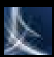
UNIVERSAL CABLE (M) BERHAD
(Co. No. : 7042-D)



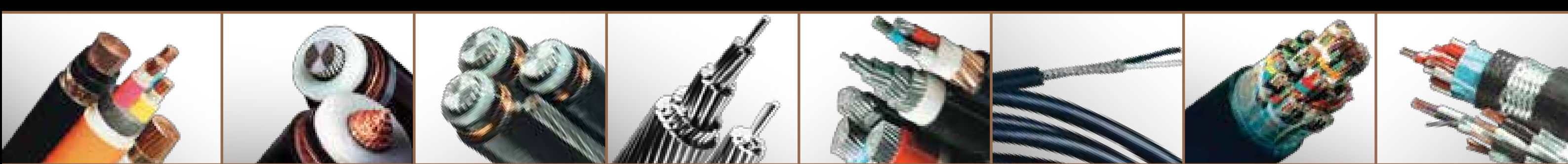






THE UNIVERSAL CHOICE

ALUMINUM RODS BARE CONDUCTORS AND CABLES



A Member of **SARAWAK CABLE BERHAD GROUP**

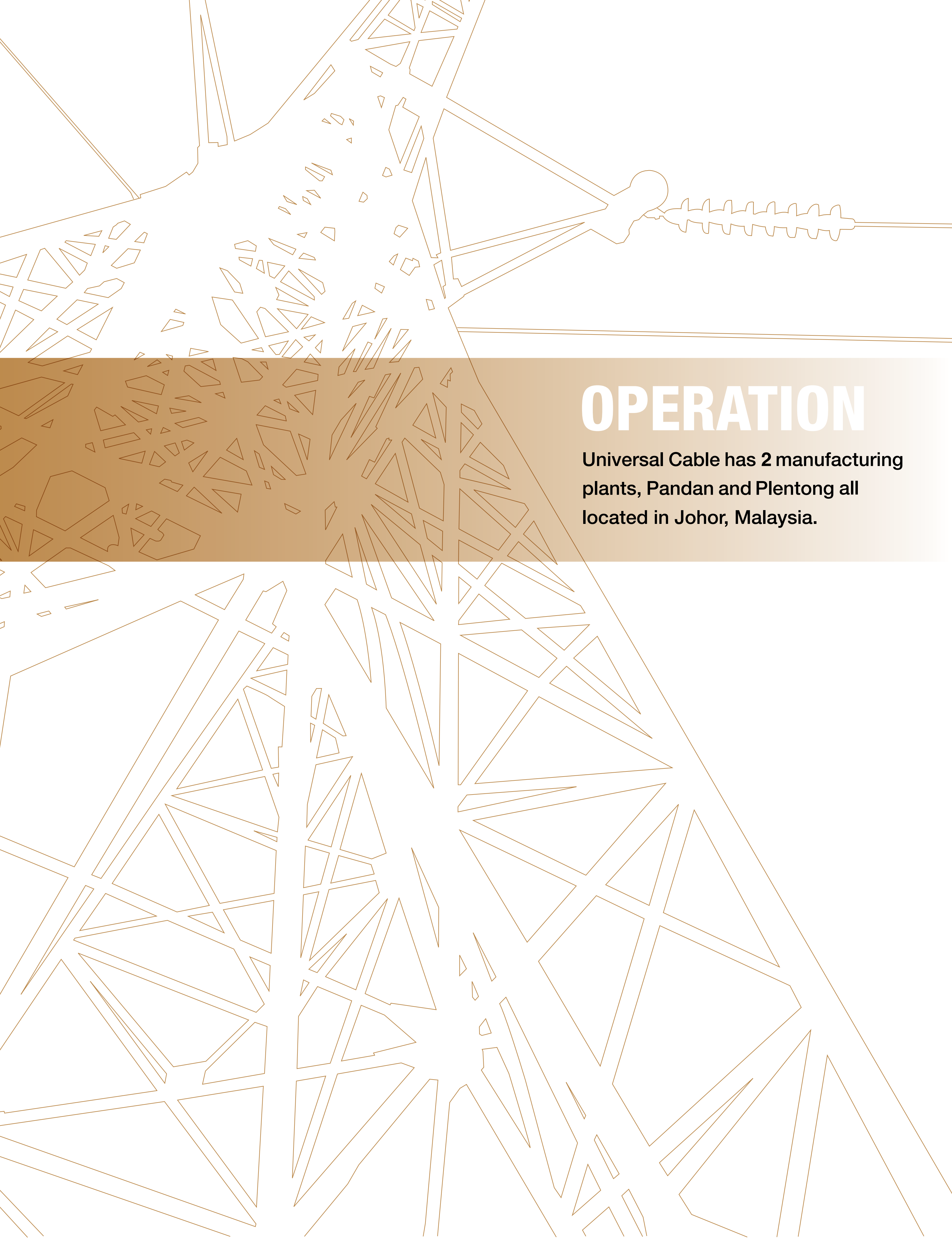
INTRODUCTION

History

Universal Cable (M) Berhad was established in March 1967. Phenomenal growth and success over the years has enabled Universal Cable to achieve the formidable status as the largest cable manufacturer in Malaysia and most trusted cable and wire manufacturer in the region.

Universal Cable Today

Universal Cable today has a broad manufacturing portfolio of cable and wire products, which includes advanced power and control cables, instrumentation cables, aluminium conductors and cables, cables for the oil & gas industry and various types of specialty cables such as welding cables and automotive cables.



OPERATION

Universal Cable has **2** manufacturing plants, Pandan and Plentong all located in Johor, Malaysia.

Pandan

Our Pandan plant commenced its manufacturing operation in the 1970s. Since then, Pandan has broaden its range of products to include:

- Low voltage power and control cables
- Offshore, marine and shipboard cables
- Fire resistant and flame retardant cables
- Instrumentation cables and
- Specialty cables
- Aluminium conductors
- Aluminium power cables
- Aerial bundle cables (ABC)

Plentong

The Plentong plant was set up in the early 90s and started producing Medium Voltage and High Voltage cables in 1995. Universal Cable Plentong has the ability and technology to manufacture Medium Voltage and High Voltage cables up to 275kV. Universal Cable is the first and only cable manufacturer in Malaysia with the ability and technology to manufacture up to 275kV power cables.

With this capability, Universal Cable produces products that are highly demanded by the electricity authorities locally and internationally.

QUALITY ASSURANCE & CERTIFICATIONS

CESI Centro Elettrotecnico Sperimentale Italiano,Italy
ABS Founded 1862 A Division of American Bureau (of Shipping)
KEMA Netherlands
PSB TEST
SIRIM QAS International, Malaysia
Underwriters Laboratories Inc.
BUREAU VERITAS

Over the years, Universal Cable has been bestowed with many certifications and awards from the most stringent local and international accreditation authorities.

Universal Cable has spared no efforts in maintaining and constantly upgrading its sophisticated product Research & Development capabilities. We have made remarkable headway through our constant investments in new state-of-the-art machinery that incorporate the latest technologies. In addition, our testing equipments represent the most stringent standards applied in the manufacture of our extensive range of cables.

Universal Cable's unrelenting pursuit for impeccable product quality and functional enhancements, and improvements strongly reaffirms our total dedication and devotion to our product Research & Development strengths and achievements.

Our stringent emphasis on total quality control and exhaustive testing at all stages of cable production further enhance the demanding standards that are exacted on our cable products. Universal Cable products are renowned for maximum operating efficiency under the most severe operating environments.

Our extensive and in-depth commitment to Total Customer Satisfaction, gained us both local and international recognitions and certifications. The quality management system MS ISO 9001:2015 certification and the type tests by KEMA from Netherlands, CESI from Italy, ABS from the United States, LR from United Kingdom, PSB from Singapore and SIRIM from Malaysia are testaments to our total commitment in product quality and manufacturing excellence. The ISO 45001:2018 (OHSAS 18001:2007) Management Systems and our pursuance of ISO 14001:2015 in Environmental Management System demonstrates our pledge towards a safe & healthy workplace, practices and legislative compliances.

AWARDS & ACCOLADES

Superbrands is a registered trademark
"thebrandlaureate" The Grammy Awards for Branding
Universal Cable is a BrandLaureate
FROST & SULLIVAN MALAYSIA MANUFACTURING EXCELLENCE AWARDS 2008
MS ISO 9001:2000 REG NO. AR 0772 SIRIM QAS International, Malaysia
OHSAS 18001:1999 CERT. NO: U00350001 SIRIM QAS International, Malaysia
MATRADE Ministry of International Trade and Industry "Export Excellence (Merchandise) Awards" (2005) Merit Certification status

In 2005 & 2006, the Malaysia International Trade and industry (MITI) recognized our efforts by way of Export Excellence Merit status. In 2007, we were honored with the prestigious Export Excellence Award (Merchandise) from the MITI.

We are the first cable manufacturer in Malaysia to receive both the prestigious Business Superbrands Malaysia in 2006 and the coveted BrandLaureate Award for 7 consecutive terms of 2006/2007, 2007/2008, 2008/2009, 2009/2010, 2010/2011, 2011/2012 & 2012/2013 for the Best Brands in Asiz Pacific. Pioneering the industry, our commitment towards manufacturing excellence has also been recognized by receiving the coveted Frost & Sullivan Malaysia Manufacturing Excellence Award (Gold-Engineering Category) in 2008. In 2009, we were awarded the Brand Excellence Award (certificate) by MITI.

Our vision is to be the dominant world-class cable manufacturer in ASEAN. Our mission is to manufacture cables for electricity supply and information & communication technology to meet the needs of the public. We uphold our universal values to ensure total customer satisfaction, strive for continuous growth and create value for our shareholders.

INTERNATIONAL MARKET

Our remarkable achievement in transcending local market boundaries into the international arena is witnessed by the global partners with which Universal Cable have developed strong affiliations.

Our list of international destinations grows from Australia, Fiji Islands, New Zealand, Brunei, China, India, Indonesia, Japan, Maldives, Nepal, Pakistan, South Korea, Sri Lamka, Philippines, Singapore, Vietnam, Cambodia, Oman, Jordan, Sudan, UAE, Djibouti, Yemen, Bahrain, Saudi Arabia, Mauritius, South Africa, Myanmar, Papua New Guinea, Hong Kong, Brazil, Germany, Bangladesh, which demonstrates the wide reach of our cable products.

Today, the brand name Universal Cable has become synonymous with product excellence and gained worldwide recognition for its premium quality.

ALUMINIUM RODS BARE CONDUCTORS AND CABLES

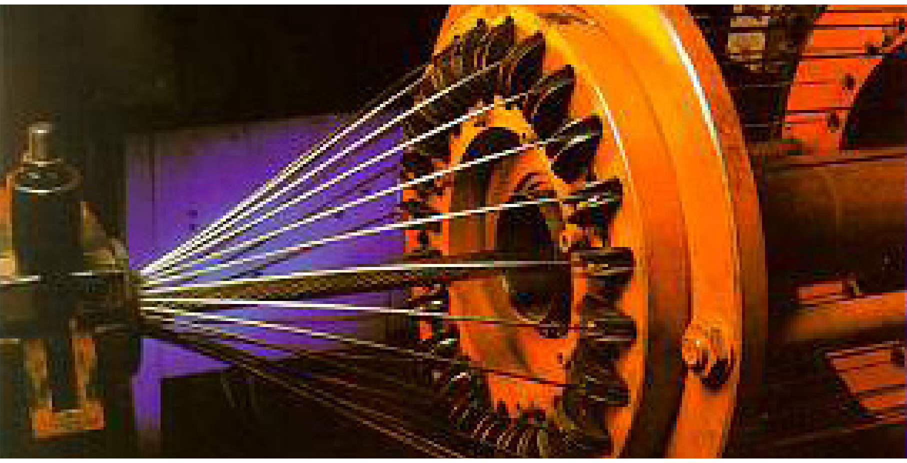
CONTENTS

ALUMINIUM & ALUMINIUM ALLOY CONDUCTORS

Aluminium & aluminium alloy conductors are the preferred and dominant conductors in several areas of power transmission and distribution. The major areas dominated by aluminium and aluminium alloy conductors are non-insulated overhead power transmission, insulated overhead power transmission and non overhead power distribution.

This dominance is due to the excellent overall properties of aluminium and aluminium alloy conductors. Aluminium and aluminium alloy conductors offer good conductivity, light weight, excellent resistance to corrosion, good bending properties, greater tensile strength than copper and excellent compatibility with most common insulation used by the wire and cable industry.

These conductors now command a significant share of the insulated, interior wire market particularly in the larger dimensions (i.e. heavy current installations) where weight and ease of handling are important factors.



This trend is due to their excellent overall properties. Principally these are listed as :

1. **Conductivity**
   In excess of twice that of copper by unit weight.

2. **Strength**
   A range of strengths from dead soft to that of mild steel, depending on the required temperature of aluminium alloy.

3. **Workability**
   Permitting a wide range of processing from wire drawing to stranding. This offers excellent bend quality.

4. **Light Weight**
   Ease of handling, low installation costs, longer spans and more distance between pull-ins.

5. **Corrosion resistance**
   Most industrial, marine and chemical atmospheres cause corrosion.
   In addition, the corrosion resistance of all alloys can be further improved by anodizing.

6. **Compatibility with insulation**
   Does not adhere to or combine with usual insulating materials. No tin-coating required : clean stripping.

Aluminium and aluminium alloy electrical conductors are made by various processes from wire-drawing (i.e. rod breakdown to fine wire) to wire stranding from a large diameter of redraw aluminium and aluminium alloy rods.

These rods fabricated by melting the aluminium ingots (from smelter), plus required alloying materials, in an alloying furnace and rolled in a “rod-mill”. Subsequent operations may vary according to the end-products desired such as additional processes of annealing and heat-treating.

Our EC grade aluminium rods and aluminium alloy rods are widely used in the production of overhead power transmission and distribution cables where the characteristics of aluminium are of importance.

With strong and consistent emphasis on quality, Universal Cable continues to strive for improvement in the production of our aluminium and aluminium alloy rods to better meet customer requirements and expectations.

CHEMICAL COMPOSITION

Element		Composition (%)				
		1350	1370	1120	6101	6201
Silicon	Max.	0.10	0.10	0.10	0.4 ~ 0.7	0.5 ~ 0.9
Iron	Max.	0.40	0.25	0.40	0.50	0.50
Copper	Max.	0.05	0.02	0.05 ~ 0.35	0.10	0.10
Manganese	Max.	0.01	0.01	0.01	0.03	0.03
Magnesium	Max.	-	0.02	0.20	0.4 ~ 0.7	0.6 ~ 0.9
Chromium	Max.	0.01	0.01	0.01	0.03	0.03
Zinc	Max.	0.05	0.04	0.05	0.10	0.10
Boron	Max.	0.05	0.02	0.05	0.06	0.06
Gallium	Max.	0.03	0.03	0.03	-	-
Vanadium & Titanium, total	Max.	0.02	0.02	0.02	-	-
Other elements, each	Max.	0.03	0.02	0.03	0.03	0.03
Other elements, total	Max.	0.10	0.10	0.10	0.10	0.10
Aluminium	Min.	99.50	99.70	99.20	Remainder	Remainder

MECHANICAL AND ELECTRICAL PROPERTIES

Designation	Tensile strength		Conductivity at 20°C	Volume resistivity at 20 °C
	Kgf/mm²	MPa	% IACS	Ohm.mm²/m
Aluminium 1350 Rod				
1350 - O	6.0 ~ 9.9	59 ~ 97	61.8	0.027899
1350 - H12 & H22	8.5 ~ 11.9	83 ~ 117	61.5	0.028035
1350 - H14 & H24	10.5 ~ 14.1	103 ~ 138	61.4	0.028080
1350 - H16 & H26	11.9 ~ 15.5	117 ~ 150	61.3	0.028126
Aluminium 1370 Rod				
1370 - O	6.1 ~ 8.1	60 ~ 80	63.3	0.02725
1370 - H11	8.1 ~ 9.6	80 ~ 95	61.9	0.02785
1370 - H12	9.6 ~ 11.2	95 ~ 110	61.5	0.02801
1370 - H13	10.7 ~ 12.2	105 ~ 120	61.5	0.02801
1370 - H14	11.7 ~ 13.2	115 ~ 130	61.5	0.02801
Aluminium Alloy Rod *				
1120	17 ~ 18.5	167 ~ 181	58.8	0.029300
6101	16 ~ 19	157 ~ 186	52	0.033156
6201	16 ~ 19	157 ~ 186	51	0.033806

* The aluminium alloy rod after redraw into the final diameter of wire and under controlled heat treatment will comply with the requirements as per ASTM B 398 and IEC 60104. The aluminium alloy rod will age or harden over time, thus immediate redraw into the final diameter of wire is recommended.

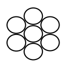
DIAMETER TOLERANCE

Specified diameter	Deviation of mean diameter from specified diameter	Deviation at any point from specified diameter
mm	mm	mm
12.0	± 0.5	± 0.76
9.5	± 0.5	± 0.76
7.6	± 0.4	± 0.61

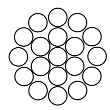
ALL ALUMINIUM CONDUCTORS (AAC)

The stranded All Aluminium Conductor (AAC) are made up of concentric-lay-stranded aluminium wires only. The conductor may be made up of 7, 19, 37, 61 or more wires in 1, 2, 3, 4 or more layers arounda central wire. Each successive layer shall have six more wires than the layer immediately beneath.For a given cross-sectional area, the conductor becomes more flexible as the number of wires is increased(with a corresponding decrease in size of each wire).

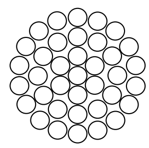
When All Aluminium Conductors are to be used in overhead lines, full hard drawn temper wires are used. The illustration below show some typical stranding patterns.



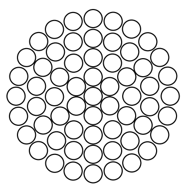
7(1+6)



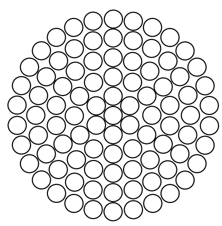
19(1+6+12)



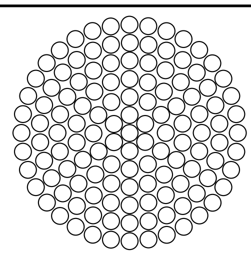
37(1+6+12+18)



61(1+6+12+18+24)



91(1+6+12+18+24+30)



127(1+6+12+18+24+30+36)

ALL ALUMINIUM CONDUCTORS (AAC)
(BS EN 50182)

Code name	Area		Construction, No/Wire diameter	Calculated area	Approx. overall diameter	Approx. weight	Rated strength	DC resistance at 20°C	Hard-drawn copper equivalent area
	Code	Nominal							
		mm²	No./mm	mm²	mm	Kg/Km	kN	Ohm/Km	mm²
Midge	23-AL1	22	7/2.06	23.3	6.18	64	4.20	1.2249	14.6
Gnat	27-AL1	25	7/2.21	26.9	6.63	73	4.83	1.0643	16.9
Mosquito	37-AL1	35	7/2.59	36.9	7.77	101	6.27	0.7749	23.2
Ladybird	43-AL1	40	7/2.79	42.8	8.37	117	7.28	0.6678	26.9
Ant	53-AL1	50	7/3.10	52.8	9.30	144	8.72	0.5409	33.2
Fly	64-AL1	60	7/3.40	63.6	10.2	174	10.49	0.4497	40.0
Bluebottle	74-AL-1	70	7/3.66	73.6	11.0	201	11.78	0.3880	46.3
Earwig	79-AL-1	75	7/3.78	78.6	11.3	215	12.57	0.3638	49.4
Grasshopper	84-AL-1	80	7/3.91	84.1	11.7	230	13.45	0.3400	52.9
Clegg	96-AL1	90	7/4.17	95.6	12.5	261	15.30	0.2989	60.1
Wasp	106-AL1	100	7/4.39	106	13.2	290	16.95	0.2697	66.6
Bettle	106-AL1	100	19/2.67	106	13.4	292	18.08	0.2701	66.6
Bee	132-AL1	125	7/4.90	132	14.7	361	21.12	0.2165	83.0
Hornet	158-AL1	150	19/3.25	158	16.3	433	26.01	0.1823	99.3
Caterpillar	186-AL1	175	19/3.53	186	17.7	511	29.75	0.1546	117
Chafer	213-AL1	200	19/3.78	213	18.9	586	34.12	0.1348	134
Spider	238-AL1	225	19/3.99	238	20.0	653	38.01	0.1210	149
Cockroach	266-AL1	250	19/4.22	266	21.1	730	42.52	0.1081	167
Butterfly	323-AL1	300	19/4.65	323	23.3	887	51.63	0.0891	203
Moth	373-AL1	350	19/5.00	373	25.0	1,025	59.69	0.0770	235
Drone	372-AL1	350	37/3.58	372	25.1	1,027	59.59	0.0774	234
Centipede	415-AL1	400	37/3.78	415	26.5	1,145	66.43	0.0695	261
Maybug	486-AL1	450	37/4.09	486	28.6	1,341	77.78	0.0593	305
Scorpion	530-AL1	500	37/4.27	530	29.9	1,461	84.77	0.0544	333
Cicada	628-AL1	600	37/4.65	628	32.6	1,733	100.54	0.0459	395

ALL ALUMINIUM CONDUCTORS (AAC)
(BS 215, Part 1)

Code name	Nominal area	Construction, No/Wire diameter	Calculated area	Approx. overall diameter	Approx. weight	Calculated breaking load	Calculated DC resistance at 20°C	Hard-drawn copper equivalent area
	mm²	No./mm	mm²	mm	Kg/Km	kN	Ohm/Km	mm²
Midge	22	7/2.06	23.3	6.18	64	3.99	1.227	14.6
Ant	50	7/3.10	52.8	9.30	145	8.28	0.5419	33.2
Fly	60	7/3.40	63.6	10.2	174	9.90	0.4505	40.0
Wasp	100	7/4.39	106	13.2	290	16.00	0.2702	66.6
Hornet	150	19/3.25	158	16.3	434	24.70	0.1825	99.3
Chafer	200	19/3.78	213	18.9	587	32.40	0.1349	134
Cockroach	250	19/4.22	266	21.1	731	40.40	0.1083	167
Butterfly	300	19/4.65	323	23.3	888	48.75	0.08916	203
Centipede	400	37/3.78	415	26.5	1,145	63.10	0.06944	261

ALL ALUMINIUM CONDUCTORS (AAC / 1350)
(AS 1531)

Code name	Construction, No/Wire diameter	Calculated sectional area	Approx. overall diameter	Approx. weight	Calculated minimum breaking load	Calculated DC resistance at 20°C	Hard-drawn copper equivalent area
	No./mm	mm²	mm	Kg/Km	kN	Ohm/Km	mm²
Leo	7/2.50	34.4	7.50	94.3	5.71	0.833	21.6
Leonids	7/2.75	41.6	8.25	113	6.72	0.689	26.2
Libra	7/3.00	49.5	9.00	135	7.98	0.579	31.1
Mars	7/3.75	77.3	11.3	211	11.8	0.370	48.6
Mercury	7/4.50	111	13.5	304	16.9	0.258	69.8
Moon	7/4.75	124	14.3	339	18.9	0.232	78.0
Neptune	19/3.25	158	16.3	433	24.7	0.183	99.3
Orion	19/3.50	183	17.5	503	28.7	0.157	115
Pluto	19/3.75	210	18.8	576	31.9	0.137	132
Saturn	37/3.00	262	21.0	721	42.2	0.110	165
Sirius	37/3.25	307	22.8	845	48.2	0.0941	193
Taurus	19/4.75	337	23.8	924	51.3	0.0857	212
Triton	37/3.75	409	26.3	1,120	62.2	0.0706	257
Uranus	61/3.25	506	29.3	1,400	75.2	0.0572	318
Ursula	61/3.50	587	31.5	1,620	87.3	0.0493	369
Venus	61/3.75	674	33.8	1,860	97.2	0.0429	424

ALL ALUMINIUM CONDUCTORS (AAC)
(ASTM B 231)

Code name	Nominal Size	Hard-drawn copper equivalent area	Stranding class *	Construction, No./Wire diameter	Calculated area	Approx. diameter	Standard weight	Calculated breaking strength	Calculated DC resistance at 20°C
	AWG/KCM	AWG/KCM		No./mm	mm²	mm	Kg/Km	Kg	Ohm/Km
Peachbell	6	8	A	7/1.56	13.4	4.68	37	258	2.15
Rose	4	6	A	7/1.96	21.1	5.88	58	399	1.37
Iris	2	4	AA, A	7/2.47	33.5	7.41	92	611	0.860
Pansy	1	3	AA, A	7/2.78	42.5	8.34	117	745	0.679
Poppy	1/0	2	AA, A	7/3.12	53.5	9.36	147	901	0.539
Aster	2/0	1	AA, A	7/3.50	67.4	10.5	185	1,134	0.428
Phlox	3/0	1/0	AA, A	7/3.93	84.9	11.8	234	1,372	0.340
Oxlip	4/0	2/0	AA, A	7/4.42	107	13.3	296	1,735	0.268
Sneezewort	250	157.2	AA	7/4.80	127	14.4	349	2,047	0.228
Valerian	250	157.2	A	19/2.91	126	14.6	348	2,110	0.228
Daisy	266.8	3/0	AA	7/4.96	135	14.9	372	2,185	0.213
Laurel	266.8	3/0	A	19/3.01	135	15.1	372	2,257	0.213
Peony	300	188.7	A	19/3.19	152	16.0	418	2,478	0.190
Tulip	336.4	4/0	A	19/3.38	171	16.9	470	2,782	0.169
Daffodil	350	220	A	19/3.45	178	17.3	489	2,898	0.162
Canna	397.5	250	AA, A	19/3.67	201	18.4	554	3,222	0.143
Goldentuft	450	283	AA	19/3.91	228	19.6	628	3,571	0.126
Cosmos	477	300	AA	19/4.02	241	20.1	664	3,775	0.120
Syringa	477	300	A	37/2.88	241	20.2	664	3,938	0.120
Zinnia	500	314	AA	19/4.12	253	20.6	698	3,965	0.114
Hyacinth	500	314	A	37/2.95	253	20.7	696	4,131	0.114
Dahlia	556.5	350	AA	19/4.35	282	21.8	778	4,420	0.102
Mistletoe	556.5	350	AA, A	37/3.12	283	21.8	779	4,516	0.102
Meadowsweet	600	377	AA, A	37/3.23	303	22.6	835	4,840	0.0951
Orchid	636	400	AA, A	37/3.33	322	23.3	887	5,145	0.0895
Heuchera	650	409	AA	37/3.37	330	23.6	909	5,269	0.0874
Verbena	700	440	AA	37/3.49	354	24.4	975	5,651	0.0815
Flag	700	440	A	61/2.72	355	24.5	976	5,824	0.0813

* NOTE : AA - For bare conductors usually used in overhead lines.
A - For conductors to be covered with weather - resistant materials, and for bare conductors where greater flexibility than is afforded by Class AA is required.

ALL ALUMINIUM CONDUCTORS (AAC)
(ASTM B 231)

Code name	Nominal Size	Hard-drawn copper equivalent area	Stranding class *	Construction, No./Wire diameter	Calculated area	Approx. diameter	Standard weight	Calculated breaking strength	Calculated DC resistance at 20°C
	AWG/KCM	AWG/KCM		No./mm	mm^2	mm	Kg/Km	Kg	Ohm/Km
Violet	715.5	450	AA	37/3.53	362	24.7	997	5,781	0.0796
Nasturtium	715.5	450	A	61/2.75	362	24.8	998	5,954	0.0796
Petunia	750	472	AA	37/3.62	381	25.3	1,049	5,974	0.0757
Cattail	750	472	A	61/2.82	381	25.4	1,049	6,156	0.0757
Arbutus	795	500	AA	37/3.72	402	26.0	1,107	6,308	0.0717
Lilac	795	500	A	61/2.90	403	26.1	1,110	6,510	0.0716
Cockscomb	900	566	AA	37/3.96	456	27.7	1,255	6,979	0.0633
Snapdragon	900	566	A	61/3.09	457	27.8	1,260	7,223	0.0630
Magnolia	954	600	AA	37/4.08	484	28.6	1,332	7,409	0.0596
Goldenrod	954	600	A	61/3.18	485	28.6	1,334	7,650	0.0595
Hawkweed	1,000	629	AA	37/4.18	508	29.3	1,398	7,776	0.0568
Camellia	1,000	629	A	61/3.25	506	29.3	1,394	7,990	0.0570
Bluebell	1,033.5	650	AA	37/4.25	525	29.8	1,446	8,039	0.0549
Larkspur	1,033.5	650	A	61/3.31	525	29.8	1,446	8,288	0.0549
Marigold	1,113	700	AA, A	61/3.43	564	30.9	1,552	8,900	0.0511
Hawthorn	1,192.5	750	AA, A	61/3.55	604	32.0	1,663	9,533	0.0477
Narcissus	1,272	800	AA, A	61/3.67	645	33.0	1,777	10,011	0.0447
Columbine	1,351	850	AA, A	61/3.78	685	34.0	1,885	10,620	0.0421
Carnation	1,431	900	AA, A	61/3.89	725	35.0	1,997	10,981	0.0398
Gladiolus	1,510.5	950	AA, A	61/4.00	767	36.0	2,111	11,611	0.0376
Coreopsis	1,590	1,000	AA	61/4.10	805	36.9	2,218	12,199	0.0358
Jessamine	1,750	1,101	AA	61/4.30	886	38.7	2,440	13,418	0.0325
Cowslip	2,000	1,260	A	91/3.77	1,016	41.5	2,798	15,584	0.0284
Sagebrush	2,250	1,415	A	91/3.99	1,138	43.9	3,164	17,043	0.0256
Lupine	2,500	1,570	A	91/4.21	1,267	46.3	3,523	18,974	0.0230
Bitterroot	2,750	1,730	A	91/4.42	1,396	48.6	3,883	20,915	0.0208
Trillium	3,000	1,890	A	127/3.90	1,517	50.7	4,219	22,725	0.0192
Bluebonnet	3,500	2,200	A	127/4.22	1,776	54.9	4,988	26,607	0.0165

* NOTE : AA - For bare conductors usually used in overhead lines.
A - For conductors to be covered with weather - resistant materials, and for bare conductors where greater flexibility than is afforded by Class AA is required.

ALL ALUMINIUM CONDUCTORS (AAC)
(DIN 48201, Part 5)

Nominal area	Construction, No./Wire diameter	Calculated area	Approx. overall diameter	Standard weight	Calculated breaking strength	Calculated DC resistance at 20°C	Hard-drawn copper equivalent area
mm²	No./mm	mm²	mm	Kg/Km	Kg	Ohm/Km	mm²
16	7/1.70	15.9	5.1	43.5	290	1.802	10.0
25	7/2.10	24.2	6.3	66.3	425	1.181	15.2
35	7/2.50	34.4	7.5	94.0	590	0.8332	21.6
50	7/3.00	49.5	9.0	135	810	0.5786	31.1
50	19/1.80	48.3	9.0	133	862	0.5950	30.4
70	19/2.10	65.8	10.5	181	1,155	0.4371	41.4
95	19/2.50	93.3	12.5	256	1,599	0.3085	58.6
120	19/2.80	117	14.0	322	1,916	0.2459	73.6
150	37/2.25	147	15.8	405	2,581	0.1960	92.5
185	37/2.50	182	17.5	500	3,115	0.1587	114
240	61/2.25	243	20.3	670	4,030	0.1191	153
300	61/2.50	299	22.5	827	4,865	0.09650	188
400	61/2.89	400	26.0	1,105	6,208	0.07221	251
500	61/3.23	500	29.1	1,381	7,616	0.05781	314
625	91/2.96	626	32.6	1,733	9,716	0.04625	394
800	91/3.35	802	36.9	2,220	12,076	0.03611	504
1000	91/3.74	1,000	41.1	2,767	14,868	0.02897	629

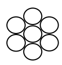
ALL ALUMINIUM CONDUCTORS (AAC)
(JIS C 3109)

Nominal area	Construction, No./Wire diameter	Calculated area	Approx. overall diameter	Standard weight	Minimum breaking load	Calculated DC resistance at 20°C	Hard-drawn copper equivalent area
mm²	No./mm	mm²	mm	Kg/Km	Kgf	Ohm/Km	mm²
30	7/2.3	29.1	6.9	79.5	469	0.983	18.3
38	7/2.6	37.2	7.8	102	575	0.769	23.4
55	7/3.2	56.3	9.6	154	838	0.507	35.4
95	7/4.2	97.0	12.6	265	1,410	0.295	61.0
150	19/3.2	153	16.0	419	2,270	0.188	96.2
200	19/3.7	204	18.5	560	3,030	0.140	128
240	19/4.0	239	20.0	655	3,490	0.120	150
300	37/3.2	298	22.4	820	4,430	0.0969	187
400	37/3.7	398	25.9	1,097	5,890	0.0726	250
510	37/4.2	513	29.4	1,413	7,460	0.0563	323
660	61/3.7	656	33.3	1,812	9,720	0.0441	412
850	61/4.2	845	37.8	2,334	12,300	0.0342	531
980	91/3.7	978	40.7	2,716	14,500	0.0297	615
1,260	91/4.2	1,261	46.2	3,499	18,350	0.0230	793

ALL ALUMINIUM ALLOY CONDUCTORS (AAAC)

All Aluminium alloy conductor (AAAC) contains a small percentage (about 0.6%) of silicon and magnesium elements. It provides several benefits for overhead lines.

1. **Strength**
   About twice that of aluminium EC 1350.
2. **Weight**
   20% (approx.) lighter than ACSR conductor of equal diameter.
3. **Corrosion resistance**
   It has a high resistance to atmospheric corrosion which is suitable for coastal and industrial areas.
4. **Surface hardness**
   AAAC's surface is significantly harder than aluminium EC 1350. It is less liable to damage during installation which is an important advantage of EHV transmission lines where corona and radio interference is a major consideration.
5. **Termination**
   Much simpler jointing accessories required compared to ACSR.
6. **AC Resistance**
   AAAC is a non-magnetic material. It does not exhibit the magnetic core losses found in ACSR conductor.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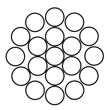
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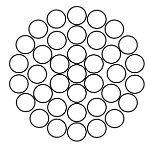
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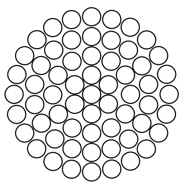
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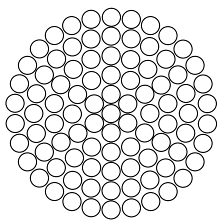
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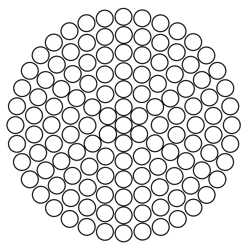
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ALL ALUMINIUM ALLOY CONDUCTORS (AAAC) (BS EN 50182)

Code name	Area		Construction, No/Wire diameter	Calculated area	Approx. overall diameter	Approx. weight	Rated strength	DC resistance at 20°C
	Code	Nominal						
		mm²	No./mm	mm²	mm	Kg/Km	kN	Ohm/Km
Box	19-AL3	15	7/1.85	18.8	5.55	51	5.55	1.7480
Acacia	24-AL3	20	7/2.08	23.8	6.24	65	7.02	1.3828
Almond	30-AL3	25	7/2.34	30.1	7.02	82	8.88	1.0926
Cedar	35-AL3	30	7/2.54	35.5	7.62	97	10.46	0.9273
Deodar	42-AL3	35	7/2.77	42.2	8.31	115	12.44	0.7797
Fir	48-AL3	40	7/2.95	47.8	8.85	131	14.11	0.6875
Hazel	60-AL3	50	7/3.30	59.9	9.90	163	17.66	0.5494
Pine	72-AL3	60	7/3.61	71.7	10.8	196	21.14	0.4591
Holly	84-AL3	70	7/3.91	84.1	11.7	230	24.79	0.3913
Willow	90-AL3	75	7/4.04	89.7	12.1	245	26.47	0.3665
Oak	119-AL3	100	7/4.65	119	14.0	325	35.07	0.2767
Mulberry	151-AL3	125	19/3.18	151	15.9	414	44.52	0.2192
Ash	181-AL3	150	19/3.48	181	17.4	496	53.31	0.1830
Elm	211-AL3	175	19/3.76	211	18.8	579	62.24	0.1568
Poplar	239-AL3	200	37/2.87	239	20.1	659	70.61	0.1387
Sycamore	303-AL3	250	37/3.23	303	22.6	835	89.40	0.1095
Upas	362-AL3	300	37/3.53	362	24.7	998	106.82	0.0917
Yew	479-AL3	400	37/4.06	479	28.4	1320	141.31	0.0693
Totara	498-AL3	425	37/4.14	498	29.0	1372	146.93	0.0666
Rubus	587-AL3	500	61/3.50	587	31.5	1622	173.13	0.0567
Sorbus	659-AL3	550	61/3.71	659	33.4	1823	194.53	0.0505
Araucaria	821-AL3	700	61/4.14	821	37.3	2269	242.24	0.0406
Redwood	996-AL3	850	61/4.56	996	41.0	2753	293.88	0.0334

ALL ALUMINIUM ALLOY CONDUCTORS (AAAC) (BS 3242 / MS 1143)

Code name	Nominal aluminium area	Construction, No./Wire diameter	Sectional area	Approx. overall diameter	Approx. weight	Calculated breaking load	Calculated DC resistance at 20°C
	mm²	No./mm	mm²	mm	Kg/Km	kN	Ohm/Km
Almond	25	7/2.34	30.1	7.0	82	8.44	1.094
Cedar	30	7/2.54	35.5	7.6	97	9.94	0.9281
Fir	40	7/2.95	47.8	8.9	131	13.40	0.6880
Hazel	50	7/3.30	59.9	9.9	164	16.80	0.5498
Oak	100	7/4.65	119	14.0	325	33.30	0.2769
Ash	150	19/3.48	181	17.4	497	50.65	0.1830
Elm	175	19/3.76	211	18.8	580	59.10	0.1568
Upas	300	37/3.53	362	24.7	997	101.5	0.09155

ALL ALUMINIUM ALLOY CONDUCTORS (AAAC / 1120) (AS 1531)

Code name	Construction, No./Wire diameter	Sectional area	Calculated equivalent aluminium area	Approx. overall diameter	Approx. weight	Calculated breaking load	Calculated DC resistance at 20°C
	No./mm	mm²	mm²	mm	Kg/Km	kN	Ohm/Km
Chlorine	7/2.50	34.4	32.8	7.5	94.3	8.18	0.864
Chromium	7/2.75	41.6	39.7	8.3	113	9.91	0.713
Fluorine	7/3.00	49.5	47.2	9.0	135	11.8	0.599
Helium	7/3.75	77.3	73.7	11.3	211	17.6	0.383
Hydrogen	7/4.50	111	106	13.5	304	24.3	0.266
Iodine	7/4.75	124	118	14.3	339	27.1	0.239
Krypton	19/3.25	158	150	16.3	433	37.4	0.189
Lutetium	19/3.50	183	173	17.5	503	41.7	0.163
Neon	19/3.75	210	199	18.8	576	47.8	0.142
Nitrogen	37/3.00	262	248	21.0	721	62.2	0.114
Nobelium	37/3.25	307	291	22.8	845	72.8	0.0973
Oxygen	19/4.75	337	320	23.8	924	73.6	0.0884
Phosphorus	37/3.75	409	387	26.3	1,120	93.1	0.0731
Selenium	61/3.25	506	478	29.3	1,400	114	0.0592
Silicon	61/3.50	587	555	31.5	1,620	127	0.0511
Sulphur	61/3.75	674	636	33.8	1,860	145	0.0444

ALL ALUMINIUM ALLOY CONDUCTORS (AAAC / 6201) (AS 1531)

Code name	Construction, No./Wire diameter	Sectional area	Calculated equivalent aluminium area	Approx. overall diameter	Approx. weight	Calculated breaking load	Calculated DC resistance at 20°C
	No./mm	mm²	mm²	mm	Kg/Km	kN	Ohm/Km
Diamond	7/2.50	34.4	29.3	7.5	94.3	9.64	0.967
Dolomite	7/2.75	41.6	35.4	8.3	113	11.6	0.799
Emerald	7/3.00	49.5	42.2	9.0	135	13.9	0.671
Garnet	7/3.75	77.3	65.8	11.3	211	21.7	0.430
Jade	7/4.50	111	94.8	13.5	304	31.2	0.298
Jasper	7/4.75	124	106	14.3	339	34.8	0.268
Opal	19/3.25	158	134	16.3	433	44.2	0.212
Patronite	19/3.50	183	155	17.5	503	51.3	0.183
Pearl	19/3.75	210	178	18.8	576	58.8	0.159
Ruby	37/3.00	262	221	21.0	721	73.5	0.128
Ruthenium	37/3.25	307	260	22.8	845	86.1	0.109
Rutile	19/4.75	337	285	23.8	924	94.4	0.0991
Sapphire	37/3.75	409	345	26.3	1,120	115	0.0819
Spinel	61/3.25	506	427	29.3	1,400	135	0.0662
Tantalum	61/3.50	587	495	31.5	1,620	156	0.0572
Topaz	61/3.75	674	568	33.8	1,860	179	0.0498

ALL ALUMINIUM ALLOY CONDUCTORS (AAAC)
(DIN 48201, Part 6)

Nominal area	Construction, No./Wire diameter	Calculated area	Approx. overall diameter	Standard weight	Calculated breaking strength	Calculated DC resistance at 20°C
mm²	No./mm	mm²	mm	Kg/Km	Kg	Ohm/Km
16	7/1.70	15.9	5.1	43.5	453	2.091
25	7/2.10	24.2	6.3	66.4	691	1.370
35	7/2.50	34.4	7.5	94.1	979	0.9669
50	7/3.00	49.5	9.0	135	1,410	0.6714
50	19/1.80	48.3	9.0	133	1,377	0.6905
70	19/2.10	65.8	10.5	181	1,875	0.5073
95	19/2.50	93.3	12.5	257	2,657	0.3580
120	19/2.80	117	14.0	322	3,333	0.2854
150	37/2.25	147	15.7	406	4,191	0.2274
185	37/2.50	182	17.5	501	5,174	0.1842
240	61/2.25	243	20.2	671	6,909	0.1383
300	61/2.50	299	22.5	828	8,530	0.1120
400	61/2.89	400	26.0	1,106	11,400	0.08380
500	61/3.23	500	29.1	1,382	14,239	0.06709
625	91/2.96	626	32.6	1,735	17,840	0.05367
800	91/3.35	802	36.9	2,222	22,850	0.04190
1000	91/3.74	1,000	41.1	2,770	28,480	0.03362

ALL ALUMINIUM ALLOY CONDUCTORS (AAAC)
(ASTM B 399)

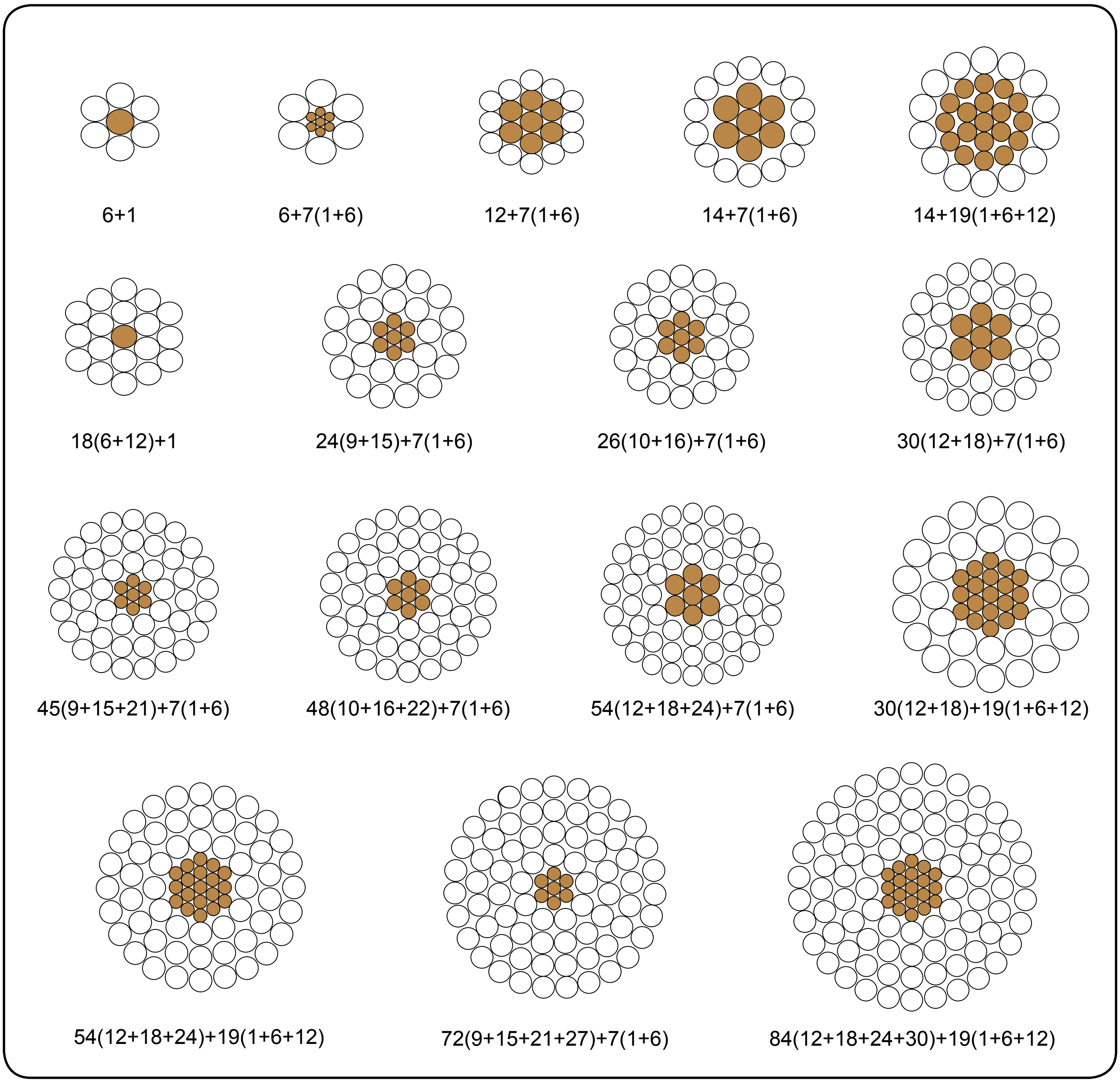
Code name	Conductor size		Stranding class *	Construction, No./Wire diameter	Approx. diameter	Standard weight	Calculated breaking strength	Calculated DC resistance at 20°C
	KCM	mm²		No./mm	mm	Kg/Km	Kg	Ohm/Km
Akron	30.58	15.5	A	7/1.68	5.0	42.8	503	2.16
Alton	48.69	24.7	A	7/2.12	6.4	68.1	801	1.36
Ames	77.47	39.3	AA, A	7/2.67	8.0	108	1,270	0.855
Azusa	123.3	62.5	AA, A	7/3.37	10.1	172	1,938	0.536
Anaheim	155.4	78.7	AA, A	7/3.78	11.3	217	2,438	0.426
Amherst	195.7	99.2	AA, A	7/4.25	12.8	274	3,082	0.337
Alliance	246.9	125	AA	7/4.77	14.3	345	3,883	0.268
Butte	312.8	158	A	19/3.26	16.3	437	4,769	0.211
Canton	394.5	200	AA, A	19/3.66	18.3	551	6,011	0.168
Cairo	465.4	236	AA	19/3.98	19.9	652	7,108	0.142
Darien	559.5	283	AA	19/4.36	21.8	782	8,530	0.118
Elgin	652.4	331	AA	19/4.71	23.6	913	9,955	0.101
Flint	740.8	375	AA	37/3.59	25.1	1,033	11,020	0.0894
Greeley	927.2	470	AA	37/4.02	28.1	1,295	13,818	0.0713

* NOTE : AA - For bare conductors usually used in overhead lines
A - For conductors to be covered with weather - resistant materials.

ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR)

ACSR is a composite, concentrically stranded conductor in which the light weight and good conductivity of aluminium are combined with the high tensile strength of steel. It is composed of one or more layers of EC grade hard-drawn aluminium wires helically stranded around an inner core of high strength zinc-coated steel wires. The inner steel core may be a single zinc-coated steel wire, or concentrically stranded of one or more layer of zinc-coated steel wires.

ACSR has long been widely used as overhead high tension transmission lines and has an established reputation for economy and dependability. The illustration below shows typical standard sizes and stranding patterns.



ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR) (BS EN 50182)

Code name	Area		Construction, No/Wire diameter		Calculated area		Approx. overall diameter	Approx. weight	Rated strength	DC resistance at 20°C
	Code	Nominal	Aluminium	Steel	Aluminium	Total				
		mm^2	No./mm	No./mm	mm^2	mm^2	mm	Kg/Km	kN	Ohm/Km
Mole	11-AL1/2-ST1A	10	6/1.50	1/1.50	10.6	12.4	4.50	43	4.14	2.7027
Squirrel	21-AL1/3-ST1A	20	6/2.11	1/2.11	21.0	24.5	6.33	85	7.87	1.3659
Gopher	26-AL1/4-ST1A	25	6/2.36	1/2.36	26.2	30.6	7.08	106	9.58	1.0919
Weasel	32-AL1/5-ST1A	30	6/2.59	1/2.59	31.6	36.9	7.77	128	11.38	0.9065
Fox	37-AL1/6-ST1A	35	6/2.79	1/2.79	36.7	42.8	8.37	148	13.21	0.7812
Ferret	42-AL1/7-ST1A	40	6/3.00	1/3.00	42.4	49.5	9.00	171	15.27	0.6757
Rabbit	53-AL1/9-ST1A	50	6/3.35	1/3.35	52.9	61.7	10.1	214	18.42	0.5419
Mink	63-AL1/11-STIA	60	6/3.66	1/3.66	63.1	73.6	11.0	255	21.67	0.4540
Skunk	63-AL1/37-ST1A	60	12/2.59	7/2.59	63.2	100.1	13.0	463	52.79	0.4568
Beaver	75-AL1/13-ST1A	70	6/3.99	1/3.99	75.0	87.5	12.0	303	25.76	0.3820
Horse	73-AL1/43-ST1A	70	12/2.79	7/2.79	73.4	116.2	14.0	537	61.26	0.3936
Racoon	79-AL1/13-ST1A	75	6/4.09	1/4.09	78.8	92.0	12.3	318	27.06	0.3635
Otter	84-AL1/14-ST1A	80	6/4.22	1/4.22	83.9	97.9	12.7	339	28.81	0.3415
Cat	95-AL1/16-ST1A	90	6/4.50	1/4.50	95.4	111.3	13.5	385	32.76	0.3003
Hare	105-AL1/17-ST1A	100	6/4.72	1/4.72	105.0	122.5	14.2	424	36.04	0.2730
Dog	105-AL1/14-ST1A	100	6/4.72	7/1.57	105.0	118.6	14.2	394	32.65	0.2733
Coyote	132-AL1/20-ST1A	125	26/2.54	7/1.91	131.7	151.8	15.9	521	45.86	0.2192
Cougar	132-AL1/7-ST1A	125	18/3.05	1/3.05	131.5	138.8	15.3	419	29.74	0.2188
Tiger	131-AL1/31-ST1A	125	30/2.36	7/2.36	131.2	161.9	16.5	602	57.87	0.2202
Wolf	158-AL1/37-ST1A	150	30/2.59	7/2.59	158.1	194.9	18.1	725	68.91	0.1829
Dingo	159-AL1/9-ST1A	150	18/3.35	1/3.35	158.7	167.5	16.8	505	35.87	0.1814
Lynx	183-AL1/43-ST1A	175	30/2.79	7/2.79	183.4	226.2	19.5	842	79.97	0.1576
Caracal	184-AL1/10-ST1A	175	18/3.61	1/3.61	184.2	194.5	18.1	587	40.74	0.1562
Panther	212-AL1/49-ST1A	200	30/3.00	7/3.00	212.1	261.5	21.0	973	92.46	0.1363
Jaguar	211-AL1/12-ST1A	200	18/3.86	1/3.86	210.6	222.3	19.3	671	46.57	0.1366
Lion	238-AL1/56-ST1A	225	30/3.18	7/3.18	238.3	293.9	22.3	1093	100.47	0.1213
Bear	264-AL1/62-ST1A	250	30/3.35	7/3.35	264.4	326.1	23.5	1213	111.50	0.1093
Goat	324-AL1/76-ST1A	300	30/3.71	7/3.71	324.3	400.0	26.0	1488	135.13	0.0891
Sheep	375-AL1/88-ST1A	350	30/3.99	7/3.99	375.1	462.6	27.9	1721	156.30	0.0771
Antelope	374-AL1/48-ST1A	350	54/2.97	7/2.97	374.1	422.6	26.7	1414	118.88	0.0773
Bison	382-AL1/49-ST1A	350	54/3.00	7/3.00	381.7	431.2	27.0	1443	121.30	0.0758
Deer	430-AL1/100-ST1A	400	30/4.27	7/4.27	429.6	529.8	29.9	1971	179.00	0.0673
Zebra	429-AL1/56-ST1A	400	54/3.18	7/3.18	428.9	484.5	28.6	1,621	131.92	0.0674
Elk	477-AL1/111-ST1A	450	30/4.50	7/4.50	477.1	588.5	31.5	2190	198.80	0.0606
Camel	476-AL1/62-ST1A	450	54/3.35	7/3.35	476.0	537.7	30.2	1799	146.40	0.0608
Moose	528-AL1/69-ST1A	500	54/3.53	7/3.53	528.5	597.0	31.8	1997	159.92	0.0547

ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR) (BS 215, Part 2)

Code name	Nominal aluminium area	Construction, No./Wire diameter		Cross-sectional area		Approx. overall diameter	Approx. weight	Calculated breaking load	Calculated DC resistance at 20°C
		Aluminium	Steel	Aluminium	Total				
	mm²	No./mm	No./mm	mm²	mm²	mm	Kg/Km	kN	Ohm/Km
Gopher	25	6/2.36	1/2.36	26.25	30.62	7.08	106	9.61	1.093
Weasel	30	6/2.59	1/2.59	31.61	36.88	7.77	128	11.45	0.9077
Ferret	40	6/3.00	1/3.00	42.41	49.48	9.00	172	15.20	0.6766
Rabbit	50	6/3.35	1/3.35	52.88	61.70	10.05	214	18.35	0.5426
Skunk	60	12/2.59	7/2.59	63.22	100.1	12.95	464	52.94	0.4567
Horse	70	12/2.79	7/2.79	73.37	116.2	13.95	538	61.20	0.3936
Dog	100	6/4.72	7/1.57	105.0	118.6	14.15	394	32.70	0.2733
Wolf	150	30/2.59	7/2.59	158.1	194.9	18.13	726	69.20	0.1828
Dingo	150	18/3.35	1/3.35	158.7	167.5	16.75	506	35.70	0.1815
Lynx	175	30/2.79	7/2.79	183.4	226.2	19.53	842	79.80	0.1576
Caracal	175	18/3.61	1/3.61	184.3	194.5	18.05	587	41.10	0.1563
Panther	200	30/3.00	7/3.00	212.1	261.5	21.00	974	92.25	0.1363
Jaguar	200	18/3.86	1/3.86	210.6	222.3	19.30	671	46.55	0.1367
Batang *	300	18/4.78	7/1.68	323.0	338.5	24.16	1,010	69.67	0.08914
Zebra	400	54/3.18	7/3.18	428.9	484.5	28.62	1,621	131.9	0.06740

* Not in BS 215 : Part 2.

ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR) (AS 3607)

Code name	Construction, No./Wire diameter		Calculated equivalent aluminium area	Cross - Sectional area	Approx. overall diameter	Approx. weight	Calculated minimum breaking load	Calculated DC resistance at 20°C
	Aluminium	Steel						
	No./mm	No./mm	mm²	mm²	mm	Kg/Km	kN	Ohm/Km
Almond	6/2.50	1/2.50	29.0	34.36	7.50	119	10.5	0.975
Apricot	6/2.75	1/2.75	35.1	41.58	8.30	144	12.6	0.805
Apple	6/3.00	1/3.00	41.8	49.48	9.00	171	14.9	0.677
Banana	6/3.75	1/3.75	65.2	77.31	11.3	268	22.7	0.433
Cherry	6/4.75	7/1.60	105	120.4	14.3	402	33.4	0.271
Grape	30/2.50	7/2.50	144	181.6	17.5	677	63.5	0.196
Lemon	30/3.00	7/3.00	207	261.5	21.0	973	90.4	0.136
Lychee	30/3.25	7/3.25	243	306.9	22.8	1,140	105	0.116
Lime	30/3.50	7/3.50	282	356.0	24.5	1,320	122	0.100
Mango	54/3.00	7/3.00	373	431.2	27.0	1,440	119	0.0758
Orange	54/3.25	7/3.25	438	506.0	29.3	1,690	137	0.0646
Olive	54/3.50	7/3.50	508	586.9	31.5	1,960	159	0.0557
Pawpaw	54/3.75	19/2.25	583	672.0	33.8	2,240	178	0.0485
Peach	54/4.75	19/2.85	936	1085	42.8	3,660	292	0.0303
Standard High - Strength Conductor								
Quince	3/1.75	4/1.75	8.74	16.84	5.3	95	12.7	3.25
Raisin	3/2.50	4/2.50	17.8	34.36	7.5	195	24.4	1.59
Sultana	4/3.00	3/3.00	31.5	49.48	9.0	243	28.3	0.897
Walnut	4/3.75	3/3.75	49.2	77.31	11.3	380	43.9	0.573

ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR) (ASTM B 232)

Code name	Nominal size	Hard-drawn copper equivalent area	Construction, No./Wire diameter		Calculated area		Approx. overall diameter	Standard weight	Calculated breaking load	Calculated DC resistance at 20°C
			Aluminium	Steel	Aluminium	Steel				
	AWG/KCM	AWG/KCM	No./mm	No./mm	mm²	mm²	mm	Kg/Km	Kgf	Ohm/Km
Turkey *	6	8	6/1.68	1/1.68	13.30	2.22	5.04	54	541	2.16
Swan *	4	6	6/2.12	1/2.12	21.18	3.53	6.36	86	847	1.35
Swanate	4	6	7/1.96	1/2.61	21.18	5.35	6.53	100	1,070	1.36
Sparrow *	2	4	6/2.67	1/2.67	33.59	5.60	8.01	136	1,291	0.854
Sparate *	2	4	7/2.47	1/3.30	33.54	8.55	8.24	159	1,649	0.855
Robin	1	3	6/3.00	1/3.00	42.41	7.07	9.00	171	1,617	0.676
Raven *	1/0	2	6/3.37	1/3.37	53.52	8.92	10.1	216	1,984	0.536
Quail *	2/0	1	6/3.78	1/3.78	67.33	11.22	11.3	272	2,400	0.426
Pigeon *	3/0	1/0	6/4.25	1/4.25	85.12	14.19	12.8	344	3,001	0.337
Penguin *	4/0	2/0	6/4.77	1/4.77	107.2	17.9	14.3	433	3,780	0.268
Waxwing *	266.8	3/0	18/3.09	1/3.09	135.0	7.5	15.5	430	3,113	0.214
Partridge *	266.8	3/0	26/2.57	7/2.00	134.9	22.0	16.3	545	5,111	0.215
Ostrich	300.0	188.7	26/2.73	7/2.12	152.2	24.7	17.3	615	5,754	0.190
Widgeon	336.4	4/0	18/3.47	1/3.47	170.2	9.5	17.4	543	3,926	0.169
Linnet *	336.4	4/0	26/2.89	7/2.25	170.6	27.8	18.3	690	6,418	0.170
Oriole *	336.4	4/0	30/2.69	7/2.69	170.5	39.8	18.8	785	7,881	0.170
Chickadee *	397.5	250	18/3.77	1/3.77	200.9	11.2	18.9	640	4,500	0.143
Brant *	397.5	250	24/3.27	7/2.18	201.6	26.1	19.6	762	6,640	0.144
Ibis *	397.5	250	26/3.14	7/2.44	201.3	32.7	19.9	814	7,387	0.144
Lark *	397.5	250	30/2.92	7/2.92	200.9	46.9	20.4	924	9,229	0.145
Pelican *	477.0	300	18/4.14	1/4.14	242.3	13.5	20.7	772	5,335	0.119
Flicker *	477.0	300	24/3.58	7/2.39	241.6	31.4	21.5	915	7,809	0.120
Hawk *	477.0	300	26/3.44	7/2.67	241.6	39.2	21.8	976	8,855	0.120
Hen *	477.0	300	30/3.20	7/3.20	241.3	56.3	22.4	1,110	10,772	0.120
Osprey *	556.5	350	18/4.47	1/4.47	282.5	15.7	22.4	900	6,219	0.102
Parakeet *	556.5	350	24/3.87	7/2.58	282.3	36.6	23.2	1,068	9,005	0.103
Dove *	556.5	350	26/3.72	7/2.89	282.6	45.9	23.6	1,142	10,285	0.103
Eagle	556.5	350	30/3.46	7/3.46	282.1	65.8	24.2	1,298	12,594	0.103
Peacock	605.0	380.5	24/4.03	7/2.69	306.1	39.8	24.2	1,159	9,778	0.0946
Squab	605.0	380.5	26/3.87	7/3.01	305.8	49.8	24.5	1,236	11,030	0.0947
Woodduck	605.0	380.5	30/3.61	7/3.61	307.1	71.6	25.3	1,413	13,131	0.0946
Teal	605.0	380.5	30/3.61	19/2.16	307.1	69.6	25.2	1,398	13,574	0.0946
Swift	636.0	400	36/3.38	1/3.38	323.0	9.0	23.7	960	6,246	0.0892
Kingbird *	636.0	400	18/4.78	1/4.78	323.0	17.9	23.9	1,030	7,112	0.0893
Rook *	636.0	400	24/4.14	7/2.76	323.1	41.9	24.8	1,222	10,306	0.0897
Grosbeak *	636.0	400	26/3.97	7/3.09	321.8	52.5	25.2	1,302	11,411	0.0900
Scoter	636.0	400	30/3.70	7/3.70	322.6	75.3	25.9	1,484	13,794	0.0900
Egret	636.0	400	30/3.70	19/2.22	322.6	73.5	25.9	1,472	14,310	0.0900
Flamingo	666.6	419	24/4.23	7/2.82	337.3	43.7	25.4	1,276	10,759	0.0859
Gannet	666.6	419	26/4.07	7/3.16	338.3	54.9	25.8	1,366	11,960	0.0856
Stilt	715.5	450	24/4.39	7/2.92	363.3	46.9	26.3	1,372	11,561	0.0797
Starling	715.5	450	26/4.21	7/3.28	361.9	59.1	26.7	1,465	12,847	0.0800
Redwing	715.5	450	30/3.92	19/2.35	362.1	82.4	27.4	1,651	15,673	0.0802
Coot	795.0	500	36/3.77	1/3.77	401.9	11.2	26.4	1,194	7,583	0.0717
Cuckoo *	795.0	500	24/4.62	7/3.08	402.3	52.2	27.7	1,522	12,630	0.0720
Drake *	795.0	500	26/4.44	7/3.45	402.6	65.40	28.1	1,627	14,246	0.0720
Tern *	795.0	500	45/3.38	7/2.25	403.8	27.8	27.0	1,335	10,017	0.0717
Condor	795.0	500	54/3.08	7/3.08	402.3	52.2	27.7	1,522	12,756	0.0720
Mallard	795.0	500	30/4.14	19/2.48	403.8	91.8	29.0	1,841	17,465	0.0719

* Indicates those “preferred” sizes most commonly used.

ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR) (ASTM B 232)

Code name	Nominal size	Hard-drawn copper equivalent area	Construction, No./Wire diameter		Calculated area		Approx. overall diameter	Standard weight	Calculated breaking load	Calculated DC resistance at 20°C
			Aluminium	Steel	Aluminium	Steel				
	AWG/KCM	AWG/KCM	No./mm	No./mm	mm²	mm²	mm	Kg/Km	Kgf	Ohm/Km
Ruddy	900.0	566	45/3.59	7/2.40	455.5	31.7	28.7	1,509	11,114	0.0636
Canary	900.0	566	54/3.28	7/3.28	456.3	59.1	29.5	1,726	14,466	0.0635
Catbird	954.0	600	36/4.14	1/4.14	484.6	13.5	29.0	1,440	8,964	0.0595
Rail *	954.0	600	45/3.70	7/2.47	483.8	33.5	29.6	1,602	11,794	0.0599
Cardinal *	954.0	600	54/3.38	7/3.38	484.5	62.8	30.4	1,833	15,362	0.0598
Tanager	1,033.5	650	36/4.30	1/4.30	522.8	14.5	30.1	1,553	9,670	0.0551
Ortolan	1,033.5	650	45/3.85	7/2.57	523.9	36.3	30.8	1,734	12,575	0.0553
Curlew	1,033.5	650	54/3.51	7/3.51	522.5	67.7	31.6	1,976	16,566	0.0554
Bluejay *	1,113.0	700	45/4.00	7/2.66	565.5	38.9	32.0	1,870	13,536	0.0512
Finch *	1,113.0	700	54/3.65	19/2.19	565.0	71.6	32.9	2,133	17,757	0.0515
Bunting	1,192.5	750	45/4.14	7/2.76	605.8	41.9	33.1	2,004	14,527	0.0478
Grackle	1,192.5	750	54/3.77	19/2.27	602.8	76.9	34.0	2,280	19,011	0.0483
Skylark	1,272.0	800	36/4.78	1/4.78	646.0	17.9	33.5	1,919	11,950	0.0446
Bittern *	1,272.0	800	45/4.27	7/2.85	644.4	44.7	34.2	2,133	15,466	0.0450
Pheasant *	1,272.0	800	54/3.90	19/2.34	645.1	81.7	35.1	2,435	19,801	0.0451
Dipper	1,351.0	850	45/4.40	7/2.93	684.2	47.2	35.2	2,263	16,395	0.0423
Martin	1,351.0	850	54/4.02	19/2.41	685.4	86.7	36.2	2,586	21,021	0.0425
Bobolink *	1,431.0	900	45/4.53	7/3.02	725.3	50.1	36.2	2,400	17,392	0.0399
Plover *	1,431.0	900	54/4.14	19/2.48	726.9	91.8	37.2	2,742	22,277	0.0400
Nuthatch	1,510.0	950	45/4.65	7/3.10	764.2	52.8	37.2	2,529	18,119	0.0379
Parrot	1,510.0	950	54/4.25	19/2.55	766.1	97.0	38.3	2,892	23,514	0.0380
Lapwing *	1,590.0	1,000	45/4.78	7/3.18	807.5	55.6	38.2	2,670	19,118	0.0359
Falcon	1,590.0	1,000	54/4.36	19/2.62	806.2	102.4	39.3	3,046	24,785	0.0361
Chukar	1,780.0	1,119	84/3.70	19/2.22	903.2	73.5	40.7	3,089	23,151	0.0322
Bluebird	2,156.0	1,356	84/4.07	19/2.44	1,093	89	44.8	3,736	27,341	0.0266
Kiwi	2,167.0	1,362	72/4.41	7/2.94	1,100	48	44.1	3,431	22,614	0.0265
Thrasher	2,312.0	1,454	76/4.43	19/2.07	1,171	64	45.8	3,759	25,689	0.0249

* Indicates those " preferred "sizes most commonly used.

ALUMINIUM CONDUCTORS STEEL REINFORCED / HIGH STRENGTH (ACSR/HS) (ASTM B 232)

Code name	Nominal size	Hard-drawn copper equivalent area	Construction, No./Wire diameter		Calculated area		Approx. overall diameter	Standard weight	Calculated breaking load	Calculated DC resistance at 20°C
			Aluminium	Steel	Aluminium	Steel				
	AWG/KCM	AWG/KCM	No./mm	No./mm	mm²	mm²	mm	Kg/Km	Kgf	Ohm/Km
Grouse	80.0	50.3	8/2.54	1/4.24	40.54	14.12	9.32	222	2,591	0.7112
Petrel	101.8	64.0	12/2.34	7/2.34	51.61	30.10	11.7	379	5,096	0.5614
Minorca	110.8	69.7	12/2.44	7/2.44	56.11	32.73	12.2	412	5,541	0.5163
Leghorn	134.6	84.6	12/2.69	7/2.69	68.20	39.78	13.5	500	6,688	0.4248
Guinea	159.0	100.0	12/2.92	7/2.92	80.36	46.88	14.6	590	7,857	0.3605
Dotterel	176.9	111.2	12/3.08	7/3.08	89.41	52.15	15.4	656	8,553	0.3240
Dorking	190.8	120.0	12/3.20	7/3.20	96.51	56.30	16.0	708	9,233	0.3002
Brahma	203.2	127.8	16/2.86	19/2.48	102.8	91.8	18.1	1,005	14,047	0.2818
Cochin	211.3	132.8	12/3.37	7/3.37	107.0	62.4	16.9	786	10,240	0.2707

ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR) (DIN 48204)

Nominal sectional area	Aluminium		Steel		Total sectional area	Overall diameter	Approx. weight	Calculated breaking load	Calculated DC resistance at 20°C
	Construction	Area	Construction	Area					
mm²	No./mm²	mm²	No./mm²	mm²	mm²	mm	Kg/Km	Kg	Ohm/Km
16/2.5	6/1.80	15.3	1/1.80	2.5	17.8	5.4	62	593	1.8793
25/4	6/2.25	23.9	1/2.25	4.0	27.9	6.8	97	920	1.2028
35/6	6/2.70	34.4	1/2.70	5.7	40.1	8.1	140	1,295	0.8353
44/32	14/2.00	44.0	7/2.40	31.7	75.7	11.2	372	4,637	0.6573
50/8	6/3.20	48.3	1/3.20	8.0	56.3	9.6	196	1,752	0.5946
50/30	12/2.33	51.2	7/2.33	29.8	81.0	11.7	378	4,517	0.5644
70/12	26/1.85	69.9	7/1.44	11.4	81.3	11.7	284	2,684	0.4130
95/15	26/2.15	94.4	7/1.67	15.3	109.7	13.6	383	3,587	0.3058
95/55	12/3.20	96.5	7/3.20	56.3	152.8	16.0	712	8,180	0.2992
105/75	14/3.10	105.7	19/2.25	75.5	181.2	17.5	891	10,882	0.2736
120/20	26/2.44	121.6	7/1.90	19.8	141.4	15.5	494	4,584	0.2374
120/70	12/3.60	122.1	7/3.60	71.3	193.4	18.0	901	10,012	0.2364
125/30	30/2.33	127.9	7/2.33	29.8	157.7	16.1	591	5,902	0.2259
150/25	26/2.70	148.9	7/2.10	24.2	173.1	17.1	605	5,546	0.1939
170/40	30/2.70	171.8	7/2.70	40.1	211.9	18.9	794	7,855	0.1682
185/30	26/3.00	183.8	7/2.33	29.8	213.6	19.0	746	6,761	0.1571
210/35	26/3.20	209.1	7/2.49	34.1	243.2	20.3	850	7,644	0.1380
210/50	30/3.00	212.1	7/3.00	49.5	261.6	21.0	981	9,410	0.1363
230/30	24/3.50	230.9	7/2.33	29.8	260.7	21.0	877	7,455	0.1249
240/40	26/3.45	243.1	7/2.68	39.5	282.6	21.9	987	8,819	0.1188
265/35	24/3.74	263.7	7/2.49	34.1	297.8	22.4	1,002	8,460	0.1094
300/50	26/3.86	304.3	7/3.00	49.5	353.8	24.5	1,236	10,719	0.0949
305/40	54/2.68	304.6	7/2.68	39.5	344.1	24.1	1,160	10,129	0.0949
340/30	48/3.00	339.3	7/2.33	29.8	369.1	25.0	1,180	9,441	0.0851
380/50	54/3.00	381.7	7/3.00	49.5	431.2	27.0	1,453	12,333	0.0757
385/35	48/3.20	386.0	7/2.49	34.1	420.1	26.7	1,344	10,640	0.0748
435/55	54/3.20	434.3	7/3.20	56.3	490.6	28.8	1,653	13,900	0.0666
450/40	48/3.45	448.7	7/2.68	39.5	488.2	28.7	1,561	12,259	0.0644
490/65	54/3.40	490.3	7/3.40	63.6	553.9	30.6	1,866	15,591	0.0590
495/35	45/3.74	494.4	7/2.49	34.1	528.5	29.9	1,636	12,272	0.0584
510/45	48/3.68	510.5	7/2.87	45.3	555.8	30.7	1,770	13,702	0.0566
550/70	54/3.60	549.7	7/3.60	71.3	621.0	32.4	2,092	17,077	0.0526
560/50	48/3.86	561.7	7/3.00	49.5	611.2	32.2	1,954	14,921	0.0514
570/40	45/4.02	571.2	7/2.68	39.5	610.7	32.2	1,889	14,074	0.0506
650/45	45/4.30	653.5	7/2.87	45.3	698.8	34.4	2,163	15,863	0.0442
680/85	54/4.00	678.6	19/2.40	86.0	764.6	36.0	2,570	21,419	0.0426
1045/45	72/4.30	1045.6	7/2.87	45.3	1,090.9	43.0	3,249	22,223	0.0277

ALUMINIUM CONDUCTORS STEEL REINFORCED (ACSR) (JIS C 3110)

Nominal sectional area	Construction, No./Wire diameter		Calculated cross-sectional area		Approx. overall diameter	Approx. weight	Minimum tensile load	Calculated DC resistance at 20°C
	Aluminium	Steel	Aluminium	Steel				
mm²	No./mm	No./mm	mm²	mm²	mm	Kg/Km	Kgf	Ohm/Km
25	6/2.3	1/2.3	24.9	4.2	6.9	101	907	1.15
32	6/2.6	1/2.6	31.9	5.3	7.8	129	1,140	0.899
58	6/3.5	1/3.5	57.7	9.6	10.5	233	1,980	0.497
95	6/4.5	1/4.5	95.4	15.9	13.5	385	3,180	0.301
120	30/2.3	7/2.3	124.7	29.1	16.1	574	5,540	0.233
160	30/2.6	7/2.6	159.3	37.2	18.2	733	6,980	0.182
200	30/2.9	7/2.9	198.2	46.2	20.3	912	8,640	0.147
240	30/3.2	7/3.2	241.2	59.3	22.4	1,110	10,210	0.120
330	26/4.0	7/3.1	326.8	52.8	25.3	1,320	10,950	0.0888
410	26/4.5	7/3.5	413.4	67.3	28.5	1,673	13,910	0.0702
520*	54/3.5	7/3.5	519.5	67.3	31.2	1,969	15,600	0.0559
610	54/3.8	7/3.8	612.4	79.4	34.2	2,320	18,350	0.0474
810	45/4.8	7/3.2	814.5	56.3	38.4	2,700	18,480	0.0356

* Not in JIS C 3110.

ALUMINIUM SOLID SECTOR

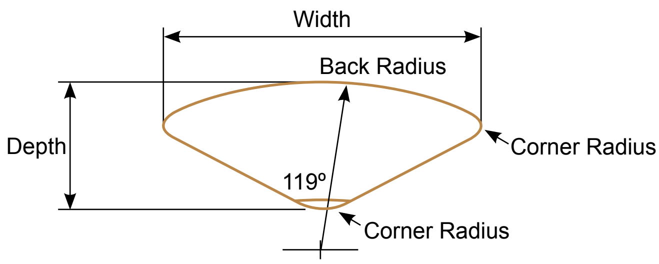
ALUMINIUM SOLID SECTOR (BS 3988)

3-Core Sector

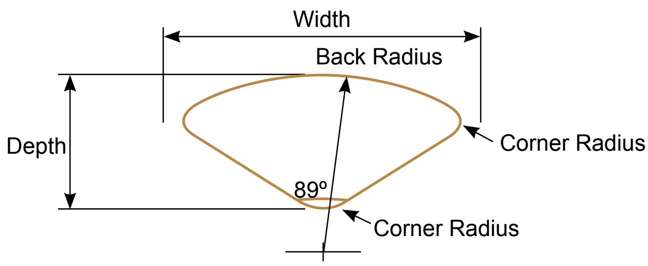
Nominal area	Calculated area	Nominal dimensions				Resistance at 20°C		Nominal weight
		Width	Depth	Back radius	Corner radius	Standard	Maximum	
mm²	mm²	mm	mm	mm	mm	Ohm/Km	Ohm/Km	Kg/Km
120	116.5	17.69	10.30	11.41	1.14	0.241	0.248	315
150	143.1	19.64	11.40	12.76	1.27	0.196	0.202	387
185	179.5	21.97	12.78	14.17	1.41	0.156	0.161	485
240	235.9	25.17	14.66	16.20	1.62	0.119	0.123	638

4-Core Sector

Nominal area	Calculated area	Nominal dimensions				Resistance at 20°C		Nominal weight
		Width	Depth	Back radius	Corner radius	Standard	Maximum	
mm²	mm²	mm	mm	mm	mm	Ohm/Km	Ohm/Km	Kg/Km
120	116.5	16.22	11.65	13.36	1.33	0.241	0.248	315
150	143.1	17.99	12.90	14.96	1.49	0.196	0.202	387
185	179.5	20.14	14.46	16.59	1.65	0.156	0.161	485
240	235.9	23.08	16.59	18.59	1.89	0.119	0.123	638



3-Core Sector



4-Core Sector

PVC - COVERED ALUMINIUM CONDUCTORS

The PVC - covered conductors have been developed primarily to give protection to telecommunication lines which are crossed by power lines and to give protection to the public from low voltage lines in case of accidental contact for short periods.

The PVC - covered power lines have also been found useful in corrosive atmospheres and for preventing faults due to birds and trees. For such purposes, thickness of covering other than those specified in this catalouge may be used. The conductors are sometimes referred to as “Weather - Resistant Line Wire” and may consist of a single solid wire, or all aluminium stranded conductors (AAC) over which a covering has been applied.

The insulation thickness of Type 8 is intended for use where the operating voltages does not exceed 650 V r.m.s. between any two conductors or 250 V r.m.s. between any conductor and earth.

PVC - COVERED ALUMINIUM CONDUCTORS (BS 6485 and BS 215, Part 1)

Nominal aluminium wire	Construction, No./Wire diameter	Approx. overall diameter of conductor	Calculated DC resistance at 20°C	Approx. breaking load	Approx. overall diameter of covered conductor	Approx. mass of covered conductor
					Type 8	Type 8
mm²	No./mm	mm	Ohm/Km	kN	mm	Kg/Km
22	7 / 2.06	6.18	1.227	3.99	8.2	100
50	7 / 3.10	9.30	0.5419	8.28	11.7	220
60*	7 / 3.40	10.20	0.4504	9.90	13.0	270
100	7 / 4.39	13.17	0.2702	16.00	16.0	420
150*	19 / 3.25	16.25	0.1825	25.70	19.7	610
200	19 / 3.78	18.90	0.1349	32.40	21.7	760
250*	19 / 4.22	21.10	0.1083	40.40	24.5	970

* Not in BS 6485.

APPENDIX : TECHNICAL DATA

PROPERTIES OF ALUMINIUM, ALUMINIUM ALLOY AND COPPER

Characteristics	Unit	Aluminium		Aluminium Alloy Rod			Copper	
		Hard-drawn	Annealed	1120	6101	6201	Hard-drawn	Annealed
Specific gravity	g/cm³	2.703	2.703	2.703	2.703	2.703	8.89	8.89
Tensile strength	Kgf/mm²	Min. 16	Max. 9.2	17 ~ 18.5	16 ~ 19	16 ~ 19	34 ~ 47	20 ~ 28
Electrical resistivity at 20°C	μ Ohm.cm	2.8264	2.803	2.93	3.31	3.38	1.777	1.724
Conductivity at 20°C	% IACS	61	61.5	58.8	52	51	97	100
Temperature coefficient at 20°C	per °C	0.00403	0.00410	0.00390	0.00347	0.00347	0.00381	0.00393
Coefficient of linear expansion	$\times 10^{-6}$ / °C	23	23	23	23	23	17	17
Melting Point	°C	660					1083	

Mechanical properties of aluminium alloy wires as per ASTM B 398

Nominal diameter (mm)		Tensile strength (MPa)		Elongation (%)
Over	Up to and including	Average for a lot	Individual	Individual
1.5	3.25	330	315	3.0
3.25	4.75	315	305	3.0

Mechanical properties of aluminium alloy wires as per IEC 60104

Nominal diameter (mm)		Tensile strength (MPa)	Elongation (%)
Over	Up to and including	Minimum	Minimum
---	3.5	325	3.0
3.5	---	315	3.0

Electrical properties of aluminium alloy wires as per ASTM B 398 and IEC 60104

Nominal diameter (mm)		Tensile strength (MPa)		Elongation (%)
Over	Up to and including	(mm)	(Ohm.mm²/m)	(% IACS)
---	3.00	± 0.03	0.03284	52.5
3.00	---	± 1%	0.03284	52.5

Mechanical and electrical properties of aluminium 1120 wires as per AS 1531

Nominal diameter (mm)		Tensile strength	Elongation	Resistivity	Conductivity
Over	Up to and including	(MPa)	(%)	(Ohm.mm² /m)	(% IACS)
1.5	2.5	250	0.8	0.0293	58.8
2.5	3.25	250	1.0	0.0293	58.8
3.25	3.75	240	1.2	0.0293	58.8
3.75	4.00	230	1.2	0.0293	58.8
4.00	4.75	230	1.4	0.0293	58.8

COMPARISON OF ALUMINIUM AND COPPER CONDUCTORS

Particular	Hard-drawn Aluminium Take annealed copper as 100%	Copper (annealed) Take hard-drawn aluminium as 100%
	%	%
For equal sectional area and length		
Weight	30	329
Resistance	164	61
Approximate breaking load	41	244
For equal weight and length		
Area	329	30
Diameter	180	55
Resistance	50	200
Approximate breaking load	137	73
For equal resistance		
Area	164	61
Diameter	128	78
Weight	50	200
Approximate breaking load	68	147
For equal current and temperature rise		
Weight	42	237
Diameter	119	84

CURRENT RATING CALCULATION FOR BARE CONDUCTOR (IEC 61597)

The symbols used in this section :

D = conductor diameter (m)
γ = solar radiation absorption coefficient
S_i = intensity of solar radiation (W/m^2)
K_e = emissivity coefficient in respect to black body
R_T = electrical resistance of conductor at temp. T (Ω/m)
Nu = Nusselt number : $Nu = 0.65\ Re^{0.2} + 0.23\ Re^{0.61}$
s = the Stefan-Boltzmann constant ($5.67 \times 10^{-8}\ W.m^{-2}.K^{-4}$)
Re = the Reynolds number : $Re = 1.644 \times 10^9\ v\ D\ [(T_1 + 0.5 (T_2 - T_1)]^{-1.78}$
λ = the thermal conductivity of the air film in contact with the conductor, $0.02585\ W.m^{-1}.K^{-1}$

v = wind speed (m/s)
T_1 = ambient temperature (K)
T_2 = final equilibrium temperature (K)
I_{max} = current rating (A)

Current Rating Formula

$$I_{max} = [(P_{rad} + P_{conv} - P_{sol})/R_T]^{1/2}$$

(a) P_{rad} - the heat loss by radiation of the conductor (W/m)

$$P_{rad} = s\ \pi\ D\ K_e\ (T_2^4 - T_1^4)$$

(b) P_{conv} - the convection heat loss (W/m)

$$P_{conv} = \lambda\ Nu\ (T_2 - T_1)\ \pi$$

(c) P_{sol} - the solar heat gain by the conductor surface (W/m)

$$P_{sol} = \gamma\ D\ S_i$$

(d) R_T = the electrical resistance of conductor at a temp. T (Ω/m)

$$R_T = f(x).R_{T2}$$

$$R_{T2} = R_{20}\ [\ 1 + \alpha(T_2 - 20)\ ]$$

α = 0.00403 (aluminium)
α = 0.00360 (aluminium alloy)
R_{T2} = conductor DC resistance at temperature T_2

$$f(x) = 0.996\ 09 + 0.018\ 578x - 0.030\ 263x^2 + 0.020\ 735x^3$$

D_1 = conductor diameter in cm
d_1 = steel core diameter in cm
For conductor other than ACSR, d_1 = 0 cm

$$x = \frac{0.01\ (D_1 + 2d_1)}{(D_1 + d_1)} \left[\frac{8\pi\ .\ f\ (D_1 - d_1)}{R_{T2}\ (D_1 + d_1)} \right]^{1/2}$$

Example

ACSR 30/7/2.59mm
(BS 215 Part 2)

D = 18.13mm	R_{20} = 0.1828 ohm/km	d = 7.77 mm	
v = 1 m/s	T_1 = 40ºC (313K)	f = 50 Hz	
S_i = 900 W/m²	T_2 = 80ºC (353K)	Re = 964.6	
γ = 0.5	K_e = 0.6		

Calculation

(a) $P_{rad} = 5.67 \times 10^{-8} \times 3.142 \times 0.01813 \times 0.6 \times (313^4 - 353^4)$ (W/m) = 11.49 W/m

(b) $P_{conv} = 0.02585 \times (0.65 \times 964.6^{0.2} + 0.23 \times 964.6^{0.61}) \times (353 - 313) \times 3.142$ (W/m) = 57.76 W/m

(c) $P_{sol} = 0.5 \times 0.01813 \times 900$ (W/m) = 8.16 W/m

(d) $R_T = f(x).R_{T2}$
$R_{T2} = 0.1828[1 + 0.00403(80 - 20)]$ = 0.2270 ohm/km = 0.000227 ohm/m

$$x = \frac{0.01\ (1.813 + 1.554)}{(1.813 + 0.777)} \left[\frac{8\pi\ (50)(1.813 - 0.777)}{0.227\ (1.813 + 0.777)} \right]^{1/2} = 0.61174$$

$f(x) = 0.99609 + 0.018578\ (0.61174) - 0.030263\ (0.61174)^2 + 0.020735\ (0.61174)^3 = 1.000877$

RT = 1.000877 x 0.000227 ohm/m = 0.0002272 ohm/m

$I_{max} = [(P_{rad} + P_{conv} - P_{sol})/R_T]^{1/2}$

$I_{max} = [(11.49 + 57.76 - 8.16)/0.0002272]^{1/2}$

= 519 A

CURRENT RATING CALCULATION FOR BARE CONDUCTOR

The symbols used in this section :

I	=	current rating (A)
d	=	conductor inside diameter (cm)
D	=	overall diameter (cm)
L	=	unity length (cm)
S	=	aluminium sectional area (mm^2)
$\propto_{20}$	=	temperature coefficient at 20ºC, 0.004 for Aluminium
R	=	effective resistance for unity length (Ohm)
R_a	=	a.c resistance (Ohm/Km)
R_{d1}	=	conductor d.c resistance at final temperature (Ohm/Km)
R_{d20}	=	conductor d.c resistance at 20ºC (Ohm/Km)
T_0	=	ambient temperature (˚C)
T_r	=	temperature difference (˚C)
ΔT	=	temperature rise (˚C)
Ws	=	solar radiation (W/cm^2)
f	=	operating frequency (Hz)
$f(x)$	=	the skin effect constant
h_w	=	heat dissipated due to wind velocity ($W/^oC.cm^2$)
h_r	=	heat dissipated due to radiation ($W/^oC.cm^2$)
v	=	wind velocity (m/s)
æ	=	black body radiation coefficient

$$\text{Current Rating,} \quad I(A) = \left[\frac{\pi.D.L.Tr \{ h_w + æ [hr - Ws / (\pi.T_r)] \}}{R} \right]^{1/2}$$

where by :

(a) Heat dissipated due to wind velocity, h_w

$$h_w \; (W/^oC.cm^2) = \frac{5.72 \times 10^{-3}}{(273 + T_0 + 0.5T_r)^{0.123}} \left[\frac{V}{D} \right]^{1/2}$$

(b) Heat dissipated due to radiation, h_r

$$h_r \; (W/^oC.cm^2) = \frac{5.67 \times 10^{-12}}{T_r} \{ (273 + T_0 + T_r)^4 - (273 + T_0)^4 \}$$

(c) Effective resistance, R

$$R \text{ (ohm)} = R_a . L$$

where by :

$$R_a = f(x) . R_{d1} \qquad \text{where as } R_{d1} = R_{d20} (1 + \propto_{20}.\Delta T)$$

$$f(x) = 0.996\,09 + 0.018\,578x - 0.030\,263x^2 + 0.020\,735x^3$$

$$X = \frac{0.01 (D + 2d)}{(D + d)} \left[\frac{8\pi. f (D - d)}{R_{d1} (D + d)} \right]^{1/2}$$

CURRENT RATING CALCULATION FOR BARE CONDUCTOR

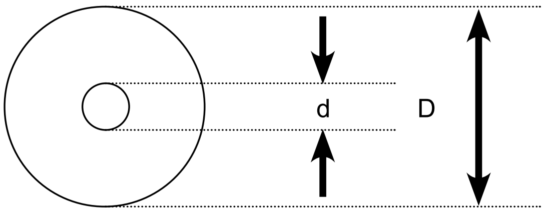
For ACSR with 3 layers of aluminium,

$R_a = f(x) \cdot f(x)^1 \cdot R_{d1}$

$f(x)^1 = 0.999\,47 + 0.028\,895x - 0.005\,9348x^2 + 0.000\,422\,59x^3$

where by :

$x = I / S$ where as I= current,A (above) and $S = \pi / 4 \, (D^2 - d^2) \cdot 100\text{mm}^2$



Additional information :
- i) for conductor other than ACSR, d = 0 cm
- ii) in most case the following assumption is valid :
  - W = 0.1 W/cm^2
  - æ = 0.9
  - L = 1 cm

Example :

Conductor : ACSR 6/1/4.0mm

d	=	0.4 cm
D	=	1.2 cm
R_{d20}	=	0.38 ohm/km

Conditions :

Ws	=	0.1 W/cm^2
v	=	0.5 m/s
T_o	=	40ºC
T_r	=	60ºC
f	=	50 Hz
æ	=	0.9
L	=	1 cm

CURRENT RATING CALCULATION FOR BARE CONDUCTOR

Calculation :

$$h_w = \frac{5.72 \times 10^{-3}}{(273 + 40 + 30)^{0.123}} \left[\frac{0.5}{1.2} \right]^{½} = 0.001801 \text{ W/°C.cm}^2$$

$$hr = \frac{5.67 \times 10^{-12}}{60} \{ (273 + 40 + 60)^4 - (273 + 40)^4 \} = 0.000922 \text{ W/°C.cm}^2$$

$$R_{d1} = 0.38 \{ 1 + 0.004 (100 - 20) \} = 0.5016 \text{ Ohm/Km}$$

$$x = \frac{0.01 (1.2 + 0.8)}{(1.2 + 0.4)} \left[\frac{8\pi (50) (1.2 - 0.4)}{0.5016 (1.2 + 0.4)} \right]^{½} = 0.44241$$

$$f(x) = 0.99609 + 0.018578 (0.44241) - 0.030263 (0.44241)^2 + 0.020735 (0.44241)^3 = 1.0001812$$

$$R_a = f(x) \,.\, R_{d1} = (1.0001812).(0.5016) = 0.50169 \text{ Ohm/Km}$$

$$R = (0.50169 \text{ Ohm/Km}).(1\text{cm}) = 0.50169 \times 10^{-5} \text{ Ohm}$$

Then

Current Rating,

$$I(A) = \left[\frac{\pi(1.2)(1)(60) \{0.001801 + 0.9[0.000922 - 0.1/\pi.60]\}}{0.50169 \times 10^{-5}} \right]^{½}$$

$$= 311.5$$

WIRE GAUGES

Gauge system		Diameter		Cross-sectional area			Weight of copper	Weight of aluminium
A.W.G.	S.W.G.	mm	mil	mm²	sq. mil	CM	kg / km	kg / km
6/0	-	14.732	580	170.5	264200	336400	1515	460.2
5/0	-	13.119	516.5	135.2	209500	266800	1202	365.0
-	7/0	12.700	500	126.7	196400	250000	1126	342.0
-	6/0	11.786	464	109.1	169100	215300	969.9	294.6
4/0	-	11.684	460	107.2	166200	211600	953.2	289.5
-	5/0	10.973	432	94.56	146600	186600	840.6	255.3
3/0	-	10.404	409.6	85.01	131800	167800	755.8	229.5
-	4/0	10.16	400	81.07	125700	160000	720.7	218.9
-	3/0	9.449	372	70.12	108700	138400	623.4	189.3
2/0	-	9.266	364.8	67.43	104500	133100	599.5	182.1
-	2/0	8.839	348	61.36	95110	121100	545.5	165.7
0	-	8.252	324.9	53.49	82910	105600	475.5	144.4
-	0	8.230	324	53.19	82450	105000	472.9	143.6
-	1	7.620	300	45.60	70690	90000	405.4	123.1
1	-	7.348	289.3	42.41	65730	83690	377.0	114.5
-	2	7.011	276	38.60	59830	76180	343.2	104.2
2	-	6.544	257.6	33.63	52120	66370	299.0	90.80
-	3	6.401	252	32.18	49880	63500	286.1	86.88
-	4	5.893	232	27.27	42270	53820	242.4	73.63
3	-	5.827	229.4	26.66	41330	52620	237.0	71.99
-	5	5.385	212	22.77	35300	44940	202.4	61.49
4	-	5.189	204.3	21.15	32780	41730	188.0	57.10
-	6	4.877	192	18.68	28950	36860	166.1	50.43
5	-	4.621	181.9	16.77	26000	33100	149.1	45.28
-	7	4.470	176	15.69	24320	30970	139.5	42.37
6	-	4.115	162	13.30	20620	26250	118.3	35.92
-	8	4.064	160	12.97	20110	25600	115.3	35.02
7	-	3.665	144.3	10.55	16350	20820	93.78	28.48
-	9	3.658	144	10.51	16290	20740	93.41	28.37
8	-	3.264	128.5	8.367	12970	16510	74.39	22.59
-	10	3.251	128	8.302	12870	16380	73.80	22.42
-	11	2.946	116	6.818	10570	13460	60.61	18.41
9	-	2.906	114.4	6.633	10280	13090	58.96	17.91
-	12	2.642	104	5.481	8495	10820	48.72	14.80
10	-	2.588	101.9	5.261	8155	10380	46.77	14.21
-	13	2.337	92	4.289	6648	8465	38.13	11.58
11	-	2.305	90.74	4.172	6467	8234	37.09	11.26
12	-	2.053	80.81	3.309	5129	6531	29.42	8.935
-	14	2.032	80	3.243	5027	6400	28.83	8.756
-	15	1.829	72	2.627	4072	5185	23.35	7.093
13	-	1.828	71.96	2.624	4067	5178	23.33	7.085
14	-	1.628	64.08	2.081	3225	4107	18.50	5.618
-	16	1.626	64	2.075	3217	4096	18.45	5.604
15	-	1.450	57.07	1.650	2558	3257	14.67	4.456
-	17	1.422	56	1.589	2463	3136	14.13	4.290
16	-	1.291	50.82	1.309	2029	2583	11.63	3.534
-	18	1.219	48	1.167	1810	2304	10.38	3.152
17	-	1.150	45.26	1.0380	1609	2048	9.226	2.802
18	-	1.024	40.3	0.8227	1275	1624	7.314	2.221
-	19	1.016	40	0.8107	1257	1600	7.207	2.189
-	20	0.9144	36	0.6567	1018	1296	5.838	1.773
19	-	0.9117	35.89	0.6529	1012	1288	5.804	1.763
-	21	0.8128	32	0.5189	804.2	1024	4.613	1.401
20	-	0.8116	31.95	0.5174	801.9	1021	4.600	1.397
21	-	0.7230	28.46	0.4105	636.3	810.1	3.649	1.108

WIRE GAUGES

Gauge system		Diameter		Cross-sectional area			Weight of copper	Weight of aluminium
A.W.G.	S.W.G.	mm	mil	mm²	sq. mil	CM	kg / km	kg / km
-	22	0.7112	28	0.3973	615.8	784.0	3.532	1.073
22	-	0.6439	25.35	0.3256	504.7	642.6	2.895	0.8792
-	23	0.6096	24	0.2919	452.4	576.0	2.595	0.7880
23	-	0.5733	22.57	0.2581	400.1	509.4	2.295	0.6970
-	24	0.5588	22	0.2452	380.1	484.0	2.180	0.6622
24	-	0.5106	20.1	0.2047	317.3	404.0	1.820	0.5528
-	25	0.5080	20	0.2027	314.2	400.0	1.802	0.5472
-	26	0.4572	18	0.1642	254.5	324.0	1.460	0.4433
25	-	0.4546	17.9	0.1623	251.6	320.4	1.443	0.4383
-	27	0.4166	16.4	0.1363	211.3	269.0	1.212	0.3680
26	-	0.4049	15.94	0.1288	199.6	254.1	1.145	0.3477
-	28	0.3759	14.8	0.1110	172.0	219.0	0.9867	0.2997
27	-	0.3606	14.2	0.1021	158.3	201.5	0.9077	0.2757
-	29	0.3454	13.6	0.09372	145.3	185.0	0.8332	0.2530
28	-	0.3211	12.64	0.08097	125.5	159.8	0.7198	0.2186
-	30	0.3150	12.4	0.07791	120.8	153.8	0.6926	0.2104
-	31	0.2947	11.6	0.06819	105.7	134.6	0.6062	0.1841
29	-	0.2860	11.26	0.06422	99.54	126.7	0.5709	0.1734
-	32	0.2743	10.8	0.05908	91.58	116.6	0.5252	0.1595
30	-	0.2548	10.03	0.05097	79.01	100.6	0.4531	0.1376
-	33	0.2540	10	0.05067	78.54	100.0	0.4505	0.1368
-	34	0.2337	9.2	0.04289	66.48	84.64	0.3813	0.1158
31	-	0.2268	8.928	0.04039	62.60	79.71	0.3590	0.1090
-	35	0.2134	8.4	0.03575	55.42	70.56	0.3178	0.09653
32	-	0.2019	7.95	0.03203	49.64	63.20	0.2847	0.08647
-	36	0.1930	7.6	0.02927	45.36	57.76	0.2602	0.07902
33	-	0.1798	7.08	0.02540	39.37	50.13	0.2258	0.06858
-	37	0.1727	6.8	0.02343	36.32	46.24	0.2083	0.06326
34	-	0.1602	6.305	0.02014	31.22	39.75	0.1791	0.05439
-	38	0.1524	6	0.01824	28.27	36.00	0.1622	0.04925
35	-	0.1426	5.615	0.01597	24.76	31.53	0.1420	0.04313
-	39	0.1321	5.2	0.01370	21.24	27.04	0.1218	0.03700
36	-	0.1270	5	0.01267	19.63	25.00	0.1126	0.03420
-	40	0.1219	4.8	0.01167	18.10	23.04	0.1038	0.03152
37	-	0.1131	4.453	0.01005	15.57	19.83	0.08931	0.02713
-	41	0.1118	4.4	0.009810	15.21	19.36	0.08721	0.02649
-	42	0.1016	4	0.008107	12.57	16.00	0.07207	0.02189
38	-	0.1007	3.965	0.007968	12.35	15.72	0.07084	0.02151
-	43	0.09140	3.6	0.006567	10.18	12.96	0.05838	0.01773
39	-	0.08970	3.531	0.006319	9.794	12.47	0.05618	0.01706
-	44	0.08128	3.2	0.005189	8.042	10.24	0.04613	0.01401
40	-	0.07988	3.145	0.005012	7.768	9.891	0.04456	0.01353
41	45	0.07113	2.8	0.003973	6.159	7.842	0.03532	0.01073
42	-	0.06334	2.494	0.003151	4.884	6.219	0.02801	0.008508
-	46	0.06069	2.4	0.002919	4.524	5.760	0.02595	0.007880
43	-	0.05641	2.221	0.002499	3.873	4.932	0.02222	0.006747
-	47	0.05080	2	0.002027	3.142	4.000	0.01802	0.005472
44	-	0.05023	1.978	0.001982	3.072	3.911	0.01762	0.005351
45	-	0.04474	1.761	0.001572	2.436	3.102	0.01397	0.004244
-	48	0.04064	1.6	0.001297	2.011	2.560	0.01153	0.003502
46	-	0.03984	1.568	0.001246	1.932	2.460	0.01108	0.003365
47	-	0.03548	1.397	0.0009884	1.532	1.951	0.008787	0.002669
48	-	0.03159	1.244	0.0007838	1.215	1.547	0.006968	0.002116
-	49	0.03048	1.2	0.007297	1.131	1.440	0.006487	0.00197
49	-	0.02813	1.108	0.0006216	0.9635	1.227	0.005526	0.001678
-	50	0.02540	1	0.0005067	0.7854	1.000	0.004505	0.001368
50	-	0.02505	0.9863	0.0004929	0.7641	0.9728	0.004382	0.001331

COMMON CONVERSION FACTOR

Equivalent					Reciprocal
			Mass		
1	cwt	=	50.802	kg	0.0197
1	oz	=	28.349	gm	0.0352
1	lb	=	0.4536	kg	2.2046
1	lb	=	0.00454	tonne (metric)	220.26
1	ton (long)	=	1.016	tonne (metric)	0.09842
			Length		
1	in	=	25.4	mm	0.03937
1	mil	=	0.001	in	1000
1	mil	=	0.0254	mm	39.37
1	ft	=	0.3048	m	3.2808
1	yd	=	0.9144	m	1.0936
1	mile	=	1.6093	km	0.6214
			Area		
1	in^2	=	645.16	mm^2	0.00155
1	CM (circular mil)	=	0.0005067	mm^2	1974
1	mm^2	=	1974	CM (circular mil)	0.0005067
1	ft^2	=	0.0929	m^2	10.7642
1	yd^2	=	0.8361	m^2	1.196
			Volume		
1	in^3	=	16.387	cm^3 (ml or cc)	0.061
1	ft^3	=	0.0283	m^3	35.3335
1	ft^3	=	6.229	gal (Imp)	0.1605
1	ft^3	=	28.328	l	0.0353
1	yd^3	=	0.7645	m^3	1.3079
1	gal (USA)	=	0.8327	gal (Imp)	1.2009
			Force		
1	lbf	=	0.4535	kgf	2.2046
1	kgf	=	9.8065	N	0.1019
1	ton (long) f	=	9.964	kN	0.10036
			Pressure and Stress		
1	atm	=	0.1013	MPa	9.869
1	atm	=	1.0133	bar	0.9869
1	lbf / in^2 (psi)	=	6.894	kN / mm^2 (kPa)	0.145
1	bar	=	1.0197	kgf / cm^2	0.09806
			Energy (Work and Heat)		
1	HP.h	=	2544.5	Btu	0.00393
1	Btu	=	0.000293	kW.h	3413
1	Btu	=	1.0551	kJ	0.9478
1	Btu	=	107.59	kgf.m	0.00929
1	cal	=	4.187	J	0.239

FORMULA FOR ELECTRIC CALCULATION

To Calculate	Given	D.C	A.C. single phase	A.C. 3 phase
Current (A)	kW	$A = \frac{1000 \times kW}{V}$	$A = \frac{1000 \times kW}{V \times pf}$	$A = \frac{1000 \times kW}{1.73 \times V \times pf}$
Current (A)	kVA	---	$A = \frac{1000 \times kVA}{V}$	$A = \frac{1000 \times kVA}{1.73 \times V}$
Current (A)	hp	$A = \frac{746 \times hp}{V \times eff}$	$A = \frac{746 \times hp}{V \times eff \times pf}$	$A = \frac{746 \times hp}{1.73 \times eff \times pf}$
Power (kW)	VA	$kW = \frac{A \times V}{1000}$	$kW = \frac{A \times V \times pf}{1000}$	$kW = \frac{1.73 \times A \times V \times pf}{1000}$
Apparent Power (kVA)	VA	---	$kVA = \frac{A \times V}{1000}$	$kVA = \frac{1.73 \times A \times V}{1000}$

pf - Power factor of equipment or system under consideration
eff - Efficiency of motor or machinery
V - Line voltage

PUBLICATIONS REFERRED TO

AS 1531	Conductors - Bare Overhead - Aluminium And Aluminium Alloy
AS 3607	Conductors - Bare Overhead, Aluminium And Aluminium Alloy -Steel Reinforced
ASTM B 230	Specification For Aluminium 1350 - H19 Wire For Electrical Purposes
ASTM B 231	Specification For Concentric-Lay-Stranded Aluminium 1350 Conductors
ASTM B 232	Specification For Concentric - Lay - Stranded Aluminium Conductor - Steel Reinforced (ACSR).
ASTM B 398	Specification For Aluminium - Alloy 6201-T81 Wire For Electrical Purposes
ASTM B 399	Specification For Concentric - Lay - Stranded Aluminium Alloy 6201 - T81 Conductors.
ASTM B 498	Specification For Zinc-Coated (Galvanized) Steel Core Wire For Aluminium Conductors, Steel Reinforced (ACSR)
ASTM B 606	Specification For High-Strength Zinc-Coated (Galvanized) Steel Core Wire For Aluminium And Aluminium - Alloy Conductors, Steel Reinforced
BS 183	Specification For General Purpose Galvanized Steel Wire Strand
BS 215	Specification For Aluminium Conductors And Aluminium Conductors Steel - Reinforced - For Overhead Power Transmission. Part 1 - Aluminium Stranded Conductors Part 2 - Aluminium Conductors, Steel - Reinforced
BS 2627	Specification For Wrought Aluminium For Electrical Purposes
BS 3242	Specification For Aluminium Alloy Stranded Conductors For Overhead Power Transmission
BS 3988	Wrought Aluminium For Electrical Purposes - Solid Conductors For Insulated Cables
BS 4565	Specification For Galvanized Steel Wire For Aluminium Conductors, Steel-Reinforced
BS 6485	Specification For PVC - Covered Conductors For Overhead Power Lines
BS EN 50182	Conductors For Overhead Lines - Round Wire Concentric Lay Stranded Conductors
DIN 48 201 Part 5	Aluminium Stranded Conductors
DIN 48201, Part 6	E-AlMgSi Stranded Conductors
DIN 48 204	Steel Reinforced Aluminium Stranded Conductors
JIS C 3108	Hard - Drawn Aluminium Wires For Electrical Purposes
JIS C 3109	Hard - Drawn Aluminium Stranded Conductors
JIS C 3110	Aluminium Conductors Steel Reinforced
MS 1143	Specification For Aluminium Alloy Stranded Conductors For Overhead Power Transmission

The manufacturer reserves the right to modify or vary the construction or specification of any of the products at their discretion and without prior notice. The information contained herein is in line with the appropriate standards and sound electrical practice - it is believed to be reliable but as each applicant is unique, the manufacturer can accept no responsibility as to the suitability of any products for a particular use, or for any errors or omissions, unintentional or otherwise.

Note:

UNIVERSAL CABLE (M) BERHAD
(Co. No.: 7042-D)

ADMINISTRATIVE CENTRE & MANUFACTURING PLANT

No. 33, Jalan Tiran, Kangkar Tebrau,
81100 Johor Bahru, Johor, Malaysia.
Tel • +607 355 3333
Fax • +607 355 5298
Email • info@ucable.com.my

SHAH ALAM SALES OFFICE

Unit 8.2, Level 8, Building A, Dataran PHB,
Saujana Resort, Seksyen U2, 40150 Shah Alam,
Selangor D.E., Malaysia.
Tel • +603 7845 6699
Fax • +603 7845 8323

PLENTONG MANUFACTURING PLANT

Lot 7650, Muklim Plentong,
81750 Masai, Johor, Malaysia.
Tel • +607 387 7377
Fax • +607 386 5889

A Member of **SARAWAK CABLE BERHAD GROUP**

www.ucable.com.my

Version 2019