SECTION FIVE – AERIALS

THERMAL CHARACTERISTICS

Continuous Current Carrying Capacity

The continuous current carrying capacity of a conductor depends on the permissible conductor temperature rise above ambient air temperature. For the calculation of current ratings of bare overhead conductors, ambient air temperatures between 20°C and 40°C are usually considered.

The maximum permissible continuous operating temperature of an overhead conductor is limited by the permanent effects of high temperatures on the strength of the conductor material. Aluminium wire may be operated indefinitely at temperatures of up to 75°C without significant annealing occurring. Therefore, this temperature is taken as the continuous operating temperature for bare aluminium and aluminium alloy conductors.

For aluminium and aluminium alloy conductors, a maximum operating temperature limit of 100°C is recommended, resulting in approximately 3% loss of strength after 1000 hours of operation. Under emergency operating conditions with higher temperatures, the effect of annealing should be considered. The loss of strength for an AAC or AAAC/1120 conductor operated at 150°C for 10 hours is equivalent to the loss of strength for the same conductor operated at 100°C for 7000 hours. The effect is less significant with steel-reinforced conductors, where the steel provides most of the strength of the conductor and is essentially unaffected by temperature. However, to allow for the effects on grease and fittings, a maximum operating temperature limit of 120°C is recommended in this case.

The maximum load capacity of a long line is usually dictated by consideration of system stability, permissible voltage regulation, or the cost of energy losses. However, the maximum load capacity of a short line may be determined by the maximum permissible operating temperature of the conductor. The maximum permissible operating temperature is that which results in the greatest permissible sag (allowing for creep) or that which results in the maximum allowable permanent loss of tensile strength due to annealing.

The conductor temperature depends on the current load, the electrical characteristics of the conductor, and the atmospheric parameters such as wind and sun. Assuming these factors to be fairly constant, the conductor temperature does not change significantly. In this situation, the heat supplied to the conductor is balanced by the heat dissipated and the thermal condition of the conductor is then defined as “steady state”. At such a steady state, with the conductor at maximum permissible temperature, a heat balance equation can be used to calculate the continuous current carrying capacity of a conductor.

The formulae used for the calculations are generally in accordance with those published by V. T. Morgan.

THERMAL CHARACTERISTICS (CONT.)

Ambient Temperature

For dry conductors the choice of ambient temperature has little influence on the increase of the calculated current carrying capacity for a given temperature rise. For example, for temperature rises higher than 30°C, the increase in the current carrying capacity for a given temperature rise above an ambient of 20°C is within 2% of the value obtained with the same temperature rise above an ambient of 35°C. Rain has a major effect on the current carrying capacity of a conductor, and the rating of a wet conductor is higher than that of a dry one. For conductors with a wet surface, the choice of ambient temperature significantly influences the current carrying capacity.

Solar Radiation

Many factors can influence the effect of solar radiation. The altitude of the sun, the clearness ratio of the sky, the incidence of the solar beam and the reflectance of the sun from the ground, affect the magnitude of the solar heat input into the conductor. However, small changes in solar radiation intensity have little effect on the current carrying capacity. An increase in solar radiation intensity from 1000 W/m2 to 1200 W/m2 decreases the rating of a conductor by about 2%. A value of 1000 W/m2 for direct solar radiation and 100W/m2 for diffuse solar radiation for summer noon conditions has been chosen as appropriate to general conditions throughout Australia and New Zealand.

Emissivity and Solar Absorption Coefficients

Emissivity is the value between zero and unity which defines the fraction of the black-body radiation that the surface emits. Similarly, absorptivity is the value between zero and unity that defines the fraction of the incident irradiation that is absorbed by the surface. The surface condition of a conductor affects both these parameters, and for convenience they are assumed to be equal.

The Rural Weathered condition is considered to exist on old lines in clean atmospheres and may also exist as sections of new conductor in an old line arising from augmentation or alteration works.

Air Movement

This is the most significant of all the parameters. The rate of increase of the current carrying capacity of a conductor with increasing wind velocity is greatest at low wind velocities. This is partly due to the effect of wind velocity on the radial temperature gradient in the conductor.

Wind direction also affects the current carrying capacity of a conductor. However, it would be difficult to take the variability of the wind into account because of its dependence on many factors, including local topography and climate.

In view of this and of the lack of comprehensive meteorological data across the country, current carrying capacities have been calculated for the theoretical extreme condition of still air and for 1.0 metre/second.

ELECTRICAL CHARACTERISTICS

AC Resistance

The electrical resistance of a conductor with alternating current is greater than its resistance with direct current. For all-aluminium conductors, the increased resistance is due mainly to skin effect, which causes the current to concentrate in the outer portion of the conductor. Non-uniformity of current distribution is also caused by a proximity effect, which results from electromagnetic fields from nearby conductors. However, for normal spacing of overhead lines this effect is small and can be ignored.

For steel-reinforced conductors the current that follows the spiral of the helically applied aluminium wires around the steel core produces a longitudinal magnetic flux in the steel core. This alternating flux causes both hysteresis and eddy current losses, increasing the effective resistance of the conductor to alternating current. The magnetic flux in the steel varies with current and is most significant when the number of aluminium layers is odd, because there is incomplete cancellation of the magnetic flux in the steel core.

Skin effect and, in the case of steel-reinforced conductors with single and three layers of aluminium, hysteresis and eddy current effects, were taken into consideration in determining the AC resistance.

Inductive Reactance

The inductive reactance of stranded conductors in an overhead line is calculated by considering the flux linkages caused by current flowing in the conductors. To simplify the calculation, it is usually considered to consist of two components: the conductor component of reactance resulting from the magnetic flux, and the spacing component of reactance resulting from the magnetic flux to the equivalent return conductor.

The conductor component depends on the number of strands and the geometry of the conductor. The spacing component takes into consideration the spacing between conductors and the geometry of the circuit. The reactance of an overhead line is found by adding the two components.

For steel-reinforced conductors, the magnetic flux in the steel core depends on the amount of current flowing in the conductors and is most significant when the number of aluminium layers is odd. However, the magnetic properties of the steel core are highly non-linear, and the conductor component of reactance can be accurately determined only from tests. The values shown in the tables of electrical performance data in the following sections are sufficiently accurate for most practical installations.

Values for inductive reactance to 300 mm horizontal spacing are shown in the following Product Sheets.

PHYSICAL & MECHANICAL CHARACTERISTICS

Sag and Tension

The general theory of sag-tension calculations is based on the fact that a conductor suspended between two points assumes the shape of a catenary. The basic relationship between sag and tension can be established from knowledge of the stress-strain characteristics of a conductor. Factors which will subsequently affect the sag and tension are thermal elongation of the conductor due to changes in temperature, creep with time under load, and increased loadings due to wind and ice. These factors affect the length of the conductor and consequently the sag and tension characteristics.

The physical and mechanical performance characteristics required for sag-tension calculations are shown in the product sheets which follow, and the factors which affect the length of a stranded conductor are briefly explained in the following sections.

Suitable formulae for selecting the appropriate tension are published in AS/NZS 7000:2010, Overhead Line Design - Detailed Procedures.

Stress-Strain Characteristics

The stress-strain behaviour of a stranded conductor depends on the properties of the component wires and the construction of the conductor, including the number of layers and the lay length of the wires.

Stress-strain tests are used to establish the behaviour of a stranded conductor during the initial loading period, and a relationship for its elastic behaviour in its final state. The test procedure used to obtain the stress-strain characteristics is to load and hold the conductor at 30%, 50% and 70% of its calculated breaking load with load-holding periods of 30 minutes, 1 hour and 1 hour respectively and the conductor is unloaded at the end of each holding period.

From the initial loading curve where the conductor is loaded to 30% of its breaking load and held for 30 minutes, the amount of geometric settlement of the component wires, the initial creep and the initial modulus of elasticity can be determined.

Subsequent loading and unloading of the conductor at 50% and 70% of its breaking load with load holding periods of 1 hour, ensures that the component wires are settled and that most of the initial creep has been removed. This leaves the conductor in its final state and the final unloading of the conductor is used to determine the final modulus of elasticity.

The final modulus of elasticity is used for sag-tension calculations to determine the behaviour of a conductor which has been in service for some time and has been subjected to high tensions due to low temperatures, wind and in some cases ice loading.

At some high temperature, all the load is transferred to the steel and the thermal elongation of the composite conductor is identical to the thermal elongation of the steel core alone. In practice, for normal operating conditions, it is sufficiently accurate to assume a direct relationship between thermal elongation and the coefficient of linear expansion of the composite conductor. The coefficient of linear expansion for the composite conductor may be calculated, taking into account the material properties and the areas of each component making up the conductor.

PHYSICAL & MECHANICAL CHARACTERISTICS (CONT.)

Thermal Elongation

Variations in temperature will change the length of a conductor and this change in length is known as thermal elongation or thermal strain.

For homogeneous AAC, AAAC and hard drawn copper conductors the thermal elongation is directly related to the coefficient of linear expansion of the material.

For composite ACSR and AACSR conductors the thermal elongation is more complex to establish, due to the relationship between stresses and strains of constituent wires. The stress distribution in a composite conductor changes with temperature. Due to the lower coefficient of thermal expansion of steel compared with that of aluminium, a rise in temperature increases the proportion of the tensile load carried by the steel core.

Creep

Creep is defined as the plastic deformation or non-recoverable extension of conductors which occurs with time under load. It can be considered to consist of two components: initial creep and long-term creep.

Initial creep is the result of settling in of wires when the conductor is first subjected to maximum tension. This component of creep can be offset by pre-tensioning the conductor at a load higher than the everyday tension (EDT) before final sagging. This procedure can effectively stabilise the conductor before final sagging and also provides a consistent base for determining subsequent long-term creep. If conductors are installed at a value of the tension below that used for final sagging, full allowance for both initial and long-term creep should be made.

Long term creep depends on stress, operating temperature and time. It can be calculated from information on the material and design of the conductor. Typically, extensions of 400–500 micrometres per metre may occur over a 30-year life of a line. In order to avoid problems associated with the increase of sag resulting from creep, a number of solutions may be adopted.

One solution is to assume an imaginary lower temperature of installation which would (when the temperature is raised to the actual installation temperature) result in a thermal expansion equal in value to that of the predicted creep. For example, if the predicted creep is equal to the thermal expansion caused by a temperature increase of 20°C, then the installation temperature is assumed to be less than the actual by 20°C. This results in the line being tensioned at a higher EDT than normal at the time of installation. In the 30-year life span of the conductor, the tension will gradually decrease to the value of true EDT.

Alternatively, commercially available computer programs based on the more complex strain-summation method can be used to determine the stringing tension for any given future loading conditions and limiting constraints on one or more parameters. Determining the stringing tension is done by iteration, working forward in time.

Everyday Tension

Aeolian vibration can damage overhead line conductors as a result of mechanical fatigue. The standard practice for preventing fatigue damage is to limit the tension of the conductor to a value that will not subject the conductor to excessive vibration under normal operating conditions.

The tension that may be applied to a conductor is usually expressed as a percentage of the conductor breaking load. As the damage from fatigue is most pronounced in the outer layers of the conductor, the safe tension is based on the allowable stress in the outer layers. Three main factors which cause vibration fatigue on conductors are considered when determining the safe allowable outer layer stress: the type of suspension arrangement used, the terrain, and the efficiency of the vibration damping system, if used. Reference should be made to AS/NZS 7000:2010, Overhead Line Design - Detailed Procedures, for EDT figures.

BARE OVERHEAD CONDUCTORS

Materials

Nexans offers a number of materials meeting the requirements of both Australian and International Standards.

Aluminium 1350: High purity electrical conductor (EC) grade aluminium (alloy 1350) has a conductivity of 61% IACS and UTS of 160–185 MPa.

Aluminium alloy 1120: Nexans alloy 1120 (Ductolex) has a conductivity of 59% IACS and UTS of 240–250 MPa. It provides a conductor with comparable electrical resistance and 40–50% higher strength than a similar conductor of EC grade material. This alloy can be considered a 'high tech' version of EC grade aluminium and offers significant advantages over older type alloys, such as alloy 6201. Steel-reinforced aluminium alloy 1120 conductors have a high strength to weight ratio, resulting in small sags on long span lengths. Fittings for alloy 1120 conductors are similar to those used for EC grade aluminium conductors.

Copper: Hard drawn copper wire produced from high conductivity alloy 110A has a conductivity of 97% IACS and UTS of 405–460 MPa.

Galvanised steel: Galvanised steel wire made from fully-killed steel with a carbon content of 0.6% has a UTS of 1.31–1.39 GPa. It is galvanised by either a hot dip or electrolytic process to give a zinc coating mass of 200–260 g/m2.

Construction

The wires in all bare conductors are stranded concentrically with successive layers having an opposite direction of lay, the outermost layer being right-handed. When required, a larger central wire (king wire) is included in a conductor. The diameter of this wire is based on conductor design considerations and is usually 5% greater than the surrounding wires. The incorporation of a king wire is often an advantage for ACSR type conductors, as it ensures that the surrounding layer of wires fits firmly on the central wire.

ACSR conductors may be subjected to corrosive conditions such as high pollution found in industrial areas or salt spray in coastal areas. The application of high melting point grease over the steel wires provides additional protection against corrosion. Aluminium alloy 1120 conductors are becoming more popular as replacements for steel-reinforced conductors in areas of high corrosion risk.

Property of Materials

Property	Unit	Aluminium	Aluminium Alloy 1120 (Ductolex)	Copper	Galvanised Steel
Density at 20ºC	kg/m^3	2700	2700	8890	7800
Conductivity at 20ºC	% IACS	61	59	97	10.1
Resistivity at 20ºC	μΩ.m	0.0283	0.0293	0.01777	0.17
Constant-Mass Temperature Coefficient of Resistance	per ºC	0.00403	0.00390	0.00381	0.0044
Ultimate Tensile Stress	MPa	160–185	230–250	405–460	1310–1390
Modulus of Elasticity	GPa	68	68	124	193
Coefficient of Linear Expansion	per ºC	23.0×10^{-6}	23.0×10^{-6}	17×10^{-6}	11.5×10^{-6}

AAC AERIAL CONDUCTORS

Aluminium conductor

Product Sheet No. 310-01 A

Code Name	Stranding (mm)	Cross Sectional Area (mm^2)	Nominal Overall Diameter (mm)	Mass (kg/km)	Breaking Load (kN)
Namu	7/2.11	24.5	6.33	66.9	4.07
Poko	7/2.36	30.6	7.08	83.7	5.09
Ladybird	7/2.79	42.8	8.37	117	6.92
Kutu	7/3.00	49.5	9.00	135	7.98
Fly	7/3.40	63.6	10.2	174	9.98
Rango	7/3.66	73.6	11.0	201	11.2
Grasshopper	7/3.91	84.1	11.7	230	12.8
Wasp	7/4.39	106	13.2	290	16.1
Beetle	19/2.67	106	13.4	292	17.2
Weke	7/4.72	122	14.2	335	18.6
Bee	7/4.90	132	14.7	361	20.1
Cricket	7/5.36	158	16.1	432	24.0
Weta	19/3.35	167	16.8	460	26.2
Pluto	19/3.75	210	18.8	576	31.9
Mata	19/3.86	222	19.3	611	33.8
Cockroach	19/4.22	266	21.1	731	40.4
Butterfly	19/4.65	323	23.3	888	49.1
Cicada	37/4.65	628	32.6	1730	95.6

Issue: June 2019
Made to AS 1531

Notes:

1. Coefficient of linear expansion 23.0 x 10-6/°C.
2. Modulus of elasticity:
   65 GPa for seven (7) and nineteen (19) wire conductors.
   64 GPa for thirty seven (37) wire conductors.

AAC AERIAL CONDUCTORS

Aluminium conductor

Product Sheet No. 310-01 B

Code Name	Calculated DC Resistance at 20°C (Ohm/km)	Reactance at 50Hz with 300 mm Spacing (Ohm/km)	Current Rating Still Air (Amps)	Current Rating 1 m/s (Amps)
Namu	1.17	0.321	85	164
Poko	0.936	0.314	98	189
Ladybird	0.670	0.303	121	232
Kutu	0.579	0.299	132	253
Fly	0.451	0.291	155	295
Rango	0.389	0.286	170	323
Grasshopper	0.342	0.282	184	350
Wasp	0.271	0.275	213	403
Beetle	0.271	0.271	213	404
Weke	0.234	0.270	233	441
Bee	0.217	0.268	244	461
Cricket	0.181	0.262	275	515
Weta	0.172	0.257	286	533
Pluto	0.137	0.250	333	612
Mata	0.130	0.248	345	632
Cockroach	0.108	0.242	390	707
Butterfly	0.0895	0.236	443	792
Cicada	0.0460	0.214	689	1178

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Note: Current ratings are based on an ambient temperature of 30°C, a maximum conductor temperature of 75°C, rural weathered, summer noon and intensity of solar radiation 1000 W/m2.

AAAC AERIAL CONDUCTORS

1120 Aluminium alloy conductor

Product Sheet No. 310-02 A

Code Name	Stranding (mm)	Cross Sectional Area (mm^2)	Nominal Overall Diameter (mm)	Mass (kg/km)	Breaking Load (kN)
Chlorine	7/2.50	34.4	7.50	94.3	8.18
Chromium	7/2.75	41.6	8.25	113	9.91
Fluorine	7/3.00	49.5	9.00	135	11.8
Helium	7/3.75	77.3	11.3	211	17.6
Hydrogen	7/4.50	111	13.5	304	24.3
Iodine	7/4.75	124	14.3	339	27.1
Krypton	19/3.25	158	16.3	433	37.4
Lutetium	19/3.50	183	17.5	503	41.7
Neon	19/3.75	210	18.8	576	47.8
Nitrogen	37/3.00	262	21.0	721	62.2
Sulfur	61/3.75	674	33.8	1860	145

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Made to AS 1531

Notes:

1. Coefficient of linear expansion 23.0 x 10-6/°C.
2. Modulus of elasticity:
   65 GPa for seven (7) and nineteen (19) wire conductors.
   64 GPa for thirty-seven (37) and sixty-one (61) wire conductors.
3. For the greased versions of the above conductors, the grease used will be Type 20A150 complying with BS EN 50326.

AAAC AERIAL CONDUCTORS

1120 Aluminium alloy conductor

Product Sheet No. 310-02 B

Code Name	Calculated DC Resistance at 20°C (Ohm/km)	Reactance at 50Hz with 300 mm Spacing (Ohm/km)	Current Rating Still Air (Amps)	Current Rating 1 m/s (Amps)
Chlorine	0.864	0.310	104	200
Chromium	0.713	0.304	117	224
Fluorine	0.599	0.299	131	250
Helium	0.383	0.285	173	328
Hydrogen	0.266	0.273	217	410
Iodine	0.239	0.270	231	438
Krypton	0.189	0.259	271	507
Lutetium	0.163	0.254	299	555
Neon	0.142	0.250	328	603
Nitrogen	0.114	0.242	381	690
Sulfur	0.0444	0.212	711	1210

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Made to AS 1531

Note: Current ratings are based on an ambient temperature of 30°C, a maximum conductor temperature of 75°C, rural weathered, summer noon and intensity of solar radiation 1000 W/m2.

ACSR AERIAL CONDUCTORS

Aluminium conductor
Galvanised steel reinforced

Product Sheet No. 310-03 A

Code Name	Number of Strands/Wire Diameter (mm)		Equivalent Aluminium Cross-Sectional Area	Nominal Overall Diameter	Mass	Breaking Load	Modulus of Elasticity	Coefficient of Linear Expansion
	Aluminium	Steel	(mm²)	(mm)	(kg/km)	(kN)	(GPa)	(x 10^{-6}/°C)
Magpie	3/2.11	4/2.11	12.7	6.33	139	17.4	136	13.9
Squirrel	6/2.11	1/2.11	20.7	6.33	84.8	7.49	83	19.3
Gopher	6/2.36	1/2.36	26.0	7.08	106	9.37	83	19.3
Ferret	6/3.00	1/3.00	41.8	9.00	171	14.9	83	19.3
Mink	6/3.66	1/3.66	62.2	11.0	255	21.6	83	19.3
Raccoon	6/4.09	1/ 4.09	77.7	12.3	318	27.0	83	19.3
Dog	6/4.72	7/1.57	103	14.2	396	32.9	80	19.9
Dingo	18/3.35	1/3.35	155	16.8	505	35.4	71	21.4
Wolf	30/2.59	7/2.59	155	18.1	724	67.4	88	18.4
Jaguar	18/3.86	1/3.86	207	19.3	671	46.0	71	21.4
Goat	30/3.71	7/3.71	317	26.0	1490	135	88	18.4
Zebra	54/3.18	7/3.18	420	28.6	1620	131	78	19.9
Cardinal	54/3.38	7/3.38	474	30.4	1830	149	78	19.9
Moose	54/3.53	7/3.53	517	31.8	1990	159	78	19.9
Pawpaw	54/3.75	19/2.25	584	33.8	2240	178	78	20.0

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Note: The grease used within these conductors is Type 20A150 complying with BS EN 50326.

ACSR AERIAL CONDUCTORS

Aluminium conductor
Galvanised steel reinforced

Product Sheet No. 310-03 B

Code Name	Calculated DC Resistance at 20°C (Ohm/km)	Reactance at 50Hz with 300 mm Spacing (Ohm/km)	Current Rating Still Air (Amps)	Current Rating 1 m/s (Amps)
Magpie	2.23	0.349	59	113
Squirrel	1.37	0.322	75	145
Gopher	1.09	0.315	86	167
Ferret	0.677	0.299	117	223
Mink	0.455	0.287	152	285
Raccoon	0.364	0.280	175	326
Dog	0.274	0.271	210	387
Dingo	0.182	0.257	274	494
Wolf	0.183	0.252	280	501
Jaguar	0.137	0.248	336	616
Goat	0.0893	0.229	462	814
Zebra	0.0674	0.222	544	942
Cardinal	0.0597	0.219	590	1014
Moose	0.0547	0.216	626	1068
Pawpaw	0.0485	0.212	678	1148

Issue: June 2019
Made to AS 3607

Note: Current ratings are based on an ambient temperature of 30°C, a maximum conductor temperature of 75°C, rural weathered, summer noon and intensity of solar radiation 1000 W/m2.

HARD DRAWN CU AERIAL CONDUCTORS

Copper conductor

Product Sheet No. 320-01 A

Cross Sectional Area (mm²)	Stranding (mm)	Nominal Conductor Diameter (mm)	Mass (kg/km)	Breaking Load (kN)
6	7/1.04	3.12	53.6	2.51
7	7/1.12	3.36	62.2	2.9
10	7/1.35	4.05	90.2	4.17
16	7/1.70	5.10	143	6.5
25	7/2.14	6.42	227	10.1
35	19/1.53	7.65	314	14.1
40	19/1.63	8.15	359	16.0
50	19/1.83	9.15	451	20.0
70	19/2.14	10.7	617	26.8
95	37/1.83	12.8	882	39.0

Issue: June 2019
Made to AS 1746

Notes:

1. Coefficient of linear expansion 17.0 x 10-6/°C.
2. Modulus of elasticity:
   119 GPa for seven (7) wire conductors.
   118 GPa for nineteen (19) wire conductors.
   117 GPa for thirty-seven (37) wire conductors.

HARD DRAWN CU AERIAL CONDUCTORS

Copper conductor

Product Sheet No. 320-01 B

Cross Sectional Area (mm²)	Calculated DC Resistance at 20°C (Ohm/km)	Reactance at 50Hz with 300 mm Spacing (Ohm/km)	Current Rating Still Air (Amps)	Current Rating 1 m/s (Amps)
6	3.03	0.365	44	87
7	2.61	0.36	49	96
10	1.80	0.349	61	120
16	1.13	0.334	82	160
25	0.716	0.320	110	212
35	0.516	0.306	135	260
40	0.455	0.302	146	281
50	0.361	0.295	169	323
70	0.264	0.285	206	392
95	0.186	0.273	256	486

Issue: June 2019
Made to AS 1746

Note: Current ratings are based on an ambient temperature of 30°C, a maximum conductor temperature of 75°C, rural weathered, summer noon and intensity of solar radiation 1000 W/m2.

PVC INSULATED HARD DRAWN CU AERIAL CABLES

Copper conductor
PVC insulation

Product Sheet No. 330-01 A

Cross Sectional Area (mm2)	Stranding (mm)	Conductor Diameter (mm)	Insulation Thickness (mm)	Nominal Overall Diameter (mm)	Mass (kg/km)	Breaking Load (kN)
6	7/1.04	3.12	1.0	5.3	80	2.3
10	7/1.35	4.05	1.0	6.3	120	3.9
16	7/1.70	5.10	1.0	7.3	180	5.9
25	19/1.35	6.75	1.2	9.3	300	10.4
35	19/1.53	7.65	1.2	10.3	370	12.7
50	19/1.83	9.15	1.4	12.2	510	17.3
70	19/2.14	10.7	1.4	13.8	710	25.0
95	37/1.83	12.8	1.6	16.2	980	32.8

Issue: June 2019
Made to AS/NZS 5000.1

Notes:

1. Coefficient of linear expansion 17.0 x 10-6/°C.
2. Modulus of elasticity:
   112 GPa for seven (7) wire conductors.
   110 GPa for nineteen (19) wire conductors.
   108 GPa for thirty-seven (37) wire conductors.

PVC INSULATED HARD DRAWN CU AERIAL CABLES

Copper conductor
PVC insulation

Product Sheet No. 330-01 B

Cross Sectional Area (mm²)	Calculated DC Resistance at 20°C (Ohm/km)	Inductive Reactance at 50Hz with 300 mm Spacing (Ohm/km)	Current Rating Still Air (Amps)	Current Rating 1 m/s (Amps)
6	3.17	0.365	45	81
10	1.88	0.349	63	110
16	1.18	0.334	84	147
25	0.749	0.314	115	194
35	0.540	0.306	141	235
50	0.399	0.295	172	281
70	0.276	0.285	218	353
95	0.198	0.273	266	421

Issue: June 2019
Made to AS/NZS 5000.1

Note: Current ratings are based on an ambient temperature of 30°C, a maximum conductor temperature of 75°C and intensity of solar radiation 1000 W/m2.

PVC INSULATED AAC AERIAL CABLES

Aluminium conductor
PVC insulation

Product Sheet No. 330-02 A

Code Name	Stranding (mm)	Cross Sectional Area (mm²)	Insulation Thickness (mm)	Nominal Overall Diameter (mm)	Mass (kg/km)	Breaking Load (kN)
Namu	7/2.11	24.5	1.2	8.85	119	4.07
Poko	7/2.36	30.6	1.3	9.75	154	5.09
Ladybird	7/2.79	42.8	1.4	11.4	200	6.92
Kutu	7/3.00	49.5	1.4	12.0	224	7.98
Fly	7/3.40	63.6	1.4	13.2	276	9.98
Rango	7/3.66	73.6	1.4	14.0	314	11.2
Wasp	7/4.39	106	1.6	16.6	443	16.1
Beetle	19/2.67	106	1.6	16.8	437	17.2
Weke	7/4.72	122	1.8	18.0	520	18.6
Weta	19/3.35	167	1.8	20.7	650	26.2

Issue: June 2019
Generally made to AS/NZS 5000.1

Notes:
1. Coefficient of linear expansion 23.0 x 10-6/°C.
2. Modulus of elasticity 65 GPa.

PVC INSULATED AAC AERIAL CABLES

Aluminium conductor
PVC insulation

Product Sheet No. 330-02 B

Code Name	Calculated DC Resistance at 20°C (Ohm/km)	Reactance at 50Hz with 300mm Spacing (Ohm/km)	Current Rating Still Air (Amps)	Current Rating 1 m/s (Amps)
Namu	1.17	0.321	90	152
Poko	0.936	0.314	104	174
Ladybird	0.670	0.303	130	212
Kutu	0.579	0.299	142	232
Fly	0.451	0.291	168	271
Rango	0.389	0.286	185	297
Wasp	0.271	0.275	234	368
Beetle	0.271	0.271	235	369
Weke	0.234	0.270	258	399
Weta	0.172	0.257	317	484

Issue: June 2019
Generally made to AS/NZS 5000.1

Note: Current ratings are based on an ambient temperature of 30°C, a maximum conductor temperature of 75°C, rural weathered, summer noon and intensity of solar radiation 1000 W/m2.

AL AERIAL BUNDLED CABLES (ABC)

Aluminium conductor
XLPE insulation

Product Sheet No. 330-03 A (Two Core)

Cross Sectional Area (mm²)	Conductor Diameter (mm)	Insulation Thickness (mm)	Nominal Overall Diameter of Bundle (mm)	Mass (kg/km)	Breaking Load (kN)
25	5.99	1.3	18.4	200	7.0
35	6.90	1.3	20.6	260	9.8
50	8.05	1.5	23.8	350	14.0
95	11.40	1.7	31.8	680	26.6

Issue: June 2019
Made to AS/NZS 3560.1

Product Sheet No. 330-04 A (Three Core)

Cross Sectional Area (mm²)	Conductor Diameter (mm)	Insulation Thickness (mm)	Nominal Overall Diameter of Bundle (mm)	Mass (kg/km)	Breaking Load (kN)
35	6.90	1.3	22.2	390	14.7

Issue: June 2019
Made to AS/NZS 3560.1

Product Sheet No. 330-05 A (Four Core)

Cross-sectional Area (mm²)	Conductor Diameter (mm)	Insulation Thickness (mm)	Nominal Overall Diameter of Bundle (mm)	Mass (kg/km)	Breaking Load (kN)
25	5.99	1.3	22.2	400	14.0
35	6.90	1.3	24.9	520	19.6
50	8.05	1.5	28.7	700	28.0
70	9.69	1.5	32.8	960	39.2
95	11.40	1.7	38.4	1350	53.2
120	12.90	1.7	42.2	1660	67.2
150	14.35	1.7	45.6	2020	84.0

Issue: June 2019
Made to AS/NZS 3560.1

Notes:
1. Coefficient of linear expansion 23 x 10-6/°C.
2. Modulus of elasticity 59 GPa up to and including 50 mm² and 56 GPa for conductors above 50 mm².
3. Subject to confirmation these cables can be manufactured with pilots.

AL AERIAL BUNDLED CABLES (ABC)

Aluminium conductor
XLPE insulation

Product Sheet No. 330-03 B (Two Core)

Cross Sectional Area (mm²)	Calculated DC Resistance at 20°C (Ohm/km)	Maximum AC Resistance at 80°C (Ohm/km)	Positive Sequence Reactance at 50Hz (Ohm/km)	Current Rating (Amps)
25	1.20	1.49	0.102	118
35	0.868	1.08	0.0982	140
50	0.641	0.796	0.0924	168
95	0.320	0.398	0.0868	258

Issue: June 2019
Made to AS/NZS 3560.1

Product Sheet No. 330-04 B (Three Core)

Cross Sectional Area (mm²)	Calculated DC Resistance at 20°C (Ohm/km)	Maximum AC Resistance at 80°C (Ohm/km)	Positive Sequence Reactance at 50Hz (Ohm/km)	Current Rating (Amps)
35	0.868	1.08	0.0982	134

Issue: June 2019
Made to AS/NZS 3560.1

Product Sheet No. 330-05 B (Four Core)

Cross Sectional Area (mm²)	Calculated DC Resistance at 20°C (Ohm/km)	Maximum AC Resistance at 80°C (Ohm/km)	Positive Sequence Reactance at 50Hz (Ohm/km)	Current Rating (Amps)
25	1.20	1.49	0.102	109
35	0.868	1.08	0.0982	134
50	0.641	0.796	0.0924	157
70	0.443	0.551	0.0893	196
95	0.320	0.398	0.0868	241
120	0.253	0.315	0.0844	280
150	0.206	0.257	0.0844	314

Issue: June 2019
Made to AS/NZS 3560.1

Note: Current ratings are based on an ambient temperature of 30°C, a maximum conductor temperature of 80°C, wind speed of 1 m/s and intensity of solar radiation 1000 W/m2.

NOTES