh opening is desirable.

CHANNELS AND ANGLES

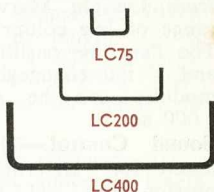
Lysaght Cold Formed Channels and Angles are accurately rollformed from hot rolled steel strip.

All sections are finished with a corrosion resistant red oxide zinc chromate primer ready for finish painting.

Many combinations of sections are possible, and the sizes of the five largest channels are such that they nest readily. This enables many structural joints and splice connections to be effected without special preparation. Normal or tapered box sections are easily fabricated. Accurately controlled dimensions ensure a neat fit and provide an easy method of assembly for sliding joints. This characteristic facilitates welding or bolting with a minimum of preparation.

CHANNELS:

Cat. No.	Web (ins.)	Flange (ins.)	Gauge	Lin. ft. per Ton (Min.)
LC75	$\frac{3}{4}$ "	$\frac{1}{2}$ "	16	6180
LC100	1"	$\frac{1}{2}$ "	16	5270
LC150	$1\frac{1}{2}$ "	$\frac{5}{8}$ "	16	3710
LC200	2"	$\frac{5}{8}$ "	16	3100
LC225	$2\frac{1}{4}$ "	$1\frac{1}{8}$ "	12	1460
LC250	$2\frac{1}{2}$ "	1"	12	1460
LC375	$3\frac{3}{4}$ "	$1\frac{1}{2}$ "	10	780
LC400	4"	$1\frac{3}{8}$ "	10	780



NOTE—LC200 will nest into LC225.

LC225 will nest into LC250.

LC375 will nest into LC400.

ANGLES:

Cat. No.	Leg (in.)	Lengths (in.)	Gauge	Lin. ft. per Ton (Min.)
LA125	1-1/4"	15/16"	12	3030
LA175	1-13/16"	1-1/2"	10	1590
LA200	2"	1-5/16"	10	1590



PENCILINE PARTITION SYSTEM

The Penciline partition system is manufactured in Australia by John Lysaght (Australia) Limited under licence from the Penn Metal Company Inc., Boston, U.S.A. Penciline partition system combines beauty with structural stability. It consists of a comprehensive range of components including galvanized steel stud, track and bridging, all assembled into a rigid framework to form a complete, fully demountable interior partition system. These partitions can be readily dismantled and re-erected in a new location to suit changed floor plan requirements. Low initial costs, reduced maintenance and demountability, with complete re-use of all parts, result in long-term economics.

The Penciline partition is $3\frac{1}{4}$ " thick, with a stud and recess base thickness of $2\frac{1}{2}$ ".

Range.—Ceiling-height, Free-standing and Rail-height. The panels and trims (base, cornices, door and window frames, starter and closer panels) are manufactured from Lysaght Marviplate vinyl-coated steel sheet. A range of five colour stylings is available for panelling. The Penciline partition system is based on standard 4' and 3' interchangeable building modules. Custom-sized modules can be provided in partitions exceeding 1,000 sq. ft.

Sound Control.—The Penciline partition has been tested for "Determination of air-borne sound transmission loss" at the Commonwealth Experimental Building Station.

Fire Resistance.—The combination of galvanized steel framework and Marviplate steel panels, door and window frames, provides a non-combustible partition.

Termite and Rodent Proof.—The Penciline partition system is completely termite and rodent proof.

Ample Services Access.—The Penciline partition system is hollow and the studs are provided with regularly spaced openings, ideal for the passage of concealed services. Standard junction boxes, switches, etc., can be located in any convenient position. Alterations to existing services can be effected easily and quickly.

LYSAGHT ZED SYSTEM

The Lysaght ZED System is a completely new concept of steel support for roof and wall cladding in framed structures. Purlins and girts are capable of spanning up to 30 feet and being spaced at up to 8ft. centres.

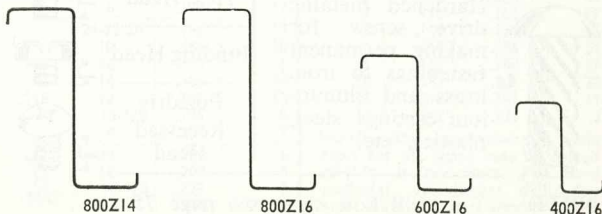
The high-strength galvanized steel ZED Sections, together with a complete range of specially designed accessories, form an integrated purlin and girt system.

Each ZED Section in the range has one flange slightly broader than the other so that end lapping at the connections can be effected by simply inverting ZEDs in alternate bays.

By the use of these lapped joints, bolted in such a manner as to achieve continuity over the supports, the Lysaght ZED System offers economies never before available.

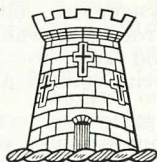
The ZEDs are produced from continuously galvanized steel strip having a minimum yield strength of 70,000 lbs./sq.inch. They are obtainable in lengths up to 35' 4" and section sizes of 8" x 3" x .075", 8" x 3" x .060", 6" x 2½" x .060" and 4" x 2" x .060". Longer lengths can be manufactured for special requirements.

Galvanized accessories include angle stiffeners, fascia purlins, fascia brackets, raking girts, universal cleats, gutter channels and a variety of fasteners.



NETTLEFOLDS PTY. LTD.
SUNSHINE VICTORIA

THE GUARANTEE



OF QUALITY

NETTLEFOLDS
CASE-HARDENED SELF-TAPPING SCREWS

Case-hardened Self-tapping Screws are used for joining and making fastenings to metal sheets and other metal parts. These screws eliminate the need for tapping holes. They tap their own threads as they are driven in.

THREAD TYPES

HEAD TYPES

	<p>For joining and making fastenings to metal sheets from 28 gauge (.016) up to 6 gauge (.198).</p>	<p>C'sunk Head</p>	
	<p>For assembling light metal sheets up to 18 gauge (.050).</p>	<p>Raised Head</p>	
	<p>Hardened metallic drive screw for making permanent fastenings to iron, brass and aluminium castings, steel, plastics, etc.</p>	<p>Round Head</p>	
		<p>Mush. Head</p>	
		<p>Hex. Head</p>	
		<p>Binding Head</p>	
		<p>Pozidriv Recessed Head</p>	

NOTE.— For drill hole sizes, see page 75.

HOLE SIZES FOR NETTLEFOLDS SELF-TAPPING SCREWS

TYPE "Z" SCREWS

Dia. of Screw	Steel Sheet Gauge	Dia. of Hole	Drill Size
No. 2 .088"	28-26	.063	No. 52
	24	.067	51
	22	.070	50
	20-18	.073	49
	16	.076	48
No. 4 .114"	28-26	.086	44
	24	.089	43
	22-20	.093	42
	18	.096	41
	16	.099	39
No. 6 .139"	14	.101	38
	28-26	.104	37
	24-22	.106	36
	20	.110	35
	18	.111	34
No. 7 .154"	16	.116	32
	14	.120	31
	12	.128	30
	26-20	.116	32
	18	.120	31
No. 8 .166"	16	.128	30
	14	.136	29
	12	.140	28
	10-1/8	.149	25
	10-1/8	.152	24
No. 10 .189"	24-22-20	.116	32
	18	.128	30
	16	.136	29
	14	.140	28
	12	.149	25
No. 12 .215"	10-1/8	.152	24
	26-18	.144	27
	16	.152	24
	14	.157	22
	12	.161	20
No. 14 .246"	10-1/8	.169	18
	8	.173	17
	24-22-20	.166	19
	18	.169	18
	16	.177	16
No. 16 .271"	14	.182	14
	12	.185	13
	10-1/8	.196	9
	8	.201	7
	14	.204	6
No. 18 .296"	12	.209	4
	10-1/8	.228	1
	8-6-3/16	.234	15/64
	14	.241	3
	12	.248	2

TYPE "A" SCREWS

Dia. of Screw	Steel Sheet Gauge	Dia. of Hole	Drill Size
No. 4 .114"	28-26	.086	No. 44
	24-22	.093	42
	20	.098	40
	28-26-24	.099	39
	22	.101	38
No. 6 .141"	20	.106	36
	28-26	.104	37
	24	.110	35
	22	.113	33
	20	.116	32
No. 8 .168"	18	.120	31
	26-24	.113	33
	22	.116	32
	20	.120	31
	18	.128	30
No. 10 .194"	26-24-22	.128	30
	20	.136	29
	18	.149	25
	24	.147	26
	22	.149	25
No. 12 .221"	20	.152	24
	18	.157	22
	24	.180	15
	22	.189	12
	20	.191	11
No. 14 .254"	18	.196	9
	24	.204	6
	22	.209	4
	20	.215	3
	18	.221	2

TYPE "U" SCREWS

Dia. of Screw		Dia. of Hole	Drill Size
No. 00	.060"	.052	No. 55
0	.075"	.067	51
2	.100"	.086	44
4	.116"	.104	37
6	.140"	.120	31
7	.154"	.136	29
8	.167"	.144	27
10	.182"	.161	20
12	.212"	.191	11
14	.242"	.221	2

NOTE.—The recommended hole sizes for all types may be varied slightly if necessary. For hard material, use larger drill. For soft material, use smaller drill.

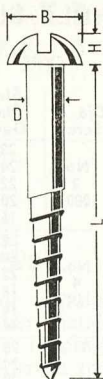
GALV. CONE-HEAD ROOFING SCREWS

ASSURE
PERMANENT
ROOF FIXINGS

Dia. of Head "B" = twice diameter of Shank "D".
Depth of Head "H" = .7 of the dia. of Shank "D".

APPROXIMATE NUMBER PER CWT.

Length	Screw Gauge					
	10 (.192)		12 (.220)		14 (.248)	
"L"	Gross	Doz.	Gross	Doz.	Gross	Doz.
1½	62	11	48	11	—	—
1¾	—	—	43	1	31	2
2	—	—	39	5	29	2
2¼	—	—	34	—	27	—
2½	—	—	30	9	24	4
3	—	—	—	—	20	3
3½	—	—	—	—	17	—
4	—	—	—	—	15	6



GALVANIZED MUSHROOM-HEAD BOLTS AND NUTS

HEAD DIMENSIONS:

Dia. of Head "B" = 2.25 dia. of Shank "D".
Depth of Head "H" = ¾ of dia. of Shank "D".

NUT DIMENSIONS:

Whit. Thread	3/16"	7/32"	1/4"	9/32"	5/16"
Across Flats	3/8"	7/16"	1/2"	1/2"	9/16"
Thickness	.112"	.131"	.150"	.150"	.169"



GALV. TANK RIVETS AND WASHERS

RIVETS:

Packed in ½ cwt. bags.

Number of gross per cwt.:

Sizes 5/16" x 3/16" = 157 gross 9 doz. per cwt.

Sizes 3/8" x 3/16" = 141 gross 9 doz. per cwt.

WASHER DIMENSIONS:

(Weights shown are approx. weights per gross)

"D"	"H"	Gauge	Weight
11/16"	3/16"	16	.95 lb.
13/16"	1/4"	16	1.35 "
3/4"	9/32"	16	1.08 "
13/16"	5/16"	16	1.22 "



REAPER RIVETS

ROUND AND COUNTERSUNK HEAD

HEAD DIMENSIONS:

Round Head.—Diameter of Head "B" = 1.5 of diameter of Shank "D". Depth of Head "H" = .55 of diameter of Shank "D". "L" = Length.

APPROX. No. PER LB.—ROUND HEAD

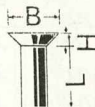
Length	$\frac{3}{8}$ "	$\frac{1}{2}$ "	$\frac{5}{8}$ "	$\frac{3}{4}$ "	$\frac{7}{8}$ "	1"	$1\frac{1}{4}$ "
No. 5 (.212")	181	149	127	110	98	88	73
No. 6 (.192")	232	190	161	139	123	110	91

Countersunk Head.—Diameter of Head "B" = 1.6 diameter of Shank "D". Depth of Head = .3 of diameter of Shank "D". Countersunk 90°. "L" = Length.



APPROX. No. PER LB.—COUNTERSUNK HEAD

Length	$\frac{3}{8}$ "	$\frac{1}{2}$ "	$\frac{5}{8}$ "	$\frac{3}{4}$ "	$\frac{7}{8}$ "	1"	$1\frac{1}{4}$ "
No. 5 (.212")	215	171	142	121	106	94	77
No. 6 (.192")	272	215	178	152	133	118	96

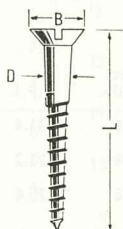


WOOD SCREWS

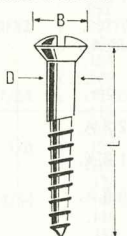
Nettlefold's Wood Screws are machine-turned to ensure perfect heads, concentricity of head with shank, freedom from burrs, and good appearance. Available in mild steel, brass, and other metals, and with Countersunk, Round, Raised or Special Heads.

HEAD TYPES AND DIMENSIONS

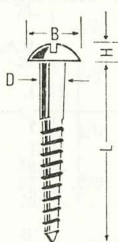
Countersunk Head



Raised Head



Round Head



Pozidriv Recessed Head



"B"=twice dia. of Shank "D". Included angle C'sink "A", 90°

"B"=twice dia. of Shank "D". Included angle C'sink "A", 90°

"B"=twice dia. of Shank "D". "H" = $\frac{3}{8}$ of dia. "D".

Raised Round or Countersunk.

NOTE.—For decimal equivalents of screw gauges, see page 79.

MACHINE SCREWS

Stocked in steel and brass in Whitworth Threads (B.S. 450/1958) and B.A. Threads (B.S. 57/1951) in Countersunk, Round and Cheese Heads.

Heads and threads, or materials other than the above, can be supplied on demand.

DECIMAL EQUIVALENTS AND THREADS PER INCH

B.S.W. AND B.S.F. THREADS

Dia.	Decimal Equiv.	Threads per in.	
		B.S.W.	B.S.F.
1/8"	.1250"	40	—
5/32"	.1563"	32	—
3/16"	.1875"	24	32
1/4"	.2500"	20	26
5/16"	.3125"	18	22
3/8"	.3750"	16	20
7/16"	.4375"	14	18
1/2"	.5000"	12	16
5/8"	.6250"	11	14
3/4"	.7500"	10	12

UNIFIED THREADS

Dia.	Dec. Equiv.	Threads per in.	
		U.N.C.	U.N.F.
No. 2	.086"	56	64
" 4	.112"	40	48
" 6	.138"	32	40
" 8	.164"	32	36
" 10	.190"	24	32
" 12	.216"	24	28
1/4"	.250"	20	28
5/16"	.3125"	18	24
3/8"	.375"	16	24
7/16"	.4375"	14	20
1/2"	.500"	13	20
5/8"	.625"	11	18
3/4"	.750"	10	16

B.A. THREAD

Dia.	Dec. Equiv.	T.P.I.	Dia.	Dec. Equiv.	T.P.I.
6 B.A.	.110	47.9	2 B.A.	.185	31.4
5 B.A.	.126	43.1	1 B.A.	.209	28.2
4 B.A.	.142	38.5	0 B.A.	.236	25.4
3 B.A.	.161	34.8			

DECIMAL EQUIVALENTS

WOOD SCREW GAUGE, IMPERIAL STANDARD WIRE GAUGE, AND FRACTIONS OF AN INCH

Screw Gauge (S.G.)	Imp. Wire Gauge	Fraction of an Inch	Equiv. in Decimal of Inch	Screw Gauge (S.G.)	Imp. Wire Gauge	Fraction of an Inch	Equiv. in Decimal of Inch
	30		.0124			3/16	.1875
	29		.0136	10	6		.192
	28	1/64	.0148			13/64	.203125
			.015625	11	5		.206
	27		.0164			7/32	.212
	26		.018				.21875
	25		.020	12	4		.220
	24		.022				.232
	23		.024	13		15/64	.234
	22		.028				.234375
		1/32	.03125	14			.248
	21		.032			1/4	.250
	20		.036		3		.252
	19		.040	15			.262
		3/64	.046875	16	2		.276
	18		.048			9/32	.28125
4/0			.054	17	1		.290
	17		.056				.300
3/0			.057	18		5/16	.304
2/0			.060				.3125
		1/16	.0625	20	0		.324
0			.063				.332
	16		.064			11/32	.34375
1			.066		2/0		.348
	15		.072	22			.360
		5/64	.078125		3/0		.372
2	14		.080			3/8	.375
	13		.092	24			.388
		3/32	.09375		4/0		.400
3			.094			13/32	.40625
	12		.104	26			.416
4			.108		5/0		.432
		7/64	.109375			7/16	.4375
	11		.116	28			.444
5			.122		6/0		.464
		1/8	.125			15/32	.46875
	10		.128	30			.472
6			.136	32	7/0	1/2	.500
		9/64	.140625	36			.556
	9		.144			9/16	.5625
7			.150	40			.612
		5/32	.15625			5/8	.625
	8		.160			11/16	.6875
8			.164			3/4	.750
		11/64	.171875			13/16	.8125
	7		.176			7/8	.875
9			.178			15/16	.9375

BOLTS AND NUTS

Nettlefolds Pty. Ltd. can supply a comprehensive range of Bolts and Nuts, as follows:—

**Black Cup Head Bolts and Nuts (to A.S. B108)—
(Cup Head, Square Neck, Square Nut)—**

RANGE: From $3/16''$ B.S.W. x $3/4''$ long to $3/4''$ B.S.W. x $24''$ long.

**Black Hexagon Head Bolts and Nuts (to A.S. B100)—
(Hex. Head, Round Shank, Hex. Nut)—**

RANGE: From $1/4''$ B.S.W. x $3/4''$ long to $1''$ B.S.W. x $24''$ long.

Black Hexagon Head Set Screws (to A.S. B100)—

RANGE: From $1/4''$ B.S.W. x $1/2''$ long to $1''$ B.S.W. x $6''$ long.

Black Hexagon Head Coach Screws—

RANGE: From $1/4''$ x $1-1/2''$ long to $3/4''$ x $9''$ long.

**Precision Bright Forged Hexagon Head Bolts and Nuts
—Set Screws (to A.S. B117)—**

RANGE: From $1/4''$ x $3-1/2''$ long to $3/4''$ x $6''$ long.

**50/55 Ton High Tensile Hexagon Head Bolts and Nuts
—Set Screws (to B.S. 1768) U.N.C., U.N.F. Threads—**

RANGE: From $1/4''$ x $3/4''$ long to $3/4''$ x $6''$ long.

The above can be supplied in any required finish, including Hot Dipped Galvanizing and non-standard products are available subject to economic manufacturing quantities.

STRENGTH GROUPS FOR STRUCTURAL TIMBERS

Group	Modulus of Rupture lb./sq.in.		Modulus of Elasticity lb./sq.in.		Crushing Strength Parallel to Grain lb./sq.in.		Strength Shear lb./sq.in.	
	Green	12 per cent m.c.	Green	12 per cent m.c.	Green	12 per cent m.c.	Green	12 per cent m.c.
A	15,000	24,000	2,400,000	3,000,000	7,500	12,000	2,000	2,500
B	12,000	20,000	2,100,000	2,600,000	6,000	10,000	1,500	1,900
C	10,000	16,000	1,700,000	2,200,000	5,000	8,000	1,200	1,600
D	7,000	12,000	1,500,000	1,900,000	3,500	6,000	800	1,100

CLASSIFICATION OF STRUCTURAL TIMBERS INTO STRENGTH GROUPS

	Wt. lb./cu.ft.		Percentage Shrinkage	
	Green	Air-Dry	Radial	Tangential
Group A				
Box, coast grey	80	69	4	8
Box, grey	80	70	3.5	7
Gum, grey	80	66	5	6
Gum, spotted	75	63	4	6
Ironbark, broad-leaved red	80	71	4	6
Ironbark, grey	80	69	4	6
Ironbark, narrow-leaved red	80	67	4.5	6
Tallow-wood	75	62	4	7
Wandoo	80	68	2.5	3.5
Group B				
Ash, hickory	75	62	3	4.5
Ash, silvertop	75	53	5	12
Blackbutt	70	55	4	7
Blackbutt, W.A.	70	54	—	—
Bloodwood, red	70	55	3	4
Box, brush	75	56	5	10.5

CLASSIFICATION OF STRUCTURAL TIMBERS INTO STRENGTH GROUPS

	Wt. lb./cu.ft.		Percentage Shrinkage	
	Green	Air-Dry	Radial	Tangential
Group B				
Box, yellow	80	65	3	6
Gum, forest red	75	61	5.5	9
Gum, Maiden's	75	60	5.5	11
Gum, river red	75	56	4	8.5
Gum, southern blue	75	56	5	11
Gum, spotted	75	63	4	6
Gum, Sydney blue	70	52	5.5	8.5
Gum, yellow	75	64	3	6
Karri	75	56	5	10
Mahogany, red	80	59	4.5	6
Mahogany, southern	75	57	4.5	9
Mahogany, white	80	59	3	5.5
Messmate, gympie	80	62	—	—
Stringybark, brown	70	56	5	10.5
Stringybark, red	75	55	5.5	9
Stringybark, white	70	52	5.5	10
Stringybark, yellow	75	55	4	7
Turpentine	75	59	6.5	12
Group C				
Gum, manna	75	51	2.5	9
Gum, mountain grey	70	54	5	11
Gum, rose	65	49	4.5	7.5
Jarra	70	51	5.5	8
Peppermints (various)	70	49	—	—
Satinay	75	52	4.5	10
Stringybark, messmate	70	47	6	13.5
Group D				
Gum, river red (bending only)	75	56	4	8.5
Pine, hoop	55	33	2.5	4
Pine, white cypress	60	42	2	2.5

BUILDING FRAMES— TIMBERS AND SIZES

(C.S.I.R.O. Pamphlet No. 112)

(Class 1 Construction)

RAFTERS FOR SHEET ROOFING SUPPORTED AT ENDS ONLY

Spacing in.	Length ft.	Recommended Sizes for Strength Groups—Inches					
		A and B		C		D	
		Standard Grade	Common Grade	Standard Grade	Common Grade	Standard Grade	Common Grade
18	7	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 1½	4 x 1½
	8	3 x 1½	3 x 1½	3 x 1½	3 x 2	3 x 2	4 x 2
	9	3 x 2	3 x 2	4 x 1½	4 x 1½	4 x 1½	4 x 2
	10	4 x 1½	4 x 1½	4 x 1½	4 x 2	4 x 2	5 x 2
	11	4 x 1½	4 x 2	5 x 1½	5 x 1½	5 x 1½	5 x 2
	12	5 x 1½	5 x 1½	5 x 1½	5 x 1½	5 x 2	6 x 2
24	6	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 1½	4 x 1½
	7	3 x 1½	3 x 1½	3 x 1½	3 x 2	3 x 1½	4 x 2
	8	3 x 1½	3 x 2	3 x 2	4 x 1½	4 x 1½	4 x 2
	9	4 x 1½	4 x 1½	4 x 1½	4 x 2	4 x 1½	5 x 2
	10	4 x 1½	4 x 2	4 x 2	5 x 1½	5 x 1½	5 x 2
	11	4 x 2	5 x 1½	5 x 1½	5 x 2	5 x 1½	6 x 2
	12	5 x 1½	5 x 2	5 x 2	5 x 2	6 x 2	—
30	5	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 2
	6	3 x 1½	3 x 1½	3 x 1½	3 x 2	3 x 1½	4 x 1½
	7	3 x 1½	3 x 2	3 x 1½	4 x 1½	3 x 2	4 x 2
	8	3 x 2	4 x 1½	4 x 1½	4 x 2	4 x 1½	5 x 2
	9	4 x 1½	4 x 2	4 x 1½	5 x 1½	4 x 2	5 x 2
	10	4 x 1½	5 x 1½	4 x 2	5 x 2	5 x 1½	6 x 2
	11	5 x 1½	5 x 2	5 x 1½	6 x 2	5 x 2	—
	12	5 x 1½	5 x 2	5 x 2	6 x 2	6 x 2	—

BUILDING FRAMES— TIMBERS AND SIZES

(C.S.I.R.O. Pamphlet No. 112)

(Class I Construction)

RAFTERS FOR SHEET ROOFING SUPPORTED AT ENDS ONLY

Recommended Sizes for Strength Groups—Inches

Spacing in.	Length ft.	Recommended Sizes for Strength Groups—Inches					
		A and B		C		D	
		Standard Grade	Common Grade	Standard Grade	Common Grade	Standard Grade	Common Grade
36	5	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 1½	4 x 1½
	6	3 x 1½	3 x 2	3 x 1½	3 x 2	3 x 2	4 x 2
	7	3 x 1½	4 x 1½	3 x 1½	4 x 1½	4 x 1½	5 x 1½
	8	3 x 2	4 x 2	4 x 1½	4 x 2	4 x 2	5 x 2
	9	4 x 1½	5 x 1½	4 x 1½	5 x 2	5 x 1½	6 x 2
	10	4 x 2	5 x 2	5 x 1½	6 x 2	5 x 2	—
	11	5 x 1½	6 x 2	5 x 1½	6 x 2	5 x 2	—
	12	5 x 2	6 x 2	6 x 2	6 x 2	6 x 2	—
42	4	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 2
	5	3 x 1½	3 x 1½	3 x 1½	3 x 2	3 x 1½	4 x 1½
	6	3 x 1½	3 x 2	3 x 1½	4 x 1½	3 x 2	4 x 2
	7	3 x 1½	4 x 1½	3 x 2	4 x 2	4 x 1½	5 x 2
	8	4 x 1½	4 x 2	4 x 1½	5 x 1½	4 x 2	6 x 2
	9	4 x 1½	5 x 1½	4 x 2	5 x 2	5 x 1½	6 x 2
	10	4 x 2	5 x 2	5 x 1½	6 x 2	5 x 2	—
	11	5 x 1½	6 x 2	5 x 2	6 x 2	6 x 2	—
	12	5 x 2	6 x 2	6 x 2	—	6 x 2	—
48	4	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 1½	3 x 2
	5	3 x 1½	3 x 1½	3 x 1½	3 x 2	3 x 1½	4 x 2
	6	3 x 1½	4 x 1½	3 x 1½	4 x 1½	4 x 1½	5 x 1½
	7	3 x 1½	4 x 2	3 x 2	4 x 2	4 x 2	5 x 2
	8	4 x 1½	5 x 1½	4 x 1½	5 x 2	5 x 1½	6 x 2
	9	4 x 1½	5 x 2	4 x 2	6 x 2	5 x 2	—
	10	5 x 1½	6 x 2	5 x 1½	6 x 2	6 x 2	—
	11	5 x 1½	6 x 2	5 x 2	—	6 x 2	—
	12	6 x 2	—	6 x 2	—	7 x 2	—

BUILDING FRAMES— TIMBERS AND SIZES

(C.S.I.R.O. Pamphlet No. 112)

(Class I Construction)

PURLINS FOR SHEET ROOFING—SUPPORTED AT ENDS ONLY

Spacing in.	Length ft.	Recommended Sizes for Strength Groups—Inches					
		A and B		C		D	
		Standard Grade	Common Grade	Standard Grade	Common Grade	Standard Grade	Common Grade
30	10	4 x 1½	5 x 1½	5 x 1½	5 x 2	5 x 1½	6 x 2
	11	5 x 1½	5 x 2	5 x 1½	6 x 2	5 x 2	6 x 3
	12	5 x 1½	5 x 2	5 x 2	6 x 2	6 x 2	6 x 3
	13	6 x 2	6 x 2	6 x 2	6 x 3	6 x 2	—
	14	6 x 2	6 x 2	6 x 2	6 x 3	6 x 3	—
	15	6 x 2	6 x 3	6 x 3	6 x 3	7 x 3	—
	16	6 x 3	—	7 x 3	—	7 x 3	—
	17	7 x 3	—	8 x 3	—	8 x 3	—
	18	8 x 3	—	8 x 3	—	8 x 3	—
	19	8 x 3	—	9 x 3	—	9 x 3	—
	20	9 x 3	—	9 x 3	—	10 x 3	—
36	10	4 x 2	5 x 2	5 x 1½	6 x 2	5 x 2	6 x 3
	11	5 x 1½	6 x 2	5 x 1½	6 x 2	5 x 2	6 x 3
	12	5 x 2	6 x 2	6 x 2	6 x 3	6 x 2	6 x 3
	13	6 x 2	6 x 2	6 x 2	6 x 3	6 x 2	—
	14	6 x 2	6 x 3	6 x 3	6 x 3	6 x 3	—
	15	6 x 3	6 x 3	7 x 3	—	7 x 3	—
	16	7 x 3	—	7 x 3	—	8 x 3	—
	17	7 x 3	—	8 x 3	—	8 x 3	—
	18	8 x 3	—	8 x 3	—	9 x 3	—
	19	8 x 3	—	9 x 3	—	9 x 3	—
	20	9 x 3	—	10 x 3	—	10 x 3	—

BUILDING FRAMES— TIMBERS AND SIZES

(C.S.I.R.O. Pamphlet No. 112)

(Class I Construction)

PURLINS FOR SHEET ROOFING—SUPPORTED AT ENDS ONLY

Recommended Sizes for Strength Groups—Inches

Spacing in.	Length ft.	A and B		C		D	
		Standard Grade	Common Grade	Standard Grade	Common Grade	Standard Grade	Common Grade
42	10	5 x 1½	5 x 2	5 x 1½	6 x 2	5 x 2	6 x 3
	11	5 x 1½	6 x 2	5 x 2	6 x 3	6 x 2	6 x 3
	12	5 x 2	6 x 2	6 x 2	6 x 3	6 x 2	—
	13	6 x 2	6 x 3	6 x 2	6 x 3	6 x 3	—
	14	6 x 2	6 x 3	6 x 3	—	7 x 3	—
	15	6 x 3	—	7 x 3	—	7 x 3	—
	16	7 x 3	—	7 x 3	—	8 x 3	—
	17	7 x 3	—	8 x 3	—	8 x 3	—
	18	8 x 3	—	9 x 3	—	9 x 3	—
	19	8 x 3	—	9 x 3	—	9 x 3	—
	20	9 x 3	—	10 x 3	—	10 x 3	—
48	10	5 x 1½	6 x 2	5 x 1½	6 x 2	6 x 2	6 x 3
	11	5 x 1½	6 x 2	5 x 2	6 x 3	6 x 2	—
	12	6 x 2	6 x 3	6 x 2	6 x 3	6 x 3	—
	13	6 x 2	6 x 3	6 x 3	—	6 x 3	—
	14	6 x 3	6 x 3	7 x 3	—	7 x 3	—
	15	7 x 3	—	7 x 3	—	7 x 3	—
	16	7 x 3	—	8 x 3	—	8 x 3	—
	17	8 x 3	—	8 x 3	—	8 x 3	—
	18	8 x 3	—	9 x 3	—	9 x 3	—
	19	9 x 3	—	9 x 3	—	10 x 3	—
	20	9 x 3	—	10 x 3	—	10 x 3	—

SAWN TIMBER SECTIONS

RECOMMENDED SIZES

Use	ALL MEMBERS (Class I Construction)
Size in inches	
Sole Plates	12 x 6 x 1½ or 9 x 9 x 1½
Stumps	4 x 4 or 5 x 3
Wall Plates (top and bottom)	4 x 2
Bearers	4 x 3 up to 5' x 5' spacing
	5 x 3 up to 6' x 6' spacing
Floor Joists	4 x 2
Flooring	18" centres up to 6' span 9/16" T and G or ¾" end-matched Groups A, B and C; joists up to 18" spacing ¾" T and G, Group D or other pines; joists up to 18" spacing 13/16" T and G, Group D or other pines; joists up to 21" spacing ¾" T and G, Groups A, B and C; joists up to 24" spacing
Studs — up to 24 in. spacing	3 x 2 or 4 x 1½ for Groups A, B and C 4 x 2 for Group D 2 x 1
Braces	See pages 83 and 84.
Rafters	See pages 85 and 86.
Purlins	
Roofing Battens	
Tiles	1½ x 1 rafters up to 18" spacing 2 x 1 rafters up to 24" spacing 2 x 1½ rafters up to 30" spacing 2 x 1½ for Groups A, B and C 3 x 1½ for Group D 4 x 3 3 x 1½ for Groups A, B and C 4 x 1½ for Group D 4 x 3 7 x 1 or to suit rafters
Sheet Roofing	
Under Purlins	
Collar Ties	
Struts	
Ridges, Valleys, Hips	
Verandah Plates —	
Tiles	6 x 2 for Groups A, B and C 8 x 2½ for Group D 5 x 2 for Groups A, B and C 6 x 2½ for Group D
Sheet Roofing	

- (1) Durable timbers only.
- (2) Where buildings are a considerable height above the ground as in parts of Queensland and Northern Territory, it is the usual practice to use round stumps about 9 inches in diameter.
- (3) Common grade unsuitable.
- (4) Freedom from sapwood, if prone to attack by Lyctus borers, is essential.
- (5) Battens must be of the highest quality.
- (6) For complete information obtain C.S.I.R.O. pamphlet No. 112 (Building Frames: Timbers and Sizes).

TABLE OF THERMAL CONDUCTIVITIES OF BUILDING MATERIALS

Material	Description	Density lb. per cu. ft.	Con- duc- tivity K.	Res't'ce R for Thick- ness listed or 1"
Air Space:	Horizontal $\frac{3}{4}$ "-4"	—	—	0.82
	Vertical $\frac{3}{4}$ "-4"	—	—	0.92
Air Surfaces:	Still—Horizontal	—	—	0.61
	Vertical	—	—	0.68
	15 m.p.h. H. or V.	—	—	0.17
Building Boards:	Gypsum Board $\frac{3}{8}$ "	58	1.39	0.27
	Plywood $\frac{1}{4}$ "	34	—	0.31
Flooring Materials:	Carpet and U/felt	—	—	2.08
	Ceramic Tile 1"	—	—	0.08
	Lino $\frac{1}{8}$ "	—	—	0.05
	Plastic Tile $\frac{1}{8}$ "	110	6.25	0.02
	Terrazzo 1"	—	—	0.08
	Hardwood $\frac{3}{4}$ "	—	—	0.68
Insulating Materials:	Mineral Wool (Glass, Slag or Rock)	2.0-5.0	0.30	3.33
	Glass Fibre	9.5	0.25	4.00
	Cane Fibre Tile $\frac{3}{4}$ "	10.5	—	3.16
	Esterfoam	1.62	0.29	3.45
	Asbestos Fibre (Spray) ..	6.0	0.32	3.13
Roof Insulation: (For use above deck):	Cane Fibre $\frac{1}{2}$ "	16.0	0.35	1.39
	Cane Fibre 1"	16.0	0.35	2.78
	Cane Fibre 2"	16.0	0.35	5.26
Concretes:	Gypsum Mortar	116	5.00	0.20
	L.W. Aggregates	120	5.20	0.19
	Including:			
	Shale	100	3.60	0.28
	Slate, Slag	80	2.50	0.40
	Pearlite	60	1.70	0.59
	Vermiculite and Cellu- lar Concretes	40	1.15	0.86
	Sand, Gravel + Stone ..	140	12.0	0.03
Brick:	Common	120	5.00	0.20
	Face	130	9.00	0.11
Plaster:	Cement + Sand $\frac{1}{2}$ "	116	5.00	0.10
	Gypsum + Sand $\frac{1}{2}$ "	105	—	0.09
Woods:	Hardwoods	45	1.10	0.91
	Softwoods	32	0.80	1.25

HEAT TRANSMISSION THROUGH BUILDINGS

Heat transfer through buildings depends on the thermal conductivity of the components which form the enclosing units of that building.

Thermal Conductivity, K , is the time rate of heat flow through a given homogeneous material, and is expressed in B.t.u./hr./sq. ft./°F.1" thickness.

The overall coefficient of heat transmission, U , is the time rate of heat flow from air to air through the various materials used to construct walls, roofs or floors. U is expressed in B.t.u./hr./sq. ft./°F.

The Thermal Resistance, R , is the reciprocal of the overall coefficient, U , for a particular construction. Thus resistances are additive, i.e., $R_{\text{Total}} = R_1 + R_2 + \dots + R_n$, where $R_1, R_2, \dots, R_n$ are the individual resistances of the components.

EFFECT OF ROOFING ON INTERNAL TEMPERATURES

The rate of heat-flow through the roofing membrane depends on its thermal conductivity and its thickness. Heat flows through a 24-gauge galvanized steel roofing sheet 1,500 times to 2,000 times more rapidly than through a terra cotta tile $\frac{1}{2}$ " thick, and only one-quarter as fast as through an aluminium sheet of the same thickness. This fact, as shown later, has very little bearing on the thermal resistance of a roof.

From the underside of the roofing membrane, heat is transferred to the cooler interior of the building by three processes:—

- (i) **Conduction.**—Heat is transferred to the roof frame and thence to the remainder of the structure through the purlins or battens. Only a very small quantity of heat is transferred in this manner.
- (ii) **Convection.**—Heat is transferred to cool air in contact with the underside of the roof. This heated air circulates throughout the inside of the

structure and, in turn, heats surfaces at cooler temperatures.

(iii) Radiation.—Heat radiates from the hot roof to cooler surfaces below.

The rate of heat-flow by convection and radiation from the underside of the roof is reduced to a very small proportion of its rate of flow through the roofing material by the surface air film between the sheet and the surrounding air. This rate of flow through this surface film is constant, being independent of the roofing material.

GENERAL INSTRUCTIONS FOR PAINTING

To obtain the best possible results from paint it is essential that the surface be clean and firm, and that the necessary primer or sealer is applied to ensure durability and adhesion and prevent excessive absorption. Check the instructions on the container of each type of paint.

Ensure all surfaces are free from dirt, grease, oil, rust, and moisture, so that a finish resistant to peeling, cracking, blistering or discolouration is obtained.

Stir all materials thoroughly before use, a good plan being to decant the vehicle off the surface of the pigment, work up the pigment mass, and add the decanted liquid slowly while stirring. Where practicable, place the container upside down for as long as possible before opening.

Always allow ample drying time between successive coats.

When painting masonry, cement render, plaster and similar surfaces, allow to age for at least one month to ensure moisture and alkali content is reduced to safe, workable condition. Cement sealers are designed to form an alkali-resistant barrier, and to prevent excessive absorption.

Softwood requires an oil-based undercoat reduced with raw linseed oil. Hardwood requires a similar undercoat thinned with turpentine only.

Iron and steel should be primed with a red-lead or red oxide-zinc chromate primer or other recommended inhibitive metal primer.

The recommended procedures for painting the normal Lysaght galvanized steel sheet qualities are provided in Advisory Service Leaflet T1-2.1, obtainable on application to John Lysaght (Australia) Limited, Branch Offices.

In brief, new galvanized steel may be treated in any of four ways:—

- (i) Weathering which involves six to twelve months exterior exposure.
- (ii) The application of a two-pack etch primer.
- (iii) The application of proprietary solutions to produce a zinc phosphate coating under controlled conditions.
- (iv) The application of zinc dust—zinc oxide primer. For general purposes use 6 lb. of zinc dust per gallon of oil based medium. For tanks increase the amount of zinc dust to 12 lb.

Having provided a suitable base by one of the foregoing approved methods, good quality paints should be used as a finish coat. In the case of zinc dust—zinc oxide paint, if preferred, a second coat may be used as a finish coat.

In coastal and industrial areas and hot climates, the painting of end laps with an adherent paint system as in the foregoing is strongly recommended.

Zincanneal quality is in a separate class; it is primarily zinc alloy coating which receives a phosphate treatment during manufacture and is suitable for painting without priming.

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. Table of quantities for various classes of work is given below.

Class of Work	Proportions of nominal mix (volumes)	Materials required to make 10 cub. yds. of concrete			Yield of mixture per paper bag of cement (c. ft.)	Water in gals. per bag of cement
		Cement (Bags)	Sand (Dry) (c.yds.)	Metal or Gravel (c.yds.)		
High structural strength concrete for thin reinforced walls, slender reinforced columns, concrete products, heavy-duty floors	1:1.1/2:3	76	4.2	8.5	3.55	4.7
Commonly adopted mixture for reinforced concrete beams and floor slabs, roads, foot-paths, etc., silos, etc.	1:2:4	60	4.4	8.9	4.50	5.4
For strong foundations, road bases	1:2.1/2:5	49	4.5	9.1	5.50	6.1
Foundations for domestic machinery, buildings, etc., and for concrete in mass walls	1:3:6	41	4.6	9.1	6.60	6.5
Watertight plaster coats for cellars, tanks, dairy walls, etc.	1:2	128	9.5	—	2.10	4.2
Surface rendering for two-course concrete paths.	1:2.1/2	110	10.1	—	2.45	4.5
Mortar for wall plaster, rough-casting, and stucco.	1:3*	96	10.6	—	2.80	4.9

Job proportioning may be by volume or weight; volumetric method is usual for small jobs. Water should be carefully measured, allowance being made for moisture content of sand.

*If lime is added, proportions of sand to cementitious materials remain at 3 to 1, e.g., mix 1 cement, 1 lime, 6 sand.

MATERIALS

Portland Cement.—Normal type suited to all normal work; High-Early Strength and Low-Heat for special applications only.

Packing.—Paper bags hold 1 cu. ft. = 94 lb. nett.

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) Lightweight aggregate of the bloated clay or shale type is suitable for structural concretes with strengths up to 4,000-5,000 p.s.i. The concrete density varies from 90 to 105 p.c.f. (4) Exceptionally lightweight 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.

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 $1\frac{1}{2}$ 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—
 - (a) Thoroughly wire-brush surface and wash to remove all loose particles.
 - (b) Apply layer of mortar of same composition as new concrete (but without coarse aggregate), and of plastic consistency, to surface—preferably brushing in.
 - (c) Immediately place fresh concrete.

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.

Waterproofing admixtures may provide additional insurance where low hydraulic heads only are to be resisted, but are not a substitute for good concrete.

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 five to 10lb. 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 1,000 sq. ft. of surface:—

Paving thickness	Concrete Mix					
	1:2:4			1:2.1/2:5		
	Cement (bags)	Sand (c.ft.)	Metal (c.ft.)	Cement (bags)	Sand (c.ft.)	Metal (c.ft.)
2" (Light foot traffic)	38	75	150	31	77	154
3" (Normal footpath)	56	112	224	46	115	230
4" (Car drives, etc.)	76	150	298	62	154	308
6" (Heavy trucks, etc.)	112	224	448	92	230	460

Render thickness	1:2		1:2.1/2		1:3	
	Cement (bags)	Sand (c.ft.)	Cement (bags)	Sand (c.ft.)	Cement (bags)	Sand (c.ft.)
1/2"	20	40	17	43	15	44
3/4"	30	60	25	63	22	68
1"	40	80	34	85	30	88

SPECIFICATIONS OF STANDARD MESHES

A.R.C. OBLONG FABRICS

A.S. A84 Ref. No.	Mesh sizes Nominal pitch of wires		Size of wires		Cross-sectional area per ft. width		Nominal weight per sq. yd. lb.	A.R.C. Ref. No.
	Main in.	Cross in.	Main S.W.G.	Cross S.W.G.	Main sq. in.	Cross sq. in.		
301	3	8	4/0	1	.5027	.1061	18.63	1
302	3	8	3/0	1	.4348	.1061	16.55	2
303	3	8	2/0	1	.3804	.1061	14.89	3
304	3	8	1/0	1	.3298	.1061	13.34	4
305	3	10	1	1	.2828	.0848	11.25	5
306	3	10	2	1	.2393	.0848	9.92	6
307	3	10	3	1	.1996	.0848	8.70	7
308	6	12	1/0	1	.1649	.0707	7.20	8
309	6	12	1	1	.1414	.0707	6.48	9
310	6	12	2	1	.1197	.0707	5.82	10
312	3	12	8	8	.0804	.0201	3.07	12
314	3	12	10	10	.0515	.0129	1.97	14
(Vic.)	3	14	2	8	.2393	.0172	7.84	6 T.M.
(N.S.W.)	3	16	3	8	.1996	.0150	6.57	7 T.M.

A.R.C. SQUARE FABRICS

A.S. A84 Ref. No.	Mesh sizes Nominal pitch of wires		Size of Wires each way S.W.G.	Cross- sectional area per ft. width each way sq. in.	Nominal weight per sq. yd. lb.	A.R.C. Ref. No.
	Main in.	Cross in.				
601	6	6	1/0	.1649	10.09	600
602	6	6	1	.1414	8.65	611
603	6	6	2	.1197	7.32	622
604	6	6	3	.0998	6.11	633
605	6	6	4	.0845	5.17	644
606	6	6	5	.0706	4.32	655
608	6	6	6	.0579	3.54	666
610	6	6	8	.0402	2.46	688
	6	6	10	.0257	1.58	610
A.R.C. Ref. No.						
333	3	3	3	.1996	12.21	333
335	3	3	5	.1412	8.64	335

STANDARD SHEETS AND ROLLS

SIZES AND SHIPPING DIMENSIONS

A.R.C. OBLONG FABRICS

STANDARD SHEET SIZE			STANDARD ROLL SIZE			
Length		20 ft.	Length		200 ft.	
Width		8 ft.	Width		8 ft.	
Area		17.78 sq. yd.	Area		177.78 sq. yd.	
A.S. Ref. No.	Normally stocked in	Weight per sheet (lb.)	Weight per roll/10 sheets (lb.)	Depth of 10 sheets (in.)	Diam. of 1 roll (in.)	A.R.C. Ref. No.
301	Sheets Only	331	3311	3 $\frac{7}{8}$		1
302		294	2942	3 $\frac{1}{2}$		2
303		265	2647	3 $\frac{1}{2}$		3
304		237	2371	3 $\frac{3}{8}$		4
305		200	2000	3 $\frac{1}{4}$		5
306		176	1763	3		6
307		155	1547	2 $\frac{7}{8}$		7
308		128	1281	3 $\frac{3}{8}$		8
309		115	1154	3 $\frac{1}{4}$		9
310		104	1035	3		10
312	Rolls	—	546		21	12
314	Only	—	350		17	14
(Vic.)	Sheets	138	1384	2		6T.M.
(N.S.W.)	Only	117	1168	1 $\frac{1}{2}$		7T.M.

A.R.C. SQUARE FABRICS

STANDARD SHEET SIZE			STANDARD ROLL SIZE			
Length		20 ft.	Length		200 ft.	
Width		8 ft.	Width		8 ft.	
Area		17.78 sq. yd.	Area		177.78 sq. yd.	
A.S. Ref. No.	Normally stocked in	Weight per sheet (lb.)	Weight per roll/10 sheets (lb.)	Depth of 10 sheets (in.)	Diam. of 1 roll (in.)	A.R.C. Ref. No.
601	Sheets	179	1792	3 $\frac{1}{2}$		600
602	Only	154	1538	3 $\frac{3}{4}$		611
		130	1302	3		622
603	Sheets and Rolls	109	1085	2 $\frac{3}{4}$	37 $\frac{1}{2}$	633
604		92	920	2 $\frac{1}{2}$	35	644
605		77	768	2 $\frac{1}{4}$	32	655
606		63	630	2	30	666
608		44	438	1 $\frac{3}{4}$	27	688
610	Rolls Only		279		20	610
	Standard Sheets	109	1085	2 $\frac{3}{4}$		333
	10' 0" x 8' 0"	77	768	2 $\frac{1}{2}$		335

CONVERSION—STRUCTURAL GRADE BARS TO A.R.C. FABRIC

A.R.C. Ref. Nos. equivalent to Structural Grade Round and Deformed Bars at various cts.

Stresses. Fabric 30,000 p.s.i. Bars 20,000 p.s.i.

OBLONG FABRIC

Diam.	Spac- ing (in.)	Area ft. wth. (sq. in.)	A.R.C. Ref. No.	Diam.	Spac- ing (in.)	Area ft. wth. (sq. in.)	A.R.C. Ref. No.
$\frac{1}{4}$ "	3	.196	9	$\frac{3}{8}$ " or No. 3	3	.442	4
	4	.147	10		4	.331	6
	5	.118	12		5	.265	7
	6	.098	12		6	.221	8
	9	.084	14		7	.189	9
			8		.166	10	
			9		.147	10	
			12		.110	12	
$\frac{1}{2}$ " or No. 4	4	.589	2	$\frac{5}{8}$ " or No. 5	5	.736	1
	5	.471	4		6	.614	2
	6	.393	5		7	.526	3
	7	.336	6		8	.460	4
	8	.294	7		9	.409	5
	9	.262	7		10	.368	5
	12	.196	9		12	.307	7
	15	.157	10	15	.245	8	
$\frac{3}{4}$ " or No. 6	7	.756	1	$\frac{7}{8}$ " or No. 7	10	.722	1
	8	.663	1		11	.656	2
	9	.589	2		12	.601	2
	10	.530	3		13	.555	3
	11	.482	4		14	.515	3
	12	.442	4		15	.481	4
	15	.354	6		18	.401	5
		18	.295		7		

SQUARE FABRIC

$\frac{1}{4}$ "	3	.196	611	$\frac{3}{8}$ " or No. 3	5 $\frac{1}{2}$	.241	600
	4	.147	633		7	.189	611
	5	.118	644		8	.166	622
	6	.098	655		9	.147	633
	7	.084	666		10	.132	633
	9	.065	666		11	.120	644
	12	.049	688		12 $\frac{1}{2}$	.106	655
					15	.088	666
$\frac{1}{2}$ " or No. 4	9 $\frac{1}{2}$	.247	600				
	11	.214	611				
	12	.196	611				
	13	.181	622				
	15	.157	622				
	18	.131	644				

BRICKS AND BRICKWORK

1,000 common bricks weight about 4 tons.

Standard brick size = 9" x 4-5/16" x 3".

Standard measure = 1 rod = 16' 6" x 16' 6" x 13-1/2".

1 Rod = 272 super feet x 1-1/2 brick thickness.

= 408 " " x 1 " "

= 816 " " x 1/2 " "

= 306 cubic feet or 11-1/3 cubic yards.

QUANTITIES OF MATERIALS REQUIRED FOR ONE UNIT OF BRICKWORK

Unit Quantity	Bricks		Mortar: Lime or Cement Cu. Ft.	2:1 Cement Mortar	
	No.	Cu. Ft.		Cement	Sand
				Bags	Cu. Ft.
<u>1/4" Joints</u>					
1 Rod	3,703	260	48	23	46
1 Cu. Yd.	327	22.97	4.03	2	4
<u>3/8" Joints</u>					
1 Rod	3,429	241	65	23.2	70
1 Cu. Yd.	302	21.27	5.73	2.04	6.12

Weight of Brickwork.—In lime mortar, about 112 lb. per cu. ft.
In cement mortar, about 120 lb. per. cu. ft.

Paving requires per sq. yd.—32 bricks on flat; 48 bricks on edge.

MORTAR FOR BRICKWORK:

- Cement mortar should be used where a high degree of impermeability is required, as in walls and piers below dampcourse, 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.
- 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.
- 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 1 part cement to 1 part hydrated lime or lime putty to 6 parts sand by volume.

MODULAR BRICKS

Although at present they represent only a small proportion of the total numbers produced, there has been a steady increase in the production and use of bricks made to modular sizes. They are at present being incorporated in a revision of Australian Standards A 21.

Sizes of modular bricks are expressed as nominal, that is, including the mortar joint. Thus, in calculating numbers required it is only necessary to work on the nominal sizes, ignoring the mortar joint.

Nominal sizes are: 12" x 4" x 4".

8" x 4" x 4".

SPECIAL BRICKS

New applications in brickwork call for many special, or non-standard sizes. Space does not permit a complete listing but the following are more common examples.

"Nu-lite" Block: 9" x 4-5/16" x 4-11/16".

Norman: 11-5/8" x 3-1/2" x 2-5/8".

Modulated: 12" x 4" x 4-1/2" (nominal).

BRICKWORK DIMENSIONS

NOTES.— $\frac{1}{8}$ " should be added for bed under sills bearers, etc. Openings are $\frac{3}{4}$ " longer than piers. Four courses equals 1'-1 $\frac{1}{2}$ ".

Courses or Bricks	Piers	Openings	Heights	Courses or Bricks	Piers	Openings	Heights
1/2	4-5/16"	5-1/16"		13	10' 1-1/2"	10' 2-1/4"	3' 7-7/8"
1	9"	9-3/4"	3-3/8"	13-1/2	10' 6-3/16"	10' 6-15/16"	
1-1/2	1' 1-11/16"	1' 2-7/16"		14	10' 10-7/8"	10' 11-5/8"	3' 11-1/4"
2	1' 6-3/8"	1' 7-1/8"	6-3/4"	14-1/2	11' 3-9/16"	11' 4-5/16"	
2-1/2	1' 11-1/16"	1' 11-13/16"		15	11' 8-1/4"	11' 9"	4' 2-5/8"
3	2' 3-3/4"	2' 4-1/2"	10-1/8"	15-1/2	12' 0-15/16"	12' 1-11/16"	
3-1/2	2' 8-7/16"	2' 9-3/16"		16	12' 5-5/8"	12' 6-3/8"	4' 6"
4	3' 1-1/8"	3' 1-7/8"	1' 1-1/2"	16-1/2	12' 10-5/16"	12' 11-1/16"	
4-1/2	3' 5-13/16"	3' 6-9/16"		17	13' 3"	13' 3-3/4"	4' 9-3/8"
5	3' 10-1/2"	3' 11-1/4"	1' 4-7/8"	17-1/2	13' 7-11/16"	13' 8-7/16"	
5-1/2	4' 3-3/16"	4' 3-15/16"		18	14' 0-3/8"	14' 1-1/8"	5' 0-3/4"
6	4' 7-7/8"	4' 8-5/8"	1' 8-1/4"	18-1/2	14' 5-1/16"	14' 5-13/16"	
6-1/2	5' 0-9/16"	5' 1-5/16"		19	14' 9-3/4"	14' 10-1/2"	5' 4-1/8"
7	5' 5-1/4"	5' 6"	1' 11-5/8"	19-1/2	15' 2-7/16"	15' 3-3/16"	
7-1/2	5' 9-15/16"	5' 10-11/16"		20	15' 7-1/8"	15' 7-7/8"	5' 7-1/2"
8	6' 2-5/8"	6' 3-3/8"	2' 3"	20-1/2	15' 11-13/16"	16' 0-9/16"	
8-1/2	6' 7-5/16"	6' 8-1/16"		21	16' 4-1/2"	16' 5-1/4"	5' 10-7/8"
9	7' 0"	7' 0-3/4"	2' 6-3/8"	21-1/2	16' 9-3/16"	16' 9-15/16"	
9-1/2	7' 4-11/16"	7' 5-7/16"		22	17' 1-7/8"	17' 2-5/8"	6' 2-1/4"
10	7' 9-3/8"	7' 10-1/8"	2' 9-3/4"	22-1/2	17' 6-9/16"	17' 7-5/16"	
10-1/2	8' 2-1/16"	8' 2-13/16"		23	17' 11-1/4"	18' 0"	6' 5-5/8"
11	8' 6-3/4"	8' 7-1/2"	3' 1-1/8"	23-1/2	18' 3-15/16"	18' 4-11/16"	
11-1/2	8' 11-7/16"	9' 0-3/16"		24	18' 8-5/8"	18' 9-3/8"	6' 9"
12	9' 4-1/8"	9' 4-7/8"	3' 4-1/2"	24-1/2	19' 1-5/16"	19' 2-1/16"	
12-1/2	9' 8-13/16"	9' 9-9/16"		25	19' 6"	19' 6-3/4"	7' 0-3/8"

CONCRETE MASONRY

ESTIMATING DATA

112 x 16" x 8" (face area) units equals one 10' x 10' Wall Square or 100 sq. ft.

10.125 x 16" x 8" (face area) units equals one square yard.

4 cu. ft. mortar per 100 sq. ft. of wall in either 8" or 4" thick walls.

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.—It will be noted that all dimensions end in $\frac{3}{8}$ ". When taken with the standard $\frac{3}{8}$ " mortar joint this means that all joints are spaced horizontally and vertically at intervals of 8" or multiples thereof. The effective length and height of all standard blocks are thus 16" and 8" respectively. Note that all external measurements are multiples of 4" minus $\frac{3}{8}$ " and openings are plus $\frac{3}{8}$ " to allow for one mortar 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 shall be full bedding and also at damp proof courses. Thereafter, vertical and horizontal joints shall be 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, a reasonable strength in

compression, a high resistance to shear, a high degree of adhesion between mortar and block, and a high degree of 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 course level—

- 1 part portland cement
- 1 part hydrated lime
- 6 parts clean pit sand

As lime does not set while moist, lime mortars and cement lime mortars are unsuitable in retaining walls and in work below damp-proof course level where they are subject to continuous dampness. Cement mortars with only sufficient lime to facilitate working are therefore recommended.

- 1 part portland cement
- $\frac{1}{4}$ part hydrated lime
- 3 parts clean pit sand

To lay 112 blocks, either 4" or 8" wide (face shell bedding) giving 100 sq. ft. of wall area will require 3 cubic feet sand, $\frac{1}{2}$ bag cement, and $\frac{1}{2}$ bag lime (1.1.6).

Joint Reinforcement.—To assist in controlling shrinkage, cracking and distribution of stresses through the walls, joint reinforcement should be used. It may consist of welded wire strips $2\frac{1}{4}$ " wide for 4" walls, $6\frac{1}{4}$ " wide for 8" walls, and $10\frac{1}{4}$ " wide for 12" walls. In walls less than 20' long and in walls where control joints are used in conjunction with bond beams, no joint reinforcement is necessary—otherwise it is placed in every third bed joint throughout the wall. It is also used in the first bed joint above a lintel, and in the first two bed joints under a sill, unless bond beams are used in these locations. Joint reinforcement must not extend across any expansion or control joint. Lap 8" at all joints and intersections.

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 compactness is important since mortar, when hardening, has a tendency to shrink slightly.

Control Joints.—Use should be made of control joints to prevent masonry walls from cracking due to unusual stresses. Such joints are built into walls in such a manner as to permit slight wall movement without cracking. The spacing and location of these joints will depend on several factors—such as the length of wall and architectural details, but they should be used at wall openings and at the junction of walls and columns. In long walls with joint reinforcement, control joints should be provided every 25'. If no joint reinforcement is used, the control joints should be at 16' intervals. After mortar has stiffened rake out joints to a depth of $\frac{3}{4}$ " and fill joints with an approved elastic caulking compound. It is advisable to prime the control joint before caulking to prevent absorption of oils from compound. Control joints should provide a continuous vertical separation through the entire thickness of the masonry wall, and joint reinforcement is to be broken at control joints.

Bond Beam.—This is a continuous lintel around the exterior of the building for the purpose of providing lateral stability to the walls, and to minimise shrinkage cracking at openings. It is constructed of beam blocks and filled with concrete and reinforcing steel.

Reinforcement should be not less than two $\frac{1}{2}$ " dia. bars cross tied at 12" intervals with No. 8 gauge wire stirrup for walls up to 40' long.

Bond beams must be used in the following locations:—

At or near the top of all exterior load-bearing walls.

On all internal walls which provide lateral support to load-bearing walls.

Immediately below intermediate floor levels in multi-storey construction.

Bond beams may be omitted in single storied construction provided the roof rafters are adequately tied across the building at wall top level if control joints are provided.

Lintels.—Reinforced lintels are necessary over all door and window openings. Lintel blocks are manufactured for this purpose. The 8" lintel block, reinforced with two $\frac{1}{2}$ " dia. rods and No. 8 gauge ties at 12" centres, will support a superimposed uniformly distributed load of 160 lb. per foot on spans up to 7 feet. However, a minimum 8-inch bearing should be required for all lintels. Where convenient, the lintel may actually be a section of the bond beam. Where reinforced concrete masonry lintels are used, the first course of masonry above the lintel should be laid in full mortar bed so that the cross ribs as well as the face shells of the units will bear on the lintel and thus reduce the shear stress between the core fill concrete and the face shell of the unit.

Spans up to 20 feet can be obtained with 16" deep lintel blocks.

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.

Top Plate Fixing.—Fix plates by grouting holding down bolts into block cavity and bedding plate on top of standard blocks or by tying down with hoop iron straps carried down two courses looped under cross web and spiked to top of plate.

External Finish.—To 8" and 12" blockwork: seal all exterior faces of concrete blockwork with two coats of approved latex based paint or cement based paint or approved clear sealer. Alternatively, one coat of cement based paint plus one coat of latex paint may be used. Rendered or Tyrolean finish is also suitable for weatherproofing exterior walls.

Damp Proofing.—Waterproof all mortar up to one course above floor levels with approved mortar waterproofing admixture, or use approved metal core damp-course in first course below floor level.

CONCRETE MASONRY WALLS

No. of Blocks	MODULAR LENGTHS (Note: Full Module = 4 x 4" = 16")				MODULAR HEIGHTS	
	Full Module	Plus $\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	No. of Blocks	Half Module
1	1' 4"	1' 8"	2' 0"	2' 4"	1	8"
2	2' 8"	3' 0"	3' 4"	3' 8"	2	1' 4"
3	4' 0"	4' 4"	4' 8"	5' 0"	3	2' 0"
4	5' 4"	5' 8"	6' 0"	6' 4"	4	2' 8"
5	6' 8"	7' 0"	7' 4"	7' 8"	5	3' 4"
6	8' 0"	8' 4"	8' 8"	9' 0"	6	4' 0"
7	9' 4"	9' 8"	10' 0"	10' 4"	7	4' 8"
8	10' 8"	11' 0"	11' 4"	11' 8"	8	5' 4"
9	12' 0"	12' 4"	12' 8"	13' 0"	9	6' 0"
10	13' 4"	13' 8"	14' 0"	14' 4"	10	6' 8"
11	14' 8"	15' 0"	15' 4"	15' 8"	11	7' 4"
12	16' 0"	16' 4"	16' 8"	17' 0"	12	8' 0"
13	17' 4"	17' 8"	18' 0"	18' 4"	13	8' 8"
14	18' 8"	19' 0"	19' 4"	19' 8"	14	9' 4"
15	20' 0"	20' 4"	20' 8"	21' 0"	15	10' 0"
16	21' 4"	21' 8"	22' 0"	22' 4"	16	10' 8"
17	22' 8"	23' 0"	23' 4"	23' 8"	17	11' 4"
18	24' 0"	24' 4"	24' 8"	25' 0"	18	12' 0"
19	25' 4"	25' 8"	26' 0"	26' 4"	19	12' 8"
20	26' 8"	27' 0"	27' 4"	27' 8"	20	13' 4"
21	28' 0"	28' 4"	28' 8"	29' 0"		
22	29' 4"	29' 8"	30' 0"	30' 4"		
23	30' 8"	31' 0"	31' 4"	31' 8"		
24	32' 0"	32' 4"	32' 8"	33' 0"		
25	33' 4"	33' 8"	34' 0"	34' 4"		
26	34' 8"	35' 0"	35' 4"	35' 8"		
27	36' 0"	36' 4"	36' 8"	37' 0"		
28	37' 4"	37' 8"	38' 0"	38' 4"		
29	38' 8"	39' 0"	39' 4"	39' 8"		
30	40' 0"	40' 4"	40' 8"	41' 0"		
31	41' 4"	41' 8"	42' 0"	42' 4"		
32	42' 8"	43' 0"	43' 4"	43' 8"		
33	44' 0"	44' 4"	44' 8"	45' 0"		
34	45' 4"	45' 8"	46' 0"	46' 4"		
35	46' 8"	47' 0"	47' 4"	47' 8"		
36	48' 0"	48' 4"	48' 8"	49' 0"		
37	49' 4"	49' 8"	50' 0"	50' 4"		
38	50' 8"	51' 0"	51' 4"	51' 8"		
39	52' 0"	52' 4"	52' 8"	53' 0"		
40	53' 4"	53' 8"	54' 0"	54' 4"		



G.K.N. BUILDING AND ENGINEERING

A DIVISION OF
GUEST, KEEN & NETTLEFOLDS (AUSTRALIA) PTY. LTD.

EXISTING REPRESENTATION:

CONSTRUCTION PRODUCTS
WILLIAMS Form Clamps and Ties,
Wedge Lock Wire Ties, Snap Ties,
Beam Hangers.
ROCK ANCHORS, CONSTRUCTION
ACCESSORIES
FRAMING SYSTEMS
UNISTRUT—Racking Partitions,
Displays, Pipe Supports, Concrete
Inserts, Electrical Trunking.
SPEEDRACK Boltless Racking
MET-L-STRUT FLOORING, CABLE TRAYS,
CABLE LADDERS

MILLS SCAFFOLDING AND FORMWORK
Tubular Scaffolding,
Milfast Horizontal Frame Scaffolding,
Milframe Scaffolding,
Self-Lock Scaffold Units,
Travelling Cradles,
Heavy Suspended Scaffolding,
Power-operated Cradles,
Saf-T-Climb Ladder Climbing Devices,
Trestles, Seating Units,
Milshore Heavy Duty Shoring,
Milprops, Milcentres, Milforms,
Plywood Forms.

BRANCH OFFICES:

SYDNEY: 410-416 Mitchell Road,
Alexandria.
MELBOURNE: 11 Syme Street,
Brunswick.
BRISBANE: 10-14 Graham St., Milton.
ADELAIDE: Cnr. Adam and Manton Sts.,
Hindmarsh.
HOBART: Brewster Scaffolds, Pty. Ltd.,
156 Campbell St., Hobart.

PERTH: 35 Forbes Road, Perth.
CANBERRA: 169-171 Newcastle St.,
Fyshwick.
NEWCASTLE: John Lysaght (Australia)
Limited, Newcastle Works.
PORT KEMBLA: John Lysaght
(Australia) Limited, Port
Kembla Works.
GEELONG: Station Street, Norlane.

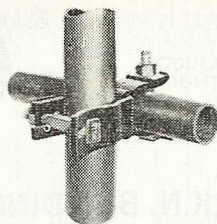
And agents in New Zealand and major
country centres in Australia.

G.K.N. BUILDING AND ENGINEERING Continued

MILLS TUBULAR SCAFFOLDING

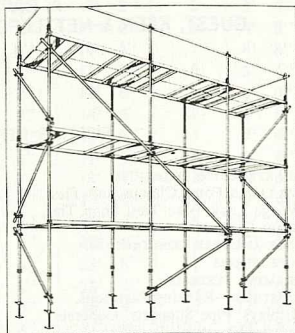
MILLS Tubular Scaffolds are erected using steel or aluminium tube and patented scaffold fittings.

MILLS Fittings are fabricated from hardened and tempered spring steel, with galvanized bolts and nuts. They are subjected to severe tests during manufacture, and are capable of carrying loads far in excess of normal requirements.



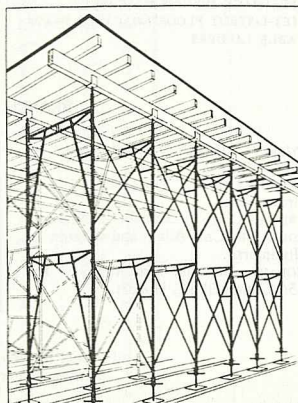
MILFAST Horizontal Frame Scaffolding

This unique system combines the many and varied advantages of conventional tubular scaffolding with the simple and fast erection methods of a rapid-assembly frame system.



MILFRAME

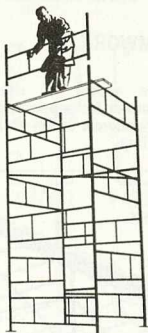
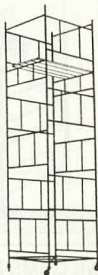
This frame scaffolding system offers speed, safety and efficiency for heavy and light-duty independent scaffolds, fixed and mobile towers and medium-duty shoring.



G.K.N. BUILDING AND ENGINEERING Continued

SELF-LOCK

An economical and versatile scaffolding system which requires no nuts, bolts, pins or clips. There are no tools needed; the frames simply slot into one another. Ideal for use as fixed or mobile towers, Self-Lock can be used in conjunction with tubular scaffolds.

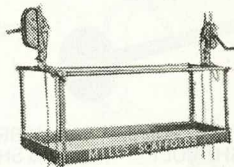


BANTAM SELF-LOCK

This slot-together working platform can be erected in minutes inside or outside the house. Ideal for tradesman or householder.

MILLS TRAVELLING CRADLE

Saves time and cuts rigging costs. Manually operated from within the Cradle, it permits the entire surface of a building to be reached.



ADJUSTABLE TRESTLES

LARGE TRESTLE:

Height (fully extended), 8'-0".

Height (fully collapsed), 5'-0".

Extension every 6"

Weight 88½ lbs.

SMALL TRESTLE:

Height (fully extended), 5'-9".

Height (fully collapsed), 2'-9".

Extension every 6".

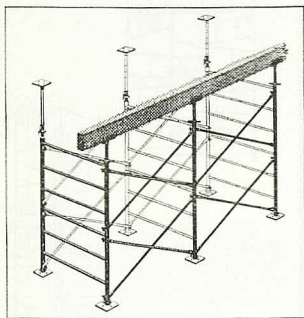
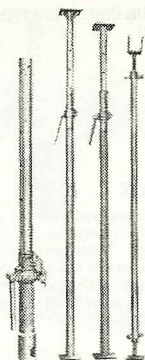
Weight 77 lbs.



G.K.N. BUILDING AND ENGINEERING Continued

MILLS FORMWORK MILSHORE

A braced-frame system of shoring designed in Australia for supporting all types of heavy concrete slabs—bridge soffits in particular.

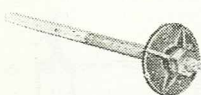


MILPROPS AND
ADJUSTABLE PUNCEON

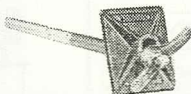


MILCENTRE

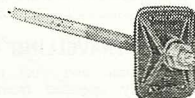
WILLIAMS FORM HARDWARE



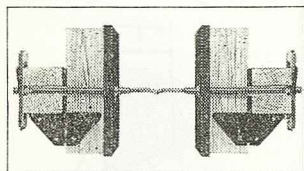
HEX-NUT CLAMP
& SHE BOLT



VIBRA-LOCK CLAMP
& SHE BOLT



HEX-LOCK CLAMP
& SHE BOLT



WEDGE-LOCK OUTER UNIT
ASSEMBLY



CRIMPED INNER ROD

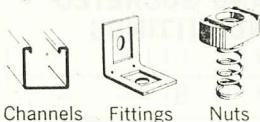
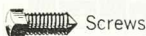


STRESS GRADIENT PIGTAIL
ANCHOR

Wedge-Lock Beam Hangers
Reinforcement Bar Chairs
G.K.N. Rock Bolts

G.K.N. BUILDING AND ENGINEERING Continued

UNISTRUT All-purpose metal framing



UNISTRUT ELECTRICAL TRUNKING

Strong, rigid Unistrut Channel allows longer spans and fewer hangers than any other system. It is easily erected, and suits any type of fluorescent fixture.

CONCRETE INSERTS

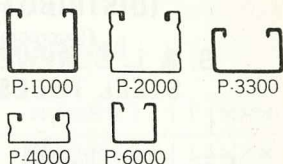
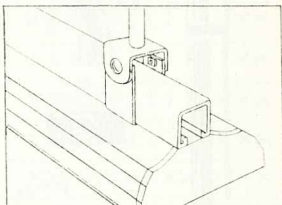
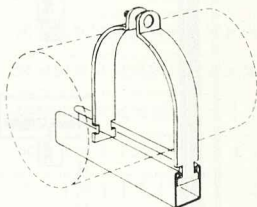
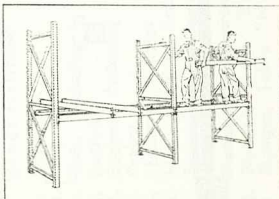
Ensure maximum economy and flexibility in the installation of mechanical and electrical services. Placement on a pre-determined grid saves design time, eliminates site fabrication.

UNISTRUT PIPE AND CABLE SUPPORTS

Backed with standard Unistrut Channel and Concrete Inserts. Service installation can be easily and quickly erected without drilling or welding and allows for new services to be added at any time.

SPEEDRACK

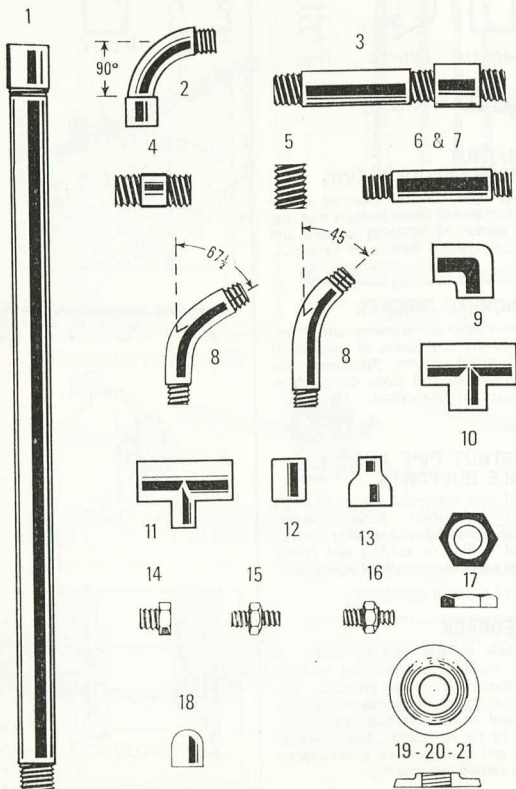
This new boltless racking system is robust, versatile and designed to meet every warehouse storage problem. The two-piece system comprises an upright truss and a beam which are simply joined by the connector. Installation is simple and extensions or modifications can be carried out speedily.



STEWARTS & LLOYDS (DISTRIBUTORS) PTY. LTD.

(Incorporated in Victoria)

S. & L. SCREWED AND SOCKETED STEEL TUBES AND FITTINGS



STEEL TUBES AND FITTINGS

Range of Galvanized and Ungalvanized Types manufactured

	6"	5"	4"	3½"	3"	2½"	2"	1½"	1¼"	1"	¾"	½"	⅜"	¼"	⅛"	
TUBES																
1. Tubes (2' long and over)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
TUBULARS																
2. Bends (90°)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3. Longscrews	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
4. Barrel Nipples	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
5. Plain Nipples	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
6. Pieces not socketed (4"-11")	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
7. Pieces not socketed (12"-23½")	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
8. Springs not socketed	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
OTHER FITTINGS																
9. Elbows	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
10. Tees	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
11. Tees, Reducing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
12. Sockets	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
13. Sockets, Reducing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
14. Bushes	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
15. Hexagon Nipples	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
16. Hex. Nipples, Red.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17. Backnuts	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
18. Caps	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
19. Flanges, Table "D"	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
20. Flanges, Table "E"	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
21. Flanges, Table "H"	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

PIPE CHARACTERISTICS

Plain End and Screwed and Socketed Steel Tubes

Nom. Bore in.	Outside Dia. in.	Quality	Thickness		Ft. per ton		Thick- ness	Ft. per ton	
			SWG	in.	P/E	S & S		SWG	in.
1"	13/32"	Medium	14	0.080	8205	8146	1 1/2"	10	0.128
		Heavy	12	0.104	6829	6787	1 1/2"	10	0.128
1 1/4"	17/32"	Medium	13	0.092	5150	5114	2"	8	0.160
		Med. Gal.	13	0.092	4859	4828	2"	5	0.212
3/8"	1 1/16"	Heavy	11	0.116	4316	4291	2 1/2"	9	0.144
		Ammonia	11	0.116	4316	—	2 1/2"	9	0.144
1/2"	27/32"	Medium	13	0.092	3923	3895	3"	7	0.176
		Med. Gal.	13	0.092	3709	3685	3"	5	0.212
3/4"	1-1/16"	Heavy	11	0.116	3246	3228	3 1/2"	9	0.144
		Ammonia	10	0.128	3006	—	3 1/2"	7	0.176
1"	1-11/32"	Medium	12	0.104	2725	2705	4"	4	0.232
		Med. Gal.	12	0.104	2613	2595	4"	8	0.160
1 1/4"	1-11/16"	Heavy	10	0.128	2288	2274	4"	8	0.160
		Ammonia	9	0.144	2082	—	4"	6	0.192
1 1/2"	1-11/8"	Medium	12	0.104	2109	2094	5"	4	0.232
		Med. Gal.	12	0.104	2024	2009	5"	8	0.160
1 3/4"	1-11/4"	Heavy	10	0.128	1758	1747	6"	6	0.192
		Ammonia	8	0.160	1456	—	6"	7	0.176
2"	1-11/2"	Medium	10	0.128	1363	1354	6 1/2"	7	0.176
		Med. Gal.	10	0.128	1317	1309	6 1/2"	7	0.176
2 1/4"	1-11/2"	Heavy	8	0.160	1120	1114	6 1/2"	5	0.212
		Ammonia	7	0.176	1032	—	6 1/2"	6	0.192
2 3/4"	1-11/2"	Medium	10	0.128	1062	1054	6 1/2"	6	0.192
		Med. Gal.	10	0.128	1030	1023	6 1/2"	6	0.192
3"	1-11/2"	Heavy	8	0.160	867	862	6 1/2"	5	0.212
		Ammonia	6	0.192	738	—	6 1/2"	5	0.212

Weights per foot of screwed and socketed tubing are based on the overall length of tube plus socket, screwed to basic engagement.

MALLEABLE PIPE FITTINGS

1. Backnuts	6"	X X X X X X
2. Bends, M. & F.	5"	X
3. Bends, F. & F.	4"	X X X X X X X X X X X X
4. Bends, M. & F. 45° ..	3½"	X
5. Bushes	3"	X X X X X X X X X X X X X X X X X X
6. Caps	2½"	X X X X X X X X X X X X X X X X X X
7. Crosses	2"	X X X X X X X X X X X X X X X X X X X X
8. Elbows, F. & F.	1½"	X X X X X X X X X X X X X X X X X X X X X X
9. Elbows, M. & F.	1¼"	X X X X X X X X X X X X X X X X X X X X X
10. Elbows, Three-way	1"	X X X X X X X X X X X X X X X X X X X X X X X
11. Elbows, M. & F. 45° ..	¾"	X X X X X X X X X X X X X X X X X X X X X
12. Elbows, F. & F. 45° ..	½"	X X X X X X X X X X X X X X X X X X X X X
13. Flanges	⅜"	X X X X X X X X X X X X X X X X
14. Flanges, Oval	¼"	X X X X X X X X X X X X
15. Hexagon Nipples	⅛"	X
16. Hex. Nipples, Red.		
17. Plugs		
18. Sockets		
19. Sockets, Reducing		
20. Tees		
20a. Tees, Reducing		
21. Tees, Four-way		
22. Unions, F.S.		
23. Unions, B.S.		
24. Unions, M. & F., B.S. .		
25. Unions, Deflection 5° ..		

STEWARTS & LLOYDS

(AUSTRALIA) PTY. LTD.

STANTON PIPES DIVISION

SPUN CAST IRON PIPES

TYTON FLEXIBLE JOINT

DIMENSIONS AND WEIGHTS—UNLINED

Nominal Internal Diameter	Class	Wall Thick- ness Inch	Weight Pipe Barrel per ft. Lb.	Total Weight Per 18' Length Lb.	Pipes Per Ton
4"	B	0.30	13.03	257	8.75
	C	0.31	13.43	264	8.49
	D	0.35	15.03	293	7.64
6"	B	0.33	21.18	413	5.43
	C	0.37	23.60	457	4.90
	D	0.43	27.18	521	4.30
8"	B	0.36	30.50	597	3.75
	C	0.43	36.15	698	3.21
	D	0.49	40.91	784	2.86
9"	B	0.37	35.10	686	3.27
	C	0.45	42.34	816	2.74
	D	0.52	48.58	928	2.42
10"	B	0.39	40.91	799	2.81
	C	0.47	48.94	944	2.42
	D	0.55	56.85	1086	2.06
12"	B	0.43	54.65	1070	2.09
	C	0.52	65.64	1268	1.76
	D	0.60	75.28	1441	1.56
15"	B	0.47	73.98	1453	1.54
	C	0.58	90.68	1753	1.28
	D	0.67	104.17	1996	1.12
18"	B	0.52	97.57	1907	1.17
	C	0.64	119.33	2299	0.97
	D	0.74	137.26	2622	0.85
20"	B	0.55	114.19	2230	1.00
	C	0.67	138.31	2665	0.84
	D	0.77	158.21	3023	0.74
24"	B	0.60	148.60	2893	0.77
	C	0.74	182.26	3499	0.64
	D	0.85	208.45	3970	0.56

Pipe barrels meet the requirements of Australian Standard A.145,
British Standard BS.1211.

LYSAGHT PREFABRICATED RURAL PRODUCTS

John Lysaght (Australia) Limited manufacture a wide range of prefabricated rural products and will be pleased to supply full details of their products and dealers' names. All communications should be directed to the Branch Office of John Lysaght (Australia) Limited in your State.

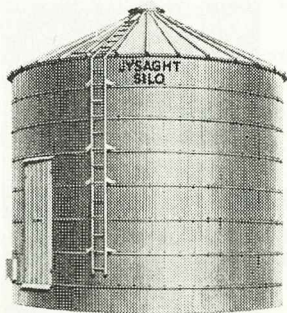
GRAIN SILOS

Lysaght General Purpose (GP.) Grain Silos are produced in capacities from 200 Bushels to 3700 Bushels. Segmented steel floors are standard equipment with the 200B. and 500B. Silos.

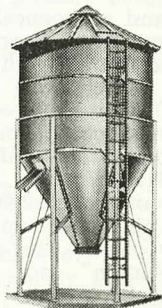
Silos from 1200B. upwards are fitted with a full size door, external ladder and bagging outlet complete with bag holder.

Optional extras include steel floors, steel earth rings, and elevated perforated steel floors for Silos from 1200B. to 3700B.

Eight elevated silos, two for mash or grain, four for seed grain, and two for pellets or grain are also available. Capacities range from 260B. to 550B.



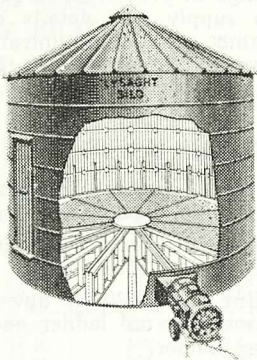
3,700 Bushel GP. Silo



EMG 275 Elevated Silo

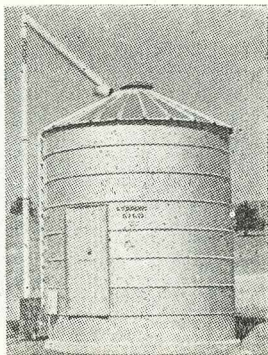
PERFORATED ELEVATED STEEL FLOOR—SILOS from 1,200B. to 3,700B.

For use with moisture extraction equipment. Enables the crop to be taken off when ready, any excess moisture content being reduced after harvesting. No critical drying out period in the field. Also enables the annual fumigation of oats to be carried out easily and effectively.

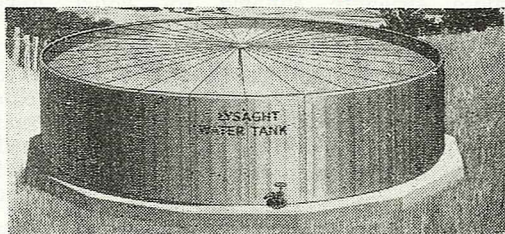


LYSAGHT VERTICAL GRAIN AUGERS and underfloor auger system

The most economical way to fill your Silos. Specially developed for use with Lysaght Silos. Swivel head — telescopic chute tube—8-bushel built-in hopper. Three sizes to choose from—21ft., 26ft., and 31ft. Enquire also for details of the Lysaght underfloor auger system. Completely empties the silo with "push-button" ease. For all Lysaght Silos from 1200B. to 3700B.



WATER TANKS—open top Heavy Gauge Flat Plate Galvanized Steel 1,000 to 50,000 Gallon Capacity



Prefabricated from heavy gauge galvanized steel plate ready for immediate assembly by unskilled labour.

Rigidized wall panels will hold their correct curvature during transit and erection, and because of their extra stability, ensure perfect joints and reduce erection time.

Standard fittings include internal wind bracing; 3" sludge outlet complete with 9' length of piping and plug; overflow unit; 3" outlet fitting; sealing compound; all bolts, nuts, washers.

Sealing compound is supplied in strip form — no mess — just unroll on to joint faces. It has been successfully tested to withstand many times the pressure developed in the tanks.

Complete step-by-step assembly instructions are supplied with each tank.

Fully enclosed "Blue Cap" models, 1,000 to 10,000 gallons also available.

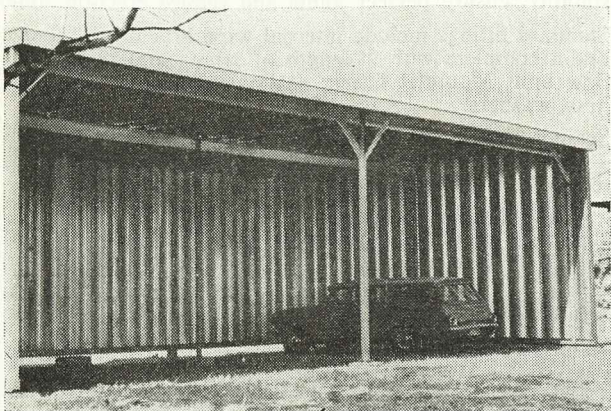
LYSAGHT SHEEP SELF FEEDER

Robustly constructed from heavy gauge galvanized steel. 25 Bushels capacity with trough length of 12 ft. and double hinged lid; and 50 Bushels capacity with trough length of 16 ft. and sliding hinged lid. Deep adjustable swinging troughs.

LYSAGHT-BEHLEN BUILDINGS SERIES A

The Lysaght-Behlen Series A Steel Building is a sturdy all-purpose structure suitable for either town or country use. Illustrated building is 42' long, 24' wide, 12' high. Front fascia gutter is standard fitting. Fully bolted construction. Unique, almost frameless design makes it simple and speedy to erect. May be extended in length or enclosed without wasting original material. Partitions, Roll-up Doors, Personal Access Doors, Down-pipes, Louvre Windows, rear Guttering available on request.

The Series A contains a complete range of useful sizes of buildings.



Lysaght-Behlen Series A Building

CORRUGATED GALVANIZED STEEL TANKS

Recommendations

INTRODUCTION

Where piped water supplies are not available, established practice is to install storage tanks of corrugated galvanized steel, varying in size from 800-1,000 gallons for small cottages to the large 20,000-30,000 gallon 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 steel roof forms an admirable, clean 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 gauges of Lysaght Blue Orb corrugated sheets and, on pages 130 and 131 is shown in tabular form, a range of tank sizes in common use up to 30,000 gallons.

MATERIALS FOR CONSTRUCTION

Walls.—The walls are made from Lysaght Blue Orb sheets curved to suit the required diameter of the tank. The use of sheets with a 2.00 ozs./sq. ft. zinc coating is considered essential for this purpose. Whilst 24BG. sheet can be used for tank sizes up to 10,000 gallons, we recommend the use of 22BG. sheets for tanks of 5,000 gallon capacity and over.

Bottom.—The bottom should be made of Galvabond or Queen's Head sheet. The thickness of the bottom should be the same as the sheet in the bottom ring of the tank. Corrosive conditions on the bottom of the tank are considerably less severe than in the walls of the tank and, hence, a sheet with a lower coating weight performs satisfactorily. This is largely due to the protection afforded to the bottom by the build-up of silt.

Top.—It is generally necessary to cover the tank in order to both protect the water from contamination and prevent the growth of algae. Up to 10,000 gallons the top should be 26Comm. Galvabond or Queen's Head sheets but over 18 feet diameter (10,000 gallons) the top generally takes the form of hessian or other fabric, covering a mesh support.

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 will 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 light 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 rain-drops 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. The more soluble compound, which constitutes $\frac{1}{3}$ of the total, dissolves within 24 hours to give the initial protection required, whilst the other constituent takes 6 to 9 months to dissolve, during which time the initial film is completely stabilized. 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.

Suitably designed **Tect-A-Tank** tubes are available for use in squat or tall tanks, as required, and one tube containing $1\frac{1}{2}$ lb. of crystals should be used in each tank up to 1,500 gallons capacity with one additional tube for each 1,000 gallons in excess of this.

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 with two coats of paint before their first filling. The paint which should be used is zinc dust-zinc oxide containing 12 lb. of zinc dust per gallon of oil based medium. See also Advisory Service Leaflet No. H.19-1.1 Galvanized Water Tanks and No. A1-18.1 Painting Galvanized Sheets. Bituminous paints should never be used 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.

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.

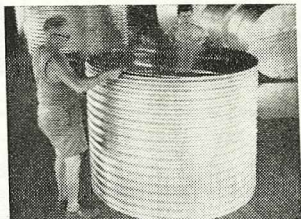
Large catchment areas, over 800 sq. ft. per 1,000 gallons of water storage capacity, have been found to be associated with shorter tank lives. This is only of im-

portance 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. This particular aspect of tank lives has been under investigation for a number of years and whilst it is not possible to quote quantitative data in support, it is possible to indicate the order of preference for various roofing materials.

The investigations indicate that the best materials for roof catchments feeding rain-water tanks are unpainted Lysaght Orb sheets or asbestos cement sheeting; less satisfactory are painted Orb sheets, and least satisfactory are glazed terra-cotta tiles, roofs painted with aluminium paint or roofs sheeted with copper or aluminium.

LYSAGHT ORB CORRUGATED STEEL SHEETS FOR TANK-MAKING



In Australia to-day many millions of gallons of water are safely stored in tanks made from Lysaght Blue Orb corrugated galvanized steel sheet. Ranging in size from the familiar 500-gallon householder tank to giants capable of holding 100,000 gallons, they have proved themselves a most economical and efficient means of storing water available to the country dweller.

In industry, where supplies of "soft" rain water are a necessary part of the manufacturing process, Lysaght Blue Orb galvanized steel tanks provide adequate storage facilities at low cost extended over many years.

Capacity of Tanks—Calculations

Square or Rectangular Section.—All dimensions in feet: length x breadth x depth x $6\frac{1}{4}$ = capacity in gallons.

Circular.—Capacity in gallons given by the following rules:

- A. Capacity = $\frac{\pi}{4}$ x (diameter)² x height x $6\frac{1}{4}$.
- B. Capacity = Multiply circumference by itself and by half the height — C^2 x $h/2$.
- C. Capacity = Multiply diameter by itself and by five times the height — D^2 x $5h$.

Example.—Diameter 6ft., height 6ft.

$6 \times 6 \times 30\text{ft.} = 1,080$ gals. approximately.

CORRUGATED GALVANIZED STEEL TANKS IN COMMON USE

Tank Capacity	Tank Dimensions		Walls—8/3" Corr. Blue Orb Sheets		Bottoms—Galvabond Sheets		Roofs—Galvabond Sheets 26 Comm.	
	Height	Dia-meter	No.	B.G.	No.	B.G.	No.	Dimensions
Gallons								
100	2' 1½"	3' 2"	1	24	1	24	1	24" x 72"
200	4' 1½"	3' 2"	2	24	1	24	1	24" x 72"
300	6' 1½"	3' 2"	3	24	1	24	1	24" x 72"
300 Squat	4' 1½"	4' 0"	2	24	1	24	1	36" x 72"
400	6' 1½"	3' 8"	2	24				
			3	24	1	24	1	36" x 72"
400 Squat	4' 1½"	4' 4"	4	24	1	24	1	36" x 72"
500	6' 1½"	4' 0"	3	24	1	24	1	36" x 72"
			3	24				
500 Squat	4' 1½"	4' 11"	4	24	1	24	1	48" x 72"
600	6' 1½"	4' 4"	6	24	1	24	1	36" x 72"
600 Squat	4' 1½"	5' 3"	2	24	1	24	1	36" x 72"
			2	24	1	24	1	30" x 72"
800	6' 1½"	5' 0"	6	24	1	24	1	48" x 72"
800 Squat	4' 1½"	6' 3"	4	24	1	24	1	48" x 72"
					1	24	1	30" x 72"
1,000 Small	6' 1½"	5' 7"	6	24				
1,000 Full	6' 1½"	5' 11"	3	24	2	24	2	36" x 72"
			3	24	2	24	2	36" x 72"
1,000 Squat	4' 1½"	6' 11"	4	24	2	24	2	48" x 72"
1,000 Squat	4' 1½"	7' 4"	6	24	3	24	3	36" x 72"

CORRUGATED GALVANIZED STEEL TANKS IN COMMON USE

Tank Capacity	Tank Dimensions		Walls—8/3" Corr. Blue Orb Sheets			Bottoms—Galvabond Sheets			Roofs—Galvabond Sheets 26 Comm.	
	Height	Dia-meter	No.	B.G.	Length	No.	B.G.	Dimensions	No.	Dimensions
1,200	6' 1½"	6' 3"	6	24	120"	1	24	48" x 72"	1	48" x 72"
1,500	6' 1½"	7' 1"	3	24	132"	1	24	30" x 72"	1	30" x 72"
2,000	6' 1½"	8' 3"	3	24	144"	2	24	48" x 72"	2	48" x 72"
2,000 Squat	4' 1½"	10' 0"	9	24	108"	2	24	36" x 72"	2	36" x 72"
3,000	6' 1½"	10' 0"	6	24	132"	2	24	30" x 72"	2	30" x 72"
4,000	6' 1½"	11' 6"	9	24	132"	2	24	48" x 96"	2	48" x 96"
5,000	6' 1½"	13' 0"	6	24	108"	2	24	30" x 96"	2	30" x 96"
10,000	6' 1½"	18' 0"	6	24	120"	2	24	48" x 96"	2	48" x 96"
15,000	6' 1½"	22' 6"	3	22	120"	8	24	30" x 96"	8	36" x 72"
20,000	6' 1½"	25' 6"	18	22	132"	9	24	48" x 96"	9	36" x 96"
30,000	6' 1½"	32' 6"	21	22	144"	2	22	48" x 96"		
			27	20	144"	6	22	48" x 96"		
			3	22	120"	2	22	30" x 96"		
			18	22	132"	2	22	36" x 96"		
			21	22	144"	12	22	48" x 96"		
			27	20	144"	18	22	48" x 96"		
			3	22	120"	28	20	48" x 96"		

As tanks of 10,000 gallons capacity and above are not usually provided with tops, no material is included in this data for same.

AVERAGE DISTRICT RAINFALL THROUGHOUT AUSTRALIA

(100 points = 1 inch)

	DISTRICT	Annual fall, Points	DISTRICT	Annual fall, Points
N.S.W.	Western Far North		Manning	5350
	West	829	Hunter	3463
	Western Lower		Central Tablelands	
	Darling	967	North	2310
	Western Upper		Central Tablelands	
	Darling	1282	South	3342
	Western S.W. Plains	1287	Central Western	
	Central Western		Slopes North	2285
	Plains South	1746	Central Western	
	Plains North	1713	Slopes South	2193
	North-west Plains East	2181	Metropolitan East ...	4190
	North-west Plains		Metropolitan West ..	3004
	West	1838	Illawarra	4340
	North-west Slopes		South Coast	3628
VIC.	North	2606	Southern Tablelands,	
	North-west Slopes		Goulburn, Monaro .	2495
	South	2428	Southern Tablelands,	
	Northern Tablelands		Snowy Mountains ..	3338
	Western	3045	South-west Slopes	
	Northern Tablelands		South	3343
	Eastern	3755	South-west Slopes	
	North Coast Upper	5544	North	2353
	North Coast Lower ..	5563	Riverina East	1846
			Riverina West	1371
	Mallee North	1123	East Gippsland	3021
	Mallee South	1335	West Gippsland	3570
	North Wimmera	1578	East Central	3472
	South Wimmera	1892	West Central	2355
	Lower North	1655	North Central	2816
	Upper North	1951	Western Plains	2432
	Lower North-east	3038	West Coast	2929
	Upper North-east ...	4365		

AVERAGE DISTRICT RAINFALL THROUGHOUT AUSTRALIA

	DISTRICT	Annual fall, Points	DISTRICT	Annual fall, Points
TAS.	Northern	3776	Central Plateau	5055
	East Coast	3118	West Coast	9625
	Midland	2270	King Island	3330
	South-east	2772	Flinders Island	3010
	Derwent Valley	2824		
S.A.	North-west Interior ..	741	Central West	1688
	Far North Interior ..	613	Central East	2338
	Western	1304	Murray Valley	1219
	Upper North	1247	Murray Mallee	1183
	North-east	771	Upper South-east ...	1658
	Lower North	1665	Lower South-east	2550
W.A.	North Kimberley	3116	North Coastal	1590
	East Kimberley	1493	Central Coastal	3549
	West Kimberley	2008	South Coastal	3675
	De Grey	1181	Central North	1386
	Fortescue	995	Central South	1710
	West Gascoyne	845	Eucla	740
	East Gascoyne	953	South-east	1037
	Murchison	869	North-east	923
N.T.	Northern Rivers	4264	Northern Plateau	1232
QLD.	Peninsula North	5575	Upper West	1430
	Peninsula South	3605	Lower West	911
	Carpentaria Lower ..	2420	South Coast, Port Curtis	3640
	Carpentaria Upper ..	2404	South Coast, Moreton	4156
	North Coast, Barron .	6255	Darling Downs East .	2599
	North Coast, Herbert	8412	Darling Downs West .	2130
	Central Coast East ..	3694	Maranoa	2066
	Central Coast West .	2254	Warrego	1621
	Central Highlands ..	2318	Far South West	1121
	Central Lowlands ...	1754		

USEFUL HYDRAULIC DATA

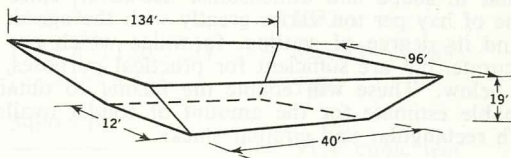
One Imperial Gallon	=	Volume occupied by 10 lbs. of distilled water at 62°F under a pressure of 1 atmosphere
	=	.16054 cubic feet
	=	277.420 cubic inches
	=	1.201 U.S. gallons
	=	4.5496 litres
U.S. gallons x .833	=	Imperial gallons
Imperial gallons x 1.2	=	U.S. gallons
Head of water (in ft.)	=	$\frac{\text{Pounds per sq. in.} \times 2.31}{\text{Specific gravity}}$
Pounds per sq. in. pressure	=	$\frac{\text{Foot head} \times \text{specific gravity}}{2.31}$
Specific Gravity of Water	=	1.00
One cubic foot of Water	=	62.288 pounds
	=	6.229 gallons
	=	7.48 U.S. gallons
One cubic inch of Water	=	.03605 pounds
One pound of Water	=	27.74 cubic inches
One cubic yard of Water	=	168 gallons
One acre-inch of water	is the quantity required to cover one acre of area to a depth of one inch.	
One acre-inch	=	3630 cubic feet
	=	22610 gallons
	=	101 tons (approximately)

One acre-foot = 12 acre-inches
 = 43,560 cubic feet
 = 271,316 gallons

One cubic foot of Water per second (cusec) = 374 Imperial gallons per min.
 = 1 acre-inch in about 1 hour
 = 2 acre-feet in about 24 hours

Atmospheric pressure (mean) = 14.7 lb. per square inch at sea level. With a perfect vacuum, one atmosphere will sustain a column of mercury 29.9 inches high (760 mm.) or a column of water 33.95 ft. high.

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:—

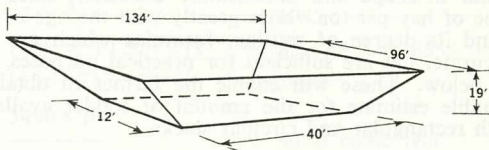
- (a) Length at Bottom multiplied by width at Bottom = $40 \times 12 = 480$
- (b) Length at Top multiplied by width at Top = $134 \times 96 = 12864$
- (c) Sum of the Length multiplied by sum of the Widths = $174 \times 108 = 18792$
- a plus b plus c = 32136
- (d) a plus b plus c multiplied by the depth and divided by 6 = $\frac{32136 \times 19}{6} = 101,764 \text{ cu. ft.}$

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- a plus b plus c = 32136
- (d) a plus b plus c multiplied by the depth and divided by 6 = $\frac{32136 \times 19}{6} = 101,764 \text{ cu. ft.}$

Step (d) gives the cubic contents of the tank in cubic feet and if this figure is divided by 27, the result will be cubic yards:—

$$= \frac{101,764}{27} = 3769 \text{ cu. yds.}$$

If the cubic contents of the tank, in cubic feet, is multiplied by $6\frac{1}{4}$ it will give its capacity in gallons.

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 ton 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 for 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 of base in feet by breadth at base in feet.
2. Multiply together length and breadth at eaves in feet.
3. Add length at base and length at eaves in feet together and multiply this figure by the sum of the breadth at the base and the breadth at the eaves in feet. Add (1), (2) and (3) together and multiply by the height in feet 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 feet.

For the top portion:—

4. Multiply together the length and breadth in feet at the eaves.

5. Multiply the breadth in feet at the eaves by the sum of the length at the eaves and length along the ridge in feet.

Add (4) and (5) together, multiply by the height of the ridge above the eaves in feet 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.

Examples.—Consider a rectangular stack the dimensions of which are: 40 ft. by 20 ft. at base; 45 ft. by 23 ft. at eaves; 30 ft. long at the ridge; eaves 10 ft. above the ground; ridge 10 ft. vertically above the eaves. Applying the formula:—

Volume of base or body =

$$\begin{array}{rcl}
 1. & 40 \times 20 & = 800 \\
 2. & 45 \times 23 & = 1035 \\
 3. & (40+45) (20+23) & = 85 \times 43 = 3655 \\
 & (1)+(2)+(3) & = 5490 \\
 & 5490 \times 10 & \\
 \hline
 & 6 & = 9150 \text{ cubic feet}
 \end{array}$$

Volume of portion above eaves:—

$$\begin{array}{rcl}
 4. & 45 \times 23 & = 1035 \\
 5. & 23 \times (45 + 30) & = 23 \times 75 = 1725 \\
 & (4) + (5) & = 2760 \\
 & 2760 \times 10 & \\
 \hline
 & 6 & = 4600 \text{ cubic feet}
 \end{array}$$

Total volume of stack = 13,750 cubic feet

Cubic contents of circular stack:—

1. Measure the circumference at both the base and eaves in feet.
2. Add these together and multiply this figure by itself (i.e., "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 feet 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 feet.

For the top conical position of the stack, square the circumference in feet at the eaves and multiply by the height in feet of the top or peak above the eaves. Divide by 38 and the result obtained is the volume in cubic feet of the top portion. By adding the volume of the base and top together, the total content of the stack is obtained.

Example.—Circumference at ground level 60 feet, at the eaves 70 feet and 9 feet high at the eaves and 8 feet at the top from the eaves.

Volume of body of the stack =

$$= (60 + 70) (60 + 70) - (60 \times 70) \times \frac{9}{38}$$

$$= (16900 - 4200) \times \frac{9}{38}$$

$$= 12700 \times \frac{9}{38}$$

$$= 3078 \text{ cubic feet}$$

Volume of conical top =

$$= \frac{70 \times 70 \times 8}{38}$$

$$= \frac{4900 \times 8}{38}$$

$$= 1031 \text{ cubic feet}$$

Total volume of haystack = 4190 cubic feet.

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.

WEIGHT OF HAY IN STACKS

Average Width Feet	Average Length Feet	Height to Eaves Feet	Height of Ridge Feet	Weight of Hay Tons
10	20	8	4	5
10	20	10	5	7
13	28	10	10	14
16	30	12	10	20
20	50	14	10	50

APPROXIMATE NUMBER OF CUBIC FEET PER TON OF HAY

Period	Oats		Wheat		Lucerne cu. ft.
	Sheaf cu. ft.	Loose cu. ft.	Sheaf cu. ft.	Loose cu. ft.	
Freshly stacked	350	400	400	500	400-450
One month after stacking	300	350	350	400	350-400
One year after stacking .	300	325	325	350	300-350

These figures are subject to considerable variation and frequently fresh cereal hay is lighter than the figures given.

HINTS ON FENCING

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.

Boundary fences in rabbit infested country should be about four feet high, with the top wire barbed, making the fence proof for general stock. The line of fence should be marked out before commencing to drive the posts. Insert a peg where a straining post is required

as a guide for driving "Star" steel posts, and see that the posts are driven truly in line and perfectly upright. In ordinary ground "Star" posts should be driven about one third of their length. Wooden straining posts, preferably of natural round timber, provide the most secure anchorage for a fence and should be sunk at least three feet into the ground five chains apart.

All corner posts and those at gateways and at bends in the fence should be stayed with sound struts at least 10 feet long. The struts should be mortised into the straining post above the centre. The back end of the struts should be placed hard up against the next post or against a peg driven firmly into the ground so that it cannot shift. At corners, two well-fitted struts should be used, one on each line of fence.

At either side of corners or gateways where stock is liable to congregate, fences should be strengthened. This can be ensured by using shorter panels or more droppers. Gate posts must be independent and not in any way connected with the fence.

For fencing wire, the number of steel posts commonly used is four to the chain, but in soft ground it is advisable to increase the number. Droppers, where used, are generally placed about eight feet apart.

When straining a fence, begin at the bottom wire, otherwise the straining post may be pulled out of line.

Short lengths of wire looped across from wire to wire on the opposite sides of a wooden straining post prevent any collapse of the fence and ensure it remaining stock-proof in the event of the wooden straining post being burnt out, provided steel posts have been used in the construction of the fence.

Wire netting is best supported by steel posts placed about 11 feet apart without droppers between the posts. If posts are placed 22 feet apart with droppers between, livestock will be much more likely to lift the netting from the ground owing to the extra spring of the fence on the widely spaced posts.

Rabbit netting should be placed in the ground at a depth of six inches, and this can most easily be accom-

plished by cutting a furrow with a small plough. Rabbit netting should be supported by three plain wires. A wire should run six inches 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 four feet, but there should be a tie one foot 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.

STEEL FENCE POSTS—"STAR" SECTION

Table showing number and approximate weight of "Star" fence posts of different lengths and spacing per mile of fencing.

Spacing of Fence Posts in Feet	Number of Posts per Mile	Length of "Star" Section Steel Posts		
		5' 0"	5' 6"	6' 0"
		Weight c. q. lb.	Weight c. q. lb.	Weight c. q. lb.
8	660	41 1 0	45 1 14	49 2 0
9	586	36 2 14	40 1 0	43 3 14
10	528	33 0 0	36 1 0	39 2 0
11	480	30 0 0	33 0 0	36 0 0
12	440	27 2 0	30 1 0	33 0 0
15	352	22 0 0	24 1 0	26 1 14
16½	320	20 0 0	22 0 0	24 0 0
18	293	18 1 14	20 0 14	22 0 0
22	240	15 0 0	16 2 0	18 0 0
24	220	13 3 0	15 0 14	16 2 0
36	147	9 1 0	10 0 14	11 0 0
66	80	5 0 0	5 2 0	6 0 0

NOTE.—No allowance has been made in the above table for straining posts, the number of which will need to be deducted from the quantities shown.

RYLANDS FENCE DROPPERS

These fence droppers are made from high tensile galvanized steel so that they are fire and rust proof. 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 8 and 12-1/2 gauge thickness, and barbed wire.

A suggested fence construction would be posts spaced at up to 1 chain apart with droppers clipped at intervals of 6' to 14', depending on the number of line wires and site conditions.

The dropper dimensions are as follows:—

Thickness	— 19BG. (Approximately).
Length	— 38" and 44".
Depth	— 11/16" (Approximately).
Width	— 1½" (Approximately).
Hole diameter	— ⅛".
Hole spacing	— the extreme holes are approximately ½" from the ends of the dropper, other holes are at 1" centres.

Approximate weights are:—

One only 38" dropper	— 14.4 ozs.
One only 44" dropper	— 1lb.
Complete bundle of 50	— 38" droppers with clips and fixing tools—47lb.
Complete bundle of 50	— 44" droppers with clips and fixing tools—52lb.

GALVANIZED FENCE WIRE

Gauge	Type	Length per cwt. in yards	Approx. Breaking Strain in lb.
8	Standard	546	1576
9	Standard	675	1276
10	Standard	854	1008
11	H.T. Hvy. Galv.	1040	1800
12½	High Tensile	1500	850
12½	"Tyeasy" High Ten.	1500	1250

The above represents Standard Gauges regularly produced for fencing purposes; for special needs other gauges can be produced and details are:—

4	Standard	260	3313
6	Standard	380	2269
12	Soft	1293	570

12 Gauge Soft frequently used for short telephone line.

Quantity of Wire per Mile of Fencing

PLAIN GALVANIZED

No. of Wires in Fence	Gauge								
	8 Standard			10 Standard			12½ High-tensile		
	cwt. qr. lb.			cwt. qr. lb.			cwt. qr. lb.		
1	3	1	0	2	0	14	1	0	14
2	6	1	14	4	0	14	2	1	14
3	9	3	14	6	1	0	3	2	0
4	12	3	14	8	1	0	4	2	14
5	16	0	14	10	1	14	5	3	14
6	19	1	0	12	1	14	7	0	0

BARBED GALVANIZED

No. of Wires in Fence	Reels	Standard 12½G IOWA Pattern			High Tensile —16G Reverse Twist		
		cwt. qr. lb.			cwt. qr. lb.		
1	4	3	2	8	1	2	20
2	8	7	1	2	3	1	12
3	12	10	3	10	5	0	4
4	16	14	2	4	6	2	24
5	20	18	0	12	8	1	16
6	24	21	2	20	10	0	8

Weights for Barbed include weight of spool.

WIRE NETTING

Standardisation on types and ranges of sizes in widths and gauges avoids waste of production time and is an aid to economic production with greater efficiency and lowest costs.

The main sizes regularly produced are:—

Type	Mesh	Gauge	Widths (Inches)
Rabbit-proof	1½ and 1½"	17	12, 36, 42
Sheep	3"	16, 17	24, 30, 36
Sheep	4"	15, 16, 17	24, 30, 36
Dingo 3 ply 3 twist	3"	15, 16	60, 72
Poultry	4"	15, 16	60, 72
Poultry	1"	20	36
Poultry	2"	19	36, 72
Fish Trap	2"	16, 17	36, 48, 60, 72
Oyster	1"	17	36
Dried Fruit Racks .	2"	17	42, 48

NAILS

APPROXIMATE NUMBER PER LB.

Size	No. per lb.	Size	No. per lb.	Size	No. per lb.
1" x 16G	1080	2" x 11G	158	3" x 9G	67
1" x 15G	840	2" x 10G	120	3" x 8G	60
1" x 14G	723	2" x 9G	100	3" x 7G	48
1½" x 14G	460	2½" x 13G	200	3" x 6G	39
1½" x 13G	340	2½" x 12G	150	3½" x 8G	44
1½" x 12G	240	2½" x 11G	130	3½" x 7G	40
1½" x 11G	206	2½" x 10G	100	4" x 7G	35
2" x 14G	280	2½" x 9G	80	4" x 6G	30
2" x 13G	230	2½" x 8G	65	5" x 5G	21
2" x 12G	190	3" x 10G	81	6" x 4G	13

STOCK BREEDING TABLE

Expected Date of Parturition

Date of Service	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 Apl.	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 Apl.
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 "

STOCK BREEDING TABLE—Cont'd.

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)*
26 Feb.	1 Feb.	6 Dec.	26 July	23 July	22 June	30 Apl.
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 Apl.	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 Apl.	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 "	23 "	15 "	12 "	12 "	20 "
25 "	31 "	4 Apl.	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 Apl.	1 Apl.	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 Apl.	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.

PLANTING FRUIT TREES

Number of Trees Required per Acre

The two most frequently used systems of planting fruit trees are the square system and the triangular system. In the square system, the ground is divided into squares, the sides of which are equal to the desired tree spacings, and a tree is planted at each corner. The number of trees per acre is given by the following formula:—

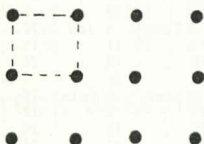
$$\frac{43560}{\text{Square of Planting Distance (feet)}} = \text{Number of trees per acre.}$$

In the equilateral triangular system of planting, the ground is divided into a series of equilateral triangles and a tree is planted at each corner. The number of trees to the acre is given by the following formula:—

$$\frac{43560}{\text{Square of side of triangle} \times 1.155} = \text{Number of trees per acre.}$$

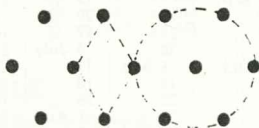
(in feet)

In triangular planting each tree is placed in the most advantageous position possible, with regard to adjacent trees, for equal root development all round. A comparison between the square and triangular systems is given below.



Square Planting

By joining four adjacent trees a square is formed.



Triangular Planting

By joining four adjacent trees a rhombus is formed—i.e., two equilateral triangles and each tree is at the centre of a circle of equidistant trees.

In the quincunx method the trees are planted as in the square method with the addition of one tree in the centre of each square. There is no simple method of calculating the number of trees per acre—it depends on the number of rows in each direction. Approximately, the number of extra trees is three for every four or a 75% increase.

A common method is the rectangular. This is the same as the square method except that the distance between the rows differs from the distance between the trees in the row. To find the number of trees per acre, divide 43560 by the product of the two planting distances in feet.

Tree planting distances are dependent upon climate and soil and vary widely from one district to another. It is always advisable to seek advice on this point from the State Department of Agriculture.

AERIAL AGRICULTURE

During recent years an increasing use has been made of aircraft for top dressing and seeding, for spraying and dusting of crops and pastures and for pest and vermin extermination. For 1956-57 (the first year for which information is available) the total area treated was 1,466,000 acres; in 1965 (the latest year for which information is available) the total area treated was 15,441,636 acres, over ten times as great. The table on a following page shows the areas treated, the material used for each State and is indicative of the significant role that aircraft can play in agriculture.

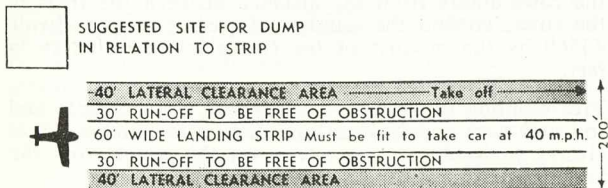
AIRSTRIP REQUIREMENTS

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 and it will be appreciated that in addition to these it is also necessary to provide a good access road and dump site for the storage of fertilizers, etc.



The diagram above sets out the landing strip requirements and suggests a siting of the dump area in relation to it.

A 60-foot wide graded landing area is required and it is essential that it should be free of stone. The surface of the run-off area (30ft. wide each side) must be completely free of obstructions of any sort and smooth enough so that there will be no damage to the plane should it swing on landing or take-off. The 40-foot wide clearance area on each flank should have no obstructions more than 1 foot above the ground.

The basic length for an airstrip is 500 yds. at sea level, with an extra 50 yds. for each 1000 feet above sea level. At an altitude of 2000 feet, for example, a 600-yard strip would be necessary.

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 both the first 200 yards of the strip 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 a good idea to mark your airstrips with four small car tyres, painted white, along each side. A fair test of serviceability of an airstrip surface is to drive a car over it at 40 m.p.h. At this speed there should be no undue roughness in the ride and there should be NO pitching or rolling.



AERIAL AGRICULTURE—AUSTRALIA

Statistics for Year Ended 31st December, 1965

Particulars	N.S.W.	Vic.	Qld. (2)	S.A.	W.A.	Tas.	Australia
TOP DRESSING AND SEEDING:—							
Area treated with superphosphate alone—acres	7,599,065	1,510,260	87,918	882,874	481,667	177,280	10,739,064
Seed alone—acres	255,368	14,821	270,383	351,202	—	8,150	583,924
Superphosphate and seed together—acres	7,474	40,200	500	—	165,388	—	213,562
Gypsum—acres	1,314,537	—	—	—	—	—	1,314,537
Other, lime, urea, etc.—acres	509,228	60	1,772	1,690	2,545	—	515,295
MATERIALS USED:—							
Superphosphate—tons	412,304	102,827	6,330	47,223	37,167	14,897	620,768
Seed—lbs.	861,578	52,623	419,686	441,880	89,653	39,950	1,905,370
SPRAYING AND DUSTING:—							
Insecticides, herbicides, etc.—acres	764,900	717,311	336,727	272,074	1,068,171	24,328	3,154,299
Other, rabbit baiting, etc.—acres	66,650	130,170	28,000	—	—	—	224,820
Total area treated—acres	9,188,520	2,412,822	724,360	1,190,150	1,716,026	209,758	15,441,636

(1) Where an area has been treated with a mixture of materials or more than one material, the area is included in the line relating to each material but is counted in the total once only.

(2) Includes details for the Northern Territory.

BRITISH WEIGHTS AND MEASURES

LENGTH

12 inches (ins.)	=	1 Foot (ft.)	4 Rods	} = 1 Chain
3 Feet	}	= 1 Yard (yd.)	22 Yards	
36 Inches			100 Links	} = 1 Mile
5½ Yards	}	= 1 Rod, pole, or perch	8 Furlongs	
16½ Feet			80 Chains	
40 Rods	=	1 Furlong	320 Rods	
			1760 Yards	

SQUARE

Square Inches	Square Feet	Square Yards	Square Rods	Square Chains	Acres	
144	1	—	—	—	—	1 sq. ft.
1,296	9	1	—	—	—	1 sq. yd.
39,204	272¼	30¼	1	—	—	1 sq. rod
627,264	4,356	484	16	1	—	1 sq. chain
6,272,640	43,560	4,840	160	10	1	1 acre
4,014,489,600	27,878,400	3,097,600	102,400	6,400	640	1 sq. mile

CUBIC

1 cubic ft.	=	1728 cubic ins.	1 Perch of stone	=	24½ cubic ft.
1 cubic yd.	=	27 cubic ft.	1 Bushel	=	1.284 cubic ft.
1 cord ft.	=	16 cubic ft.	1 Gall. of water	=	0.161 cubic ft.
1 cord of wood	=	128 cubic ft.	1 Shipping ton	=	40 cubic ft.

AVOIRDUPOIS

16 Drams	=	1 Ounce (oz.)	=	437.5 Grains
16 Ounces	=	1 Pound (lb.)	=	7,000 Grains
14 Pounds	=	1 Stone		
2 Stone	=	1 Quarter	=	28 Pounds
4 Quarters	=	1 Hundredweight (cwt.)	=	112 Pounds
20 Cwts.	=	1 Ton	=	2,240 Pounds
100 Pounds	=	1 Hundredweight (cwt. U.S.A.)		
2,000 Pounds	=	1 Short Ton (U.S.A.)		

CAPACITY

4 Gills	=	1 Pint	4 Pecks	=	1 Bushel
2 Pints	=	1 Quart	8 Bushels	=	1 Quarter
4 Quarts	=	1 Gallon	1 Bag	=	3 Bushels
2 Gallons	=	1 Peck			

APPROXIMATE EQUIVALENTS

1 Millimetre	=	1/25th of inch	1 Kilogramme	=	2½ lb.
2½ Centimetres	=	1 inch	1,000 Kilogrammes	=	1 Ton
1 Metre	=	39¾ inches	6½ Sq. Centimetres	=	1 Sq. Inch
1 Kilometre	=	5 Furlongs (⅕ m.)	1 Sq. Metre	=	10¼ Sq. ft.

(See Conversion Table, pages 154 and 155)

WEIGHTS OF VARIOUS MATERIALS

IN LB. PER CUBIC FOOT

Alcohol, Commercial	52	Lime	64
Acid—Hydrochloric	75	Limestone and Marbles	168
Nitric	76	Malt	27
Sulphuric	115	Masonry of granite or	
Aluminium	162	limestone, well dressed	165
Apples	38	Masonry of mortar rubble	154
Asbestos	192	Masonry of dry rubble,	
Asphalt Pavement	130	well scabbled	138
Ashes	40	Masonry of sandstone,	
Barley	38	well dressed	144
Beans, White	48	Milk	64
Beer	65	Mortar, hardened	103
Books in Library	30	Mud—dry, close	80-110
Bran	14	wet, fluid (mix)	120
Brass (Copper and Zinc)		Oil—Linseed	59
cast	504	Olive	57
Brass, rolled	524	Turpentine	54
Brick—pressed	150	Paper—Calendered, book	50
in cement mortar	120	Manila	59
interior	100	News	38
stone faced	140	Strawboard	33
Brickwork	112	Super-calendered	69
Cabbage	40	Paving stone	150
Cement	94	Peas	48
Chalk	156	Pianos (each)	400-500
Charcoal	30	Petroleum	55
Cheese	30	Potatoes	48
Clay—Potters', dry	119	Rice	35
Lump, loose	63	Rye	45
Clinker	86	Salt—Coarse	45
Coal—bituminous, solid	84	Table	49
bituminous, loose	49	Sand—well shaken	99-117
Coke	40	well set	120-140
Concrete	130	Sandstone	151
Copper	550	Shales	162
Cork	15	Silver	655
Cotton goods	25	Slate	175
Earth—loam, dry	76	Snow—Fresh	5-12
self-flowing mud	108	Wet	15-20
Eggs	68	Steel	490
Glass—window	157	Straw	19
Granite	170	Sugar	100
Gravel (see Sand)		Sulphur	125
Gypsum	142	Tar	63
Hay—baled	24	Tin—Cast	459
Ice	58	Turf	20-30
Iron—cast	450	Vinegar	68
wrought	480	Water	62.4
Lead	711	Water—Sea	64
Leather—sole, in piles	17	Wax—Bees'	59.3
		Wheat	50
		Zinc	437.5

GENERAL CONVERSION TABLE

Multiply by	To Convert	Into	
14.696	Atmospheres	Lb./sq. in.	.068
1013.3	"	Millibars	.000987
33.9	"	Feet of Water	.0295
.556	B.Th.U.	C.H.U.	1.8
778.2	"	Ft. lb.	.00129
3.929 x 10 ⁻⁴	" hours	H.P. Hours	2,545.06
16.387	Cubic inches	Cubic Cms.	.061
28.316	Cubic feet	Litres	.0353
6.229	"	Gallons (Imp.)	.161
.765	Cubic yards	Cub. metres	1.308
50.802	Cwt.	Kilograms	.0197
.0175	Degrees	Radians	57.296
30.48	Feet	Centimetres	.0328
.138	Foot-lb.	K'grammetres	7.233
.323	Foot-tons	Tonne-metres	3
4.546	Gallons (Imp.)	Litres	.22
10	Gallons of water ..	Pounds	.1
1.201	Gallons (Imp.)	Gallons (U.S.A.) ..	.833
1.014	Horse-power	Force-de-cheval	.986
745.7	"	Watts	.00134
33,000	"	Ft. lb./min.	1/33,000
76.04	"	Kgm./sec.	.0131
2.54	Inches	Cms.	.3937
.0736	Inches of water	Inches of Mercury .	13.595
.738	Joules	Ft. lb.	1.356
1.152	Knots	Miles/hour	.868
70.307	Lb./sq. in.	Gm./sq. cm.	.0142
2.306	" "	Head of Water (ft.)	.434
.7	" "	" " (M.)	1.429
4.882	Lb./sq. ft.	Kgm./sq. metre ...	.205
16.019	Lb./cub. ft.	Kgm./cub. metre ..	.0624
.593	Lb./cub. yd.	" " " " ..	1.686
16,093	Miles	Mètres	.000621
88	Miles/hour	Ft./min.	.0114
1.467	"	Ft./sec.	.682
196.85	Mètres/Sec.	Ft./min.	.00508
1.152	Nautical miles	Statute miles	.868
28.35	Ounces	Grams	.0353
.454	Pounds (Avoir.)	Kilograms	2.205
.454	Pounds of Water ..	Litres	2.202
6.452	Square inches	Square cms.	.155
.093	Square feet	Square metres	10.764
.836	Square yards	" " " " ..	1.196
1.12	Tons	Short tons (U.S.A.)	.893
1016	"	Kilograms	.000984
1.575	Tons/sq. in.	Kgm./sq. mm.	.625
44.26	Watts	Ft. lb./min.	.0227
.102	"	Kgm./sec.	9.807
.9144	Yards	Metres	1.094
	To Obtain	From	Multiply by above

ENGINEERING CONVERSION FACTORS

Multiply	By	To Obtain
Acres	4.04686×10^{-3}	Square kilometres
Ares	1076.39	Square feet
Board feet	144 sq. in x 1 in.	Cubic inches
Board feet	.0833	Cubic feet
Centimetres	3.28083×10^{-2}	Feet
Centimetres	.3937	Inches
Cubic centimetres	3.53147×10^{-5}	Cubic feet
Cubic centimetres	6.102×10^{-2}	Cubic inches
Cubic feet	2.8317×10^{-4}	Cubic centimetres
Cubic feet	2.8317×10^{-2}	Cubic metres
Cubic feet	6.22884	Gallons, British Imperial
Cubic feet	28.3161	Litres
Cubic feet	2.38095×10^{-2}	Tons, British shipping
Cubic feet	.025	Tons, U.S. shipping
Cubic inches	16.38706	Cubic centimetres
Cubic metres	35.3147	Cubic feet
Cubic metres	1.30796	Cubic yards
Cubic yards	.764554	Cubic metres
Degrees angular	.0174533	Radians
Degrees Fah. less 32° F	.5556	Degrees Centigrade
Degrees Centigrade	1.8	Deg. Fah. less 32° F.
Foot pounds	.13826	Kilogram metres
Feet	30.48	Centimetres
Feet	.3048	Metres
Feet	304.8	Millimetres
Feet	1.64474×10^{-4}	Miles, nautical
Gallons, British Imperial	.160544	Cubic feet
Gallons, British Imperial	1.20092	Gallons, U.S.
Gallons, British Imperial	4.54596	Litres
Gallons, U.S.	.832702	Gallons, British Imperial
Gallons, U.S.	3.78543	Litres
Grams, metric	2.20462×10^{-3}	Pounds, Avoirdupois
Horse-power, metric	.98632	Horse-power, U.S.
Inches	2.54	Centimetres
Inches	2.54×10^{-2}	Metres
Inches	25.4	Millimetres
Kilograms	2.20462	Pounds
Kilograms	9.84206×10^{-4}	Long tons
Kilograms	1.10231×10^{-3}	Short tons
Kgs. metres	7.233	Foot pounds
Kgs. per metre	.67169	Pounds per foot
Kgs. per sq. centimetre	14.2233	Pounds per square inch
Kgs. per sq. metre	.204817	Pounds per square foot
Kgs. per sq. metre	9.14362×10^{-5}	Long tons per sq. foot
Kgs. per sq. millimetre	1422.33	Pounds per square inch
Kgs. per sq. millimetre	.634973	Long tons per sq. inch
Kgs. per cubic metre	6.2428×10^{-2}	Pounds per cubic foot
Kilometres	.62137	Miles, statute
Kilometres	.53961	Miles, Nautical
Litres	.219976	Gallons, British Imperial
Litres	.26417	Gallons, U.S.

ENGINEERING CONVERSION FACTORS

Multiply	By	To Obtain
Litres	3.53157 x 10 ⁻²	Cubic feet
Metres	3.28084	Feet
Metres	39.37	Inches
Metres	1.09361	Yards
Miles, Statute	1.60935	Kilometres
Miles, Statute	.8684	Miles, nautical
Miles, Nautical	6080.204	Feet
Miles, Nautical	1.85325	Kilometres
Miles, Nautical	1.1516	Miles, statute
Millimetres	3.28083 x 10 ⁻³	Feet
Millimetres	3.937 x 10 ⁻²	Inches
Pounds, Avoirdupois ..	453.592	Grams
Pounds, Avoirdupois ..	.453592	Kilograms
Pounds, Avoirdupois ..	4.464 x 10 ⁻⁴	Tons, long
Pounds, Avoirdupois ..	4.53592 x 10 ⁻⁴	Tons, metric
Pounds, per foot	1.48816	Kilograms per metre
Pounds, per square foot	4.88241	Kilograms per sq. metre
Pounds, per square inch	7.031 x 10 ⁻²	Kgs. per sq. centimetre
Pounds, per square inch	7.031 x 10 ⁻⁴	Kgs. per sq. millimetre
Pounds, per cubic foot	16.0184	Kgs. per cubic metre
Radians	57.29578	Degrees, angular
Square centimetres ..	.1550	Square inches
Square feet	9.29034 x 10 ⁻⁴	Ares
Square feet	.092903	Square metres
Square inches	6.45163	Square centimetres
Square inches	645.163	Square millimetres
Square kilometres ..	247.105	Acres
Square kilometres ..	.3861	Square miles
Square metres	10.7639	Square feet
Square metres	1.19599	Square yards
Square miles	2.590	Square kilometres
Square millimetres ..	1.550 x 10 ⁻³	Square inches
Square yards	.83613	Square metres
Tons, long	1016.05	Kilograms
Tons, long	2,240	Pounds
Tons, long	1.01605	Tons, metric
Tons, long	1.120	Tons, short
Tons, long, per sq. foot	1.09366 x 10 ⁻⁴	Kilograms per sq. metre
Tons, long, per sq. inch	1.57494	Kgs. per sq. millimetre
Tons, metric	2204.62	Pounds
Tons, metric	.98421	Tons, long
Tons, metric	1.10231	Tons, short
Tons, short	907.185	Kilograms
Tons, short	.892857	Tons, long
Tons, short	.907185	Tons, metric
Tons, British shipping .	42.00	Cubic feet
Tons, British shipping .	.952381	Tons, U.S. shipping
Tons, U.S. shipping ..	40.00	Cubic feet
Tons, U.S. shipping ..	1.050	Tons, British shipping
Yards	.9144	Metres

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 = 0.8852 diameter.

Diameter of circle equal in area to square = 1.1284 side.

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 $\times$ 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 $\times \frac{1}{2}$ height = $\frac{bl \times h.}{2}$

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 (diam. $\times$ height) + 1.5708 diam.²

ANY PRISM OR CYLINDER.—Volume = $h \times$ area of base. Lateral surface area = length of cylinder $\times$ perimeter of normal sector.

REGULAR PYRAMID OR CONE.—Volume = $1/3$ (area of base $\times$ height). Lateral area of regular figure = half (perimeter of base $\times$ slant height).

ANY PYRAMID OR CONE.—Volume = $1/3$ (area of base $\times$ distance from vertex to plane of base).

FRUSTUM OF ANY PYRAMID OR CONE.—Volume = $h/3 (A_1 + A_2 + \sqrt{A_1 A_2})$, where A_1 and A_2 are the areas of bases made by parallel planes.

AREAS AND CIRCUMFERENCES OF CIRCLES IN INCHES

Dia. in ins.	Areas				Dia. in ins.	Circumferences			
	0 in.	$\frac{1}{4}$ in.	$\frac{1}{2}$ in.	$\frac{3}{4}$ in.		0 in.	$\frac{1}{4}$ in.	$\frac{1}{2}$ in.	$\frac{3}{4}$ in.
0	.0	.0490	.1963	.4417	0	.0	.7854	1.570	2.356
1	.7854	1.227	1.767	2.405	1	3.142	3.927	4.712	5.497
2	3.142	3.976	4.908	5.939	2	6.283	7.069	7.854	8.639
3	7.068	8.295	9.621	11.04	3	9.424	10.21	10.99	11.78
4	12.56	14.18	15.90	17.72	4	12.56	13.35	14.13	14.92
5	19.63	21.64	23.76	25.96	5	15.70	16.49	17.27	18.06
6	28.27	30.68	33.18	35.78	6	18.84	19.63	20.42	21.20
7	38.48	41.28	44.18	47.17	7	21.99	22.77	23.56	24.34
8	50.26	53.45	56.74	60.13	8	25.13	25.91	26.70	27.48
9	63.61	67.20	70.88	74.66	9	28.27	29.05	29.84	30.63
10	78.54	82.51	86.59	90.76	10	31.42	32.20	32.98	33.77
11	95.03	99.40	103.8	108.4	11	34.55	35.34	36.12	36.91
12	113.1	117.8	122.7	127.6	12	37.69	38.48	39.27	40.05
13	132.7	137.8	143.1	148.4	13	40.84	41.62	42.41	43.19
14	153.0	159.4	165.1	170.8	14	43.98	44.76	45.55	46.33
15	176.7	182.6	188.6	194.8	15	47.12	47.90	48.69	49.48
16	201.0	207.3	213.8	220.3	16	50.26	51.05	51.83	52.62
17	226.9	233.7	240.5	247.4	17	53.40	54.19	54.97	55.76
18	254.4	261.5	268.8	276.1	18	56.54	57.33	58.11	58.90
19	283.5	291.0	298.6	306.3	19	59.69	60.47	61.26	62.04
20	314.2	322.0	330.0	338.1	20	62.83	63.61	64.40	65.18
21	346.3	354.6	363.0	371.5	21	65.97	66.75	67.54	68.32
22	380.1	388.8	397.6	406.4	22	69.11	69.90	70.68	71.47
23	415.4	424.5	433.7	443.0	23	72.25	73.04	73.82	74.61
24	452.3	461.8	471.4	481.1	24	75.39	76.18	76.96	77.75
25	490.8	500.7	510.7	520.7	25	78.54	79.32	80.11	80.89
26	530.9	541.1	551.5	562.0	26	81.68	82.46	83.25	84.03
27	572.5	583.2	593.9	604.8	27	84.82	85.60	86.39	87.17
28	615.7	626.8	637.9	649.1	28	87.96	88.75	89.53	90.32
29	660.5	671.9	683.3	695.1	29	91.10	91.89	92.67	93.46
30	706.8	718.6	730.6	742.6	30	94.24	95.03	95.81	96.60
31	754.8	767.0	779.3	791.7	31	97.39	98.18	98.96	99.75
32	804.2	816.9	829.6	842.4	32	100.5	101.3	102.1	102.9
33	855.3	868.3	881.4	894.6	33	103.7	104.5	105.2	106.0
34	908.0	921.3	934.8	948.4	34	106.8	107.6	108.4	109.2
35	962.1	975.9	989.8	1003.8	35	110.0	110.7	111.5	112.3
36	1017.9	1032.1	1046.4	1060.7	36	113.1	113.8	114.6	115.5
37	1075.2	1089.8	1104.5	1119.2	37	116.2	117.0	117.8	118.6
38	1134.1	1149.3	1164.2	1179.3	38	119.4	120.2	121.0	121.7
39	1194.6	1210.0	1225.4	1241.0	39	122.5	123.3	124.1	124.8
40	1256.6	1272.4	1288.3	1304.2	40	125.7	126.4	127.2	128.0

DECIMAL EQUIVALENT OF FRACTIONS

1/64	.015625	11/32	.34375	43/64	.671875
1/32	.03125	23/64	.359375	11/16	.6875
3/64	.046875	3/8	.375	45/64	.703125
1/16	.0625	25/64	.390625	23/32	.71875
5/64	.078125	13/32	.40625	47/64	.734375
3/32	.09375	27/64	.421875	3/4	.75
7/64	.109375	7/16	.4375	49/64	.765625
1/8	.125	29/64	.453125	25/32	.78125
9/64	.140625	15/32	.46875	51/64	.796875
5/32	.15625	31/64	.484375	13/16	.8125
11/64	.171875	1/2	.5	53/64	.828125
3/16	.1875	33/64	.515625	27/32	.84375
13/64	.203125	17/32	.53125	55/64	.859375
7/32	.21875	35/64	.546875	7/8	.875
15/64	.234375	9/16	.5625	57/64	.890625
1/4	.25	37/64	.578125	29/32	.90625
17/64	.265625	19/32	.59375	59/64	.921875
9/32	.28125	39/64	.609375	15/16	.9375
19/64	.296875	5/8	.625	61/64	.953125
5/16	.3125	41/64	.640625	31/32	.96875
21/64	.328125	21/32	.65625	63/64	.984375

SQUARES, CUBES, SQUARE ROOTS AND CUBE ROOTS

No.	Square	Cube	Sq. Root	Cube Root	No.	Square	Cube	Sq. Root	Cube Root
$\frac{1}{8}$	.015	.0019	.353	.5	$4\frac{1}{4}$	18.062	76.765	2.061	1.61
$\frac{1}{4}$	.062	.0156	.500	.620	$4\frac{1}{2}$	20.250	91.125	2.121	1.65
$\frac{3}{8}$	.140	.0527	.612	.721	$4\frac{3}{4}$	22.562	107.171	2.179	1.68
$\frac{1}{2}$	.250	.1250	.707	.793	5	25	125	2.236	1.71
$\frac{5}{8}$	.390	.244	.790	.855	$5\frac{1}{4}$	27.562	144.703	2.291	1.73
$\frac{3}{4}$	.562	.421	.866	.908	$5\frac{1}{2}$	30.250	166.375	2.345	1.76
$\frac{7}{8}$	.765	.670	.935	.956	$5\frac{3}{4}$	33.062	190.109	2.397	1.79
1	1	1	1	1	6	36	216	2.449	1.81
$1\frac{1}{8}$	1.265	1.423	1.060	1.04	$6\frac{1}{4}$	39.062	244.140	2.500	1.84
$1\frac{1}{4}$	1.562	1.953	1.118	1.07	$6\frac{1}{2}$	42.250	274.625	2.549	1.86
$1\frac{3}{8}$	1.890	2.599	1.172	1.11	$6\frac{3}{4}$	45.562	307.546	2.598	1.88
$1\frac{1}{2}$	2.250	3.375	1.224	1.14	7	49	343	2.645	1.91
$1\frac{5}{8}$	2.641	4.291	1.274	1.17	$7\frac{1}{4}$	52.562	381.078	2.692	1.93
$1\frac{3}{4}$	3.062	5.359	1.322	1.20	$7\frac{1}{2}$	56.250	421.875	2.738	1.95
$1\frac{7}{8}$	3.515	6.591	1.369	1.23	$7\frac{3}{4}$	60.062	465.484	2.783	1.97
2	4	8	1.414	1.26	8	64	512	2.828	2
$2\frac{1}{8}$	4.515	9.595	1.457	1.28	$8\frac{1}{4}$	68.062	561.515	2.872	2.02
$2\frac{1}{4}$	5.062	11.390	1.500	1.30	$8\frac{1}{2}$	72.250	614.125	2.915	2.04
$2\frac{3}{8}$	5.640	13.396	1.541	1.33	$8\frac{3}{4}$	76.562	669.921	2.958	2.06
$2\frac{1}{2}$	6.250	15.625	1.581	1.35	9	81	729	3	2.08
$2\frac{5}{8}$	6.890	18.088	1.620	1.37	$9\frac{1}{4}$	85.562	791.453	3.041	2.09
$2\frac{3}{4}$	7.562	20.796	1.658	1.40	$9\frac{1}{2}$	90.25	857.375	3.082	2.11
$2\frac{7}{8}$	8.265	23.763	1.695	1.42	$9\frac{3}{4}$	95.062	926.859	3.122	2.13
3	9	27	1.732	1.44	10	100	1000	3.162	2.15
$3\frac{1}{8}$	9.765	30.517	1.767	1.46	$10\frac{1}{4}$	105.062	1076.89	3.201	2.17
$3\frac{1}{4}$	10.562	34.328	1.802	1.48	$10\frac{1}{2}$	110.250	1157.625	3.240	2.18
$3\frac{3}{8}$	11.390	38.443	1.837	1.50	$10\frac{3}{4}$	115.562	1242.296	3.278	2.20
$3\frac{1}{2}$	12.250	42.875	1.870	1.51	11	121	1331	3.316	2.22
$3\frac{5}{8}$	13.140	47.634	1.903	1.53	$11\frac{1}{4}$	126.562	1423.828	3.354	2.24
$3\frac{3}{4}$	14.062	52.734	1.936	1.55	$11\frac{1}{2}$	132.250	1520.875	3.391	2.25
$3\frac{7}{8}$	15.015	58.185	1.968	1.57	$11\frac{3}{4}$	138.062	1622.234	3.427	2.27
4	16	64	2	1.58	12	144	1728	3.464	2.29

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

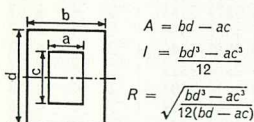
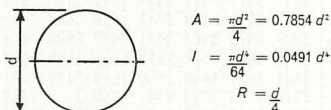
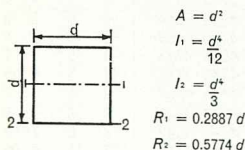
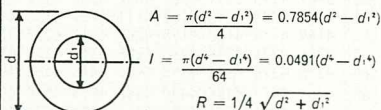
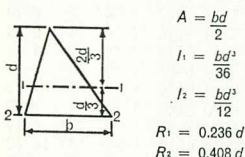
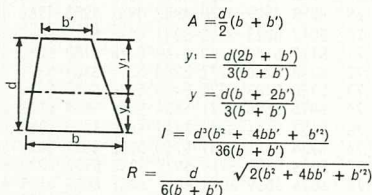
	0	1	2	3	4	5	6	7	8	9	1	3	5	7	9
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	2	4	5	7
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	4	5	7
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	4	5	7
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	4	6	7
.54	3467	3475	3483	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.

PROPERTIES OF SECTIONS

A = Area of Section.
I = Moment of Inertia.

R = Radius of Gyration.
Z = Modulus of Section.



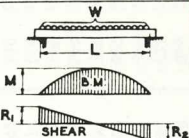
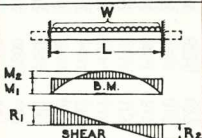
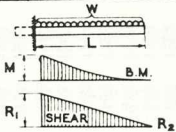
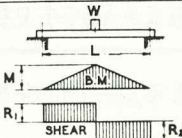
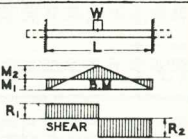
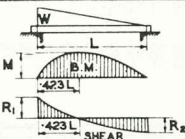
CORRUGATED SHEETS

Recommended Maximum Distributed Loads—LB./SQ. FT.

Support Spacing Feet	Blue Orb			Red Orb, Custom Orb	
	22BG.	24BG.	26Comm.	24BG.	26Comm.
2	—	—	97	—	—
3	83.5	64.5	45	—	79
4	47	37	25.2	63	44.5
5	31	24	16	39.6	29.1
6	21.5	16.5	11.3	28	20.3
7	16.3	12.4	8.4	21	15.3
8	12.6	9.5	6.3	16.1	11.8
9	9.8	7.1	4.8	13	9

The usual span for 26 Comm. Red Orb or Custom Orb is 3ft.

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 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.	$M_1 = \frac{WL}{8}$ $M_2 = \frac{WL}{8}$		$R_1 = \frac{W}{2}$ $R_2 = \frac{W}{2}$	$\frac{WL^3}{192EI}$
Load uniformly increasing to one end. Ends supported.	$M = \frac{2WL}{9\sqrt{3}}$		$R_1 = \frac{2W}{3}$ $R_2 = \frac{W}{3}$	$\frac{WL^3}{76.6EI}$

TEMPERATURE CONVERSION TABLE

The numbers in **BROWN TYPE** refer to the temperature either in degrees Centigrade or Fahrenheit which it is desired to convert into the other scale. If converting from Fahrenheit degrees to Centigrade degrees the equivalent temperature will be found in the left column, while if converting from degrees Centigrade 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					

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			

$$^{\circ}\text{F} = \frac{9}{5} (^{\circ}\text{C} + 32)$$

CONVERSION FORMULAE

$$^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32)$$

THE MICROMETER

GENERAL

The basis of the micrometer is a highly accurately machined screw which can be revolved in an equally accurate fixed nut so that the distance between the two measuring faces, one at the end of the micrometer spindle and the other on the anvil, is strictly related to the number of revolutions of the spindle. The graduations on the barrel and thimble indicate precisely the position of the screw and hence the amount of opening between the faces.

The thimble rotates with the screw-spindle and travels along the barrel. The graduations on the barrel conform to the pitch of the measuring screw, one line for each revolution. The graduations on the bevelled edge of the thimble sub-divide each revolution of the screw so that readings may be taken in units of one thousandth of an inch (0.001 inch).

A micrometer is a delicate precision instrument and must be treated accordingly. All new micrometers are guaranteed to be accurate within 0.0001 inch throughout the traverse of the screw and within ± 0.0001 inch for zero setting.

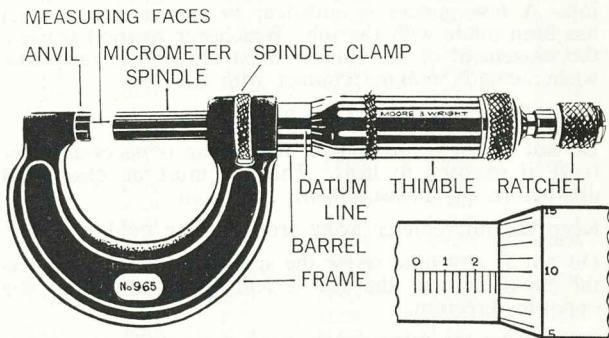
READING A MICROMETER

Normal micrometers, which measure thousandths of an inch, have screw-spindles with a pitch of $1/40$ inch, that is, the screw has 40 threads per inch. Therefore each complete revolution of the thimble alters the distance between the measuring faces by $1/40$ inch or 0.025 inch. The graduation lines on the barrel conform to the pitch of the micrometer screw, each mark indicating 0.025 inch and each fourth line being numbered 1, 2, 3, etc., to indicate 0.100 inch, 0.200 inch, 0.300 inch, etc.

The bevelled edge of the thimble is divided into 25 equal parts so that when the thimble is turned an amount equal to the distance between any two of these marks, the measuring faces are moved 0.001 or one thousandth of an inch. This, of course, is because one twenty-fifth of a complete revolution or $1/25 \times 1/40$

equals $1/1,000 =$ one thousandth of an inch. Every fifth line around the bevelled edge of the thimble is numbered for ease in reading.

To read a measurement on the micrometer, first note what number is showing on the datum line, to this add .025" for each line visible between that number and the thimble edge. Then to this total add the number of the line, on the thimble, which coincides with, or has just passed the datum line. Take as an example the enlarged inset in the diagram; the highest number showing on the datum line is 0.200"; to this is added 0.075" for the three lines between 0.200" and the thimble and finally 0.010" is added for the graduation on the thimble which coincides with the datum line. The reading would be 0.200" plus 0.075" plus 0.010" or 0.285".



CAUSES OF ERRORS

Even with the best micrometers, errors in readings are liable to occur through:

1. Dirt or rust on the measuring faces or inside the micrometer.
2. Distortion of the frame due to heating or mechanical damage.
3. Incorrect usage.

Before taking measurements, wipe the measuring faces with a clean hairless cloth or chamois leather.

CARE IN READING

When taking readings, either the ratchet or the thimble may be used to rotate the spindle slowly. The use of the ratchet is strongly recommended as it ensures uniform pressure. If the thimble is used, it must be gently rotated between the thumb and forefinger, but care and practice are needed to obtain good results with this method. Pressure must never be exerted when taking readings as this causes wear on the measuring faces, strain on the instrument and possibly distortion of the job. A few ounces is sufficient to ensure that contact has been made with the job. Whichever method is used, the movement of the spindle must always be very slow when actually making contact with the job.

GENERAL INSTRUCTIONS

Do not handle a micrometer more than is necessary, nor leave it exposed to heat. The job must be clean and dry before any measurements are taken.

Keep the micrometer away from cutting fluid.

Do not at any time screw the spindle so that it contacts the anvil, nor to the full extent of its travel in the opposite direction.

After using the micrometer, wipe it carefully to remove any trace of dirt. Cotton waste must not be used for this purpose.

When not in use, keep the micrometer in its box with the lid on.

If the micrometer is not likely to be used for some time, oil it carefully before putting it away.

Weights and Areas of SQUARE AND ROUND STEEL BARS

Thickness or diam. in inches	Weight in lb. of Square bar one foot long	Weight in lb. of Round bar one foot long	Area of Square bar in inches	Area of Round bar in inches	Circumfer- ence of Round bar in inches
3/16	.120	.094	.0352	.0276	.5891
1/4	.212	.167	.0625	.0491	.7854
5/16	.332	.261	.0977	.0767	.9818
3/8	.478	.376	.1406	.1104	1.1781
7/16	.651	.511	.1914	.1503	1.3745
1/2	.850	.668	.2500	.1963	1.5708
9/16	1.076	.845	.3164	.2485	1.7672
5/8	1.328	1.043	.3906	.3068	1.9635
11/16	1.607	1.262	.4727	.3712	2.1599
3/4	1.913	1.502	.5625	.4418	2.3562
13/16	2.245	1.763	.6602	.5185	2.5526
7/8	2.603	2.044	.7656	.6013	2.7489
15/16	2.988	2.347	.8789	.6903	2.9453
1	3.400	2.670	1.0000	.7854	3.1416
1-1/8	4.303	3.380	1.2656	.9940	3.5343
1-1/4	5.313	4.172	1.5625	1.2272	3.9270
1-3/8	6.428	5.049	1.8906	1.4849	4.3197
1-1/2	7.650	6.008	2.2500	1.7671	4.7124
1-5/8	8.978	7.051	2.6406	2.0739	5.1051
1-3/4	10.41	8.178	3.0625	2.4053	5.4978
1-7/8	11.95	9.388	3.5156	2.7612	5.8905
2	13.60	10.68	4.0000	3.1416	6.2832
2-1/8	15.35	12.06	4.5156	3.5466	6.6759
2-1/4	17.21	13.52	5.0625	3.9761	7.0686
2-3/8	19.18	15.06	5.6406	4.4301	7.4613
2-1/2	21.25	16.69	6.2500	4.9087	7.8540
2-5/8	23.43	18.40	6.8906	5.4119	8.2467
2-3/4	25.71	20.19	7.5625	5.9396	8.6394
2-7/8	28.10	22.07	8.2656	6.4918	9.0321
3	30.60	24.03	9.0000	7.0686	9.4248
3-1/4	35.92	28.21	10.563	8.2958	10.210
3-1/2	41.65	32.71	12.250	9.6211	10.996
3-3/4	47.82	37.55	14.063	11.045	11.781
4	54.40	42.73	16.000	12.566	12.566
4-1/4	61.41	48.24	18.063	14.186	13.352
4-1/2	68.85	54.07	20.250	15.904	14.137
4-3/4	76.71	60.25	22.563	17.721	14.923
5	85.00	66.76	25.000	19.635	15.708
5-1/2	102.9	80.78	30.250	23.758	17.279
6	122.4	96.13	36.000	28.274	18.850

One cubic foot of steel weighs 489.6 lb.

WEIGHTS OF STEEL PLATES

POUNDS PER LINEAL FOOT

Width Inches	Thickness in inches							
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2
12	2.55	5.10	7.65	10.20	12.75	15.30	17.85	20.40
13	2.76	5.53	8.29	11.05	13.81	16.58	19.34	22.10
14	2.98	5.95	8.93	11.90	14.88	17.85	20.83	23.80
15	3.19	6.38	9.56	12.75	15.94	19.13	22.31	25.50
16	3.40	6.80	10.20	13.60	17.00	20.40	23.80	27.20
17	3.61	7.23	10.84	14.45	18.06	21.68	25.29	28.90
18	3.83	7.65	11.48	15.30	19.13	22.95	26.78	30.60
19	4.04	8.08	12.11	16.15	20.19	24.23	28.26	32.30
20	4.25	8.50	12.75	17.00	21.25	25.50	29.75	34.00
21	4.46	8.93	13.39	17.85	22.31	26.78	31.24	35.70
22	4.68	9.35	14.03	18.70	23.38	28.05	32.73	37.40
23	4.89	9.78	14.66	19.55	24.44	29.33	34.21	39.10
24	5.10	10.20	15.30	20.40	25.50	30.60	35.70	40.80
26	5.53	11.05	16.58	22.10	27.63	33.15	38.68	44.20
28	5.95	11.90	17.85	23.80	29.75	35.70	41.65	47.60
30	6.38	12.75	19.13	25.50	31.88	38.25	44.63	51.00
32	6.80	13.60	20.40	27.20	34.00	40.80	47.60	54.40
34	7.23	14.45	21.68	28.90	36.13	43.35	50.58	57.80
36	7.65	15.30	22.95	30.60	38.25	45.90	53.55	61.20
38	8.08	16.15	24.23	32.30	40.38	48.45	56.53	64.60
40	8.50	17.00	25.50	34.00	42.50	51.00	59.50	68.00
42	8.93	17.85	26.78	35.70	44.63	53.55	62.48	71.40
44	9.35	18.70	28.05	37.40	46.75	56.10	65.45	74.80
46	9.78	19.55	29.33	39.10	48.88	58.65	68.43	78.20
48	10.20	20.40	30.60	40.80	51.00	61.20	71.40	81.60
50	10.6	21.3	31.9	42.5	53.1	63.8	74.40	85.0
52	11.1	22.1	33.2	44.2	55.3	66.3	77.4	88.4
54	11.5	23.0	34.4	45.9	57.4	68.9	80.3	91.8
56	11.9	23.8	35.7	47.6	59.5	71.4	83.3	95.2
58	12.3	24.7	37.0	49.3	61.6	74.0	86.3	98.6
60	12.8	25.5	38.3	51.0	63.8	76.5	89.3	102.0
62	13.2	26.4	39.5	52.7	65.9	79.1	92.2	105.4
64	13.6	27.2	40.8	54.4	68.0	81.6	95.2	108.8
66	14.0	28.1	42.1	56.1	70.1	84.2	98.2	112.2
68	14.5	28.9	43.4	57.8	72.3	86.7	101.2	115.6
70	14.9	29.8	44.6	59.5	74.4	89.3	104.1	119.0
72	15.3	30.6	45.9	61.2	76.5	91.8	107.1	122.4
74	15.7	31.5	47.2	62.9	78.6	94.4	110.1	125.8
76	16.2	32.3	48.5	64.6	80.8	96.9	113.1	129.2
78	16.6	33.2	49.7	66.3	82.9	99.5	116.0	132.6
80	17.0	34.0	51.0	68.0	85.0	102.0	119.0	136.0
82	17.4	34.9	52.3	69.7	87.1	104.6	122.0	139.4
84	17.9	35.7	53.6	71.4	89.3	107.1	125.0	142.8

WEIGHTS OF FLAT ROLLED STEEL

POUNDS PER LINEAL FOOT

Width inches	Thickness in inches															
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
1 <small>1 1/2 in. - 1 3/4 in.</small>	.053 .106 .159 .213	.106 .213 .319 .425	.159 .319 .478 .638	.213 .425 .638 .850	.27 .53 .80 1.06	.32 .64 .96 1.28	.37 .74 1.12 1.49	.43 .85 1.28 1.70	.48 .96 1.43 1.91	.53 1.06 1.59 2.13	.58 1.17 1.75 2.34	.64 1.28 1.91 2.55	.69 1.38 2.07 2.76	.74 1.49 2.23 2.98	.80 1.59 2.39 3.19	.85 1.70 2.55 3.40
2 <small>1 3/4 in. - 2 in.</small>	.266 .319 .372 .425	.531 .638 .744 .850	.797 .956 1.116 1.275	1.063 1.275 1.488 1.700	1.33 1.59 1.86 2.13	1.59 1.91 2.23 2.55	1.86 2.23 2.60 2.98	2.13 2.55 2.98 3.40	2.39 2.87 3.35 3.83	2.66 3.19 3.72 4.25	2.92 3.51 4.09 4.68	3.19 3.83 4.46 5.10	3.45 4.14 4.83 5.53	3.72 4.46 5.21 5.95	3.98 4.78 5.58 6.38	4.25 5.10 5.95 6.80
3 <small>2 in. - 2 1/4 in.</small>	.478 .531 .584 .638	.956 1.063 1.169 1.275	1.434 1.594 1.753 1.913	1.913 2.125 2.338 2.550	2.39 2.66 2.92 3.19	2.87 3.19 3.51 3.83	3.35 3.72 4.09 4.46	3.83 4.25 4.68 5.10	4.30 4.78 5.26 5.74	4.78 5.31 5.84 6.38	5.26 5.84 6.43 7.01	5.74 6.38 7.01 7.65	6.22 6.91 7.60 8.29	6.69 7.44 8.18 8.93	7.17 7.97 8.77 9.56	7.65 8.50 9.35 10.20
4 <small>2 1/4 in. - 2 3/4 in.</small>	.691 .744 .797 .850	1.381 1.488 1.594 1.700	2.072 2.231 2.391 2.550	2.763 2.975 3.188 3.400	3.45 3.72 3.98 4.25	4.14 4.46 4.78 5.10	4.83 5.21 5.58 5.95	5.53 5.95 6.38 6.80	6.22 6.69 7.17 7.65	6.91 7.44 7.97 8.50	7.60 8.18 8.77 9.35	8.29 8.93 9.56 10.20	8.98 9.67 10.36 11.05	9.67 10.41 11.16 11.90	10.36 11.16 11.95 12.75	11.05 11.90 12.75 13.60
5 <small>2 3/4 in. - 3 in.</small>	.903 .956 1.009 1.063	1.806 1.913 2.019 2.125	2.709 2.869 3.028 3.188	3.613 3.825 4.038 4.250	4.52 4.78 5.05 5.31	5.42 5.74 6.06 6.38	6.32 6.69 7.07 7.44	7.23 7.65 8.08 8.50	8.13 8.61 9.08 9.56	9.03 9.56 10.09 10.63	9.93 10.52 11.10 11.69	10.84 11.48 12.11 12.75	11.74 12.43 13.12 13.81	12.64 13.39 14.13 14.88	13.55 14.34 15.14 15.94	14.45 15.30 16.15 17.00
6 <small>3 in. - 3 1/2 in.</small>	1.116 1.169 1.222 1.275	2.231 2.338 2.444 2.550	3.347 3.506 3.666 3.825	4.463 4.675 4.888 5.100	5.58 5.84 6.11 6.38	6.69 7.01 7.33 7.65	7.81 8.18 8.55 8.93	8.93 9.35 9.78 10.20	10.04 10.52 11.00 11.48	11.16 11.69 12.22 12.75	12.27 12.86 13.44 14.03	13.39 14.03 14.66 15.30	14.50 15.19 15.88 16.58	15.62 16.36 17.11 17.85	16.73 17.53 18.33 19.13	17.85 18.70 19.55 20.40

WEIGHTS OF STEEL WIRE

Diam. inches (app.)	Size S.W.G.	Decimal of an inch	Milli- metres	Sectional area in sq. in.	Appr. wt. in lb.	
					100 yds.	Mile
1/2	7/0	.500	12.7	.19635	200.11	3,522
15/32	6/0	.464	11.8	.16910	172.33	3,033
7/16	5/0	.432	11.0	.14657	149.37	2,629
13/32	4/0	.400	10.2	.12568	128.07	2,254
3/8	3/0	.372	9.4	.10869	110.80	1,950
11/32	2/0	.348	8.8	.09510	96.93	1,706
	1/0	.324	8.2	.08244	84.03	1,479
	1	.300	7.6	.07069	72.04	1,268
	2	.276	7.0	.05982	60.97	1,073
	3	.252	6.4	.04987	50.85	895
1/4	4	.232	5.9	.04227	43.07	758
	5	.212	5.4	.03530	35.97	633
3/16	6	.192	4.9	.02896	29.43	518
	7	.176	4.5	.02432	24.77	436
	8	.160	4.1	.02011	20.45	360
	9	.144	3.7	.01628	16.59	292
	10	.128	3.3	.01287	13.12	231
1/8	11	.116	3.0	.01057	10.80	190
	12	.104	2.6	.00850	8.63	152
3/32	13	.092	2.3	.00665	6.76	119
	14	.080	2.0	.00503	5.11	90
	15	.072	1.8	.00407	4.15	73
	16	.064	1.6	.00322	3.29	58
1/16	17	.056	1.4	.00246	2.50	44
	18	.048	1.2	.00181	1.83	32.5
3/64	19	.040	1.0	.00126	1.27	22.54
	20	.036	0.9	.00102	1.03	18.25
1/32	21	.032	0.8	.00080	0.819	14.42
	22	.028	0.7	.00062	0.628	11.04
3/128	23	.024	0.6	.00045	0.461	8.11
	24	.022	0.55	.00038	0.387	6.82
	25	.020	0.5	.00031	0.320	5.63
	26	.018	0.45	.00025	0.259	4.56
	27	.0164	0.4	.00021	0.215	3.79

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 (I.W.R.C.).

FACTORS OF SAFETY

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	5280 ft.
Diam. or Circumference	3½" Circ.
(b) Construction:	
No. of strands	6
No. of wires per strand	× 19
Arrangement of wires in strands	9/9/1
Lay: Direction and type	R.H.O.L.
Core	I.W.R.C.
Kind of Fabrication	Preformed
(c) Grade:	
Quality of steel	Basic
Tensile strength of wire	100/110 t.p.s.i.
(d) Lubrication:	
P.J., Graphite, Crater, Corbula, etc.	Graphite

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 work-

ing 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 GAUGE TABLE

Weight lb. per base box	Equivalent Weight lb. per sq. ft.	Approximate thickness, in.	Old Symbol
60	0.2755	0.0066	—
65	0.2985	0.0072	—
70	0.3214	0.0077	—
75	0.3444	0.0083	—
80	0.3673	0.0088	—
85	0.3903	0.0094	—
90	0.4133	0.0099	—
95	0.4362	0.0105	—
100	0.4592	0.0110	ICL
107	0.4913	0.0118	IC
112	0.5143	0.0123	—
118	0.5418	0.0130	—
128	0.5878	0.0141	IXL
135	0.6199	0.0149	IX
139	0.6383	0.0153	DC
148	0.6796	0.0163	2XL
155	0.7117	0.0171	2X
168	0.7714	0.0185	3XL
175	0.8036	0.0193	3X
180	0.8265	0.0198	DX
188	0.8633	0.0207	4XL
195	0.8954	0.0215	4X
208	0.9551	0.0229	5XL
210	0.9643	0.0231	D2X
215	0.9872	0.0237	5X
228	1.0496	0.0251	6XL

Standard size 28" x 20"—112 sheets per double box.

NOTE.—Tinplate is always supplied on a weight basis and not thickness (thickness figures are used as a guide only). Determine substance from single sheet weight as follows:—

$$\text{Substance (lb.)} = \frac{\text{Single Sheet Weight} \times 112}{\text{Ratio}}$$

$$\text{Ratio} = \frac{\text{Nominal Sheet Area (sq. in.)}}{280 \text{ (sq. in.)}}$$

280 sq ins. = 14" x 20" (basis sheet size).

STRENGTH OF VARIOUS NON-FERROUS METALS AND ALLOYS

Metal or Alloy	Approximate Composition %	Density lb./cu. in.	Strength in Tension lb./sq. in.	
			Elastic Limit	Ultimate
COPPER, Cast Annealed Drawn Rod	Copper, 100	0.32	4,000	20,000
		0.32	6,000	30,000
		0.32	30,000	40,000
ZINC, Cast Rolled	Zinc, 100	0.256	—	9,000
		0.260	4,000	24,000
LEAD, Rolled	Lead, 100	0.411	800	*2,700
LEAD ALLOY, Cast	Lead, 95.5; Antimony, 4.5	0.380	4,000	6,400
NICKEL, Rolled and Annealed Cold-rolled	Nickel, 100	0.340	12,000	70,000
		0.340	70,000	165,000
ALUMINIUM, Cast Rolled and Annealed Cold-rolled Hard-drawn Wire	Aluminium, 100	0.093	—	13,000
		0.097	8,500	14,000
		0.097	20,000	30,000
		0.097	30,000	40,000
DURALUMIN, Rolled and Heat-treated	Aluminium, 96; Magnesium, 1.5; Copper, 2.5	0.102	19,000	55,000
BRASS, Cast Annealed } Drawn Rod }	Copper, 65; Lead, 2; Zinc, 33 Copper, 60; Zinc, 40	0.30	10,000	30,000
		0.30	15,000	55,000
		0.30	40,000	70,000
PHOSPHOR BRONZE, Cast Annealed } Drawn Rod }	Copper, 90; Tin, 10 Copper, 95; Tin, 5	0.32	15,000	35,000
		0.32	15,000	45,000
		0.32	40,000	70,000
ALUMINIUM BRONZE, Cast Annealed Drawn Rod	Copper, 87; Aluminium, 10; Iron, 3	0.27	20,000	70,000
		0.27	30,000	75,000
		0.27	40,000	85,000
MANGANESE BRONZE, Cast Annealed Drawn Rod	Copper, 58; Zinc, 39; Tin, Iron and Manganese 1 each	0.30	15,000	45,000
		0.30	25,000	65,000
		0.30	30,000	75,000
MONEL METAL, Hot-rolled Cold-rolled and Annealed	Nickel, 67; Copper, 28; Iron, Silicon, Carbon and Manganese, 5	0.32	48,000	88,000
		0.32	60,000	110,000

*Under long-continued static load, lead will flow very slowly under stresses as low as 600 lb. per sq. in.

COPPER—SHEET AND STRIP

GENERAL.—1. Types available: High Conductivity, Commercial, De-oxidised, Arsenical.

2. Finishes available: Hard (Cold) Rolled; Semi, Medium or Half Hard (Cold) Rolled; Soft (Cold) Rolled; Hot (Soft) Rolled.

TRADE SIZES.—Sheets: 26G and heavier (48" x 14" sheathing), 4' x 2', 6' x 2', 6' x 2' 6", 6' x 3', 8' x 3', 6' x 4', 8' x 4', according to gauge.

Strip: .002" and heavier, 5/16" to 24" wide.

WEIGHT PER SQUARE FOOT.—It is customary to order copper sheets by the Standard Wire Gauge or by weight in pounds and ounces per square foot. A table showing the weight per square foot equivalents to the various gauge numbers, calculated on the assumption that one square foot of rolled copper, 1 inch in thickness, weighs 46½ lb., is detailed below.

S.W.G. No.	Decimal of inch	Wt. per sq. ft. in lb.	Equiv. per sq. ft. in lb.	S.W.G. No.	Decimal of inch	Wt. per sq. ft. in lb.	Equiv. per sq. ft. in oz.
7/0	.500	23.25	—	23	.024	1.116	18
6/0	.464	21.57	—	24	.022	1.023	16
5/0	.432	20.08	—	25	.020	.930	14
4/0	.400	18.60	—	26	.018	.837	13
3/0	.372	17.29	—	27	.0164	.762	12
2/0	.348	16.18	—	28	.0148	.688	11
0	.324	15.06	—	29	.0136	.632	—
1	.300	13.950	—	30	.0124	.576	9
2	.276	12.834	—	31	.0116	.539	—
3	.252	11.718	—	32	.0108	.502	8
4	.232	10.788	—	33	.0100	.465	—
5	.212	9.858	10	34	.0092	.427	—
6	.192	8.928	9	35	.0084	.390	—
7	.176	8.184	8	36	.0076	.353	—
8	.160	7.440	7½	37	.0068	.316	—
9	.144	6.696	—	38	.0060	.279	—
10	.128	5.952	6	39	.0052	.241	—
11	.116	5.394	—	40	.0048	.223	—
12	.104	4.836	5	41	.0044	.204	—
13	.092	4.278	4½	42	.0040	.186	—
14	.080	3.720	3¾	43	.0036	.167	—
15	.072	3.348	—	44	.0032	.149	—
16	.064	2.976	3	45	.0028	.130	—
17	.056	2.604	2½	46	.0024	.112	—
18	.048	2.232	2¼	47	.0020	.093	—
19	.040	1.860	2	48	.0016	.074	—
20	.036	1.674	1¾	49	.0012	.056	—
21	.032	1.488	1½	50	.0010	.047	—
22	.028	1.302	1¼				

WEIGHT OF DRAWN COPPER BARS

Standard Rectangular Sizes

POUNDS PER LINEAL FOOT

Size ins.	Pounds	Size ins.	Pounds	Size ins.	Pounds
1 — x 16	.1206	1	1.447	1	2.894
	.1507	1 $\frac{1}{4}$	1.809	1 $\frac{1}{4}$	3.617
	.1809	1 $\frac{1}{2}$	2.170	1 $\frac{1}{2}$	4.341
	.2110	1 $\frac{3}{4}$	2.532	1 $\frac{3}{4}$	5.064
	.2412	2	2.894	2	5.788
	.3014	2 $\frac{1}{4}$	3.256	2 $\frac{1}{4}$	6.511
1 — x 8	.3617	2 $\frac{1}{2}$	3.617	2 $\frac{1}{2}$	7.235
	.2412	2 $\frac{3}{4}$	3.979	2 $\frac{3}{4}$	7.958
	.3014	3	4.341	3	8.681
	.3617	3 $\frac{1}{4}$	4.702	3 $\frac{1}{4}$	9.405
	.4220	3 $\frac{1}{2}$	5.064	3 $\frac{1}{2}$	10.13
	.4823	3 $\frac{3}{4}$	5.426	3 $\frac{3}{4}$	10.85
	.6029	4	5.788	4	11.58
	.7235	4 $\frac{1}{4}$	6.149	4 $\frac{1}{4}$	12.30
	.8440	4 $\frac{1}{2}$	6.511	4 $\frac{1}{2}$	13.02
	.9646	4 $\frac{3}{4}$	6.873	4 $\frac{3}{4}$	13.75
	1.085	5	7.235	5	14.47
	1.206			5 $\frac{1}{4}$	15.19
3 — x 16	1.326			5 $\frac{1}{2}$	15.92
	1.447			5 $\frac{3}{4}$	16.64
	.3617	1	1.929	6	17.36
	.4522	1 $\frac{1}{4}$	2.412		
	.5426	1 $\frac{1}{2}$	2.894	1	3.858
	.6330	1 $\frac{3}{4}$	3.376	1 $\frac{1}{4}$	4.823
	.7235	2	3.858	1 $\frac{1}{2}$	5.788
	.9043	2 $\frac{1}{4}$	4.341	1 $\frac{3}{4}$	6.752
	1.085	2 $\frac{1}{2}$	4.823	2	7.717
	1.266	2 $\frac{3}{4}$	5.305	2 $\frac{1}{4}$	8.681
	1.447	3	5.788	2 $\frac{1}{2}$	9.646
	1.628	3 $\frac{1}{4}$	6.270	2 $\frac{3}{4}$	10.61
1 — x 4	1.809	3 $\frac{1}{2}$	6.752	3	11.58
	1.989	3 $\frac{3}{4}$	7.235	3 $\frac{1}{4}$	12.54
	2.170	4	7.717	3 $\frac{1}{2}$	13.50
	.4823	4 $\frac{1}{4}$	8.199	3 $\frac{3}{4}$	14.47
	.6029	4 $\frac{1}{2}$	8.681	4	15.43
	.7235	4 $\frac{3}{4}$	9.164	4 $\frac{1}{4}$	16.40
	.8440	5	9.646	4 $\frac{1}{2}$	17.36
	.9646	5 $\frac{1}{4}$	10.13	4 $\frac{3}{4}$	18.33
	1.206	5 $\frac{1}{2}$	10.61	5	19.29
	1.447	5 $\frac{3}{4}$	11.09	5 $\frac{1}{2}$	20.26
	1.688	6	11.58	5 $\frac{1}{2}$	21.22
	1.929			5 $\frac{3}{4}$	22.19
1 — x 4	2.170			6	23.15
	2.412				
	2.653				
	2.894				

BRASS AND COPPER—RODS AND BARS

WEIGHT PER LINEAL FOOT—LB.

SQUARE			ROUND		
Side inches	Brass	Copper	Dia. in inches	Brass	Copper
1/8	.057	.061	1/8	.045	.048
3/16	.128	.136	3/16	.101	.108
1/4	.228	.243	1/4	.179	.190
5/16	.357	.380	5/16	.280	.300
3/8	.513	.545	3/8	.403	.430
7/16	.699	.742	7/16	.549	.585
1/2	.913	.970	1/2	.717	.760
9/16	1.15	1.23	9/16	.91	.960
5/8	1.43	1.52	5/8	1.12	1.19
11/16	1.73	1.83	11/16	1.35	1.44
3/4	2.05	2.18	3/4	1.61	1.72
13/16	2.41	2.56	13/16	1.89	2.01
7/8	2.80	2.97	7/8	2.19	2.34
15/16	3.21	3.40	15/16	2.52	2.68
1	3.65	3.88	1	2.87	3.05
1-1/8	4.62	4.91	1-1/8	3.63	3.85
1-1/4	5.70	6.06	1-1/4	4.48	4.76
1-3/8	6.90	7.33	1-3/8	5.42	5.76
1-1/2	8.21	8.72	1-1/2	6.45	6.87
1-5/8	9.64	10.23	1-5/8	7.57	8.04
1-3/4	11.18	11.87	1-3/4	8.78	9.35
1-7/8	12.83	13.62	1-7/8	10.08	10.70
2	14.60	15.50	2	11.47	12.20
2-1/8	—	—	2-1/8	12.94	—
2-1/4	—	19.62	2-1/4	14.51	15.40
2-3/8	—	—	2-3/8	16.17	—
2-1/2	—	24.22	2-1/2	17.92	19.02

B.A. AND B.S.W.

STANDARD HEXAGON SIZES—BRASS

Associa- tion	Across flats min. to max.		Lb. per lin. ft.	Standard		Across flats min. to max.		Lb. per lin. ft.
				Whit.	Fine			
No. 3	ins.	ins.	.251	ins.	ins.	ins.	ins.	2.68
No. 2	.279	.282	.332	1/2	9/16	.915	.920	3.22
No. 1	.321	.324	.421	9/16	5/8	1.002	1.010	3.82
No. 0	.362	.365	.539	5/8	11/16	1.092	1.100	4.55
Standard	.410	.413	.539	11/16	3/4	1.192	1.200	5.34
				3/4	7/8	1.292	1.300	6.92
Whit.	ins.	ins.	.539	7/8	1	1.468	1.480	8.81
Fine				1	1-1/8	1.658	1.670	10.94
ins.	7/32	.410	.413	1-1/8	1-1/4	1.845	1.860	13.29
—	1/4	.440	.445	1-1/4	1-3/8	2.035	2.050	18.36
—	5/16	.470	.475	1-3/8	1-1/2	2.200	2.200	21.03
1/4	3/8	.520	.525	1-1/2	1-5/8	2.390	2.410	24.07
5/16	7/16	.595	.600	1-5/8	1-3/4	2.555	2.580	31.35
3/8	1/2	.705	.710	1-3/4	2	2.735	2.760	—
7/16	—	.815	.820	2	—	3.125	3.150	—

SOLID DRAWN COPPER TUBES

COMMERCIAL QUALITY

Standard sizes—weight in lb. per lineal foot. Calculated on a basis of copper at .323 lb. per cubic inch. To find the weight of tubes composed of the following metals, multiply the weights of the equivalent copper tubes by the constants shown:—6/40 brass, 0.942; 70/30 brass, 0.958; aluminium, 0.304.

Standard Wire Gauge	4	6	8	10	12	14	16	17	18	19	20	22
Dec. equiv. in inches	.232	.192	.160	.128	.104	.080	.064	.056	.048	.040	.036	.028
External diameter inch												
1/2	—	—	—	.58	.50	.41	.34	.30	.26	.22	.20	.16
9/16	—	—	—	—	—	.47	.39	—	.30	—	.23	.18
5/8	—	—	—	—	.66	.53	.44	.38	.34	.28	.26	.20
11/16	—	—	—	—	.74	.59	.48	—	.37	—	.28	.22
3/4	—	—	—	.97	.82	.65	.53	.47	.41	.34	.31	.25
13/16	—	—	—	1.06	.89	.71	.58	—	.45	—	.34	.27
7/8	—	—	—	1.16	.97	.77	.63	.55	.48	.40	.37	.29
15/16	—	—	—	1.25	1.05	.83	.68	—	.52	—	.39	.31
1	—	—	1.76	1.35	1.13	.89	.73	.63	.55	.46	.42	.33
1-1/32	—	—	—	—	—	.92	—	—	—	—	—	—
1-1/8	—	2.17	1.87	1.54	1.29	1.01	.82	.72	.63	.52	.48	.37
1-1/4	—	2.45	2.11	1.74	1.45	1.13	.92	.80	.70	.58	.53	.42
1-9/32	—	—	—	—	1.48	—	—	—	—	—	—	—

LYSAGHT REFEREE

1-3/8	—	2.75	2.36	1.94	1.60	1.26	1.02	.89	.77	.64	.58	—
1-1/2	—	3.04	2.60	2.13	1.76	1.38	1.11	.97	.85	.70	.64	—
1-5/8	—	3.33	2.84	2.32	1.92	1.50	1.21	1.06	.92	.77	.69	—
1-3/4	—	3.62	3.08	2.52	2.08	1.61	1.31	1.14	.99	.83	.75	—
1-7/8	—	3.92	3.33	2.71	2.23	1.74	1.41	1.23	1.06	.89	.80	—
2	—	4.21	3.57	2.90	2.39	1.86	1.50	1.31	1.14	.95	.86	—
2-1/8	5.32	4.50	3.81	3.09	2.55	1.98	1.60	—	1.21	—	.92	—
2-1/4	5.67	4.79	4.05	3.29	2.71	2.10	1.70	1.48	1.28	1.07	.97	—
2-5/16	—	—	—	—	—	2.17	—	—	—	—	—	—
2-3/8	6.03	5.06	4.30	3.49	2.86	2.23	1.79	—	1.35	—	1.02	—
2-1/2	6.38	5.37	4.54	3.68	3.02	2.35	1.89	1.65	1.43	1.19	1.08	—
2-5/8	6.73	5.66	4.78	3.87	3.18	2.47	1.99	—	1.50	—	1.13	—
2-3/4	7.08	5.95	5.02	4.07	3.34	2.59	2.08	1.82	1.57	1.31	1.18	—
2-7/8	7.43	6.25	5.27	4.26	3.49	2.71	2.18	—	1.65	—	1.24	—
2-15/16	—	—	—	—	—	2.77	—	—	—	—	—	—
3	7.78	6.54	5.51	4.45	3.65	2.83	2.28	1.99	1.72	1.43	1.29	—
3-1/4	8.48	7.12	5.99	4.84	3.97	3.07	2.47	2.16	1.86	1.55	—	—
3-7/16	—	—	—	5.13	—	—	—	—	—	—	—	—
3-1/2	9.19	7.70	6.48	5.23	4.28	3.32	2.67	2.33	2.01	1.67	—	—
3-3/4	9.89	8.28	6.96	5.62	4.60	3.56	2.86	2.50	2.15	1.79	—	—
4	10.59	8.87	7.45	6.00	4.91	3.80	3.05	2.67	2.30	1.91	—	—
4-1/4	11.29	9.45	7.93	6.39	5.23	4.04	3.25	2.84	—	2.04	—	—
4-1/2	12.00	10.03	8.42	6.78	5.54	4.29	3.44	3.01	—	2.16	—	—
4-3/4	12.70	10.61	8.90	7.17	5.86	4.53	—	3.18	—	2.28	—	—
5	13.40	11.20	9.39	7.55	6.17	4.77	3.83	3.34	—	2.40	—	—
5-1/4	—	—	—	—	—	—	—	3.51	—	—	—	—
5-1/2	14.81	12.36	10.36	8.33	6.80	—	—	3.68	—	—	—	—
6	16.21	13.53	11.33	9.10	7.43	—	—	—	—	—	—	—

BRASS—SHEET AND STRIP

GENERAL.—1. Commercial Brass is made in three grades: 70/30 (Deep Drawing); 65/35; 63/37 (Basis Brass).

2. Finishes available: Soft (Cold) Rolled; Semi, Medium or Half Hard (Cold) Rolled; Hard (Cold) Rolled; Extra Hard (Strip only).

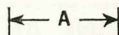
TRADE SIZES.—Sheets: 26 gauge and heavier—4' x 2', 6' x 2', 6' x 2' 6", 6' x 3'. Strip: .002" and heavier—5/16" to 24" wide (special manufacture).

WEIGHT PER SQUARE FOOT.—The weight per square foot of rolled brass varies slightly with the composition of the alloy. For the basis of all calculations, the figure used is that one square foot of rolled brass weighs 44½ lb. per square foot one inch in thickness.

S.W.G. No.	Decimal of an inch	Weight per sq. ft. in lb.	S.W.G. No.	Decimal of an inch	Weight per sq. ft. in lb.
7/0	.500	22.250	23	.024	1.068
6/0	.464	20.648	24	.022	.979
5/0	.432	19.224	25	.020	.890
4/0	.400	17.800	26	.018	.801
3/0	.372	16.540	27	.0164	.729
2/0	.348	15.486	28	.0148	.658
0	.324	14.418	29	.0136	.605
1	.300	13.350	30	.0124	.551
2	.276	12.282	31	.0116	.516
3	.252	11.214	32	.0108	.480
4	.232	10.324	33	.0100	.445
5	.212	9.434	34	.0092	.409
6	.192	8.544	35	.0084	.373
7	.176	7.832	36	.0076	.338
8	.160	7.120	37	.0068	.302
9	.144	6.408	38	.0060	.267
10	.128	5.696	39	.0052	.231
11	.116	5.162	40	.0048	.213
12	.104	4.628	41	.0044	.195
13	.092	4.094	42	.0040	.178
14	.080	3.560	43	.0036	.160
15	.072	3.204	44	.0032	.142
16	.064	2.848	45	.0028	.124
17	.056	2.492	46	.0024	.106
18	.048	2.136	47	.0020	.089
19	.040	1.780	48	.0016	.071
20	.036	1.602	49	.0012	.053
21	.032	1.424	50	.0010	.044
22	.028	1.246	—	—	—

OTHER COPPER ALLOYS ARE.—Gilding Metal (four grades), 90/10, 88/12, 85/15, 80/20 (Sheet and Strip); Nickel Silver, 10% (Sheet and Strip), 15%, 18%, 20% (Strip only); Engraving Brass (free cutting), Sheet and Strip; Naval Brass (improved Muntz Metal), Sheets and Sheathing; Phosphor Bronze (Strip only).

EXTRUDED FLAT BRASS SECTIONS



Dimensions (ins.)		Est. Weight per ft. (lb.)	Dimensions (ins.)		Est. Weight per ft. (lb.)	Dimensions (ins.)		Est. Weight per ft. (lb.)
A	B		A	B		A	B	
3	1	10.9	1-1/2	1	5.47	7/8	3/16	.599
3	7/8	9.58	1-1/2	7/8	4.79	7/8	1/8	.399
3	3/4	8.21	1-1/2	3/4	4.10	7/8	1/16	.200
3	5/8	6.84	1-1/2	5/8	3.42			
3	1/2	5.47	1-1/2	1/2	2.74	3/4	3/4	2.05
3	3/8	4.10	1-1/2	3/8	2.05	3/4	5/8	1.71
3	1/4	2.74	1-1/2	1/4	1.37	3/4	1/2	1.37
3	3/16	2.04	1-1/2	3/16	1.03	3/4	3/8	1.03
3	1/8	1.37	1-1/2	1/8	.684	3/4	1/4	.684
			1-1/2	1/16	.342	3/4	3/16	.513
2-1/2	1	9.12				3/4	1/8	.342
2-1/2	7/8	7.98	1-1/4	1	4.56	3/4	1/16	.171
2-1/2	3/4	6.84	1-1/4	7/8	3.99			
2-1/2	5/8	5.70	1-1/4	3/4	3.42	5/8	5/8	1.43
2-1/2	1/2	4.56	1-1/4	5/8	2.85	5/8	1/2	1.14
2-1/2	3/8	3.42	1-1/4	1/2	2.28	5/8	3/8	.855
2-1/2	1/4	2.28	1-1/4	3/8	1.71	5/8	1/4	.570
2-1/2	3/16	1.71	1-1/4	1/4	1.14	5/8	3/16	.428
2-1/2	1/8	1.14	1-1/4	3/16	.855	5/8	1/8	.285
			1-1/4	1/8	.570	5/8	1/16	.143
2	1	7.30	1-1/4	1/16	.285			
2	7/8	6.38				1/2	1/2	.912
2	3/4	5.47	1	1	3.65	1/2	3/8	.684
2	5/8	4.56	1	7/8	3.19	1/2	1/4	.456
2	1/2	3.65	1	3/4	2.74	1/2	3/16	.342
2	3/8	2.74	1	5/8	2.28	1/2	1/8	.228
2	1/4	1.82	1	1/2	1.82	1/2	1/16	.114
2	3/16	1.37	1	3/8	1.37			
2	1/8	.912	1	1/4	.912	3/8	3/8	.513
			1	3/16	.684	3/8	1/4	.342
1-3/4	1	6.38	1	1/8	.456	3/8	3/16	.257
1-3/4	7/8	5.59	1	1/16	.228	3/8	1/8	.171
1-3/4	3/4	4.79				3/8	1/16	.086
1-3/4	5/8	3.99	7/8	7/8	2.79			
1-3/4	1/2	3.19	7/8	3/4	2.39	1/4	1/4	.228
1-3/4	3/8	2.39	7/8	5/8	2.00	1/4	3/16	.171
1-3/4	1/4	1.60	7/8	1/2	1.60	1/4	1/8	.114
1-3/4	3/16	1.20	7/8	3/8	1.20	1/4	1/16	.057
1-3/4	1/8	.798	7/8	1/4	.798			

ZINC AND ZINC SHEET

Zinc is produced in Australia and is sold by the ton in the form of slabs weighing approximately 56 lb. each. Zinc is also rolled into plates, sheet and strip and is available in sheets up to a maximum width of 36" and a length of 96". Strip in coil is supplied up to a maximum width of 23" in standard thicknesses of 21, 22, 23 and 26 S.W.G.

Weight of Zinc Sheet

S.W.G. No.	Zinc Gauge No.*	Thickness		Wt. per sq. ft.-lb.	Approx. Sheet Wt.-lb.	
		Inch.	Mm.		36" x 72"	36" x 96"
26	—	0.018	0.457	0.6741	12.13	16.18
—	10	0.019	0.483	0.7115	12.81	17.08
25	—	0.020	0.508	0.7490	13.48	17.98
—	—	0.021	0.533	0.7864	14.16	18.87
24	11	0.022	0.559	0.8239	14.83	19.77
—	—	0.023	0.584	0.8613	15.50	20.67
23	—	0.024	0.610	0.8988	16.18	21.57
—	12	0.025	0.635	0.9362	16.85	22.47
—	—	0.026	0.660	0.9737	17.52	23.37
—	—	0.027	0.686	1.0111	18.20	24.27
22	13	0.028	0.711	1.0486	18.87	25.17
—	—	0.029	0.737	1.0860	19.55	26.07
—	—	0.030	0.762	1.1235	20.22	26.96
—	14	0.031	0.787	1.1610	20.90	27.86
21	—	0.032	0.813	1.1984	21.57	28.76
—	—	0.033	0.838	1.2358	22.25	29.66
20	15	0.036	0.915	1.3482	24.27	32.36
19	16	0.041	1.041	1.5354	27.64	36.85

*There are a number of Zinc Gauges, this is the English Zinc Gauge as given in British Standard No. 3737-1964.

Process Engravers' Zinc

Process engravers' zinc is usually supplied in 40" x 20" plates, polished on one side, and in 8, 10, 12, 14 and 16 S.W.G. The following table gives weights of these standard sizes of plates.

40" x 20" x	8G	10G	12G	14G	16G
Weight of plate	33 lb.	26½ lb.	22 lb.	16½ lb.	13 lb.

LEAD AND LEAD SHEET

Soft lead (up to 99.99% lead) and alloy lead is generally sold by the ton in ingots weighing approximately 56 lb. Lead and lead alloy plate, sheet and strip are also available. When ordering lead sheet it is usual to specify the weight of sheet per square foot rather than the thickness.

STANDARD SIZES FOR SHEET LEAD

Available as rolled or cast sheet

ROLLED SHEET: Soft lead and lead alloy (Commercial and Chemical Grades).

Widths: Up to 108 inches.

Lengths: Up to 35 feet.

Weights: From foils 1 lb. per square foot, up to 1" plate 60 lb. per square foot.

CAST SHEET: Soft lead both plain and wire reinforced for greater creep resistance.

Widths: Up to 36 inches.

Lengths: Up to 2,000 feet.

Weights: Plain, 1, 1½, 2, 3, and 4 lb. per square foot. Wire reinforced 2, 3 and 4 lb. per square foot.

DAMP COURSE:

Bitumen Coated:

Weights: 14, 17 ozs. per sq. ft., 2 and 3 lb. per sq. ft.

Plain (Uncoated):

Widths: (for both) 4½", 6", 9", 12", 14", 18", etc.

Lengths: (for both) 20 feet.

Weights: 2, 3, 4, 5 and 6 lb. per sq. ft.

Weights and Equivalent Thicknesses

Weight lb./sq. ft.	Thickness			Nearest S.W.G. No.
	Inch	mm	Fraction to nearest 1/64"	
1	0.0156	0.396	1/64	27
1-1/2	0.0234	0.594	1/32	23
2	0.0312	0.792	1/32	21
2-1/2	0.0391	0.993	3/64	19
3	0.0468	1.189	3/64	18
3-1/2	0.0547	1.389	1/16	17
4	0.0625	1.588	1/16	16
5	0.0781	1.985	5/64	15
6	0.0937	2.380	3/32	13
7	0.1092	2.789	7/64	11
8	0.1250	3.175	1/8	10
10	0.1563	3.970	5/32	8
12	0.1875	4.760	3/16	6
14	0.2188	5.560	7/32	5
16	0.2500	6.350	1/4	3
20	0.3126	7.940	5/16	0
30	0.4689	11.900	15/32	—
40	0.6252	15.890	5/8	—
60	0.9378	23.820	15/16	—

ALUMINIUM—Typical Properties

Alloy & Temper	U.T.S. p.s.i.	Yield p.s.i.	Extn. % on 2"	Remarks
2S-0	13,500	5,500	35	{ Commercially pure aluminium. A general purpose work-hardening alloy having good corrosion resistance and excellent drawing and forming characteristics in the annealed condition.
2S-H14	16,000	16,000	9	
2S-H18	26,000	24,000	6	
3003-0	16,000	6,000	30	{ A work-hardening aluminium manganese alloy having characteristics similar to 2S but having slightly higher mechanical properties.
3003-H14	22,000	21,000	8	
3003-H18	29,000	27,000	4	
5005-0	18,000	6,000	30	{ A work-hardening aluminium magnesium alloy having good working and forming characteristics and moderate strength. Excellent uniform surface appearance after anodizing.
5005-H34	23,000	21,000	6	
5005-H38	29,000	27,000	4	
5050-0	21,000	8,000	24	{ A work-hardening aluminium magnesium alloy having good forming characteristics and intermediate strength. Good corrosion resistance.
5050-H34	28,000	24,000	8	
5050-H38	32,000	29,000	6	
M57S-0	29,000	14,500	23	{ A medium-strength aluminium magnesium alloy with good corrosion resistance especially in marine atmospheres. Ductile in the soft condition but work-hardens rapidly. Good welding characteristics.
M57S-H34	37,000	31,000	9	
M57S-H38	43,000	38,000	7	
2S-F	13,000	5,500	38	{ Commercially pure aluminium used in applications where strength and hardness is unimportant.
50S-T4A	20,000	15,000	25	
50S-T5	30,000	25,000	14	
B51S-T6	45,000	39,000	12	{ An excellent architectural alloy combining both strength and good surface appearance after anodizing. Main alloying elements are magnesium and silicon.
65S-T6	45,000	39,000	12	
28S-T3	51,000	33,500	11	{ Two of the recognised structural alloys where strength is a primary factor. Both have good corrosion resistance and machining properties.
28S-T6	55,000	40,000	12	
2S-T8	56,000	42,000	10	

Extrusion Wt. = Cross Sect. Area x 1.176, lb./ft.

Sheet

Extrusions

ALUMINIUM—Weight per Square Foot—Sheet

Thickness			Thickness		
S.W.G.	Inches	Weight lb. sq. ft.	S.W.G.	Inches	Weight lb. sq. ft.
—	.500	7.042	12	.104	1.465
—	.4375	6.161	14	.080	1.127
—	.375	5.281	16	.064	0.9013
—	.3125	4.401	18	.048	0.6760
—	.250	3.521	19	.040	0.5633
—	.187	2.641	20	.036	0.5070
8	.160	2.253	22	.028	0.3943
10	.128	1.803	24	.022	0.3098
—	.125	1.760	26	.018	0.2535

MONEL METAL AND NICKEL

Weights of Rounds, Squares and Hexagons

Size in inches	Lb. per foot			Size in inches	Lb. per foot		
	Rounds	Squares	Hexs.		Rounds	Squares	Hexs.
7/32	.146	—	—	2	12.178	15.504	13.426
1/4	.190	—	.209	2 1/8	13.747	17.503	15.156
5/16	.297	.379	.327	2 1/4	15.411	19.622	16.991
3/8	.428	.545	.472	2 3/8	17.171	21.863	18.921
7/16	.583	.742	.643	2 1/2	19.027	24.225	20.977
1/2	.761	.969	.839	2 3/4	20.977	26.708	23.127
9/16	.963	1.226	1.062	2 7/8	23.022	29.312	25.382
5/8	1.189	1.514	1.311	3	25.162	32.038	27.741
11/16	1.439	1.832	1.586	3 1/8	27.399	34.884	30.207
3/4	1.712	2.180	1.887	3 1/4	32.155	40.940	35.451
13/16	2.010	2.559	2.216	3 1/2	37.291	47.481	41.113
7/8	2.331	2.968	2.570	3 3/4	42.810	54.506	47.198
15/16	2.766	3.407	2.940	4	48.706	62.016	53.698
1	3.044	3.876	3.356	4 1/4	54.985	70.010	60.621
1-1/16	3.436	4.376	3.778	4 1/2	61.644	78.489	67.963
1-1/8	3.853	4.906	4.248	4 3/4	68.714	87.452	75.757
1-3/16	4.293	5.466	4.733	5	76.105	96.900	83.906
1-1/4	4.756	6.056	5.243	5 1/4	83.908	106.832	92.509
1-5/16	5.244	6.677	5.782	5 1/2	92.086	117.249	101.525
1-3/8	5.756	7.328	6.346	5 3/4	100.648	128.150	110.964
1-7/16	6.291	8.009	6.934	6	109.590	139.536	120.823
1-1/2	6.849	8.721	7.551	6 1/4	118.916	151.406	131.105
1-9/16	7.432	9.463	8.194	6 1/2	128.617	163.761	141.800
1-5/8	8.039	10.235	8.863	6 3/4	138.703	176.600	152.910
1-11/16	8.669	11.038	9.558	7	149.168	189.924	164.458
1-3/4	9.321	11.870	10.276	7 1/4	160.009	203.733	176.410
1-13/16	10.001	12.733	11.026	7 1/2	171.238	218.025	188.790
1-7/8	10.702	13.627	11.799	7 3/4	182.843	232.802	201.584
1-15/16	11.428	14.550	12.599	8	194.827	248.064	214.797

ELECTRICITY

FUNDAMENTAL UNITS:

The Ampere is the unit in which electric current flow is measured.

The Ohm is the unit in which resistance to the flow of an electric current is measured.

The 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.— This 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 1,000 watt hours, and is called the Board of Trade unit or kilowatt hour.

$$\text{kWh} = \frac{\text{Volts} \times \text{Amperes} \times \text{Hours}}{1,000} \quad \text{or} \quad \frac{\text{Watts} \times \text{Hours}}{1,000}$$

Example: To find the cost of burning five 60-watt lamps for ten hours, assuming the cost per unit to be 3 cents—

$$\text{Cost} = \frac{60 \times 5 \times 10 \times 3c}{1,000} = \$0.09$$

$$\text{Horsepower} = \frac{\text{Watts}}{746}$$

$$\text{Kilowatts} = \frac{\text{Watts}}{1,000}$$

The normal voltage for household appliances is 240; for 3-phase motors, etc., 415.

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 flex 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.

Industry of the Population—Australia

CENSUSES OF 1954 AND 1961

(Exclusive of full-blood Aboriginals)

Class of Industry	(Persons) 1954	(Persons) 1961
Primary Production	493,298	458,885
Mining and Quarrying	61,371	54,401
Manufacturing	1,027,331	1,140,335
Electricity, Gas, Water, Sanitary Services (Production, Supply and Maintenance)	73,650	94,311
Building and Construction	325,622	372,331
Transport, Storage and Communication	335,835	350,050
Finance and Property	94,213	141,145
Commerce	577,381	686,766
Public Authority and Defence Services	156,511	169,753
Community and Business Services (Including Professional Service)	294,837	410,133
Amusements, Hotels and Accommodation, Cafes, Personal Service	224,489	248,136
Other Industries or Industries Inadequately described or not stated	37,484	85,584
Total in Work Force	3,702,022	4,225,096
Persons not in work force	5,284,508	6,283,090
GRAND TOTAL	8,986,530	10,508,186

Government Railway Statistics, 1962-1963

Government	Route Mileage	Gross Revenue \$000	Working Expenses \$000	Net Revenue \$000
Commonwealth	2,252	13,958	13,286	672
N.S.W.	6,296	182,482	158,652	23,830
Victoria	4,024	86,978	87,000	- 122
Queensland	6,077	75,244	75,436	- 192
South Australia	2,535	27,672	30,984	-3,312
Western Australia	3,797	32,920	34,606	-1,686
Tasmania	516	5,598	6,670	-1,072
TOTAL	25,497	424,752	406,634	18,118

NOTE.—Minus sign (-) denotes loss.

GAUGES OF GOVERNMENT RAILWAYS

5' 3"	5,731 miles	3' 6"	12,072 miles
4' 8½"	7,656 miles	Other	38 miles

AREA AND POPULATION

State or Territory	Year of formation into separate Colony or Territory	Present Area in Square Miles	Population		
			1961 (Census)	1964 (Est.)	1965 (Est.)
N.S.W. ..	1786	309,433	3,949,420	4,158,926	4,237,514
Vic.	1851	87,884	2,950,790	3,161,537	3,233,938
Qld.	1859	667,000	1,525,278	1,595,057	1,615,384
S.A.	1834	380,070	980,755	1,044,662	1,064,629
W.A.	1829	975,920	746,205	799,626	820,063
Tas.	1825	26,383	364,134	375,268	379,107
N. Territy.	1863	520,280	25,258	30,946	34,253
A.C.T. ..	1911	939	62,091	84,686	93,815
TOTAL ..	—	2,967,909	10,603,931	11,250,708	11,478,703

POPULATION AND VITAL STATISTICS

AUSTRALIA 1961-64-65

Heading	1961	1964	1965
Population at 31st December	10,603,931	11,250,708	11,478,703
Births	239,986	229,149	222,854
Marriages	76,686	86,013	93,546
Deaths	88,961	100,594	99,715
Deaths of Children under one year	4,689	4,367	4,118
Natural Increase	151,025	128,555	123,139
Rate of Natural Increase %	1.45	1.17	1.10

DISTANCES BETWEEN AIRPORTS

Air miles actually flown by aircraft following the prescribed airline routes

By courtesy of the Department of Civil Aviation

[illegible]

AUSTRALIAN ROAD STATISTICS (Latest Available)

Mileage of Roads in Australia at 30th June, 1963

	Mileage			Total	Percentage of Total		
	A	B	C		A	B	C
	Classified State Highways Trunk and Main Roads Miles	Other Roads Controlled and/or Subsidised by State Road Authorities Miles	All other Roads Miles		%	%	%
N.S.W.	22,281	4,272	104,479	131,032	17	3	80
Victoria	13,620	26,905	64,105	104,630	13	26	61
Queensland	11,392	12,728	77,705	101,825	11	13	76
Sth. Aust.	8,156	16,760	62,400	87,316	9	19	72
West. Aust.* ..	11,150	24,442	67,887	103,488	11	24	65
Tasmania	1,833	379	10,877	13,089	14	3	83
Sub-totals							
States	68,441	85,486	387,453	541,830	13	16	71
A.C.T.	80	535	—	615	13	87	—
Nth. Territory ..	1,247	9,427	—	10,674	12	88	—
TOTALS	69,768	95,448	—	552,669	13	17	70

*Includes 7,647 miles of important secondary roads.



FIRST AID TO THE INJURED

The following notes on First Aid have been contributed by The St. John Ambulance Association, St. John House, 21 Macquarie Place, Sydney, recognised teachers of First Aid, and have been taken from The St. John Manual, "First Aid to the Injured."

In all cases of serious illness or accidents send for a Doctor or Ambulance, notifying them clearly of the case to be treated and the location of the accident.

First Aid Kit.—It is recommended that every home be equipped with an adequate First Aid Kit and the suggested contents for each are:—Triangular Bandages; Gauze-roller Bandages—1" to 2"; Safety Pins; Medicine Glass; Thermometer; Pair of Scissors; Pair of Small Forceps; Bottle of Antiseptic; Eye Bath; Salvolatile; Lint; Gauze; Cotton Wool.

It is suggested that sterile dressings be made by cutting lint and gauze into 2" x 2" squares, placing each in a clean rag (to be sewn up, hemmed and sterilised by baking in the oven for one hour).

Shock.—All cases of accident or sudden illness result in a condition known as shock, which must be treated primarily.

Treatment of Shock.—Lie patient on the back, loosen clothing about the neck, chest and waist and ensure a free circulation of air. Keep the patient warm by covering with coats and blankets but do not overheat him.

Unconsciousness.—Ensure an abundant supply of fresh air and that the patient's air passages are not obstructed. If breathing has stopped or appears to be failing, commence artificial respiration. If breathing is NOT NOISY lay patient on his back with head and shoulders

slightly raised and supported and turn head to one side. If breathing is NOISY (bubbling through secretions) turn the patient to the three-quarter prone position, supported with a pad in front of chest or the upper knee drawn up. Do not attempt to give food or fluids to unconscious patients. Do not leave the patient until he has been placed in the care of a responsible person.

HÆMORRHAGE (Bleeding)

Place patient in a suitable position, elevate bleeding part except in the case of fractured limb. Expose the wound, removing as little clothing as possible. Do not remove any clots already formed: remove any foreign body which is visible and easily picked out or wiped off with a piece of clean dressing. Apply and maintain pressure, either direct or indirect. Apply a dressing pad and bandage. Immobilise the injured part. Direct pressure is applied with the thumb or fingers, with a pad if available, to the part of the wound from which there is blood coming. When a foreign body or broken bone is present in the wound, press alongside it and NOT over it. If the bleeding point is not readily visible grasp the whole wound and squeeze it tightly.

Neck.—Apply thumb of one hand on the artery, pressing backwards against the spine, taking care to avoid the windpipe.

Face.—Below the level of the eye.—Apply pressure on the wound from the outside of the cheek against the jawbone.

Armpit.—Place hard pad (size billiard ball) in the armpit. Apply centre of narrow bandage on the pad: cross bandage on shoulder. Pull the ends tight and tie under the opposite armpit.

Upper Arm.—Apply pressure with fingers on the artery by grasping the arm at its centre from behind and compress artery against bone.

Forearm.—Pressure may be applied by the thumb placed on either side of the wound.

Palm of hand.—When foreign body or broken bone is not present, apply dressing and firm pad, making the patient grasp it. Bandage the hand.

Fingers.—Apply small pad on wound and secure firmly with bandage.

Thigh.—Place thumbs, one on the other on the pulsating artery at the centre of the groin, grasping the thigh with hands. When wound occurs in the upper region on artery, keep the pressure up until the arrival of a Doctor. Each fresh assistant places his thumbs over those of his predecessor who slips his away and thus gushes of blood are prevented during the change.

Leg.—Front or Back. Apply pressure by fingers or pad if bleeding at the ankle and bandage firmly over the wound.

Sole of the Foot.—Apply pressure and firm pad over the bleeding point and maintain firm pressure by bandage. Support the foot in elevated position.

Antiseptic.—In wounds and on the skin no antiseptics which burn or irritate should be used. When prepared antiseptics are not available normal saline solution (one teaspoonful of common salt to one pint of sterile water) should be used.

Cold Compress.—Used to ease pain, lessen swelling, control internal bleeding. A clean handkerchief or piece of lint is soaked in cold water and applied to affected part; change frequently.

FRACTURES — Broken Bones — Signs and Symptoms

Pain at or near seat of fracture, loss of power in the limb, swelling about the seat of fracture, deformity of limb, unnatural mobility.

Treatment.—Attend to fracture on the spot. No attempt must be made to move the patient until the limb has been rendered as immobile as practicable by splints or other means of restraint. Steady and support injured limb, placing it in as natural position as possible. Apply splints and bandages.

Splints.—These may be improvised from walking sticks, umbrellas, broom handles, rifles, folded coats, pieces of wood, etc. When splints are not available tie fractured limb to the body and, in all cases, a fractured lower limb should be bandaged to its fellow.

Fractured Skull.—If breathing is not noisy.—Lay the patient on his back with his head and shoulders slightly raised and supported. Turn head to one side. Should there be bleeding from an ear, place the head so that the affected ear is on the lower side.

Fractured Skull.—If breathing is noisy with bubbling through secretion.—Lay casualty on his side in the three-quarter ($\frac{3}{4}$) prone position, i.e., half-way between side and face-down position. Support him in this position by a pad in front of the chest or draw up the upper knee. Make sure air passages are free from obstruction: make no attempt to arouse the patient. Urgent medical aid is essential.

Lower Jaw.—Warn patient not to speak and instruct him to lean forward. Place palm of your hand against the injured bone and press it gently against the upper jaw. Apply bandage under chin. Carry one end upwards over the top of the head and cross with the other hand above the ear. Carry the other end low down across the front of the forehead and the other end in the opposite direction around the back of the head. Tie off close above other ear.

Collar Bone.—Support the arm of the injured side. Place padding between the upper arm and chest, bandaging the upper arm on the injured side to the side of the chest with broad bandage, leaving forearm free. Support the upper limb on the injured side in a triangular bandage.

Ribs.—Simple fracture.—Apply two broad bandages around the chest, firmly enough to give support above and below the site of the pain. Tie the bandage slightly to the front of the uninjured side. Support the arm on the injured side in a sling.

Ribs.—Complicated fracture.—Do not apply bandages except where there is a sucking chest wound: this must

be covered immediately. Lie patient down with head and shoulders raised and body inclined to the injured side.

Forearm.—Apply well-padded splint to the front and back of forearm. Bandage firmly and support arm in arm-sling.

Upper Arm.—When elbow can be bent without difficulty or increasing pain.—Bend the elbow and lay the injured limb against the chest with fingers just touching opposite shoulder. Pad well between limb and the chest. Fix in position with collar and cuff sling. Apply two broad bandages:—

1. The upper border level with the top of the shoulder.
2. The lower border level with the tip of the elbow.

Tie off both bandages on opposite side of the body.

Upper Arm.—When elbow cannot be bent without difficulty or increasing pain.—Apply well-padded splint to front of the arm and forearm long enough to reach from just below the armpit to below the wrist. Secure with broad bandages one above the fracture, one below and one around the wrist.

Thigh.—This must always be regarded as serious due to the shock which accompanies the fracture. Apply well-padded splint between limbs. Tie feet and ankles together with figure “8” bandage to include the splint. Apply well-padded splint to the outside of the body extending from just below the armpit to the foot. Secure with seven bandages.

Knee Cap.—Lay casualty on back. Support head and shoulders, raise and support injured leg in comfortable position. Apply well-padded splint along back of the limb from buttock to heel, padding well in the natural hollow of the ankle. Secure limb by bandage.

Leg.—Place well-padded splint between the limbs and bring foot as nearly as possible into line without using force. Tie feet and ankles together with a figure “8” bandage and secure with four other bandages from below the thigh to the ankles.

Crushed Foot.—When wound is present.—Carefully remove shoe and sock and treat the wound and apply padded splint to the sole of the foot. Bandage securely.

Crushed Foot.—When wound is not present.—Do not remove shoe. Secure with figure “8” bandage. Raise and support the limb in comfortable position.

GENERAL

Dislocation.—Limbs.—Do not attempt to reduce the dislocation. Obtain medical aid urgently. Steady and support the limb in the most comfortable position.

Dislocation.—Lower Jaw.—Remove any dentures. Support the lower jaw by a bandage tied over the top of the head.

Sprains.—Place limb in the most comfortable position and apply firm bandage. Keep it wet with cold water. In all doubtful cases treat as a fracture.

Rupture.—Hernia.—Lay casualty down. Raise and support head and shoulders; bend the knees and place pillow under them. Do not attempt to reduce swelling but seek medical assistance urgently.

Foreign Body in the Eye.—If foreign body does not appear to be embedded remove it with corner of clean handkerchief, twirled up and moistened with clean water. If foreign body is imbedded do not attempt to remove. Instruct patient to close his eyelids. Apply soft pad of cotton wool and secure with bandage. Seek medical assistance urgently.

Corrosive Acid or Alkaline in the Eye.—Instruct patient to blink his eyelid under water or flush the eye with copious supplies of water. Place soft pad of cotton wool over the eye and keep in position by a lightly applied bandage. Medical aid must be obtained urgently.

Foreign Body in Ear Channel.—If an insect, fill the ear with olive or salad oil or a few drops of surgical spirit. The insect will then float and may be removed. Do not interfere with any other foreign bodies but seek medical assistance.

Foreign Body in Nose.—Instruct patient to breathe through the mouth and not to interfere with the object. Insist that medical assistance is obtained.

Heat Stroke.—Place patient in coolest position possible and remove clothing. Sprinkle with water or wrap in a wet towel or sheet and fan him. Care must be taken not to lower the temperature too far. When temperature is lowered (102°) wrap the patient in a dry sheet and continue to fan. If conscious, give plenty of cool salted water ($\frac{1}{2}$ teaspoon to 1 pint). Keep under observation.

Apoplexy.—(Stroke).—Apply rules for unconscious persons.

Fainting.—When a person feels faint get his head down quickly. If sitting, lower the head between the knees or lay him down with the head lower than the feet. Loosen tight clothing and ensure there is plenty of fresh air.

Bites.—Snake and Venomous Spiders.—Immediately place constrictive bandage on limb between the wound and heart. Incise the wound freely and squeeze out blood. Release the constrictive bandage after 15 minutes and re-apply.

Artificial Respiration.—Every person should make a point of receiving instruction in the latest methods. In cases of asphyxia every moment counts. Never delay one second before applying artificial respiration.

Oral Resuscitation (Mouth-to-Mouth).—Clear mouth of any obstruction to breathing. Quickly place patient on his back with folded coat or other material under his shoulders so that the head falls well back. It is essential to ensure a free passage of air. Kneel alongside of patient's head and keep it in full face-up position. Press down on the forehead with the upper hand so as to tilt the head back as far as possible.

Seal patient's nose by squeezing the nostrils between the fore and middle fingers of the same hand. Take a full breath, open your mouth wide and place the lips over the patient's mouth. In the case of young children, cover

the nose and mouth. Breathe strongly into the patient's lungs sufficiently to see that the chest expands. Lift and turn the head away from the patient's mouth and listen for his breaths coming out. Repeat this process as rapidly as possible for a total of ten breaths; thereafter repeat inflations every three or four seconds, using fairly deep breaths. The breaths should be less strong for a child and still less for a baby. Full instructions in this method together with the Holger Nielsen and Sylvester Methods should be obtained.

POISONS

In all cases of poisoning send for medical aid at once. Keep for examination any poison remaining in bottle or any container which may help to identify the poison and any vomited matter. If patient is unconscious place him in the prone position with head to one side and place on a pillow. If breathing is feeble or unduly slow start artificial respiration at once. When the poison has been swallowed and casualty is conscious make him vomit by tickling the back of throat with a spoon or two fingers. If this fails give him an emetic—two table-spoons of salt to a tumbler of water—preferably lukewarm. **DO NOT INDUCE VOMITING** if patient is unconscious or when the lips and mouth are burnt.

Neutralise the poison by an antidote. **FOR AN ACID**, give chalk or milk of magnesia. **FOR AN ALKALINE**, give plenty of water or, if possible, two table-spoons of vinegar, orange, lemon or lime juice to one pint of water.

Carbolic Acid and Lysol Poisoning.—Do not make casualty vomit. Give two table-spoons Epsom Salts in one pint of water or in a teacup of medicinal paraffin.

Arsenic.—Found in Weedkillers, Rat Poisons, Sheep Dips.—Make the casualty vomit. Give soothing drinks (milk, barley water, raw eggs or flour beaten up with water).

Aspirin.—Make the casualty vomit. Give water in which two teaspoons bicarbonate soda to one pint of water have been added; strong tea or coffee.

Carbon Monoxide.—Gas Stoves or Exhaust Fumes.—apply artificial respiration.

Lead.—In some Paints and Hair Dyes.—Make the casualty vomit. Give one dessertspoon of Epsom Salts with a cup of water.

Phosphorus.—Some Rat Poisons.—Make the casualty vomit. Give copious drinks of water. Never give oils.

Strychnine.—Some Vermin Killers.—Make the casualty vomit unless spasms have begun. Keep very quiet. If breathing stops apply artificial respiration.

Kerosene, Petrol, Turpentine.—Do not cause vomiting. Give milk.

The above are brief notes only on First Aid. It is strongly recommended that classes in First Aid and Home Nursing be attended so as to give members of a household a thorough knowledge of how to render First Aid in case of accident and the care of sick persons in the home. Branches of The St. John Ambulance Association are in existence at Ambulance Stations in all country towns. Enquiries are welcomed by the Head Office of the Association, 21 Macquarie Place, Sydney.

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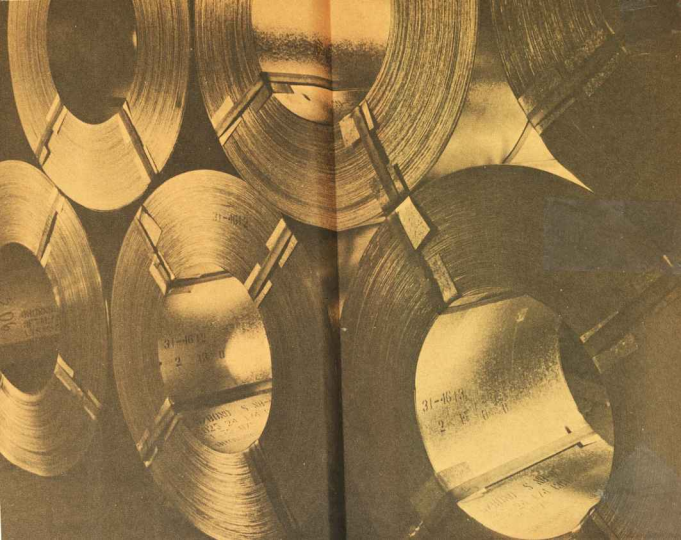
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