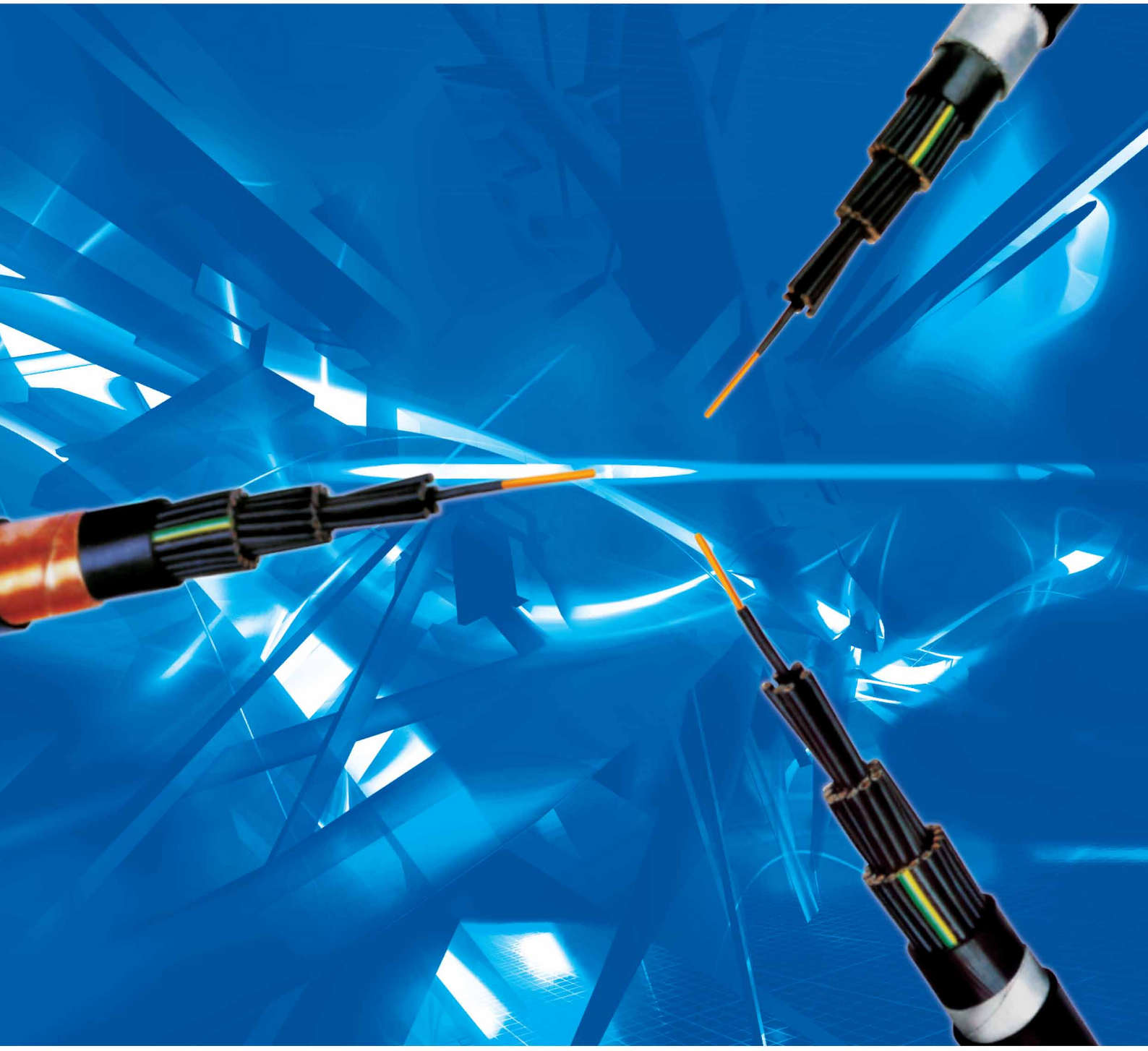
Control Cables
To IEC Standard



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Control Cables, with Solid Copper Conductors, PVC Insulated and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed solid copper conductor, as per Class 1 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For use indoors – in cable trenches or ducts; and outdoors - for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is not required, or in applications where the cable is not exposed to mechanical damage.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	11.8	200	C108PA10500CBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	12.7	250	C108PA10700CBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	15.7	340	C108PA11000CBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	16.2	385	C108PA11200CBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	17.0	435	C108PA11400CBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	17.8	490	C108PA11600CBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	18.7	560	C108PA11900CBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	21.7	700	C108PA12400CBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	23.8	850	C108PA13000CBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	24.7	1000	C108PA13700CBK21IMF

The above data is approximate and subject to manufacturing tolerance.
We reserve the right to change the above figures as a result of product development and/or changes in standard.

CU / PVC / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	12.9	260	C110PA10500CBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	13.8	330	C110PA10700CBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	17.2	450	C110PA11000CBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	17.7	540	C110PA11200CBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	18.6	600	C110PA11400CBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	19.6	670	C110PA11600CBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	20.6	780	C110PA11900CBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	24.0	1030	C110PA12400CBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	25.4	1160	C110PA13000CBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	27.4	1410	C110PA13700CBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	15.3	430	C112PA10500CBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	16.5	480	C112PA10700CBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	20.8	670	C112PA11000CBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	21.5	780	C112PA11200CBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	22.6	890	C112PA11400CBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	23.8	1000	C112PA11600CBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	25.1	1170	C112PA11900CBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	29.6	1460	C112PA12400CBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	31.6	1830	C112PA13000CBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	34.1	2320	C112PA13700CBK21IMF

Control Cables, with Stranded Copper Conductors, PVC Insulated and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed stranded circular copper conductor, as per Class 2 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For use indoors – in cable trenches or ducts; and outdoors - for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is not required, or in applications where the cable is not exposed to mechanical damage.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	12.3	215	C208PA10500CBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	13.3	265	C208PA10700CBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	16.5	360	C208PA11000CBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	17.0	410	C208PA11200CBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	17.8	465	C208PA11400CBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	18.7	530	C208PA11600CBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	19.7	600	C208PA11900CBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	22.9	740	C208PA12400CBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	24.2	890	C208PA13000CBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	26.1	1070	C208PA13700CBK21IMF

The above data is approximate and subject to manufacturing tolerance.
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CU / PVC / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	13.4	275	C210PA10500CBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	14.5	350	C210PA10700CBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	18.1	480	C210PA11000CBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	18.7	555	C210PA11200CBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	19.6	630	C210PA11400CBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	20.6	710	C210PA11600CBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	21.7	820	C210PA11900CBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	25.3	1020	C210PA12400CBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	26.8	1235	C210PA13000CBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	28.9	1495	C210PA13700CBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	16.1	410	C212PA10500CBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	17.4	520	C212PA10700CBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	22.0	720	C212PA11000CBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	22.7	840	C212PA11200CBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	23.9	950	C212PA11400CBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	25.2	1070	C212PA11600CBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	26.6	1260	C212PA11900CBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	31.4	1580	C212PA12400CBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	33.5	1965	C212PA13000CBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	36.2	2510	C212PA13700CBK21IMF

Control Cables, with Solid Copper Conductors, PVC Insulated, Copper Tape Shielded and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed solid copper conductor, as per Class 1 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Bedding : An extruded layer of Polyvinyl chloride (PVC).

Shielding : Copper tape applied helically with suitable overlap.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For use indoors – in cable trenches or ducts; and outdoors - for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is not required, or in applications where the cable is not exposed to mechanical damage.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	14.2	305	C108PA105N0CBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	15.1	350	C108PA107N0CBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	18.1	465	C108PA110N0CBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	18.6	520	C108PA112N0CBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	19.4	575	C108PA114N0CBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	20.2	635	C108PA116N0CBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	21.1	715	C108PA119N0CBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	25.3	930	C108PA124N0CBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	27.5	1115	C108PA130N0CBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	29.4	1205	C108PA137N0CBK21IMF

The above data is approximate and subject to manufacturing tolerance.
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CU / PVC / CT SHIELDED / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	15.1	380	C110PA105N0CBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	16.2	450	C110PA107N0CBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	19.6	560	C110PA110N0CBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	20.1	650	C110PA112N0CBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	21.0	750	C110PA114N0CBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	22.0	830	C110PA116N0CBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	23.0	970	C110PA119N0CBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	26.4	1260	C110PA124N0CBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	27.8	1380	C110PA130N0CBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	30.0	1670	C110PA137N0CBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	18.5	540	C112PA105N0CBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	19.9	670	C112PA107N0CBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	23.2	800	C112PA110N0CBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	23.9	920	C112PA112N0CBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	25.0	1080	C112PA114N0CBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	26.2	1230	C112PA116N0CBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	27.5	1430	C112PA119N0CBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	32.0	1780	C112PA124N0CBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	34.0	2210	C112PA130N0CBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	36.7	2790	C112PA137N0CBK21IMF

Control Cables, with Stranded Copper Conductors, PVC Insulated, Copper Tape Shielded and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed stranded circular copper conductor, as per Class 2 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Bedding : An extruded layer of Polyvinyl chloride (PVC).

Shielding : Copper tape applied helically with suitable overlap.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For use indoors – in cable trenches or ducts; and outdoors - for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is not required, or in applications where the cable is not exposed to mechanical damage.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	15.7	340	C208PA105N0CBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	16.5	370	C208PA107N0CBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	18.9	495	C208PA110N0CBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	19.4	550	C208PA112N0CBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	20.2	610	C208PA114N0CBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	21.1	670	C208PA116N0CBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	22.1	760	C208PA119N0CBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	25.3	930	C208PA124N0CBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	27.5	1115	C208PA130N0CBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	28.5	1290	C208PA137N0CBK21IMF

The above data is approximate and subject to manufacturing tolerance.
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CU / PVC / CT SHIELDED / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	15.8	390	C210PA105N0CBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	16.9	470	C210PA107N0CBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	20.5	630	C210PA110N0CBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	21.1	710	C210PA112N0CBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	22.0	800	C210PA114N0CBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	23.0	875	C210PA116N0CBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	24.1	1000	C210PA119N0CBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	27.7	1225	C210PA124N0CBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	26.8	1240	C210PA130N0CBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	31.5	1750	C210PA137N0CBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	18.5	540	C212PA105N0CBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	19.9	670	C212PA107N0CBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	24.4	850	C212PA110N0CBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	25.2	980	C212PA112N0CBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	26.3	1160	C212PA114N0CBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	27.6	1310	C212PA116N0CBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	29.0	1520	C212PA119N0CBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	33.8	1900	C212PA124N0CBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	35.9	2350	C212PA130N0CBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	38.8	2970	C212PA137N0CBK21IMF

Control Cables, with Solid Copper Conductors, PVC Insulated, Steel Tape Armoured and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed solid copper conductor, as per Class 1 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Bedding : An extruded layer of Polyvinyl chloride (PVC).

Armouring : Double layer of galvanized steel tape.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For outdoor installations, for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is required, or in applications where mechanical damages are expected to occur.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	15.0	355	C108PA1050GCBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	15.5	410	C108PA1070GCBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	18.5	540	C108PA1100GCBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	19.0	590	C108PA1120GCBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	20.6	670	C108PA1140GCBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	21.0	720	C108PA1160GCBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	21.5	800	C108PA1190GCBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	24.5	970	C108PA1240GCBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	25.8	1170	C108PA1300GCBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	27.5	1315	C108PA1370GCBK21IMF

The above data is approximate and subject to manufacturing tolerance.
We reserve the right to change the above figures as a result of product development and/or changes in standard.

CU / PVC / STA / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	15.5	340	C110PA1050GCBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	16.6	495	C110PA1070GCBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	20.0	650	C110PA1100GCBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	20.5	760	C110PA1120GCBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	21.4	820	C110PA1140GCBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	22.4	920	C110PA1160GCBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	23.4	1030	C110PA1190GCBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	27.0	1260	C110PA1240GCBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	28.2	1520	C110PA1300GCBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	30.5	1830	C110PA1370GCBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	18.9	610	C112PA1050GCBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	20.3	710	C112PA1070GCBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	23.6	890	C112PA1100GCBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	24.1	1140	C112PA1120GCBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	25.4	1180	C112PA1140GCBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	26.6	1300	C112PA1160GCBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	28.1	1500	C112PA1190GCBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	32.6	1890	C112PA1240GCBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	34.4	2480	C112PA1300GCBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	37.3	3030	C112PA1370GCBK21IMF

Control Cables, with Stranded Copper Conductors, PVC Insulated, Steel Tape Armoured and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed stranded circular copper conductor, as per Class 2 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Bedding : An extruded layer of Polyvinyl chloride (PVC).

Armouring : Double layer of galvanized steel tape.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For outdoor installations, for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is required, or in applications where mechanical damages are expected to occur.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	15.3	350	C208PA1050GCBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	17.0	430	C208PA1070GCBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	19.3	570	C208PA1100GCBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	19.8	625	C208PA1120GCBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	21.0	690	C208PA1140GCBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	21.9	800	C208PA1160GCBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	22.5	850	C208PA1190GCBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	25.7	1030	C208PA1240GCBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	27.3	1185	C208PA1300GCBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	28.9	1400	C208PA1370GCBK21IMF

The above data is approximate and subject to manufacturing tolerance.
We reserve the right to change the above figures as a result of product development and/or changes in standard.

CU / PVC / STA / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	16.2	440	C210PA1050GCBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	17.3	530	C210PA1070GCBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	20.9	710	C210PA1100GCBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	21.5	790	C210PA1120GCBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	22.4	880	C210PA1140GCBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	23.4	970	C210PA1160GCBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	24.5	1090	C210PA1190GCBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	28.1	1340	C210PA1240GCBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	30.3	1630	C210PA1300GCBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	31.9	1875	C210PA1370GCBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	19.1	660	C212PA1050GCBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	20.4	740	C212PA1070GCBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	24.9	960	C212PA1100GCBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	25.6	1120	C212PA1120GCBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	26.7	1270	C212PA1140GCBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	28.0	1390	C212PA1160GCBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	29.4	1610	C212PA1190GCBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	34.4	2030	C212PA1240GCBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	36.5	2660	C212PA1300GCBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	39.4	3250	C212PA1370GCBK21IMF

Control Cables, with Solid Copper Conductors, PVC Insulated, Steel Wire Armoured and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed solid copper conductor, as per Class 1 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Bedding : An extruded layer of Polyvinyl chloride (PVC).

Armouring : Single layer of galvanized steel wires.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For outdoor installations, for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is required, or in applications where mechanical damages are expected to occur.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	16.0	470	C108PA1050WCBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	17.2	530	C108PA1070WCBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	20.2	740	C108PA1100WCBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	22.5	1050	C108PA1120WCBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	23.3	1110	C108PA1140WCBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	24.2	1220	C108PA1160WCBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	25.2	1320	C108PA1190WCBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	28.0	1530	C108PA1240WCBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	30.1	1800	C108PA1300WCBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	33.0	2180	C108PA1370WCBK21IMF

The above data is approximate and subject to manufacturing tolerance.
We reserve the right to change the above figures as a result of product development and/or changes in standard.

CU / PVC / SWA / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	17.2	570	C110PA1050WCBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	18.4	640	C110PA1070WCBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	22.9	1125	C110PA1100WCBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	24.2	1240	C110PA1120WCBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	25.1	1350	C110PA1140WCBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	26.1	1470	C110PA1160WCBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	27.4	1620	C110PA1190WCBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	30.5	1970	C110PA1240WCBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	33.7	2380	C110PA1300WCBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	36.6	2790	C110PA1370WCBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	20.2	750	C112PA1050WCBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	22.7	1150	C112PA1070WCBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	26.3	1460	C112PA1100WCBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	28.2	1650	C112PA1120WCBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	29.2	1790	C112PA1140WCBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	30.8	1980	C112PA1160WCBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	32.1	2150	C112PA1190WCBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	37.5	3010	C112PA1240WCBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	40.4	3430	C112PA1300WCBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	43.3	4020	C112PA1370WCBK21IMF

Control Cables, with Stranded Copper Conductors, PVC Insulated, Steel Wire Armoured and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed stranded circular copper conductor, as per Class 2 of IEC 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to IEC 60502-1.

Bedding : An extruded layer of Polyvinyl chloride (PVC).

Armouring : Single layer of galvanized steel wires.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to IEC 60502-1.

APPLICATION

For outdoor installations, for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is required, or in applications where mechanical damages are expected to occur.

TECHNICAL DATA

- Nominal voltage Uo/U = 0.6/1 kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
5 X 1.5	12.1000	14.6000	18.0	15.5	13.5	16.6	500	C208PA1050WCBK12IMR
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	18.0	550	C208PA1070WCBK21IMR
10 X 1.5	12.1000	14.6000	14.0	12.5	11.5	21.0	770	C208PA1100WCBK21IMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	23.3	1080	C208PA1120WCBK21IMR
14 X 1.5	12.1000	14.6000	12.0	10.5	9.5	24.2	1140	C208PA1140WCBK21IMR
16 X 1.5	12.1000	14.6000	11.0	10.0	9.0	25.0	1260	C208PA1160WCBK21IMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	26.0	1370	C208PA1190WCBK21IMR
24 X 1.5	12.1000	14.6000	9.0	8.0	7.5	28.9	1620	C208PA1240WCBK21IMF
30 X 1.5	12.1000	14.6000	8.0	7.5	6.5	31.0	1850	C208PA1300WCBK21IMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	34.0	2250	C208PA1370WCBK21IMF

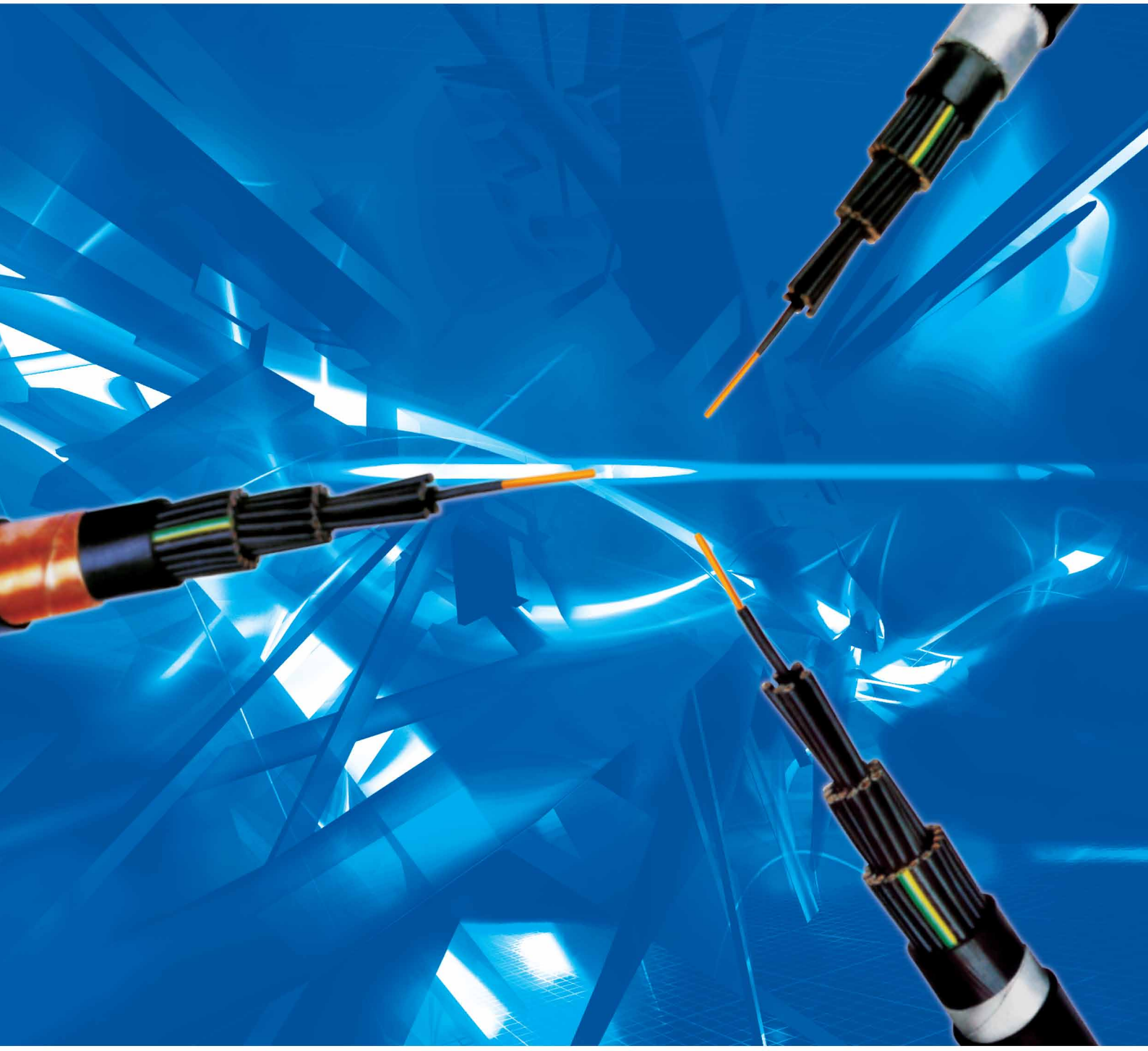
The above data is approximate and subject to manufacturing tolerance.
We reserve the right to change the above figures as a result of product development and/or changes in standard.

CU / PVC / SWA / PVC

0.6 / 1 kV

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
5 X 2.5	7.4100	8.8700	24.0	20.5	18.0	17.8	600	C210PA1050WCBK12IMR
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	19.2	660	C210PA1070WCBK21IMR
10 X 2.5	7.4100	8.8700	20.0	16.5	14.5	23.8	960	C210PA1100WCBK21IMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	25.0	1280	C210PA1120WCBK21IMR
14 X 2.5	7.4100	8.8700	16.0	14.0	12.0	26.0	1390	C210PA1140WCBK21IMR
16 X 2.5	7.4100	8.8700	15.0	13.0	11.0	27.0	1510	C210PA1160WCBK21IMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	28.3	1670	C210PA1190WCBK21IMR
24 X 2.5	7.4100	8.8700	13.0	11.0	9.5	31.4	2030	C210PA1240WCBK21IMF
30 X 2.5	7.4100	8.8700	11.5	10.0	8.5	34.5	2450	C210PA1300WCBK21IMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	37.4	2870	C210PA1370WCBK21IMF
4.0 mm^2								
5 X 4.0	4.6100	5.5100	31.0	25.5	24.0	20.8	780	C212PA1050WCBK12IMR
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	23.5	1190	C212PA1070WCBK21IMR
10 X 4.0	4.6100	5.5100	25.0	21.0	19.5	27.2	1510	C212PA1100WCBK21IMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	29.0	1700	C212PA1120WCBK21IMR
14 X 4.0	4.6100	5.5100	20.5	17.0	16.0	30.0	1850	C212PA1140WCBK21IMR
16 X 4.0	4.6100	5.5100	19.5	16.0	15.0	31.6	2040	C212PA1160WCBK21IMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	33.0	2260	C212PA1190WCBK21IMR
24 X 4.0	4.6100	5.5100	16.0	13.5	12.5	38.4	3070	C212PA1240WCBK21IMF
30 X 4.0	4.6100	5.5100	14.5	12.0	11.0	41.3	3560	C212PA1300WCBK21IMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	44.5	4120	C212PA1370WCBK21IMF

Control Cables
To **BS** Standard



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Control Cables, with Stranded Copper Conductors, PVC Insulated, Steel Wire Armoured and PVC Sheathed

CONSTRUCTION

Conductor : Plain annealed stranded circular copper conductor, as per Class 2 of BS EN 60228.

Insulation : An extruded layer of Polyvinyl chloride (PVC) insulation, rated 70 ºC at normal operation to BS 7655-3.1.

Bedding : An extruded layer of Polyvinyl chloride (PVC).

Armouring : Single layer of galvanized steel wires.

Outer sheath : An extruded layer of Polyvinyl chloride (PVC) sheathing compound type TM1 to BS 7655-4.1.

APPLICATION

For outdoor installations, for connecting signaling and control units in industries, railways, traffic signals, power stations, industrial plants and switchgears if mechanical protection is required, or in applications where mechanical damages are expected to occur.

TECHNICAL DATA

- Nominal voltage Uo/U = 600 / 1000 V
- Power frequency test voltage 3.5 kV for 5 minutes
- Max. admissible temperature of conductor at normal operation 70 ºC
- Max. admissible temperature of conductor at short circuit 160 ºC for 5 seconds

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 ºC	AC at 70 ºC	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
1.5 mm^2								
7 X 1.5	12.1000	14.6000	16.0	14.0	12.5	15.6	490	C208PA1070WCBK21BMR
12 X 1.5	12.1000	14.6000	13.0	11.5	10.5	19.7	790	C208PA1120WCBK21BMR
19 X 1.5	12.1000	14.6000	10.0	9.0	8.0	22.6	1040	C208PA1190WCBK21BMR
27 X 1.5	12.1000	14.6000	8.0	7.5	6.5	27.1	1515	C208PA1270WCBK21BMF
37 X 1.5	12.1000	14.6000	7.5	6.5	6.0	30.0	1860	C208PA1370WCBK21BMF

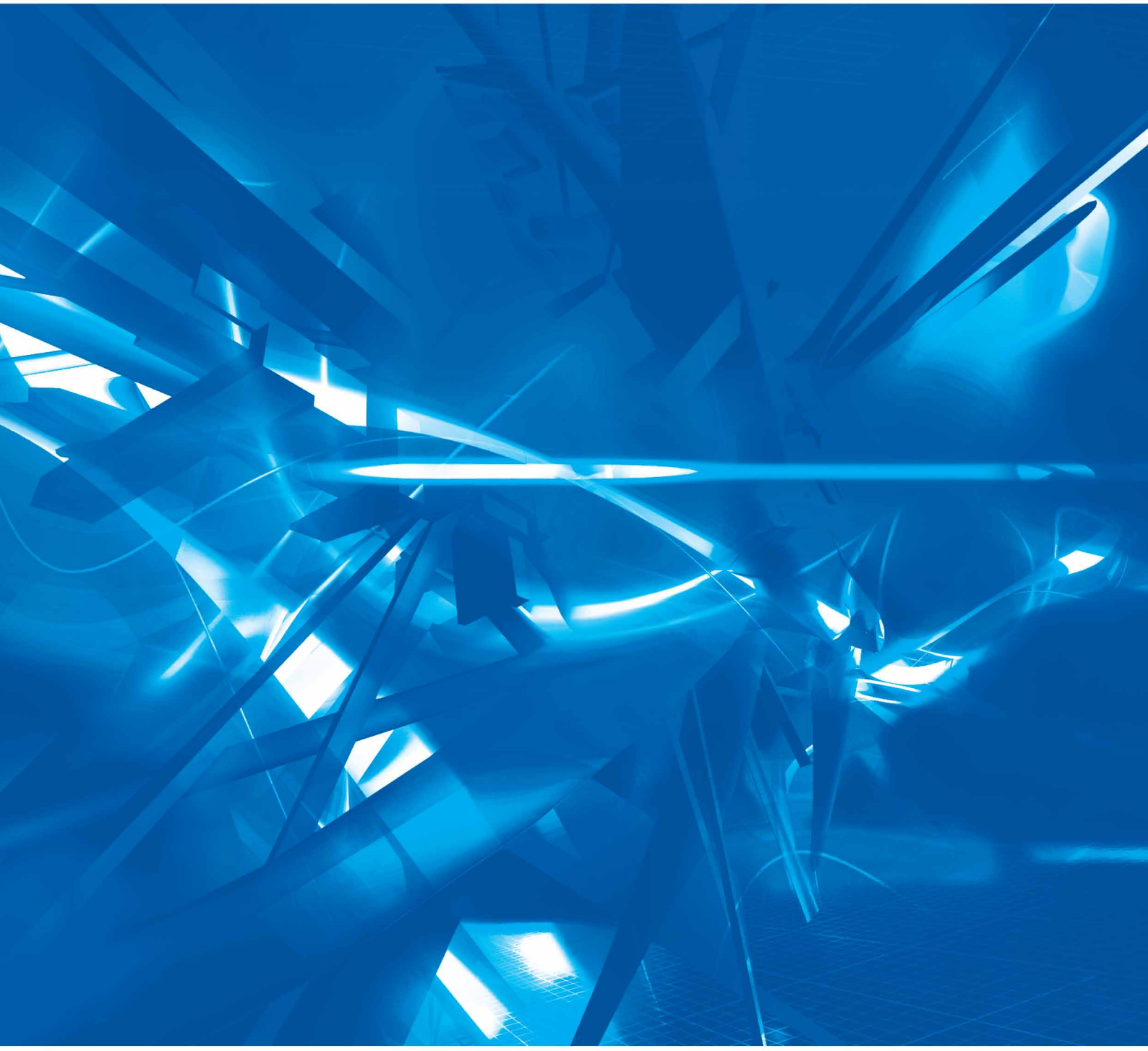
The above data is approximate and subject to manufacturing tolerance.
We reserve the right to change the above figures as a result of product development and/or changes in standard.

CU / PVC / SWA / PVC

600 / 1000 V

Number & Nominal cross sectional area	ELECTRICAL DATA					DIMENSIONS AND WEIGHTS		AES Code
	Max. Conductor Resistance		Current Rating			Approx. overall diameter	Approx. overall weight	
	DC at 20 °C	AC at 70 °C	Laid in ground	Laid in ducts	Laid in free air			
No. X mm^2	Ω / km	Ω / km	A	A	A	mm	Kg / km	
2.5 mm^2								
7 X 2.5	7.4100	8.8700	22.0	18.5	16.0	18.3	725	C210PA1070WCBK21BMR
12 X 2.5	7.4100	8.8700	18.0	15.5	13.5	22.4	1025	C210PA1120WCBK21BMR
19 X 2.5	7.4100	8.8700	14.0	12.0	10.5	26.9	1575	C210PA1190WCBK21BMR
27 X 2.5	7.4100	8.8700	11.5	10.0	8.5	31.0	2020	C210PA1270WCBK21BMF
37 X 2.5	7.4100	8.8700	10.0	9.0	7.5	34.4	2495	C210PA1370WCBK21BMF
4.0 mm^2								
7 X 4.0	4.6100	5.5100	28.0	23.0	21.5	20.9	940	C212PA1070WCBK21BMR
12 X 4.0	4.6100	5.5100	23.0	19.5	18.0	27.1	1570	C212PA1120WCBK21BMR
19 X 4.0	4.6100	5.5100	18.0	15.0	14.0	31.1	2115	C212PA1190WCBK21BMR
27 X 4.0	4.6100	5.5100	14.5	12.0	11.0	37.1	3110	C212PA1270WCBK21BMF
37 X 4.0	4.6100	5.5100	13.0	11.0	10.0	41.1	3840	C212PA1370WCBK21BMF

Cables For Special Applications



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Cables For Special Applications

Lead Sheathed Cables

Construction

Main constructions are as explained for low voltage power and control cables in accordance with IEC 60502-1 or BS 6346 / BS 5467 standards. Lead sheath is applied over an extruded bedding layer.

Application

For outdoor installations in damp and wet locations in chemical and petrol plants in which mechanical protection is required or in applications where mechanical damages are expected to occur.

Main properties

- Radially watertight
- Corrosion resistant
- Where necessary, it is available with the longitudinal watertight protection
- Suitable for use in hostile environment or underground
- Especially suitable for submarine installation
- Resistant to aggressive chemical substances
- Offer good protection against rodents

Low Smoke Halogen Free Cables

Construction

Main constructions are as explained for low voltage power and control cables in accordance with IEC 60502-1 or BS 6724 standards, except that the cables are specially constructed using low smoke, haloge free materials / compounds.

Application

Low smoke halogen free power cables with enhanced characteristics in case of fire are used for applications where harm to human life and damage to property must be prevented in the event of fire, e.g. in industrial installations, commercial establishments, hotels, airports, underground stations, railway stations, hospitals, banks, schools, etc.

Main properties

- Reduced smoke and toxic gases emission in the event of fire
- Reduced acid gases emission in the event of fire
- Excellent flame retardant properties

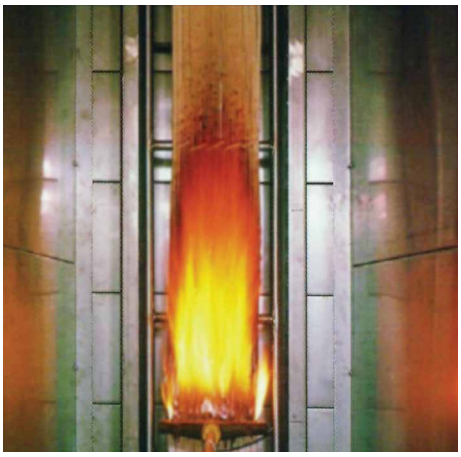
Other Types / Characteristics

Various types of constructions can be applied to meet special requirements of the customers, that is:

- Copper wires screen for control cables
- Non-magnetic armour (Aluminium) for single-core cables
- Shielded, armoured and lead sheathed power and control cables
- Cross linked polyethylene (XLPE) insulation for control cables
- Polyvinyl chloride (PVC) insulation, rated 85 ºC for power and control cables
- Fire resistant cables

Cables can also be designed for specific requirements, that is:

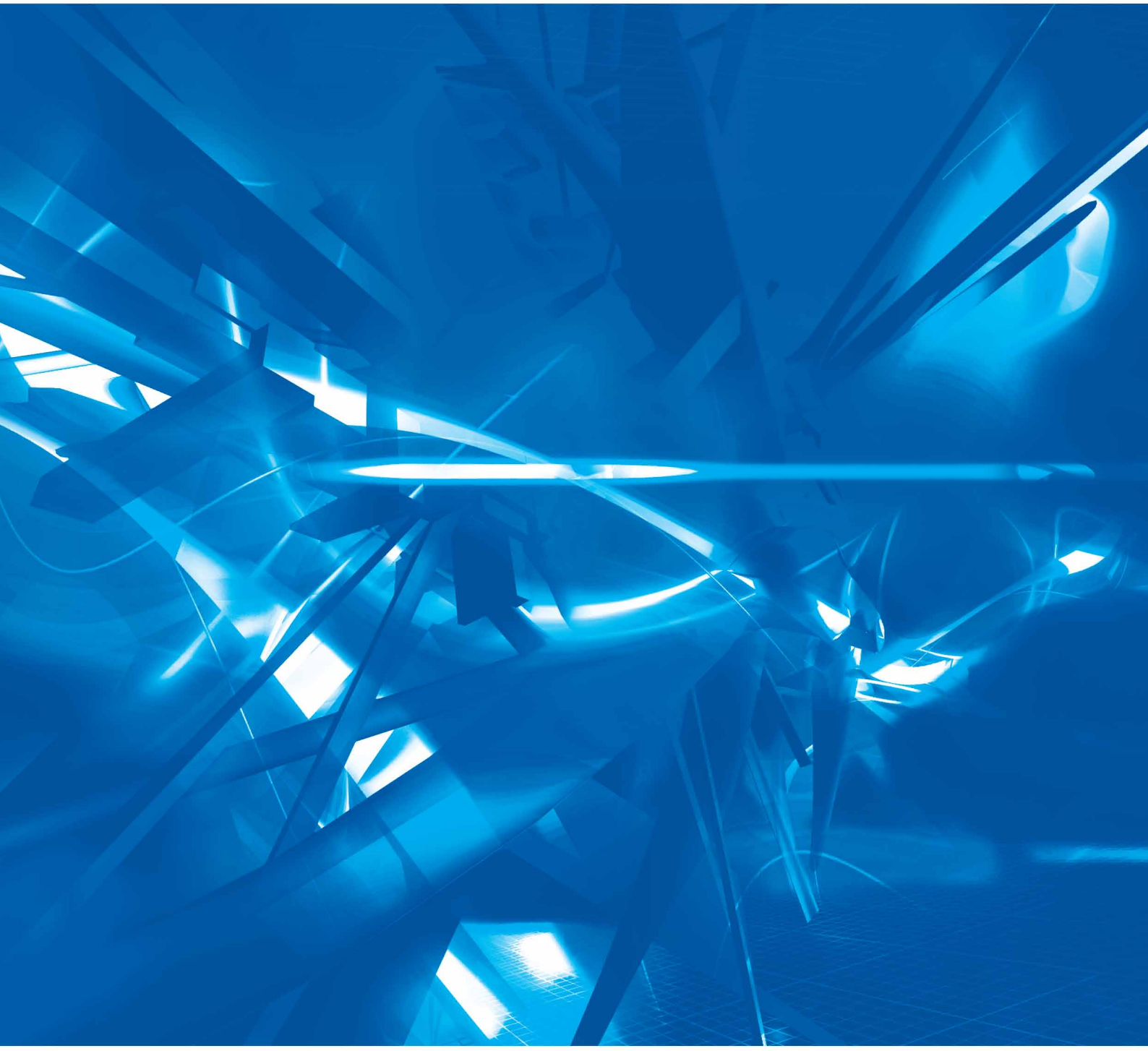
- Flexibility
- Oil resistance
- UV resistance
- Termite resistance
- Hydro-carbon resistance
- Acid and alkaline resistance
- Installation in wet locations
- Flame retardant to IEC 60332-3 or BS EN 50266-2 standards, Category A, B, C or D



Other possibilities:

- Delivery lengths other than standard lengths
- Products as per other national and international norms/standards

Technical Data



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Recommendations

Installation of Cables

A. Minimum installation radius

None of the low voltage power or control cables should be bent during installation to a radius smaller than the following:

- All multi-core cables : 12 D
- All single-core cables : 15 D

Where D is the overall diameter of the cable.

Wherever possible, larger installation radius should be used, except that the minimum bending radius where the cables are placed in position adjacent to joints and terminations may be reduced to 50% of the above values, provided that the bending is carefully controlled, e.g. by the use of a former.

B. Minimum temperature during installation

It is recommended that the cables are installed only when both the cable and the ambient temperature are above 0 ºC and have been so for the past 24 hours, or where special precautions have been taken to maintain the cable above this temperature.

C. Prevention of moisture ingress

Care should be exercised during installation to avoid any damage to cable coverings. This is important in wet or other hostile environments. The protective end cap should not be removed from the ends of the cable until immediately prior to termination or jointing, especially for cables that do not have an extruded bedding. When the caps have been removed, the unprotected ends of the cable should not be exposed to moisture.

D. Maximum pulling tension

The maximum pulling tension is dependent on the cable design, the mechanical limitations, the conductor material, and the method of laying and pulling the cables. The maximum permissible pulling force can be calculated based on the method of pulling as follows:

D.1 Pulling eye attached to the conductor

With pulling eye attached to copper conductors, the maximum pulling tension should not exceed 0.036 times circular-mil area of conductor (C_m). With pulling eye attached to aluminum conductors, the maximum pulling tension should not exceed 0.027 times circular-mil area of conductor (C_m). Or in other words:

$T_m = 0.036 \times n \times C_m$ (Copper)
$T_m = 0.027 \times n \times C_m$ (Aluminum)

Where

T_m : Maximum pulling tension in N

n : The number of conductors

C_m : Circular mil area of each conductor

The maximum limitation for this calculation is **22240 N** for single conductor (1/C) cables, and **44480 N** for multi-core cables. This limitation is due to unequal distribution of tension forces when pulling multiple conductors.

When the calculated pulling tension is close to (or within 10% of) the maximum pulling tension, the use of a tension gauge during the pulling is recommended.

D.2 Cable grip over lead sheath

With cable grip over lead sheath, with commercial lead, the maximum pulling tension on the lead sheath should not exceed **10.33 N/mm²**.

D.3 Cable grip over non-leaded cable

With cable grip over non-leaded cable, the maximum pulling tension should not exceed **4400 N**.

E. Sidewall pressure

One of the limitations to be considered for the installation of electrical cables is sidewall pressure. The sidewall pressure is the force exerted on the insulation and sheath of the cable at a bend point when the cable is under tension, and is normally the limiting factor in an installation where cable bends are involved. The sidewall pressure in general is expressed as the tension out of a bend expressed in newtons divided by the inside radius of the bend expressed in meters.

$$P = \left[\frac{T_o}{r} \right]$$

Where

P : Sidewall pressure in N/m

T_o : Tension leaving the bend in N

r : Inside radius of conduit in m

The normal maximum sidewall pressure per meter of radius is as given below. However, in order to minimize cable damage due to excessive sidewall pressure, the installer should check the proper recommendations for each type of cables to be installed.

Cable type	Maximum sidewall pressure (N/m)
Non-shielded multi-core cables	7300
Single core cables	7300
Armoured cables	4400

Formulas

1. Resistance

The values of conductor DC resistance given in the previous tables are based on 20 °C. In case the DC resistance is required at any other temperature the following formula is used :

$$R_\theta = R_{20} \times [\, 1 + \alpha (\theta - 20) \,] \qquad \Omega / Km$$

Where

R_θ	:	Conductor DC resistance at θ °C	Ω / Km
R_{20}	:	Conductor DC resistance at 20 °C	Ω / Km
θ	:	Operating temperature	^oC
α	:	Resistance temperature coefficient	$1 / ^oC$
	=	0.00393 for Copper	
	=	0.00403 for Aluminum	

To get the AC resistance of the conductor at its operating temperature the following formula is used

$$R_{a.c} = R_\theta \times (1 + y_p + y_s) \qquad \Omega / Km$$

Where

y_p and y_s are the proximity and skin effect factors respectively which depend on the laying and operating frequency of the cable.

2. Inductance

Self and mutual inductance are formulated as follow :

$$L = K + 0.2 \ln \left(\frac{2S}{d} \right) \qquad mH / Km$$

Where

L	:	Inductance	mH / Km
K	:	Constant depends on the conductor's number of wires	
D	:	Conductor diameter	mm
S	:	Axial spacing between cables	mm
	=	1 x S in case of trefoil formation	
	=	1.26 x S in case of flat formation	

3. Capacitance

$$C = \frac{\epsilon_r}{18 \ln \frac{D}{d}} \qquad \mu F / Km$$

Where

C	:	Operating capacitance	$\mu F / Km$
ϵ_r	:	Relative permittivity of insulation	
D	:	Diameter over insulation	mm
d	:	Diameter under insulation	mm

4. Insulation Resistance

$$R = K \ln \left(\frac{D}{d} \right) \qquad M\Omega / Km$$

Where

R	:	Insulation resistance	$M\Omega / Km$
K	:	Constant depends on the insulation	
d	:	Diameter of the conductor	mm
D	:	Diameter of the insulated core	mm

5. Charging Current

The charging current is the capacitive current which flows when an AC voltage is applied to the cables as a result of the capacitance between the conductor and earth, and for a multi-core cable in which cores are not screened, between conductors. The value can be derived from following the equation :

$$I_C = U_o \, \omega C \, 10^{-6} \qquad A / Km$$

Where

I_C	:	Charging current	A / Km
U_o	:	Phase voltage	V
ω	:	$2 \pi f$	
f	:	Operating frequency	Hz
C	:	Capacitance to neutral	$\mu F / Km$

6. Dielectric Losses

The dielectric losses of an AC cable are proportional to the capacitance, the frequency, the phase voltage and the power factor. The value can be derived from the following equation :

$$W_d = \omega C \, U_o^2 \tan \delta \, 10^{-6} \qquad W/Km/Ph$$

Where

W_d	:	Dielectric Losses	$W/Km/Ph$
ω	:	$2 \pi f$	
f	:	Operating frequency	Hz
C	:	Capacitance to neutral	$\mu F / Km$
U_o	:	Phase voltage	V
$\tan \delta$	:	Dielectric power factor	

7. Cable Ampacity

Cable Ampacity is defined as the continuous maximum current the cable can carry at its maximum operating temperature.

In the technical information tables the following installation conditions were assumed during the current calculation :

- Ambient air temperature = 40 ^{o}C
- Ambient ground temperature = 35 ^{o}C
- Soil thermal resistivity = 1.2 $^{o}C.m/W$
- Burial depth = 0.5 $Mt.$

In case the installation conditions are different from the stated, the derating factors tabulated in tables 3 to 12 must be used in calculating the new current carrying capacity.

All the cable Ampacities are based on IEC 60287.

8. Short Circuit Capacity

Tables 14-17 give the short circuit current for conductor based on the following conditions :

A. Short circuit starts from the maximum operating conductor temperature

XLPE	=	90	^{o}C
PVC	=	70	^{o}C

B. Maximum temperature during short circuit

XLPE	=	250	^{o}C	
PVC	=	160	^{o}C	for C.S.A ≤ 300 mm^2
	=	140	^{o}C	for C.S.A > 300 mm^2

C. Maximum short circuit current duraton is 5 seconds.

If the short circuit current is required at duration not mentioned in the catalogue, it is obtained by dividing the short circuit current for 1 second by the square root of the required duration as follows :

$$I_{s.c.t} = \frac{I_{s.c.1}}{\sqrt{t}}$$

Where

$I_{s.c.t}$	:	Short circuit current for t second	kA
$I_{s.c.1}$	:	Short circuit current for 1 second	kA
t	:	Duration	$Sec.$

9. Voltage Drop

When current flows in a cable conductor there is a voltage drop between the ends of the conductors which is the product of the current and impedance. The following equations should be used to calculate the voltage drop :

A. Single phase circuit :

$$V_d = 2\,I\,\ell\,(R\cos\Phi + X\sin\Phi) \quad V$$

B. Three phase circuit :

$$V_d = \sqrt{3}\,I\,\ell\,(R\cos\Phi + X\sin\Phi) \quad V$$

Where

V_d	:	Voltage drop	V
I	:	Load current	A
ℓ	:	Route length	Km
R	:	AC Resistance	Ω/Km
X	:	Reactance	Ω/Km
$\cos\Phi$	:	Power factor	

Where

$$X = \omega\,L\,10^{-3} \quad \Omega/Km$$

Where

ω	:	$2\pi f$	
f	:	Operating frequency	Hz
L	:	Inductance	mH/Km

Relation between cos Φ and sin Φ :

cos Φ	1.0	0.9	0.85	0.8	0.6
sin Φ	0.0	0.44	0.53	0.6	0.8

- LV cable systems should be planned so as not to exceed voltage drop of 3-5% in normal operating conditions
- Voltage drop data for LV Single & Multi-core cables are tabulated in tables 18 & 19

Material Properties

Metals Used For Cables

Table 1

ELECTRICAL PROPERTIES			
Metal	Relative Conductivity Copper 100	Electrical Resistivity at 20 °C Ω .m (10^{-8})	Temperature Coefficient of Resistance per °C
Copper (Annealed)	100	1.7241	0.00393
Copper (Hard drawn)	97	1.7770	0.00393
Tinned Copper	95 – 97	1.741 – 1.814	0.00393
Aluminum	61	2.8264	0.00403
Lead	8	21.40	0.00400

PHYSICAL PROPERTIES				
Property	Unit	Copper	Aluminum	Lead
Density at 20 °C	Kg/m^3	8890.0	2703.0	11340.0
Coeff. of thermal expansion	°C x 10^{-6}	17.0	23.0	29.0
Melting point	°C	1083.0	659.0	327.0
Thermal conductivity	W/Cm.°C	3.8	2.4	0.34

Insulation Materials Used For Cables

Table 2

Properties		XLPE	PVC	EPR
Rated Temp.	Nominal	90	70	90
	Emergency	130	95	130
	Short Circuit	250	140 * or 160 **	250
Mechanical Strength	Min. Tensile Strength (N/mm^2)	12.5	12.5	4.2
	Min. Elongation %	200	150	200
Heat deformation at 150 °C		Good	Poor	Excellent
Relative permittivity		2.5	8.0	3.0
Specific gravity g/cm^3		0.93	1.5	1.4
Solvent resistance		Good	Poor	Poor
Volume Resistivity at max. conductor temperature in normal operation Ω .cm		10^{12}	10^{10}	10^{12}
Splicing & termination		Easy	Easy	Easy
Environmental stress cracking		Good	Good	Poor

* For sizes > 300 mm^2
** For sizes ≤ 300 mm^2

Derating Factors

Table 3

Ground temperature derating factors

Max. Conductor temperature ºC	Ambient ground temperature ºC						
	25	30	35	40	45	50	55
70 ºC	1.13	1.07	1.00	0.93	0.85	0.76	0.65
90 ºC	1.09	1.04	1.00	0.95	0.90	0.85	0.80

Table 4

Air temperature derating factors

Max. Conductor temperature ºC	Ambient air temperature ºC						
	25	30	35	40	45	50	55
70 ºC	1.22	1.15	1.08	1.00	0.95	0.82	0.71
90 ºC	1.14	1.10	1.05	1.00	0.95	0.89	0.84

Table 5

Burial depth derating factors

Depth of laying mt.	Cables cross section		
	Up to 70 mm^2	95 up to 240 mm^2	300 mm^2 & above
0.50	1.00	1.00	1.00
0.60	0.99	0.98	0.97
0.80	0.97	0.96	0.94
1.00	0.95	0.93	0.92
1.25	0.94	0.92	0.89
1.50	0.93	0.90	0.87
1.75	0.92	0.89	0.86
2.00	0.91	0.88	0.85

Derating Factors

Table 6

Soil thermal resistivity derating factors

Rating factor	Soil thermal resistivity °C.m / Watt						
	0.8	0.9	1.0	1.2	1.5	2.0	2.5
	1.17	1.12	1.07	1.00	0.91	0.80	0.73

Table 7

PVC rated temperature derating factors

Rating factor	PVC rated temperature °C			
	70	85	95	105
	1.000	1.195	1.309	1.414

Table 8

Trefoil or flat formation derating factors for three single core cables laid direct in ground

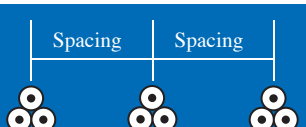
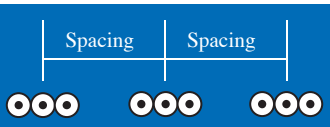
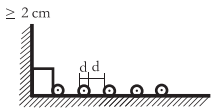
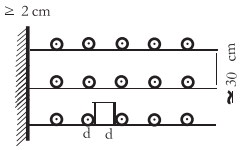
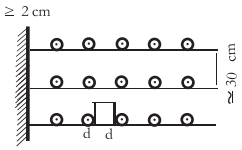
Number of circuits	 Trefoil formation		 Flat formation			
	Touching		Spacing = 0.15 Mt.		Spacing = 0.30 Mt.	
	Trefoil	Flat	Trefoil	Flat	Trefoil	Flat
2	0.77	0.80	0.82	0.85	0.88	0.91
3	0.66	0.69	0.73	0.76	0.80	0.83
4	0.60	0.63	0.68	0.71	0.74	0.77
5	0.56	0.59	0.64	0.67	0.72	0.75
6	0.53	0.57	0.61	0.64	0.70	0.73

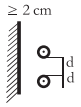
Table 9

Flat formation derating factors for three single core cables laid in free air

Laid on the ground				Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits			
	1	2	3	
Rating factor	0.92	0.89	0.88	

Laid on cables troughs (circulation of air is restricted)				Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits			
Number of troughs	1	2	3	
1	0.92	0.89	0.88	
2	0.87	0.84	0.83	
3	0.84	0.82	0.81	
6	0.82	0.80	0.79	

Laid on cables racks				Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits			
Number of racks	1	2	3	
1	1.00	0.97	0.96	
2	0.97	0.94	0.93	
3	0.96	0.93	0.92	
6	0.94	0.91	0.90	

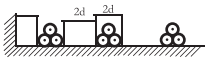
Arranged near the wall				Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits			
	1	2	3	
Rating factor	0.94	0.91	0.89	

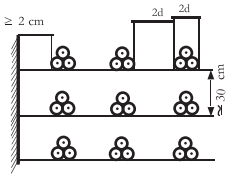
Arranged on the wall				Laying form
Clearance = cable diameter (d)	Number of circuits			
	1	2	3	
Rating factor	0.89	0.86	0.84	

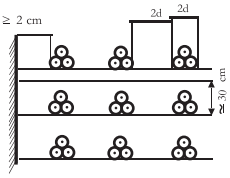
Derating Factors

Table 10

Trefoil touching formation derating factors for three single core cables laid in free air

Laid on the ground				Laying form
Clearance = 2 cable diameter (2d) Clearance from the wall ≥ 2 cm	Number of circuits			
	1	2	3	
Rating factor	0.95	0.90	0.88	

Laid on cables troughs (circulation of air is restricted)				Laying form
Clearance = 2 cable diameter (2d) Clearance from the wall ≥ 2 cm	Number of circuits			
Number of troughs	1	2	3	
1	0.95	0.90	0.88	
2	0.90	0.85	0.83	
3	0.88	0.83	0.81	
6	0.86	0.81	0.79	

Laid on cables racks				Laying form
Clearance = 2 cable diameter (2d) Clearance from the wall ≥ 2 cm	Number of circuits			
Number of racks	1	2	3	
1	1.00	0.98	0.96	
2	1.00	0.95	0.93	
3	1.00	0.94	0.92	
6	1.00	0.93	0.90	

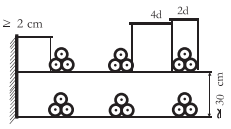
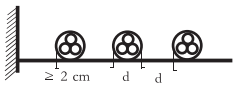
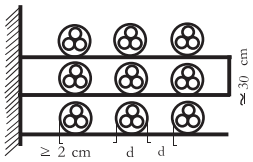
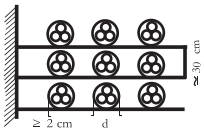
Arrangement for zero reduction				Laying form
Clearance = 4 cable diameter (4d) Clearance from the wall ≥ 2 cm	Number of circuits			
	1	2	3	
Rating factor	1.00	1.00	1.00	

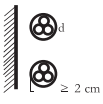
Table 11

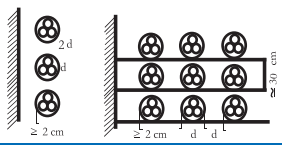
Horizontal or vertical formation derating factors for multi-core cables laid in free air

Laid on the ground						Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits					
	1	2	3	6	9	
Rating factor	0.95	0.90	0.88	0.85	0.84	

Laid on cables troughs (circulation of air is restricted)						Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits					
Number of troughs	1	2	3	6	9	
1	0.95	0.90	0.88	0.85	0.84	
2	0.90	0.85	0.83	0.81	0.80	
3	0.88	0.83	0.81	0.79	0.78	
6	0.86	0.81	0.79	0.77	0.76	

Laid on cables racks						Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits					
Number of racks	1	2	3	6	9	
1	1.00	0.98	0.96	0.93	0.92	
2	1.00	0.95	0.93	0.90	0.89	
3	1.00	0.94	0.92	0.89	0.88	
6	1.00	0.93	0.90	0.87	0.86	

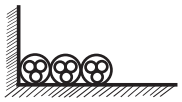
Arranged near the wall						Laying form
Clearance = cable diameter (d) Clearance from the wall ≥ 2 cm	Number of circuits					
	1	2	3	6	9	
Rating factor	1.00	0.93	0.90	0.87	0.86	

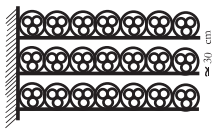
Arrangement for zero reduction						Laying form
Clearance = 2 cable diameter (2d) Clearance from the wall ≥ 2 cm	Number of circuits					
	1	2	3	6	9	
Rating factor	1.00	1.00	1.00	1.00	1.00	

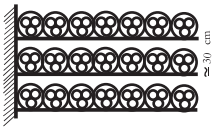
Derating Factors

Table 12

Derating factors for multi-core cables touching and in contact with the wall in air

Laid on the ground						Laying form
Cables are touched together and in contact with the wall	Number of circuits					
	1	2	3	6	9	
Rating factor	0.90	0.84	0.80	0.75	0.73	

Laid on cables troughs (circulation of air is restricted)						Laying form
Cables are touched together and in contact with the wall	Number of circuits					
Number of troughs	1	2	3	6	9	
1	0.95	0.84	0.80	0.75	0.73	
2	0.95	0.80	0.76	0.71	0.69	
3	0.95	0.78	0.74	0.70	0.68	
6	0.95	0.76	0.72	0.68	0.66	

Laid on cables racks						Laying form
Cables are touched together and in contact with the wall	Number of circuits					
Number of racks	1	2	3	6	9	
1	0.95	0.84	0.80	0.75	0.73	
2	0.95	0.80	0.76	0.71	0.69	
3	0.95	0.78	0.74	0.70	0.68	
6	0.95	0.76	0.72	0.68	0.66	

Arranged on the wall						Laying form
Cables are touched together and in contact with the wall	Number of circuits					
	1	2	3	6	9	
Rating factor	0.95	0.78	0.73	0.68	0.66	

Short Circuit Current

Table 13

Max. short circuit temperature for cable components

Material	Cable component	Max. short circuit temp. °C
Insulation	PVC Insulation	140 For C.S.A > 300 mm^2
		160 For C.S.A ≤ 300 mm^2
	XLPE Insulation	250
Sheathing	PVC Sheath	200
	LDPE Sheath	150
	HDPE Sheath	180
	Lead Sheath	170
	Lead Alloy Sheath	200

Table 14

kA short circuit current - copper conductor - PVC insulated

C.S.A	Short circuit duration sec.									
mm^2	0.1	0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0
1.5	0.55	0.39	0.31	0.27	0.24	0.17	0.12	0.10	0.09	0.08
2.5	0.91	0.64	0.52	0.45	0.41	0.29	0.20	0.17	0.14	0.13
4	1.45	1.03	0.84	0.73	0.65	0.46	0.33	0.27	0.23	0.21
6	2.18	1.54	1.26	1.09	0.98	0.69	0.49	0.40	0.35	0.31
10	3.6	2.6	2.1	1.8	1.6	1.2	0.8	0.7	0.6	0.5
16	5.8	4.1	3.4	2.9	2.6	1.8	1.3	1.1	0.9	0.8
25	9.1	6.4	5.2	4.5	4.1	2.9	2.0	1.7	1.4	1.3
35	12.7	9.0	7.3	6.4	5.7	4.0	2.8	2.3	2.0	1.8
50	18.2	12.9	10.5	9.1	8.1	5.8	4.1	3.3	2.9	2.6
70	25.5	18.0	14.7	12.7	11.4	8.1	5.7	4.6	4.0	3.6
95	34.5	24.4	19.9	17.3	15.5	10.9	7.7	6.3	5.5	4.9
120	43.6	30.9	25.2	21.8	19.5	13.8	9.8	8.0	6.9	6.2
150	54.5	38.6	31.5	27.3	24.4	17.3	12.2	10.0	8.6	7.7
185	67.3	47.6	38.8	33.6	30.1	21.3	15.0	12.3	10.6	9.5
240	87.3	61.7	50.4	43.6	39.0	27.6	19.5	15.9	13.8	12.3
300	109.1	77.1	63.0	54.5	48.8	34.5	24.4	19.9	17.3	15.4
400	130.0	91.9	75.1	65.0	58.2	41.1	29.1	23.7	20.6	18.4
500	162.5	114.9	93.8	81.3	72.7	51.4	36.3	29.7	25.7	23.0
630	204.8	144.8	118.2	102.4	91.6	64.8	45.8	37.4	32.4	29.0
800	260.1	183.9	150.1	130.0	116.3	82.2	58.2	47.5	41.1	36.8
1000	325.1	229.9	187.7	162.5	145.4	102.8	72.7	59.4	51.4	46.0

Short Circuit Current

Table 15

kA short circuit current - aluminum conductor - PVC insulated

C.S.A	Short circuit duration sec.									
mm^2	0.1	0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0
16	3.8	2.7	2.2	1.9	1.7	1.2	0.9	0.7	0.6	0.5
25	6.0	4.2	3.5	3.0	2.7	1.9	1.3	1.1	1.0	0.8
35	8.4	5.9	4.9	4.2	3.8	2.7	1.9	1.5	1.3	1.2
50	12.0	8.5	6.9	6.0	5.4	3.8	2.7	2.2	1.9	1.7
70	16.8	11.9	9.7	8.4	7.5	5.3	3.8	3.1	2.7	2.4
95	22.8	16.1	13.2	11.4	10.2	7.2	5.1	4.2	3.6	3.2
120	28.8	20.4	16.7	14.4	12.9	9.1	6.4	5.3	4.6	4.1
150	36.0	25.5	20.8	18.0	16.1	11.4	8.1	6.6	5.7	5.1
185	44.5	31.4	25.7	22.2	19.9	14.1	9.9	8.1	7.0	6.3
240	57.7	40.8	33.3	28.8	25.8	18.2	12.9	10.5	9.1	8.2
300	72.1	51.0	41.6	36.0	32.2	22.8	16.1	13.2	11.4	10.2
400	86.0	60.8	49.7	43.0	38.5	27.2	19.2	15.7	13.6	12.2
500	107.5	76.0	62.1	53.8	48.1	34.0	24.0	19.6	17.0	15.2
630	135.5	95.8	78.2	67.7	60.6	42.8	30.3	24.7	21.4	19.2
800	172.0	121.6	99.3	86.0	76.9	54.4	38.5	31.4	27.2	24.3
1000	215.0	152.1	124.2	107.5	96.2	68.0	48.1	39.3	34.0	30.4

Table 16

kA short circuit current - aluminum conductor - XLPE insulated

C.S.A	Short circuit duration sec.									
mm^2	0.1	0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0
16	4.7	3.4	2.7	2.4	2.1	1.5	1.1	0.9	0.75	0.67
25	7.4	5.2	4.3	3.7	3.3	2.3	1.7	1.4	1.2	1.0
35	10.4	7.3	6.0	5.2	4.6	3.3	2.3	1.9	1.6	1.5
50	14.8	10.5	8.6	7.4	6.6	4.7	3.3	2.7	2.3	2.1
70	20.7	14.7	12.0	10.4	9.3	6.6	4.6	3.8	3.3	2.9
95	28.1	19.9	16.3	14.1	12.6	8.9	6.3	5.1	4.5	4.0
120	35.6	25.1	20.5	17.8	15.9	11.2	8.0	6.5	5.6	5.0
150	44.4	31.4	25.7	22.2	19.9	14.1	9.9	8.1	7.0	6.3
185	54.8	38.8	31.6	27.4	24.5	17.3	12.3	10.0	8.7	7.8
240	71.1	50.3	41.1	35.6	31.8	22.5	15.9	13.0	11.2	10.1
300	88.9	62.9	51.3	44.4	39.8	28.1	19.9	16.2	14.1	12.6
400	118.5	83.8	68.4	59.3	53.0	37.5	26.5	21.6	18.7	16.8
500	148.2	104.8	85.5	74.1	66.3	46.9	33.1	27.0	23.4	21.0
630	186.7	132.0	107.8	93.3	83.5	59.0	41.7	34.1	29.5	26.4
800	237.0	167.6	136.9	118.5	106.0	75.0	53.0	43.3	37.5	33.5
1000	296.3	209.5	171.1	148.2	132.5	93.7	66.3	54.1	46.9	41.9

Table 17

kA short circuit current - copper conductor - XLPE insulated

C.S.A	Short circuit duration sec.									
mm^2	0.1	0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0
1.5	0.7	0.5	0.4	0.3	0.3	0.21	0.15	0.12	0.11	0.10
2.5	1.1	0.8	0.7	0.6	0.5	0.36	0.25	0.21	0.18	0.16
4	1.8	1.3	1.0	0.9	0.8	0.57	0.40	0.33	0.29	0.26
6	2.7	1.9	1.6	1.4	1.2	0.86	0.61	0.50	0.43	0.38
10	4.5	3.2	2.6	2.3	2.0	1.4	1.0	0.8	0.7	0.6
16	7.2	5.1	4.2	3.6	3.2	2.3	1.6	1.3	1.1	1.0
25	11.3	8.0	6.5	5.7	5.1	3.6	2.5	2.1	1.8	1.6
35	15.8	11.2	9.1	7.9	7.1	5.0	3.5	2.9	2.5	2.2
50	22.6	16.0	13.1	11.3	10.1	7.2	5.1	4.1	3.6	3.2
70	31.7	22.4	18.3	15.8	14.2	10.0	7.1	5.8	5.0	4.5
95	43.0	30.4	24.8	21.5	19.2	13.6	9.6	7.8	6.8	6.1
120	54.3	38.4	31.3	27.1	24.3	17.2	12.1	9.9	8.6	7.7
150	67.8	48.0	39.2	33.9	30.3	21.5	15.2	12.4	10.7	9.6
185	83.7	59.2	48.3	41.8	37.4	26.5	18.7	15.3	13.2	11.8
240	108.5	76.7	62.7	54.3	48.5	34.3	24.3	19.8	17.2	15.3
300	135.7	95.9	78.3	67.8	60.7	42.9	30.3	24.8	21.5	19.2
400	180.9	127.9	104.4	90.4	80.9	57.2	40.4	33.0	28.6	25.6
500	226.1	159.9	130.5	113.1	101.1	71.5	50.6	41.3	35.8	32.0
630	284.9	201.4	164.5	142.4	127.4	90.1	63.7	52.0	45.0	40.3
800	361.8	255.8	208.9	180.9	161.8	114.4	80.9	66.0	57.2	51.2
1000	452.2	319.8	261.1	226.1	202.2	143.0	101.1	82.6	71.5	64.0

Voltage Drop

Table 18

Voltage drop for single core LV cables

C.S.A mm^2	Copper Conductors			
	Voltage drop (mV / Amp / Meter)			
	PVC 85 °C Insulated & PVC Sheathed		XLPE Insulated & PVC Sheathed	
	Flat ●●●	Trefoil	Flat ●●●	Trefoil
1.5	22.6	22.5	22.9	22.8
2.5	13.9	13.8	14.1	14.1
4	8.7	8.7	8.8	8.8
6	5.9	5.48	5.9	5.9
10	3.5	3.5	3.6	3.6
16	2.3	2.2	2.3	2.3
25	1.5	1.5	1.5	1.5
35	1.1	1.1	1.1	1.1
50	0.83	0.82	0.84	0.83
70	0.61	0.60	0.61	0.60
95	0.47	0.45	0.47	0.46
120	0.39	0.38	0.39	0.38
150	0.34	0.33	0.34	0.33
185	0.29	0.28	0.29	0.28
240	0.25	0.24	0.25	0.24
300	0.22	0.21	0.22	0.21
400	0.20	0.18	0.19	0.18
500	0.18	0.17	0.17	0.16
630	0.16	0.15	0.16	0.15

C.S.A mm^2	Aluminum Conductors			
	Voltage drop (mV / Amp / Meter)			
	PVC 85 °C Insulated & PVC Sheathed		XLPE Insulated & PVC Sheathed	
	Flat ●●●	Trefoil	Flat ●●●	Trefoil
16	3.7	3.7	3.7	3.7
25	2.4	2.3	2.4	2.4
35	1.7	1.7	1.8	1.7
50	1.3	1.3	1.3	1.3
70	0.94	0.92	0.95	0.93
95	0.71	0.69	0.71	0.70
120	0.58	0.56	0.58	0.57
150	0.49	0.48	0.5	0.48
185	0.41	0.40	0.42	0.40
240	0.34	0.33	0.34	0.33
300	0.29	0.28	0.29	0.28
400	0.25	0.24	0.25	0.24
500	0.22	0.21	0.22	0.21
630	0.19	0.18	0.19	0.18

The above data is based on the following :

- Max. operating temp : 90 ºC for XLPE & 85 ºC for PVC
- Power factor : 0.85
- Rated frequency : 60 Hz

Table 19

Voltage drop for multi core LV cables

C.S.A mm^2	Copper Conductors	
	Voltage drop (mV / Amp / Meter)	
	PVC 85°C Insulated & PVC Sheathed	XLPE Insulated & PVC Sheathed
1.5	22.5	22.8
2.5	13.8	14.0
4	8.6	8.7
6	5.8	5.9
10	3.5	3.5
16	2.2	2.2
25	1.4	1.5
35	1.1	1.1
50	0.8	0.81
70	0.58	0.58
95	0.44	0.44
120	0.37	0.37
150	0.32	0.31
185	0.27	0.27
240	0.23	0.23
300	0.20	0.2
400	0.18	0.18
500	0.15	0.15

C.S.A mm^2	Aluminum Conductors	
	Voltage drop (mV / Amp / Meter)	
	PVC 85 °C Insulated & PVC Sheathed	XLPE Insulated & PVC Sheathed
16	3.6	3.7
25	2.3	2.4
35	1.7	1.7
50	1.3	1.3
70	0.91	0.92
95	0.68	0.68
120	0.55	0.56
150	0.47	0.47
185	0.39	0.39
240	0.32	0.32
300	0.27	0.27
400	0.23	0.23
500	0.20	0.20

The above data is based on the following :

- Max. operating temp: 90 °C for XLPE & 85 °C for PVC
- Power factor : 0.85
- Rated frequency : 60 Hz

Coding Key

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

The type designation provides information on the type of cable, the conductor material, the insulation and sheath materials, the no. of cores, and the principle design features in abbreviated and simplified form.

The type designation is made up of 19 digits or characters. The type of the conductor is specified first and then the cable construction from inside to outside.

You can order our product either by giving the AES item code stated in the catalogue or if the required cable construction is not included in our catalogue, you can use the following codes to determine the type of cable you require.

1. Type of conductor material

C :	Copper
A :	Aluminum

2. Type of conductor

1 :	Solid
2 :	Stranded - Circular round
3 :	Stranded - Circular compacted
4 :	Stranded - Sector shaped
5 :	Flexible
6 :	Extra-flexible

3 & 4. Size of conductor

08 :	1.5 mm^2
10 :	2.5 mm^2
12 :	4 mm^2
13 :	6 mm^2
14 :	10 mm^2
15 :	16 mm^2
16 :	25 mm^2
17 :	35 mm^2
18 :	50 mm^2
19 :	70 mm^2
32 :	3 x 10 + 6 mm^2
33 :	3 x 16 + 10 mm^2
34 :	3 x 25 + 16 mm^2
35 :	3 x 35 + 16 mm^2
36 :	3 x 50 + 25 mm^2
37 :	3 x 70 + 35 mm^2
38 :	3 x 95 + 50 mm^2
39 :	3 x 120 + 70 mm^2
40 :	3 x 150 + 70 mm^2
41 :	3 x 185 + 95 mm^2
42 :	3 x 240 + 120 mm^2
43 :	3 x 300 + 150 mm^2
44 :	3 x 400 + 185 mm^2
45 :	95 mm^2
46 :	120 mm^2
47 :	150 mm^2
48 :	185 mm^2
49 :	240 mm^2
50 :	300 mm^2
51 :	400 mm^2
52 :	500 mm^2
53 :	630 mm^2
54 :	800 mm^2
55 :	1000 mm^2

5. Type of insulation material

X :	XLPE Insulation
P :	PVC Insulation rated 70 °C
H :	PVC Insulation rated 85 °C

6. Rated voltage

A :	0.6 / 1 kV

7. Cable construction

1 :	Cores
2 :	Pairs

8 & 9. Number of cores

01 :	1 Core
02 :	2 Cores
03 :	3 Cores
04 :	4 Cores
05 :	5 Cores
≈	≈
37 :	37 Cores

10. Shielding

N :	Copper tape
C :	Copper wires
0 :	Without shielding

11. Armouring

0 :	Without armouring
L :	Pure lead sheathed
N :	Lead alloy sheathed
A :	Aluminum wire armoured
B :	Aluminum tape armoured
G :	Galvanized steel tape armoured
W :	Galvanized steel wire armoured
T :	Non-Galva. steel tape armoured
S :	Lead + G. steel tape armoured
D :	Lead + G. steel wire armoured
X :	Lead + Aluminum wire armoured
R :	Lead + Aluminum tape armoured

12. Outer sheath material

C :	PVC Sheath rated 80 °C
M :	PVC Sheath rated 90 °C
L :	LSHF Sheath rated 90 °C

13 & 14. Outer sheath color

BK :	Black
RD :	Red
GY :	Grey
GR :	Green
YG :	Yellow / Green
GL :	Green / Yellow

15 & 16. Core identification

51 :	1C - Red
01 :	2C - Red, Black
04 :	3C - Red, Yellow, Blue
08 :	4C - Red, Yellow, Blue, Black
12 :	5C - Red, Yellow, Blue, Black, G/Y
21 :	6C & Above - Black + No.

Note: The mentioned colors are the most common for core identification. However, any other colors for core identification can be used upon a customer's request.

17. Design standard

I :	IEC Standard
B :	BS Standard
C :	Customer request

18. Packing type

M :	Wooden drum
T :	Steel drum

19. Cutting length

S :	250 Meter
F :	500 Meter
R :	1000 Meter

Note: The mentioned cutting lengths are the most common. However, any other cutting lengths can be supplied as per a customer's drum schedule.

Selection of Conductor Cross-section

Conductor cross–section should be selected with a sustained current rating under the conditions of installation not less than the maximum current it will be required to carry during normal operation, and a short circuit current rating adequate for the prospective short–circuit current and time for which it may persist.
Especially in low–voltage networks, it is necessary to check the conductor cross-section, chosen with respect to the current carrying capacity, by the permissible voltage drop. It is also recommended to carry out this check for long connections in medium and high voltage networks.

Example for selection of conductor cross-section

0.05 MVA at an operating voltage of 380V have to be transmitted by 4 cores cable with copper conductor, XLPE insulated and PVC sheathed direct buried in the ground under the following laying conditions :

Burial depth	:	0.5	m
Soil thermal resistivity	:	1.2	K.m/W
Ambient ground temp.	:	35	ºC
Cable route length	:	50	m

Calculating cross-section according to load current

The load current can be calculated based on the following formula :

$$I = \frac{Sx10^6}{\sqrt{3}xU} = \frac{0.05x10^6}{\sqrt{3}x380} = 76A$$

Where

I : Load current in A
S : KVA rating
U : Line voltage in volts

According to the relevant current carrying capacity values for the used cable type, it has been found that the current carrying capacity value for 4 X 16 mm^2 cable under the required installation conditions is 97A, which is greater than the required load current (76A). So, cable 4 X 16 mm^2 can be used to carry the required load current.

Calculating cross-section according to voltage drop

The tabulated voltage drop values in this catalogue are based on a load power factor of 85% lagging and given for a current one ampere for a one meter run. For any cable length, the values should be multiplied by the cable route length in meters and by the load current in amperes.

The applicable formula to calculate the approximate voltage drop/ampere/meter is the following :

$$V_{ap} = \frac{V_p x1000}{IxL} \quad \text{mV/Amp/Meter}$$

Where

V_{ap} : Approximate voltage drop/ampere/meter
I : Load current in A
L : Cable route length
V_p : Maximum permissible voltage drop (say 2.5% of 380 V)

By substituting current, cable route length, and maximum permissible voltage drop.

$$V_{ap} = \frac{9.5x1000}{76x50} = 2.5 \quad \text{mV/Amp/Meter}$$

To determine a suitable size of conductor, select a cable from the voltage drop tables, such that the selected voltage drop value from the tables is less than the calculated value of 2.5 mv/amp/m. Also ensure that it will carry the desired current. In this example, the nearest voltage drop value is 2.2 mv/amp/m, which is corresponding to size 16 mm^2.
In situations where the load power factor is other than 85% lagging, the voltage drop equations shown in the formula section should be used to calculate the voltage drop.

Conversion Table

Multiply	By	To obtain
Weight-Imperial		
Ounces	28.3495	grams
Pounds(Av)	453.59	grams
Pounds(Av)	0.45359	Kilograms
Tons (short)	907.19	Kilograms
Tons (long)	1016.05	Kilograms
Weight-Metric		
Grams	0.03527	Ounces
Grams	0.002205	Pounds
Kilograms	35.274	Ounces
Kilograms	2.2046	Pounds
kilograms	0.001102	Tons (short)
Kilograms	0.0009842	Tons (long)
Miscellaneous-Imperial		
Pounds per 1000 feet	1.48816	kg/km
Pounds per mile	0.28185	kg/km
Pounds per square inch	0.0007031	kg. per square mm
Pounds per square inch	0.07031	kg. per square cm
Pounds per cubic	27.68	grams per cubic cm
Feet per second	18.288	meters per minute
Feet per second	1.09728	Kilometers per hour
Miles per hour	1.60935	Kilometers per hour
Ohms per 1000 feet	3.28083	Ohms per Kilometer
Ohms per mile	0.62137	Ohms per Kilometer
Decibels per 1000 feet	3.28083	Decibels per kilomter
Decibels per mile	0.62137	Decibels per kilomter
Decibels	0.1153	nepers
Miscellaneous-Metric		
kg/km	0.67197	Pounds per 1000 feet
kg/km	3.54795	Pounds per mile
kg.per square mm	1422.34	Pounds per square inch
kg.per square cm	14.2234	Pounds per square inch
Grams per cubic cm	0.03613	Pounds per cubic inch
Meters per minute	0.05468	Feet per second
Kilometers per hour	0.91134	Feet per second
Kilometer per hour	0 62137	Miles per hour
Ohms per Kilometer	0.3048	Ohms per 1000 feet
Ohms per Kilometer	1.6093	Ohms per mile
Decibels per kilomter	0.3048	Decibels per 1000 feet
Decibels per kilometer	1.6093	Decibels per mile
Temperature		
° Fahrenheit	5/9(°F)-32	°Celsius
°Celsius	9/5(°C)+32	°Fahrenheit
Lenght-Imperial		
Mils	0.001	inches
Mils	0.0254	mm
inches	1000	Mils
inches	25.40	mm
inches	2.54	cm
Feet	30.48	cm
Feet	0.3048	Meters
Feet (thousand of)	0.3048	kilometers
Yards	0.9144	Meters
Miles	1. 6093	kilometers
Length-Metric		
Millimeters	39.37	Mils
Millimeters	0.03937	inches
Centimeters	0.3937	inches
Centimeters	0.032808	Feet
Meters	39.37	inches
Meters	3.2808	Feet
Meters	1.0936	Yards
Kilometers	3280.83	Feet
Kilometers	0.62137	Miles
Area-Imperial		
Square mils	1.2732	Circular mils
Square mils	0.000001	Square inches
Circular mils	0.7854	Square mils
Circular mils	0.0000007854	Square inches
Square mils	0.0005067	Square mm
Square inches	1000000	Square mils
Square inches	1273240	Circular mils
Square inches	645.16	Square mm
Square inches	6.4516	Square cm
Square feet	0.09290	Square meters
Square yards	0.8361	Square meters
Area-Metric		
Square millimeters	1973.52	Circular mils
Square millimeters	0.00155	Square inches
Square centimeters	0.155	Square inches
Square meters	10.7639	Square feet
Square meters	1.19599	Square yards
Volume-Imperial		
Cubic inches	16.38706	Cubic cm
Cubic feet	0.028317	Cubic meters
Gallons	4.54609	Liters
Volume-U.S.		
Quarts (liquid)	0.9463	Liters
Gallons	3.7854	Liters
Volume-Metric		
Cubic cm	0.06102	Cubic inches
Cubic meters	35.3145	Cubic feet
Liters	1.05668	quarts (liquid U.S)
Liters	0.26417	gallons (U.S.)

Certificates

1. BASEC (BRITISH APPROVALS SERVICE FOR CABLES)

a. Certificate of conformity, ISO 9001–2008
b. Certification Schedule

2. Type Test Certificates

Certificates

a. Bare soft copper conductor
b. Power cable with extruded insulation with rated voltage of 0.6 / 1KV

Applicable Standards

a. IEC 60228: 2004
b. IEC 60502-1: 2004
c. IEC 60332-1-2: 2004
d. IEC 60332-3-24: 2000 (Category C)
e. IEC 60332-3-22: 2000 (Category A)

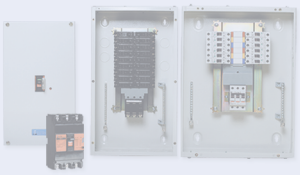
Product Range

alfanar manufactures a wide range of low, medium and high voltage electrical products under 50 categories. Listed below is alfanar's comprehensive product classification:

POWER & CONTROL

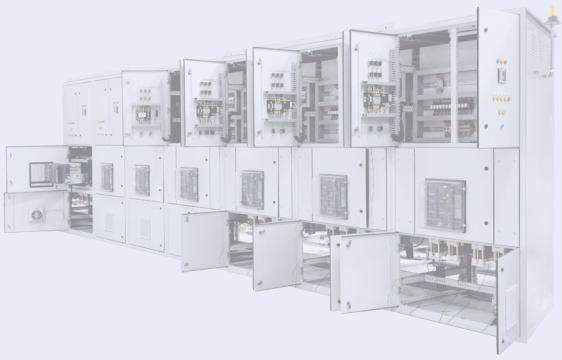
Low Voltage Products

- Load Center
- Circuit Breaker Enclosures (Indoor – Outdoor)
- Busbar Chamber with Main / Outdoor
- Breakers



Low Voltage Systems

- Switch Boards – MF Type
- Distribution Boards – MB Type
- Motor Control Centres
- Capacitor Banks – Power Factor Correction Panels
- Automatic Transfer Switch (ATS Panels)
- Distribution Boards for Substations
- Synchronizing Panels
- Control & Automation Panels



Package & Unit Substations

- Indoor Package Substation
- Outdoor Package Substation
- Indoor Unit Substation
- Outdoor Unit Substation

Medium Voltage Systems

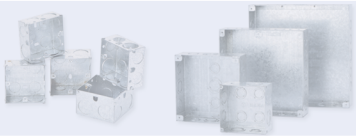
- Switchgear (Metal clad, Metal enclosed)
- Control gear
- Ring Main Unit (RMU)
- Retrofit solution

METAL ENCLOSURES

Service Box Enclosures
Modular Enclosures
Extendable Cubicles
Telephone Box
Busbar Chamber w/o Main

METAL ACCESSORIES

Switch Boxes
Junction Boxes



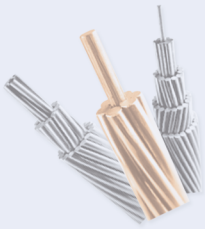
CABLES & WIRES

Building Wires

- American Standards (UL)
- British Standards (BS)
- International Electro-technical Commission Standards (IEC)
- Low Smoke, Halogen Free Wires

Overhead conductors

- Bare Stranded Soft Drawn Copper Conductors (SDC)
- Bare Stranded Hard Drawn Copper Conductors (HDC)
- All Aluminum Conductors (AAC)
- All Aluminum Alloy Conductors (AAAC)
- Aluminum Conductors, Steel Reinforced (ACSR)
- Aluminum Conductors, Aluminum-Clad Steel Reinforced (ACSR / AW)
- Aluminum Conductors, Aluminum-Alloy Reinforced (ACAR)
- Weather Resistant XLPE Insulated Service Drop Cables



Power Cables

- Low Voltage Power & Control Cables
- Low Smoke, Halogen Free Cables
- Cables for Special Applications

Signal, Communication & Data Cables

- Telephone Cables
- Coaxial Cables (RG6 / U)
- Local Area Network Cables (LAN)

LIGHTING

Halogen
Florescent
Energy Saving

COMMUNICATION SYSTEMS

Audio Intercom

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