



Cable Type Definition

» Cable Type Definition According to AS/NZS 1802

Type No.	Description	Voltage Designation kV
209	Semiconductive screened three-core cable with central pilot core	1.1/1.1 to 11/11
210	Composite screened three-core cable with central pilot core	1.1/1.1
240	Composite screened three-core cable with interstitial pilot cores	1.1/1.1 to 11/11
241	Semiconductive screened three-core cable with interstitial earth conductors and a central pilot core	1.1/1.1 to 11/11
245	Semiconductive screened three-core cable with interstitial earth conductors and three central pilot/control cores	1.1/1.1 to 3.3/3.3
260	Semiconductive screened pliable armoured three-core cable with interstitial pilot cores	1.1/1.1 to 11/11
275	Semiconductive screened three-core cable with interstitial earth conductors and a central pilot core	1.1/1.1

» Cable Type Definition According to AS/NZS 2802

Cable Class	Type No.	Description	Voltage Designation kV
Class 1	441	Semiconductive screened three-core cable with three interstitial earth conductors and a central pilot core	3.3/3.3 to 22/22
	450	Composite screened three-core cable with two interstitial earth conductors and one interstitial pilot core	3.3/3.3 to 33/33
	455	Semiconductive screened three-core cable with two interstitial earth conductors and one interstitial pilot core	3.3/3.3 to 11/11
Class 2	409	Composite screened three-core cable with a central pilot core	1.1/1.1 to 22/22
	412	Unscreened pliable armoured three-core cable with three interstitial earth cores (no pilot)	1.1/1.1 only
	440	Composite screened three-core cable with three interstitial pilot cores	1.1/1.1 to 22/22
	441.1	Semiconductive screened three-core cable with three interstitial earth conductors and a central pilot core	1.1/1.1 only



Reeling & Trailing Cable Electrical Characteristics

» A. Power Core Conductor Characteristic

Nominal Conductor Area	Strand Size	Nominal Conductor Diameter	Max. DC Resistance @20°C	Max. AC Resistance @90°C*	Nominal 3-Phase Voltage Drop*	Nominal Reactance*
mm ²	no/mm	mm	Ω/km	Ω/km	mV/A.m	Ω/km
1.5	30/0.25	1.6	14.0	17.4	30.1	0.17
2.5	50/0.25	2.0	8.37	10.5	18.2	0.15
6	84/0.30	3.5	3.39	4.33	7.5	0.14
10	77/0.40	4.6	2.02	2.58	4.5	0.13
16	126/0.40	5.7	1.24	1.57	2.7	0.12
25	209/0.40	7.6	0.746	0.936	1.6	0.11
35	285/0.40	8.8	0.547	0.675	1.2	0.10
50	380/0.40	10.1	0.410	0.523	0.92	0.10
70	203/0.67	12.1	0.271	0.346	0.62	0.097
70	570/0.40	12.4	0.271	0.346	0.62	0.096
95	259/0.67	13.3	0.212	0.270	0.50	0.095
95	475/0.50	14.5	0.208	0.266	0.49	0.093
120	336/0.67	15.4	0.164	0.209	0.40	0.092
120	608/0.50	16.2	0.162	0.208	0.39	0.091
150	427/0.67	17.2	0.129	0.166	0.33	0.091
150	777/0.50	18.1	0.127	0.163	0.32	0.089
185	518/0.67	19.3	0.106	0.137	0.28	0.089
240	672/0.67	23.0	0.0818	0.107	0.24	0.087
300	854/0.67	24.5	0.0644	0.0847	0.21	0.086

*The AC characteristics are valid for up to 1.1/1.1kV operating voltage and can be used as a guide for higher operating voltages.



» B. Continuous Current Carrying Capacity

Power Conductor Nominal Area	Cable Voltage Rating			
	Protected From Sun		Exposed To Sun	
	1.1/1.1kV	3.3/3.3kV–33/33kV	1.1/1.1kV	3.3/3.3–33/33kV
mm ²	A	A	A	A
1.5	23	–	18	–
2.5	30	–	23	–
6	49	–	38	–
10	66	–	51	–
16	88	89	67	66
25	120	120	90	89
35	145	145	110	105
50	170	170	125	125
70	220	220	160	155
95	250	250	185	180
120	295	295	210	210
150	340	340	245	240
185	385	385	270	265
240	455	450	315	310
300	515	510	355	350

» C. Current Rating Factor

Where the cable is wound on cylindrical or radial drum, the heat dispersion factor must be taken into consideration; therefore the current carrying capacity must be reduced by the derating factor:

Cylindrical Drum				
Number of layer on drum	1	2	3	4
Factor	0.85	0.65	0.45	0.35

Radial Drum	Ventilated	Unventilated
Factor	0.85	0.75

Variations in ambient temperature for cable installed in air or in underground

Ambient Temp	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C	75°C	80°C	85°C
Conductor Temperature is 90°C	1.26	1.20	1.15	1.10	1.05	1.0	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34	0.19

Continues Current Rating above is calculated based on the IEC60287 Standard and Australian typical environment: 40°C air ambient temperature, 0.8 solar radian absorption coefficients and 1000W/m² and the value is for guidance only.



Reeling & Trailing Cable Mechanical & Thermal Characteristics

» A. Cable Minimum Bending Radius

Installation condition	1.1/1.1kV	3.3/3.3~33/33kV
For dispatch drum barrel	6D	8D
For fixed bend	4D	6D
For free flexing	6D	10D
For permanently repeating reeling	10D	12D
For passing over sheaves	10D	15D

For XLPE and Paper insulated HV cables, bending radii is 18D (during installation) / 12D (installed).

» B. Cable Maximum Pulling Tension

For trailing the cable	20N/mm ² of the total cross-sectional area of phase conductor
For dragging the cable	calculated by $T = L * W * f * 10$, where T is the pulling tension, L is the length of cable to be pulled (m), W is the weight of the cable (kg/m), f is the friction coefficient (usually take as 0.5)

» C. Temperature.....

Maximum continuous conductor temperature: +90°C

Minimum continuous conductor temperature: -25°C



Reeling & Trailing Cable Material Characteristics

» A. Conductor Screen

All cables with a voltage rating of 3.3/3.3 kV and above have a cross-linked semiconductive elastomeric material extruded directly over the power core conductor through a triple extrusion process. Textile-reinforced Semiconductive tape or water barrier (water-proof) tape can be applied on special request or particular purposes.

» B. Insulation Screen

Semiconductive elastomer screen: The material used for insulation screen is cross-linked semiconductive elastomeric which directly applied over insulation of each power core.

Textile reinforced semiconductive tape screen: As an alternative to an elastomer screen, the textile-reinforced semiconductive tape screen may be applied over the insulation of power cores of 3.3/3.3kV Type 450 & 451 (Class 1) and 3.3/3.3kV up to and including 11/11kV Type 409 & 440 (Class 2). The semiconductive tape comprises a textile fabric, coated with a semiconductive elastomer and having a continuous print on one side identifying it as being semiconductive.

» C. Cradle separators / Earth Covering / Screen for Core Assembly

Semiconductive elastomer used in cradle separators, the interstitial earth conductor covering (other than for Type 412) and the screen for core assembly (Types 241, 245, 275 and 441 only) is a compound based on polychloroprene (PCP) which complies with the table below.

Test (per AS/NZS1802 / AS/NZS 2802)		Specified Value
A	Mechanical tests without ageing	
1	Tensile strength (MPa)	≥8.5
2	Elongation at rupture (percent)	≥200
3	Permanent set (percent)	≤ 20
B	Mechanical tests after ageing in air oven	
1	Tensile strength (MPa)	≥ 6.2
2	Elongation at rupture (percent)	≥ 50
C	Volume resistivity at 23°C (Ω.m)	≤1.0



Caledonian Mining Cables

Technical Information

» D. Power / Pilot Core Insulation

	AS /NZS 1802 reeling and trailing cable	AS /NZS 2802 reeling and trailing cable
Power Core Insulation	R-EP-90	XR-EP-90 (for class 1 cables) R-EP-90 (for class 2 cables)
Pilot Core Insulation	R-EP-90	XR-EP-90/R-EP-90

R-EP-90: a cross-linked compound based on ethylene propylene copolymer, terpolymer or a blend of the two, suitable for up to 90°C maximum continuous operating temperature.

XR-EP-90: a cross-linked compound based on ethylene propylene copolymer (EPM), or ethylene propylene terpolymer (EPDM or EPT), having enhanced properties compares with R-EP-90, suitable for up to 90°C maximum continuous operating temperature.

Test (per AS/NZS 1802/AS/NZS 2802)	R-EP-90		XR-EP-90
A Mechanical tests without ageing			
1 Tensile strength (MPa)	≥4.2		≥ 8.5
2 Elongation at rupture (percent)	≥200		≥200
B Mechanical tests after ageing in air oven			
1 Tensile strength (percentage of values found in unaged specimens)	≥70		≥75
2 Elongation at rupture (percentage of values found in unaged specimens)	≥70		≥ 75
C Hot set test			
1 Elongation under load (percent)	≤ 175		≤175
2 Residual elongation after cooling (percent)	≤ 15		≤15
D Electrical characteristics	≤1.1/1.1kV	≥3.3/3.3kV	
1 Insulation resistance constant (ki) at room temperature (GΩ.m)	≥1500	≥4000	≥4000
2 Insulation resistance constant (ki) at 90°C (GΩ.m)	≥1.5	≥4.0	≥ 4.0

» E. Metallic Composite Screen.....

Composite screen consists of tinned annealed copper interwoven with polyester yarn and each strand consists of seven copper wires with nominal diameter between 0.25 and 0.5mm to form a braid.

» F. Pliable Steel Strand Armour.....

Pliable amour comprises galvanized low carbon (mild) steel strands, each strand consist of seven wires helically over the inner sheath to provide close cover. The wires comply with the requirements of AS/NZS 3863.



» G. Sheath

Inner sheath (Type 206 and 412 only): GP-85-PCP (Standard), GP-90-CSP or GP-90-CPE to AS/NZS 3803.

Outer sheath:

AS1802 reeling and trailing cable	HD-85-CSP, HD-90-PCP or HD-90-CPE to AS/NZS 3808
AS2802 reeling and trailing cable	HD-85-CSP, HD-90-PCP or HD-90-CPE to AS/NZS 3808 (for class 2 cable); XHD-85-CSP, XHD-90-PCP or XHD-90-CPE to AS/NZS 3808 (for class 1 cable)

GP-85-PCP: General purpose cross-linked compound based on Polychloroprene, suitable for up to 85°C maximum continuous operating temperature.

GP-90-CSP: General purpose cross-linked compound based on chlorinated polyethylene, suitable for up to 90°C maximum continuous operating temperature.

GP-90-CPE: General purpose cross-linked compound based on Chlorosulphonated polyethylene, suitable for up to 90°C maximum continuous operating temperature.

HD-85-PCP, HD-90-CSP or HD-90-CPE is the heavy duty version of GP-85-PCP, GP-90-CSP or GP-90-CPE, and XHD is the extra-heavy duty version, the characteristic is as follow:

Test (except for D and E, per AS/NZS 1802/AS/NZS 2802)	GP-85-PCP	HD-85-PCP	XHD-85-PCP
A Mechanical tests without ageing			
1 Tensile strength (MPa)	≥8.5	≥11	≥12.5
2 Elongation at rupture (percent)	≥250	≥250	≥300
3 Tear resistance (N/mm)	–	≥ 5	≥7
B Mechanical tests after ageing in air oven			
1 Tensile strength (MPa)	≥6.2	≥8.5	≥8.5
2 Elongation at rupture (percent)	≥125	≥125	≥150
C Oil immersion test			
1 Tensile strength (percentage of values found in unaged specimens)	≥60	≥60	≥ 60
2 Elongation at rupture (percentage of values found in unaged specimens)	≥60	≥60	≥60
D Hot set test at 200±3°C, 200kPa for 15mins			
1 Elongation under load, maximum (percent)	≤175	≤175	≤175
2 Elongation after cooling, maximum (percent)	≤20	≤20	≤20
E Oxygen index			
	–	–	–



Core Identification of Reeling & Trailing Cable

» A. Core Identification Method.....

1	2	3	4	5
Type No.	Voltage Designation, KV			
	≤1.1/1.1		≥3.3/3.3	
	Power Cores	Covered Conductor(S)	Power Cores	Covered Conductor
209	(a) or (b) or (d)	(a)	(a) or (c) or (d)	(a)
210	(a) or (b) or (d)	(a)	-	-
240	(a) or (b) or (d)	(a) and (b)*	(a) or (c) or (d)	(a) and (b)*
241 and 245	(a) or (e)	(a)	(a) or (e)	(a)
260	(a) or (b) or (d)	(a) and (b)*	(a) or (c) or (d)	(a) and (b)*
275	(a)	(a)	-	-
409	(a) or (b) or (d)	(a)	(a) or (c) or (d)	(a)
412	(a) or (b)	(a) or (b)	-	-
440	(a) or (b) or (d)	(a)	(a) or (c) or (d)	(a) or (b)
441	(a) or (e)	-	(a) or (e)	(a)
450	-	-	(c) or (d) or (f)	(a)
455	-	-	(e)	(a)

(a): colour-coded insulation or covering.

(b): colour-coded or continuously numbered proofed tape over the insulation or covering.

(c): colour-coded or continuously numbered semiconductive tape over the insulation.

(d): colour-coded yarn in composite screen.

(e): Type 441 and 455----colour-coded or numbered semiconductive elastomer insulation screen, identifiable at intervals not greater than 300mm.

(f): Type 450----colour-coded or numbered semiconductive tape over the composite screen.

*: Grey or white tape may be used.

» B. Identification And Rotational Sequence

Type No.	Rotational sequence of core colours
209*	Red, White, Blue
210*	Red, White, Blue
240	Red, Grey, White, Grey, Blue, Grey
241*	Red, Black, White, Black, Blue, Black**
245***	Red, Black, White, Black, Blue, Black**

Caledonian Mining Cables

Technical Information



Type No.	Rotational sequence of core colours
260	Red, Grey, White, Grey, Blue, Grey
275*	Red, Black, White, Black, Blue, Black**
409	Red, White, Blue. The central pilot core is grey
412	Red, Green/Yellow, White, Green/Yellow, Blue, Green/Yellow
440	Red, Grey, White, Grey, Blue, Grey
441**	Red, Black, White, Black, Blue, Black. The central pilot core is grey
450**	Red, Black, White, Black, Blue, Grey
455	Red, Black, White, Black, Blue, Grey

*The central pilot conductor insulation in all cases is coloured grey.

**The earth conductors (Type 241, 245, 275, 441 and 450) are covered with semiconductive elastomer which is inherently black; it is not possible to assign the normal (green/yellow) earth colour identification to these conductors.

***The central pilot/control conductor insulation are coloured grey and numbered 1, 2 and 3.