COPPER ALLOY DATA

Sheets, Plates, Strips, Circles, Bars, Tubes, Wire

102-OF Oxygen Free Copper	The removal of oxygen without the addition of phosphorous gives oxygen-free copper very high electrical conductivity (100.5-102.2% IACS). This also allows immunity to hydrogen embrittlement and provides excellent weldability and brazing characteristics. The combination of electrical conductivity and weldability is highly beneficial with customers using automated high-speed manufacturing processes, such as in the cable industry.
101-OFE Electrical Grade Oxygen Free Copper	101-OFE oxygen-free copper is a very high purity grade that is imperative in demanding electrical applications. Stringent testing standards ensure low levels of impurities (less that .004% total) and therefore greater electrical conductivity (minimum 101.5% IACS). The electronics industry requires glass copper seals and ceramic copper bonds, thus 101-OFE contains less than 0.0003% phosphorus to ensure an adherent oxide film on the copper surface.
110 High Conductive Copper (ETP Copper)	This metal contains sufficient oxygen to induce good ductility, combined with the highest conductivity (98-100% I.A.C.S) for electrical applications such as busbars and other electrical conductors and components. They also have excellent corrosion resistance to weathering in various building applications, and have excellence resistance to most chemicals.
122 Deoxidised Copper (DHP Copper)	Deoxidised Coppers are those to which deoxidants such as phosphorus have been added to remove the oxygen. The higher the phosphorus residual, the more effective is the deoxidisation but lower the conductivity. Phosphorus deoxidised Coppers have lower electrical (85% I.A.C.S) and thermal conductivities due to residual traces of deoxidant, but have excellent ductility, hot and cold, and are readily joined by brazing and welding. The standard phosphorus deoxidised Copper has a high residual phosphorus and is required to pass a hydrogen embrittlement test.
147 Free Machining Copper	Sulphur bearing Coppers are free machining coppers. The addition of small amounts of sulphur improves the machinability to 85% of free machining brass whilst still retaining a high electric conductivity which is only reduced to 85-95% of I.A.C.S. Free machining coppers are used for welding torch nozzles and machined electrical components, or to replace brass where improved corrosion resistance may be required in a machined component.
J47Z Zirconium Chromium Copper	A small addition of Zirconium to a basic chrome copper makes this alloy particularly suitable for spot and seam welding of plated metals such as tin plate, terne plate, zinc or lead coated steels or aluminium. This alloy has a high electrical and thermal conductivity and has a great resistance to softening, retaining its hardness up to 500oC.
U50 Beryllium Nickel Copper	This alloy has 1.75% Nickel and 0.4% Beryllium which gives it a combination of strength with good electrical conductivity, high hardness and excellent wear resistance. A RWMA Class III alloy, it is suitable for welding high resistance materials such as stainless steel, heat resisting alloys and monel metal. Main applications are seamless welding wheels, dies for flash-butt, butt and projection welding, and seam welder wheel spindles.
U77 Beryllium Cobalt Copper	This alloy conforms to RWMA Class IV specification and has been developed for extremely high hardness, strength and abrasive qualities. With 2% Beryllium and .25% Cobalt, it is particularly suitable in the plastics field for dies, nozzles and inserts for pressure carrying casting or projection moulding of plastic materials. This alloy is also ideally suited for current carrying collets, chucks, bearings, shafts and structural members requiring high strength properties. Also used for special flash butt welding jaws or projection welding dies where mechanical properties are required, but where current density and heat are not excessive.
V14 Tungsten Copper	This alloy is not really a copper alloy as it contains 25% Copper and 75% Tungsten, but is included in the above group because of similar end uses. This alloy is manufactured by the powder metallurgy process and is generally not suitable for spot welding electrodes. A RWMR Class II specification, it has been developed for use as projection welding die inserts and also used as electrodes on spark erosion machines. As it is relatively brittle, die inserts are usually braised into U50 or J47 alloy backings.

Oxygen-Free Copper is also available in silver bearing grades.

Other alloys are available, for example: Cadmium Copper, Silver bearing Copper, Copper-tin alloys, Copper-Nickel alloys, Copper-Zinc Alloys.

For further information on any of the above listed items, please contact your nearest Mico Metals branch office.

COPPER ALLOY DATA

Usual Form Available

	102-OF	110	122	147	J47Z	U50	U77	V14
Sheet	✦	✦	●					
Plate	✦	✦	✦					
Strips	✦	✦	●					
Coils		✦						
Bars/ Rods		●		●	●	●	●	●
Wire			●					
Tubes		✦	●					

● Available in Stock ✦ Available on Indent only

Nearest Relative Specifications

British BS number	C103	C101	C106	C111	RWMA Class 2	RWMA Class 3	RWMA Class 4	Elkonite 20W3
Australian AS		110	122A	147				
German DIN	2.0040	2.0065	2.009	17666-CUSP	17666-2-1293	17666-2-2.0850	CuBe2	
American ASTM	C10200 OF	C11000	122 (DHP)	C14700	C18150	C17510	C17200	
						ASTM-B-441	ASTM-B-196	
							ASTM-B-251	
							ASTM-B-643	

Nearest Relative Specifications are not necessarily identical

Chemical Composition (percentage figures only)

Copper	99.99	99.975	99.975	99.55	99.5	97.85	97.75	25.0
Oxygen	trace	0.025						
Phosphorus			0.025	Trace				
Sulphur	trace			0.45				
Chromium					0.5			
Zirconium					Trace			
Beryllium						0.4	2.0	
Nickel						1.75		
Cobalt							0.25	
Tungsten								75.0
Potassium	trace							

MECHANICAL PROPERTIES

Fabrication Properties

Machinability %	20	20	20	85	80			
Riveting/ Peening	Not Recom.	Excellent	Excellent	Fair	Good/Fair	Fair	Not Recom.	Not Recom.
Thread Rolling	Not Recom.	Excellent	Excellent	Fair	Fair	Fair	Fair	Fair
Bending	Excellent	Excellent	Excellent	Fair/Good	Excellent	Excellent/Fair	Fair	Not Recom.
Hot Forging (875°C)	Not Recom.	Good	Good	Good	Not Recom.	Not Recom.	Not Recom.	Not Recom.
Electrical Conductivity (IACS %)	100-102	98-100	80	85-100	80-85	48-60	23	27-31

Heat Treatment

Annealing Temp °C	470	470	630	960	920	785		
Stress Relieving Temp	175	225	250					

Joining

Welding Coated Metal Arc	Good	Not Recom.	Not Recom.	Not Recom.	Not Recom.	Fair	Fair	Not Recom.
Welding Gas Shielded Arc	Excellent	Fair	Excellent	Fair	Good	Good	Good	Not Recom.
Soldering Soft	Excellent	Excellent	Excellent	Good/Excell.	Good	Good	Good	Good
Soldering Silver	Excellent	Good	Good/Excell.	Good/Excell.	Good	Good	Good	Good

For alloy and mechanical properties for electronic and silver bearing grades of oxygen-free copper, contact your Mico Metals team.
All properties are theoretical, and may vary in practice.

Products listed in this catalogue represent our standard range only. For information on other Brass and Copper products please contact your nearest Mico Metals Team - You'll find their address at the back of this catalogue.

MECHANICAL PROPERTIES

102-OF

	Soft	Half Hard	Hard
Tensile Strength MPA (sheet/strip)	220-250	240-290	280-330
0.2% Proof stress (sheet/strip)	40-120	120-250	250-310
Elongation % (sheet/strip)	25-60	5-40	5-30
Hardness (sheet/strip)	40-65	60-95	90-105

110 / 122

	Annealed	Soft	Quarter Hard	Half Hard	Hard	Drawn Half Hard <13mm	Drawn Half Hard 13-50mm	Drawn Half Hard >50mm
Ultimate Tensile MPA (Sheet/Plate/Strip/Coil)		220	248	280				
Ultimate Tensile MPA (Bars/ Rods)						310	280	250
Ultimate Tensile MPA (Tubes)	205-234			250-325	310-380			
0.2% Proof Stress (Sheet/Plate/Strip/Coil)		69						
0.2% Proof Stress (Bars/ Rods)						265	200	135
0.2% Proof Stress (Tubes)	62-70			205-220	275-345			
Elongation % (Sheet/Plate/Strip/Coil)		50	40	40				
Elongation % (Bars/ Rods)						25	33	40
Elongation % (Tubes)	40-55			15-40	5-10			
Hardness VPN (Sheet/Plate/Strip/Coil)		50	65-75	75-90				
Hardness VPN (Bars/Rod)						110	95	80
Hardness VPN (Tubes)	55-70			75-100	100-125			

147

	Drawn Half Hard <13mm	Drawn Half Hard 13-50mm	Drawn Half Hard >50mm
Ultimate Tensile MPA (Bars/ Rod)	340	310	260
0.2% Proof Stress (Bars/ Rods)	300	230	175
Elongation % (Bars/ Rods)	15	22	30
Hardness VPN (Bars/Rod)	115	100	85

J47Z/U50/U77

	J47Z			U50			U77	
	Drawn	Forged	Castings	Drawn	Forged	Extruced	Drawn	Forged
Ultimate Tensile MPA (Bars/ Rod)	463-540	339-432	620		689	1172		
0.2% Proof Stress (Bars/ Rods)	400			680			1108	
Elongation % (Bars/ Rods)	20-30	20-30	10		20			
Hardness VPN (Bars/Rod)	135-160	110-135			95-102			36

For alloy and mechanical properties for electronic and silver bearing grades of oxygen-free copper, contact your Mico Metals team.
All properties are theoretical, and may vary in practice.

CORROSION RESISTANCE

Copper and copper alloys offer excellent resistance to corrosion in a wide variety of environments. Apart from silver, copper is the only metal produced in commercial quantities which is below hydrogen in the galvanic series of elements, meaning that copper is noble to most other metals and less inclined to react. It is resistant to non-oxidising acids and salts, seawater and fresh water, hot or cold atmospheric corrosion and a wide variety of organic materials. Copper is not resistant to oxidising acids, oxidising heavy metal salts, ammonia and cyanides, complex ions and high velocity aerated waters.

Copper alloys retain much of the inherent corrosion resistance of copper itself. Many also form insoluble corrosion product films on the surface of the material which improve resistance to specific types of corrosion such as dezincification and impingement.

Under certain conditions the following types of corrosion may occur;

General or Uniform Thinning

General or uniform thinning is an electro-chemical process in which uniform corrosion takes place over the exposed metal surfaces with little or no pitting. This type of attack is usually caused by acids or chemical compounds.

Pitting

Pitting corrosion is a localised accelerated attack resulting in the formation of cavities around which the metal is relatively unattacked. It is due to the formation of an oxygen concentration cell in which a potential difference is set up between the metal in contact with oxygen (cathode) and the metal excluded from oxygen (anode). It is also commonly known as differential aeration. Pitting corrosion usually occurs when deposits such as decomposed wood, paper, cloth, corrosion products or gas bubbles lodge on the surface of the metal.

It should be noted that copper and its alloys are highly resistant to differential aeration.

Deposit Attack

A form of pitting corrosion that occurs underneath deposits which may be corrosive products or foreign matter.

CORROSION RATINGS FOR COPPER

1	**Excellent.** The metal should be suitable under most conditions of use.
2	**Good.** The metal offers good corrosion resistance. It may be considered in place of a metal with a '1' rating when properties other than corrosion resistance governs its use.
3	**Fair.** The metal offers fair corrosion resistance.
4	**Not to be used.** The metal is not suitable.

The accompanying charts give relative corrosion-resistance ratings for copper. These ratings are based on consideration of laboratory test data, service experience and a general knowledge of corrosion resistance properties; however, it must be fully recognised that the ratings are relative only, and definite unqualified recommendations of corrosion resistance cannot be made.

When interpreting the data, it should be remembered that corrosion resistance or rate of corrosion is greatly affected by conditions of exposure such as presence of oxidising agents, velocity of solution, aeration, temperature and similar factors.

In general, the information in the tables refers to non-oxidising conditions, low velocities (below 1.2 meters per second) and ambient temperatures.

Corrosive Media	Ratings
Acetic Acid	2
Acetic Anhydride	2
Acetone	1
Acetylene	4
Alcohols	1
Alum	2
Alumina	1
Aluminium Chloride	2
Aluminium Hydroxide	1
Aluminium Sulphate	2
Ammonia, absolutely dry	1
Ammonia, Moist	4
Ammonium Hydroxide	4
Ammonium Chloride	4
Ammonium Nitrate	4
Ammonium Sulphate	3
Amyl Acetate	1
Amyl Alcohol	1
Aniline	3
Aniline Dyes	3
Asphalt	1
Atmosphere, Industrial	1
Atmosphere, Marine	1
Atmosphere, Rural	1
Barium Carbonate	1
Barium Chloride	2
Barium Hydroxide	1
Barium Sulphate	1
Barium Sulphide	3
Beer	1
Beet Sugar Syrups	1
Benzine	1
Benzoic Acid	1
Benzol	1
Black liquor, Sulphate Proc.	3

Corrosive Media	Ratings
Bleaching Powder, Wet	2
Borax	1
Bordeaux Mixture	1
Boric Acid	1
Brines	2
Bromine, Dry	1
Bromine, Moist	2
Butane	1
Butyl Alcohol	1
Butyric Acid	2
Cane Sugar Syrups	1
Carbolic Acid	2
Carbon Dioxide, Dry	1
Carbon Dioxide, Moist	2
Carbonated Water	2
Carbonated Beverages	2
Carbon Disulphide	2
Carbon Tetrachloride, Dry	1
Carbon Tetrachloride, Moist	2
Calcium Bisulphite	2
Calcium Chloride	2
Calcium Hydroxide	1
Calcium Hypochlorite	2
Castor Oil	1
Chlorine, Dry	1
Chlorine, Moist	3
Chloracetic Acid	2
Chloroform, Dry	1
Chromic Acid	4
Cider	1
Citric Acid	1
Coffee	1
Copper Chloride	3
Copper Nitrate	3
Copper Sulphate	2
Corn Oil	1
Cottonseed Oil	1
Creosote	1
Crude Oil	2
Ethers	1
Ethyl Acetate	1
Ethyl Alcohol	1
Ethyl Chloride	2
Ethylene Glycol	1
Ferric Chloride	4
Ferric Sulphate	4
Ferrous Chloride	2
Ferrous Sulphate	2
Formaldehyde	1
Formic Acid	2

Corrosive Media	Ratings
Freon	1
Fruit Juices	2
Fuel Oil	1
Furfural	1
Gasoline	1
Gelatine	1
Glucose	1
Glue	1
Glycerine	1
Hydrobromic Acid	3
Hydrocarbons, Pure	1
Hydrochloric Acid	3
Hydrocyanic Acid	4
Hydrofluoric Acid	3
Hydrofluosilicic Acid	2
Hydrogen	1
Hydrogen Peroxide	2
Hydrogen Suphide, Dry	1
Hydrogen Sulphide, Moist	4
Kerosene	1
Lacquers	1
Lacquer solvents	1
Lactic Acid	2
Lime	1
Lime-Sulphur	3
Linseed Oil	2
Magnesium Chloride	2
Magnesium Hydroxide	1
Magnesium Sulphate	1
Mercury	4
Mercury Salts	4
Methyl Alcohol	1
Methyl Chloride, Dry	1
Milk	1
Mine water	3
Natural Gas	1
Nitric Acid	4
Nitrogen	1
Oleic Acid	2
Oxalic Acid	2
Oxygen	1
Palmitic Acid	2
Paraffin	1
Phosphoric Acid	2
Potassium Carbonate	1
Potassium Chloride	2
Potassium Chromate	1
Potassium Cyanide	4
Potassium Dichromate, Acid	4
Potassium Dichromate, Acid	4

Corrosive Media	Ratings
Potassium Hydroxide	2
Potassium Sulphate	1
Propane	1
Rosin	1
Sea Water	2
Sewage	1
Silver Salts	4
Soap Solutions	1
Sodium Bicarbonate	2
Sodium Bisulphate	2
Sodium Bisulphite	2
Sodium Carbonate	1
Sodium Chloride	2
Sodium Chromate	1
Sodium Cyanide	4
Sodium Dichromate, Acid	4
Sodium Hydroxide	2
Sodium Hypochlorite	3
Sodium Nitrate	2
Sodium Peroxide	3
Sodium Phosphate	1
Sodium Silicate	1
Sodium Sulphate	1
Sodium Sulphide	3
Sodium Sulphite	2
Sodium Thiosulphate	3
Steam	1
Stearic Acid	2
Sugar Solutions	1
Sulphur, Dry	2
Sulphur, Molten	4
Sulphur Chloride, Dry	1
Sulphur Dioxide, Dry	1
Sulphur Dioxide, Moist	2
Sulphur Trioxide, Dry	1
Sulphuric Acid	2
Sulphurous Acid	2
Tannic Acid	1
Tar	1
Tartaric Acid	1
Toluene	1
Trichloroacetic Acid	2
Trichlorethylene, Dry	1
Trichlorethylene, Moist	2
Turpentine	1
Varnish	1
Water, Potable	1
Zinc Chloride	3
Zinc Sulphate	2

NEW ZEALAND COPPER TUBE SPECIFICATIONS

3501:1976

Table 1

Copper Tubes For Water and Gas

Nominal bore* mm (inch)	Outside Diameter Max mm	Outside Diameter Min mm	Thickness mm	Hydrostatic Test Pressure Mpa	Max Working Pressures ^^ Annealed Coil MPa F=46	Max Working Pressures ^^ Half-Hard MPa F=60	Max Working Pressures ^^ As Drawn MPa F=70
15 (1/2)	14.73	14.65	1.02	5.55	6.85	8.95	-
20 (3/4)	21.08	21.00	1.02	3.90	4.70	6.10	-
25 (1)	27.43	27.35	1.02	2.95	-	4.65	-
32 (1 1/4)	34.19	34.11	1.22	2.85	-	4.45	-
40 (1 1/2)	40.54	40.46	1.22	2.40	-	3.70	-
50 (2)	53.24	53.16	1.22	1.50	-	2.80	-
65 (2 1/2)	65.94	65.79	1.22	1.52	-	-	2.65
80 (3)	79.45	79.30	1.63	1.65	-	-	2.95
90 (3 1/2)	92.15	92.41	1.83	1.60	-	-	2.80
100 (4)	105.66	105.51	2.03	1.55	-	-	2.75

Table 2

Copper Tubes For Sanitation

25 (1)	27.43	27.35	1.02	2.95	-	4.65	-
32 (1 1/4)	34.19	34.11	1.22	2.85	-	4.45	-
40 (1 1/2)	40.54	40.46	1.22	2.40	-	3.75	-
50 (2)	53.24	53.16	1.22	1.85	-	2.80	-
65 (2 1/2)	65.94	65.79	1.22	1.50	-	-	2.65
80 (3)	79.04	78.89	1.42	1.45	-	-	2.55
90 (3 1/2)	92.15	92.00	1.63	1.40	-	-	2.50
100 (4)	104.85	104.70	1.63	1.25	-	-	2.20
125 (5)	130.25	130.00	1.63	1.00	-	-	1.80
150 (6)	156.06	155.76	1.83	0.95	-	-	1.65
200 (8)	194.50	194.25	3.00	1.25	-	-	2.20

Table 3

Light Gauge Copper Tubes for Water and Gas

15 (1/2)	14.73	14.65	0.70	3.80	-	6.00	-
20 (3/4)	21.08	21.00	0.90	3.40	-	5.35	-

* The figures in brackets are the previous imperial inch dimensions

^^ Maximum working pressure at temperatures up to 65°C, from the following formula:

$$P = \frac{2Ft}{D-2}$$

WHERE: P = PRESSURE (MPa); F = ALLOWABLE STRESS FACTOR (MPa); t = THICKNESS (mm); D = OUTSIDE DIAMETER

Stock available on Indent only (minimum 1000kg)

All data is theoretical and may vary in practice

COPPER TUBE SPECIFICATIONS - AS/NZ 1571

REFRIGERATION GRADE COPPER TUBES - FOR AIR CONDITIONING AND REFRIGERATION

Annealed Coil

Size (mm)	Wall Thickness	Nominal Kg/m 50-75°C	Safe Working Pressure (Kpa)			
			SD=33.9 100-125°C	SD=32.7 150-175°C	SD=28.0 175-200°C	SD=21.9
4.8	0.71	0.081	10400	10400	8600	6700
6.4	0.71	0.113	7520	7250	6200	4850
7.9	0.71	0.144	5965	5750	4920	3850
9.5	0.71	0.176	4890	4700	4030	3150
12.7	0.71	0.239	3590	3460	2965	2320
15.9	0.91	0.383	3680	3550	3040	2380
19.1	0.91	0.464	3035	2930	2500	1960

Straight Lengths

Size (mm)	Wall Thickness	Nominal Kg/m 50-75°C	Safe Working Pressure (Kpa)			
			SD=33.9 100-125°C	SD=32.7 150-175°C	SD=28.0 175-200°C	SD=21.9
9.5	0.91	0.221	6395	6170	5280	1430
12.7	0.91	0.302	4670	4500	3860	3020
15.9	0.91	0.383	3680	3550	3040	2380
19.1	0.91	0.464	3035	2930	2500	1960
22.2	1.22	0.721	3525	3400	2900	2280
28.58	1.22	0.938	2700	2600	2235	1750
34.92	1.22	1.156	2200	2125	1820	1420
41.28	1.22	1.373	1850	1785	1530	1195
53.98	1.63	2.398	1890	1825	1560	1220
66.68	1.63	2.981	1520	1470	1260	985
79.38	-	-	-	-	-	-

SD = Maximum allowable design stress for annealed Copper in Mega Pascals

COPPER TUBE SPECIFICATIONS - ASTM B280

SEAMLESS COPPER TUBE FOR AIR CONDITIONING AND REFRIGERATION FIELD SERVICE

Standard Size (mm)	Outside Diameter (mm)	Wall Thickness (mm)	Weight (kg/m)	Nominal Weight (15m)	Safe working internal pressures (Kpa)
4.76	4.76	0.76	0.09	1.28	11650
6.35	6.35	0.76	0.12	1.80	8480
7.94	7.92	0.81	0.16	2.43	7170
9.53	9.52	0.81	0.20	2.98	5930
12.70	12.70	0.81	0.27	4.07	4344
15.88	15.90	0.89	0.37	5.62	3723
19.05	19.10	0.89	0.45	6.81	3034
19.05	19.10	1.07	0.54	8.09	3690
22.23	22.20	1.14	0.68	10.16	3450
28.58	28.60	1.27	0.98	14.62	3965
34.93	34.90	1.40	1.32	19.75	2690

All data is theoretical and may vary in practice

COPPER IN ROOFING

Copper is a premium roofing material that conveys a distinguished look that is associated with longevity and value. Copper is easy to work by bending or deep drawing, and research indicates that it may theoretically last for 1000 years. The patina effect naturally protects the copper while looking good.

Natural Copper

The value of a building can be made more distinctive through the use of natural copper. The oxidation process changes the tones from pale brown to dark brown after a few years, and eventually developing into a green patina. Sea air, rain water, sunlight and fumes all effect the rate of oxidation and the final tint, with individual environments creating different shades. The end result is a roof that has unique characteristics that people will associate with long life and natural good looks.

Nordic Green and Nordic Brown Copper

Many architects believe that the weathered result is so desirable that suppliers have accelerated the effect and introduced two new 'Pre-Patinated' products. Nordic Green and Nordic Brown give the pre-weathered appearance of a roof, without having to wait years for the process to occur naturally. These styles also have advantages in regards to repairing and extending surfaces where patina has already formed. Pre-patinated roofs give the exceptional look of weathered copper straight from the supplier.

Nordic Décor Copper

Nordic Décor is distinguishable due to its textured surface on one side of the sheet. Nordic Décor can offer an interesting alternative in both general architecture and interior design. Nordic Décor is available in both light-rolled product and a heavy rolled product, the heavy rolled product is generally stiffer due to the heavier rolling force used in manufacture. Nordic Décor is available in natural copper and in Nordic Brown.

	Thickness	Width	Vicker's Hardness	Texture Depth
Natural Copper	0.5 – 0.7 mm	Up to 1000mm	HV 75 – 90	-
Nordic Brown/ Nordic Green	0.2 – 1.6 mm	Up to 1000mm	HV 65 – 95	-
Nordic Décor 1 (light)	0.5 - 1.5mm	Up to 1000mm	HV 70 – 100	0.05 – 0.23 mm
Nordic Décor 2 (heavy)	0.5 - 0.7mm	Up to 1000mm	HV 90 - 110	0.05 – 0.25 mm

Copper has a co-efficient of thermal expansion of 17°C x 10^{-6}, and a modulus of elasticity of 117,000 MPa.

COPPER DENSITY TABLE

Rolled Product

Plate/Sheet/Coil	Multiply length (m) x width (m) x thickness (mm) by	8.94

Extrusion

Round	Multiply d^2 (mm) by	0.00702
Hexagon	Multiply AF^2 (mm) by	0.00774
Octagon	Multiply AF^2 (mm) by	0.00741
Square	Multiply AF^2 (mm) by	0.00894
Flat	Multiply width x thickness (mm) by	0.00894

Tube

Tube	Outside diameter - wall thickness x wall thickness (mm) by	0.0281

All weights are theoretical and may vary in practice.
Specifications are not intended for design purposes.