Jeddah cables COMPANY

A Company of Energya Cables Saudi Arabia

HV & EHV
POWER CABLES

INTRODUCTION

High Voltage cable systems form an integral part of electricity transmission and distribution networks throughout the world. Sucj Systems, which have been traditionnaly installed in built-up areas in places with restricted space or in regions of natural beauty or ecological value where the use of overhead lines is no appropriate, are today becoming more widely adopted. JCC continues to maintain and provide the complete range of products and services required for all extruded High Voltage Cable Systems.

JCC produces extruded cables with XLPE insulation material, using design and process technologies, which ensure continued service reliability and long term performance. Such cables can operate at elevated temperatures and under considerable electrical stress. Internationally, extruded cable systems operate up to 525 KV. Extruded cables are usually lighter and easier to handle and extruded cable systems are generally designed maintenance-free. Dependent on the system requirements, these features present significant benefits in terms of total installed system cost.

EXAMPLE OF HIGH VOLTAGE CABLES

Single Core XLPE Cables with Copper Wire Screen and APL Sheath

Single Core XLPE Cable with Lead Sheath

Index

General Information

GENERAL INFORMATION

A wide variety of high voltage cable designs is offered by JCC to provide most economical solutions. Various types of conductors, metallic screening and sheathing, corrosion protective layers etc. are available.

Conductors

The cable conductors can be made of copper or aluminum. The choice is a matter of customer's preference or current carrying capacity.

Available conductor constructions:

- Circular stranded compacted conductors up to 1000mm^2
- Segmental conductors up to 2000mm^2 (Milliken conductors)

High Voltage cables are constructed watertight by default. Water swellable materials are provided in the conductor interstices to prevent ingress of water along the conductor axis in case of cable failure due to any reason

Insulation

For manufacture of Super-Clean XLPE insulated high voltage cables, JCC disposes of latest extrusion lines. Highest quality standards together with sharpest process control equipment ensure manufacture of cables meeting the highest requirements and enabling development of most advanced power cable systems.

Metallic covering

At JCC both, extruded lead sheath as well as the aluminum sheath can be applied. While the lead sheath leads to smaller dimensions, the aluminum sheath provides high short circuit current carrying capability and lower weight.

As the XLPE insulated cables do not require an internal overpressure, they are usually equipped with a copper wire screen. For radial moisture barrier a coated aluminum foil is longitudinally applied. The combination with the polyethylene oversheath is called aluminum polyethylene laminated (APL) sheath. This solution provides high short circuit capability and water tightness combined with lowest weight and smallest dimensions.

A combination of the copper wire screen with a metal sheath is also possible. For all XLPE insulated high voltage cables, the space between cable core and water barrier is made longitudinally watertight.

Oversheath

An extruded polyethylene sheath is provided as the standard solution. With respect to its excellent mechanical strength it is the optimum for buried cables. If required, a conductive layer can be provided on the outside. For special applications different sheathing material may be used, optimized for the purpose.

Cabling and Armoring

JCC disposes of the appropriate machinery to carry out armoring of the cables when such reinforcements are required.

Technical data

SINGLE CORE

CU/XLPE/CUW/PE, 40/69 (72.5) KV

Type	: Cu/AL conductor, XLPE insulation, copper wires screen, APL, PE sheath
Standard	: IEC 60840
Watertight	: Longitudinally and radially sealed
Packing	: Non returnable wooden drums as per customer request

Laying Conditions:

Soil temperature	: 25°C	Ambient temperature	: 40°C
Depth of Laying	: 1.5m	Cable formation	: Trefoil
Soil Thermal Resistivity	: 1.0°C.m/W		

P.S.: All cables are designed for an earth fault current of 40KA for 1sec. other designs are available upon request
Other constructions are available upon request
All dimensional values are subject to manufacturing tolerances

69 KV Single Core XLPE Cables with Copper Wire Screen and Al/PE Sheath

Dimensions/ Cross Sections		mm²	400	630	800	1000
Conductor, Cu or Al, round, stranded, D		mm	23.4	30.8	33.4	38.6
Conductor Screen	approx.	mm	0.8	0.8	1.0	1.0
Super Clean XLPE insulation	nom.	mm	16.50	16.50	16.50	16.50
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8
Screen, Copper Wire, Dimension		No.xmm	81 x 2.1	81 x 2.1	81 x 2.1	81 x 2.1
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	80.0	85.0	90.0	95.0
Cable Weight (Cu/Al)	approx.	Kg/m	9.6/7.2	12.4/8.5	14.2/9.3	16.5/-
Mechanical Data						
Minimum Bending	During laying	m	1.545	1.695	1.755	1.86
Radius	At termination	m	1.160	1.27	1.315	1.395
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24
Electrical Data						
Maximum DC Resistance	Cu Conductor	Ω/km	0.047	0.0283	0.0221	0.0176
@ 20°C	Al Conductor	Ω/km	0.0778	0.0469	0.0367	-
AC Resistance	Cu Conductor	Ω/km	0.0625	0.0405	0.0336	0.0289
@ 90°C	Al Conductor	Ω/km	0.1014	0.0631	0.0508	-
Inductance		mH/km	0.4291	0.3924	0.3832	0.3657
Capacitance		µF/km	0.1704	0.2031	0.2161	0.2387
Current Carrying Capacity (continuous load)						
Directly	Cu Conductor	A	646	825	915	1002
buried	Al Conductor	A	508	662	744	-
in	Cu Conductor	A	792	1050	1177	1317
Air	Al Conductor	A	623	842	957	-

Dimensions/ Cross Sections		mm²	1000	1200	1400	1600	2000
Conductor, Cu or Al, round, Segmental, D		mm	40.6	43.8	47.3	50.4	56.4
Conductor Screen	approx.	mm	1.0	1.0	1.0	1.0	1.0
Super Clean XLPE insulation	nom.	mm	16.50	16.50	16.50	16.50	16.50
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8	1.8
Screen, Copper Wire, Dimension		No.xmm	81 x 2.1	81 x 2.1	81 x 2.1	81 x 2.1	81 x 2.1
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	95.0	100.0	105.0	105.0	115.0
Cable Weight (Cu/Al)	approx.	Kg/m	16.8/10.4	18.6/11.1	20.7/11.9	22.6/12.7	26.7/14.2
Mechanical Data							
Minimum Bending	During laying	m	1.900	1.960	2.030	2.095	2.215
Radius	At termination	m	1.425	1.470	1.525	1.57	1.66
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24	22.24
Electrical Data							
Maximum DC Resistance	Cu Conductor	Ω/km	0.0176	0.0151	0.0129	0.0113	0.009
@ 20°C	Al Conductor	Ω/km	0.0291	0.0247	0.0212	0.0186	0.0149
AC Resistance	Cu Conductor	Ω/km	0.0239	0.0210	0.0185	0.0167	0.0143
@ 90°C	Al Conductor	Ω/km	0.0382	0.0328	0.0285	0.0254	0.0210
Inductance		mH/km	0.3613	0.3514	0.343	0.3363	0.325
Capacitance		µF/km	0.2474	0.2612	0.2762	0.2896	0.3153
Current Carrying Capacity (continuous load)							
Directly	Cu Conductor	A	1112	1198	1290	1368	1505
buried	Al Conductor	A	883	964	1047	1122	1258
in	Cu Conductor	A	1473	1606	1751	1878	2105
Air	Al Conductor	A	1169	1293	1421	1538	1760

SINGLE CORE

CU/XLPE/CUW/PE, 63.5/110 (123) KV

Type	: Cu/AL conductor, XLPE insulation, copper wires screen, PE sheath
Standard	: IEC 60840
Watertight	: Longitudinally and radially sealed
Packing	: Non returnable wooden drums as per customer request

Laying Conditions:

Soil temperature	: 25°C	Ambient temperature	: 40°C
Depth of Laying	: 1.5m	Cable formation	: Trefoil
Soil Thermal Resistivity	: 1.0°C.m/W		

P.S.: All cables are designed for an earth fault current of 40KA for 1sec. other designs are available upon request

Other constructions are available upon request

All dimensional values are subject to manufacturing tolerances

110 KV SINGLE CORE XLPE CABLES WITH COPPER WIRE SCREEN

Dimensions/ Cross Sections		mm^2	400	630	800	1000
Conductor, Cu or Al, round, stranded, D		mm	23.4	30.8	33.4	38.6
Conductor Screen	approx.	mm	0.8	0.8	1.0	1.0
Super Clean XLPE insulation	nom.	mm	20.32	20.32	20.32	20.32
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8
Screen, Copper Wire, Dimension		No.xmm	81 x 2.1	81 x 2.1	81 x 2.1	81 x 2.1
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	85.0	95.0	100.0	100.0
Cable Weight (Cu/Al)	approx.	Kg/m	10.3/8	13.2/9.3	15/10.1	17.4/-
Mechanical Data						
Minimum Bending	During laying	m	1.685	1.835	1.915	2
Radius	At termination	m	1.265	1.375	1.435	1.5
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24
Electrical Data						
Maximum DC Resistance	Cu Conductor	Ω/km	0.047	0.0283	0.0221	0.0176
@ 20°C	Al Conductor	Ω/km	0.0778	0.0469	0.0367	-
AC Resistance	Cu Conductor	Ω/km	0.0625	0.0405	0.0336	0.0289
@ 90°C	Al Conductor	Ω/km	0.1014	0.0631	0.0508	-
Inductance		mH/km	0.4291	0.3924	0.3832	0.3657
Capacitance		µF/km	0.1704	0.2031	0.2161	0.2387
Current Carrying Capacity (continuous load)						
Directly	Cu Conductor	A	645	826	916	1005
buried	Al Conductor	A	507	661	744	-
Cu Conductor		A	788	1045	1171	1311
Al Conductor		A	619	837	951	-

Dimensions/ Cross Sections		mm^2	1000	1200	1600	2000
Conductor, Cu or Al, round, Segmental, D		mm	40.6	43.8	50.4	56.4
Conductor Screen	approx.	mm	1.0	1.0	1.0	1.0
Super Clean XLPE insulation	nom.	mm	20.32	20.32	20.32	20.32
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8
Screen, Copper Wire, Dimension		No.xmm	81 x 2.1	81 x 2.1	81 x 2.1	81 x 2.1
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	105.0	110.0	115.0	120.0
Cable Weight (Cu/Al)	approx.	Kg/m	17.7/11.3	19.5/12.1	23.6/13.7	27.8/15.3
Mechanical Data						
Minimum Bending	During laying	m	2.040	2.100	2.235	2.355
Radius	At termination	m	1.53	1.575	1.675	1.765
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24
Electrical Data						
Maximum DC Resistance	Cu Conductor	Ω/km	0.0176	0.0151	0.0113	0.009
@ 20°C	Al Conductor	Ω/km	0.0291	0.0247	0.0186	0.0149
AC Resistance	Cu Conductor	Ω/km	0.0238	0.0209	0.0166	0.0141
@ 90°C	Al Conductor	Ω/km	0.0382	0.0327	0.0253	0.0209
Inductance		mH/km	0.3755	0.3651	0.3492	0.3372
Capacitance		µF/km	0.2116	0.223	0.2462	0.2672
Current Carrying Capacity (continuous load)						
Directly	Cu Conductor	A	1111	1198	1370	1509
buried	Al Conductor	A	881	963	1121	1259
in	Cu Conductor	A	1461	1594	1863	2091
Air	Al Conductor	A	1159	1281	1524	1744

SINGLE CORE

CU/XLPE/CUW/PE, 66/115 (123) KV

Type	: Copper conductor, XLPE insulation, copper wires screen, PE (orPVC) sheath
Standard	: IEC 60840
Metallic sheath	: Copper wires, Lead or aluminum
Watertight	: Longitudinally and radially sealed
Packing	: Non returnable wooden drums as per customer request

Laying Conditions:

Soil temperature	: 25°C	Ambient temperature	: 40°C
Depth of Laying	: 1.5m	Cable formation	: Trefoil
Soil Thermal Resistivity	: 1.0°C.m/W		

P.S.: All cables are designed for an earth fault current of 40KA for 1sec. other designs are available upon request
Other constructions are available upon request
All dimensional values are subject to manufacturing tolerances

115 KV Single Core XLPE Cables with Lead Screen

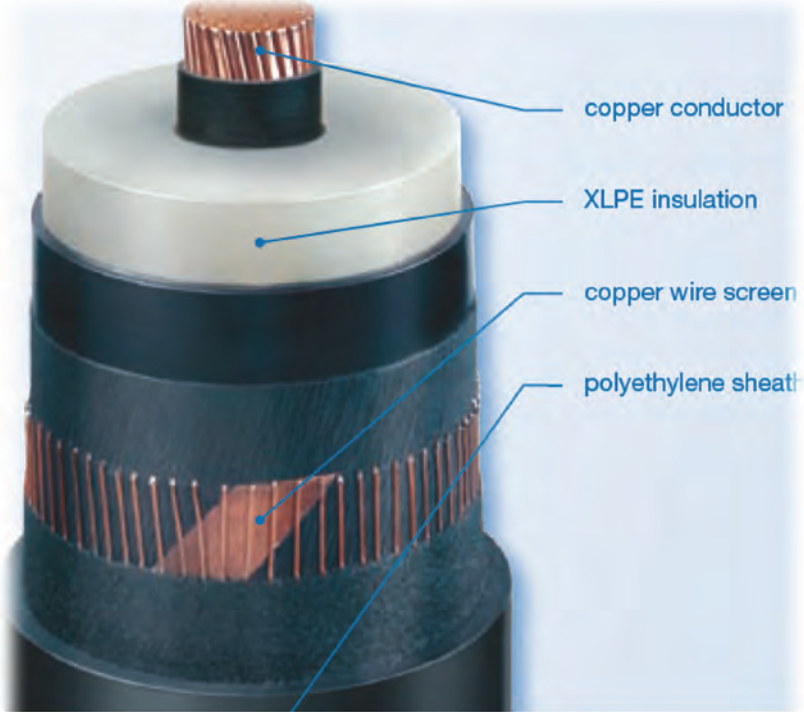
Dimensions/ Cross Sections		mm²	400	630	800	1000
Conductor, Cu or Al, round, stranded, D		mm	23.4	30.8	33.4	38.6
Conductor Screen	approx.	mm	0.8	0.8	1.0	1.0
Super Clean XLPE insulation	nom.	mm	20.32	20.32	20.32	20.32
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8
Screen, Lead Sheath, Thickness		mm	6.3	5.8	5.6	5.3
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	95.0	100.0	105.0	110.0
Cable Weight (Cu/Al)	approx.	Kg/m	26/23.7	29.1/25.1	30.8/25.8	33.2/-
Mechanical Data						
Minimum Bending	During laying	m	1.870	1.995	2.05	2.140
Radius	At termination	m	1.400	1.495	1.535	1.605
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24
Electrical Data						
Maximum DC Resistance	Cu Conductor	Ω/km	0.047	0.0283	0.0221	0.0176
@ 20°C	Al Conductor	Ω/km	0.0778	0.0469	0.0367	-
AC Resistance	Cu Conductor	Ω/km	0.0623	0.0401	0.0331	0.0284
@ 90°C	Al Conductor	Ω/km	0.1012	0.0628	0.0505	-
Inductance		mH/km	0.4669	0.4252	0.4141	0.394
Capacitance		µF/km	0.1483	0.1752	0.186	0.2045
Current Carrying Capacity (continuous load)						
Directly	Cu Conductor	A	635	800	879	954
buried	Al Conductor	A	503	650	725	-
in	Cu Conductor	A	791	1035	1153	1280
Air	Al Conductor	A	625	836	945	-

Dimensions/ Cross Sections		mm²	1000	1200	1600	2000
Conductor, Cu or Al, round, Segmental, D		mm	40.6	43.8	50.4	56.4
Conductor Screen	approx.	mm	1.0	1.0	1.0	1.0
Super Clean XLPE insulation	nom.	mm	20.32	20.32	20.32	20.32
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8
Screen, Lead Sheath, Thickness		mm	5.2	5.0	4.7	4.5
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	110.0	115.0	120.0	125.0
Cable Weight (Cu/Al)	approx.	Kg/m	33.5/27.1	35.2/27.7	39.4/29.5	43.8/31.3
Mechanical Data						
Minimum Bending	During laying	m	2.175	2.230	2.35	2.465
Radius	At termination	m	1.630	1.675	1.765	1.85
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24
Electrical Data						
Maximum DC Resistance	Cu Conductor	Ω/km	0.0176	0.0151	0.0113	0.009
@ 20°C	Al Conductor	Ω/km	0.0291	0.0247	0.0186	0.0149
AC Resistance	Cu Conductor	Ω/km	0.0238	0.0208	0.0165	0.0140
@ 90°C	Al Conductor	Ω/km	0.0382	0.0327	0.0252	0.0209
Inductance		mH/km	0.3886	0.3771	0.3595	0.3463
Capacitance		µF/km	0.2116	0.223	0.2462	0.2672
Current Carrying Capacity (continuous load)						
Directly	Cu Conductor	A	1038	1108	1238	1332
buried	Al Conductor	A	845	916	1046	1151
in	Cu Conductor	A	1409	1524	1751	1933
Air	Al Conductor	A	1137	1248	1464	1651

SINGLE CORE

CU/XLPE/CUW/PE, 76/132 (145) KV

Type	: Copper conductor, XLPE insulation, copper wires screen, PE (orPVC) sheath
Standard	: IEC 60840
Metallic sheath	: Copper wires, Lead or aluminum
Watertight	: Longitudinally and radially sealed
Packing	: Non returnable wooden drums as per customer request



Laying Conditions:

Soil temperature	: 25°C	Ambient temperature	: 40°C
Depth of Laying	: 1.5m	Cable formation	: Trefoil
Soil Thermal Resistivity	: 1.0°C.m/W		

P.S.: All cables are designed for an earth fault current of 40KA for 1sec. other designs are available upon request
Other constructions are available upon request
All dimensional values are subject to manufacturing tolerances

132 KV Single Core XLPE Cables with Copper Wire Screen

Dimensions/ Cross Sections		mm^2	400	630	800	1000
Conductor, Cu or Al, round, stranded, D		mm	23.4	30.8	33.4	38.6
Conductor Screen	approx.	mm	0.8	0.8	1.0	1.0
Super Clean XLPE insulation	nom.	mm	21.60	21.60	21.60	21.60
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8
Screen, Copper Wire, Dimension		No.xmm	81 x 2.1	81 x 2.1	81 x 2.1	81 x 2.1
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	90.0	95.0	100.0	105.0
Cable Weight (Cu/Al)	approx.	Kg/m	10.6/8.3	13.6/9.6	15.4/10.5	17.7/-
Mechanical Data						
Minimum Bending	During laying	m	1.740	1.885	1.945	2.050
Radius	At termination	m	1.305	1.415	1.46	1.540
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24
Electrical Data						
Maximum DC Resistance	Cu Conductor	Ω/km	0.047	0.0283	0.0221	0.0176
@ 20°C	Al Conductor	Ω/km	0.0778	0.0469	0.0367	-
AC Resistance	Cu Conductor	Ω/km	0.0624	0.0402	0.0332	0.0285
@ 90°C	Al Conductor	Ω/km	0.1013	0.0629	0.0506	-
Inductance		mH/km	0.4525	0.4139	0.4039	0.3854
Capacitance		µF/km	0.1426	0.1681	0.1782	0.1957
Current Carrying Capacity (continuous load)						
Directly	Cu Conductor	A	645	826	917	1006
buried	Al Conductor	A	506	662	744	-
in	Cu Conductor	A	787	1043	1169	1309
Air	Al Conductor	A	618	835	949	-

Dimensions/ Cross Sections		mm^2	1000	1200	1600	2000
Conductor, Cu or Al, round, Segmental, D		mm	40.6	43.8	50.4	56.4
Conductor Screen	approx.	mm	1.0	1.0	1.0	1.0
Super Clean XLPE insulation	nom.	mm	21.60	21.60	21.60	21.60
Insulation Screen	approx.	mm	1.8	1.8	1.8	1.8
Screen, Copper Wire, Dimension		No.xmm	81 x 2.1	81 x 2.1	81 x 2.1	81 x 2.1
Thickness of Jacket, PE		mm	4.0	4.0	4.0	4.0
Outer Diameter	approx.	mm	105.0	110.0	115.0	125.0
Cable Weight (Cu/Al)	approx.	Kg/m	18/11.7	19.9/12.4	24/14.1	28.2/15.7
Mechanical Data						
Minimum Bending	During laying	m	2.090	2.155	2.285	2.405
Radius	At termination	m	1.570	1.615	1.715	1.805
Maximum Pulling Force		kN	22.24	22.24	22.24	22.24
Electrical Data						
Maximum DC Resistance	Cu Conductor	Ω/km	0.0176	0.0151	0.0113	0.009
@ 20°C	Al Conductor	Ω/km	0.0291	0.0247	0.0186	0.0149
AC Resistance	Cu Conductor	Ω/km	0.0238	0.0209	0.0166	0.0141
@ 90°C	Al Conductor	Ω/km	0.0382	0.0327	0.0253	0.0209
Inductance		mH/km	0.3806	0.37	0.3538	0.3416
Capacitance		µF/km	0.2024	0.2131	0.235	0.2548
Current Carrying Capacity (continuous load)						
Directly	Cu Conductor	A	1111	1198	1372	1511
buried	Al Conductor	A	882	963	1121	1260
in	Cu Conductor	A	1457	1589	1859	2086
Air	Al Conductor	A	1155	1277	1519	1738

DERATING FACTORS

To determine current carrying capacity for the various laying conditions than those indicated on every tables, multiply table values by the below factors:

Correction Factors for various Ambient Air Temperature

Air Temperature (°C)	20°C	25°C	30°C	35°C	40°C	45°C	50°C
Rating Factor	1.2	1.16	1.10	1.05	1.0	0.94	0.88

Correction Factors for various Ground Temperature

Ground Temperature (°C)	15°C	20°C	25°C	30°C	35°C	40°C	45°C
Rating Factor	1.08	1.04	13.0	0.96	0.91	0.87	0.83

Correction Factors for Various Thermal Resistivity of Ground

Thermal Resistivity of Soil (°C.cm/W)	0.7	1.0	1.2	1.5	2.0	2.5	3.0
Rating Factor	1.14	1.0	0.93	0.84	0.74	0.67	0.61

Correction Factors for Various Depth of Laying

Depth of Laying (m)	Rating Factor
0.50 ~ 0.70	1.09
0.71 ~ 0.90	1.05
0.91 ~ 1.10	1.03
1.31 ~ 1.50	1.00

For other conditions, please contact JCC.

Electrical data

ELECTRICAL PARAMETERS OF THE CABLES

DC Resistance of the Conductor

The maximum DC resistance values of conductors at 20°C are as per IEC 60228 standard.
DC resistance per unit length of the conductor at other conductor temperature is given by:

$$R = R_0 \times [1 + \alpha_{20°C} \times (t - 20°C)]$$

Where:

R	: DC resistance at temperature t^oC $[\Omega/km]$
R_o	: DC resistance at temperature 20^oC $[\Omega/km]$ (given in the relative tables for each type of cable)
t	: Conductor temperature $[^oC]$
$\alpha_{20°C}$	: Temperature coefficient at 20^oC $[1/^oC]$
	[For copper conductor, $\alpha_{20°C} = 0.00393$]
	[For aluminum conductor, $\alpha_{20°C} = 0.00403$]

AC Resistance of the Conductor

The AC resistance per unit length of the conductor (effective resistance) at its maximum operating temperature is made up of the DC resistance at this temperature and the extra resistance which takes into account additional losses caused by the current displacement in the conductor (skin effect, proximity effect). The AC resistance is given in the relative tables for each type of cable.

Inductance

The values of the inductance for both multi cores and three single core cables have been calculated based on the following equation:

$$L = K + 0.2 \times ln\left(\frac{2 \times S}{d}\right)$$

Where:

L	: Cable inductance [mH/km]
K	: a constant relating to the conductor formation [mH/km]
d	: Conductor diameter [mm]
S	: Axial spacing between conductors for cables in trefoil formation [mm]
	S = 1.26 x Axial spacing between conductors for cables in flat formation [mm]

The value for inductance of single core cables has been calculated based on one cable diameter between cables in the flat formation.

Operation Capacitance

The values of operating capacitance for cables have been calculated based on the following presume:

$$C = \frac{\varepsilon_r}{18 \times ln\left(\frac{D}{d}\right)}$$

Where:

C	: Cable capacitance [μF/km]
ε_r	: Relative permittivity of insulation
D	: External diameter of insulation [mm]
d	: Conductor diameter [mm]

Operation temperature for XLPE insulated cables

90°C	for continuous normal operation.
105°C	for emergency overload conditions.
250°C	for short circuit condictions.

Voltage Drop

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

1- Single phase system

$$V_d = 2 \times (R \times \cos\varphi + X \times \sin\varphi)$$

2- Three phase system

$$V_d = \sqrt{3} \times (R \times \cos\varphi + X \times \sin\varphi)$$

Where:

V_d	: Voltage drop [V/A.m]
R	: AC resistance of conductor at maximum conductor temperature [Ω/km]
X	: Induction reactance of cable [Ω/km]
$Cos\varphi$	: Power factor of load

Cable Short-Circuit Current

The permissible short-circuit as presented in are calculated in accordance to IEC 60949, which are based on the following conditions:

1- Short circuit starts from the maximum operating temperature.
2- Maximum temperature during short-circuit (for XLPE, t=250^{o}C)
3- Maximum short-circuit current duration in 5 seconds

The short-circuit current shall be calculated from the formula.

$$I^2 = \frac{K^2 \times S^2}{\Delta T} \times ln\left(\frac{\theta_f + \beta}{\theta_i + \beta}\right)$$

Where:

I	: Short-circuit current [A]
ΔT	: Duration of short-circuit [second]
K	: Constant for the material of the conductor
S	: Area of conductor [mm^2]
θf	: Final temperature [^{o}C]
θi	: Initial temperature [^{o}C]
β	: Reciprocal of temperature coefficient of resistance (α) of the conductor.

P.O. Box 31248 Jeddah 21497, Kingdom of Saudi Arabia
Tel. + 966 2 636 0770 • Fax: +966 2 636 4695
Email: info@cables.energya.com • web: http://www.cables.energya.com