HIGH VOLTAGE POWER CABLES
CONTENTS

HV CABLES FOR SAUDI ELECTRICITY COMPANY

GENERAL
INTRODUCTION

Bahra Cables Company was established in 2008 to serve Saudi & GCC Markets. It is based in Bahra industrial city located 25km from Jeddah. Bahra Cables Factory occupies over 300,000 square meters of prime manufacturing space together with associated design offices, laboratories and storage area. It specializes in Manufacturing and Distributing Electric Cables.

Bahra Cables Company is committed to the production of the best product quality and service, utilizing cutting edge European Technology in manufacturing. The core technologies in production processes, material applications and logistic procedures were provided from German experts and the key functions are being managed by German engineers.

The organization has a lean vertical management structure which is designed to integrate with a highly developed IT-based structure. This partnership allows the rapid flow of information through the management chain and facilities timely response in the best traditions of 'hands on' management. Bahra Cables Company has the flexibility to provide a versatile product range to serve its customers. As example, construction sectors, electric utilities, distribution, industrial, oil & gas and petrochemical sectors. The cables produced comply with both American standards (CSA, ANSI and ICEA) and European standards (IEC, BS, NF and VDE Specifications.)

The scope of this catalogue is to provide an in depth view of technical information on high voltage and extra high voltage lead sheathed/screened cables upto 220kV, with XLPE insulation to IEC 60840/IEC 62067/ ICEA S-108-720.

AREA

Bahra Cables Company has a total land area of about 300,000sqm at disposal.
The built-up area, including offices and plant, of start up phase is more than 100,000sqm.
The total available stock yard for(drum) storage is more than 80,000sqm.

PRODUCT SCOPE

BAHRA CABLES COMPANY is committed to deliver the highest standard wires and power cables to the local market, GCC and for export.
To do so, Bahra Cables Company produces a versatile product range cover most of our customer needs:

- MV cables to IEC 60502-2 up to 18/30 (36) kV and to BS 6622 up to 19/33 (36) kV, which is covered in the catalogue , in addition to other products described in separate catalogues:
- MV cables with LSFZH to BS 7835.
- Flexible wires and cables up to 300 mm2 to IEC 60227, BS 6004 & BS 6500.
- Building wires, THHN/THWN & THW to UL 8.3, with conductor sizes starting from 16 AWG.
- Thermosetting insulated wires types XHHW-2, XHHW, XHH, RHW-2, RHW &RHH to UL44
- Building wires (NYA) to IEC 60227 and BS 6004, from 1.5 mm^2 and above.
- LV power cables with PVC and XLPE insulation to IEC 60502-1, BS 5476, BS 7889 and UL 1277.
- Low smoke and fume, zero halogen building wire (LSFZH) to BS 7611, with thermosetting insulation which is alternative to wire type (NYA), where the application requires higher standards of safety against the emission of smoke, fumes and toxic gases.
- LV cables with LSFZH, thermosetting insulation which under exposure of to fire generate low emission of smoke, fumes and toxic gases and zero halogens. The cables are produced according to BS 6724, IEC 60502-1 and tested to IEC 61034, IEC 60754 & IEC 60332.
- MV cables (Lead Sheathed / Armoured / Un armoured) PVC or MDPE Sheath.
- HV cables up to 230 kV according to IEC 60840 & IEC 62067, and to ANSI / ICEA S-108-720, with conductor sizes up to 2500mm^2.

The future product scope will be extended to Extra High voltage cables up to 480 kV.

FACTORY MACHINERY

All production machines are top of the line of the cables machinery suppliers. From start up with wire drawing lines to extrusion lines, to assembly machines up to the laboratories and the final test fields , all technical equipment is provided with the highest European standards of electronic control equipment and measuring devices which insures that the requirements of different quality standards are met.
All machines/production lines are prepared for data communication and data exchange bottom up and top down using the most modern decentralized control software at the lines (PLC) combined with an efficient central steering and a planning system focused on the demand of cable manufacturers. This way, full traceability will be guaranteed from production start to end, by being able to follow up the machines involved and the material used.

LOGISTICS

All material flow in BCC from incoming raw material up to outgoing cables will be planned and controlled by a complete software system. Herein a classical ERP system will be enhanced and completed by the most modern MES (Manufacturing Executive System) which has a unique focus on the specific problematic issues of cables manufacturing with longitudinal products being winded up and winded off.

The Manufacturing Executive System - MES - covers:

PLANNING

The planning system is active on several levels. For the proper function, all master data (material properties, dimensions, etc.) are saved and permanently maintained in the central database based on

- Cable design
- Planning of Sales Orders
- Planning of Production Orders

DATA COMMUNICATION

The exchange of data is important in several areas.

- Incoming inspection
- Raw Materials - Status quo of production orders
- Finished goods
- Shipping status

Bahra Cables Company is willing to provide advice and assistance on all matters concerning XLPE insulated power cables. Please contact the Technology Department for any query.

QUALITY IS OUR MAIN TARGET

Bahra Cables Company is born to be one of the leading Power Cables Manufacturers in Saudi Arabia and the GCC area. We are working in different axes to completely fulfill customers satisfaction which is the milestone of our business, such axes are:

1. Product quality complying with the local and international standards

2. Product Reliability is starting from the time of product design to fit for the intended application and environmental conditions, to the selection of the raw material from only the highest class suppliers with internationally trusted reputation. Our state of art testing equipments and the strict quality procedures ensure the product quality and integrity so we can guarantee that our cables are defect free and suitable for the intended application through the cable service lifetime.

3. High performance of the product and service through cooperation between experienced staff from Germany and local experts who are aware of the local market requirements and the highest international standards of cables manufacturing. Such cooperation in know-how is invested to provide our customer with the best service and support.

4. Bahra Cables Company's Quality Management System conforms to the ISO 9001: 2008 International Management Quality System Standard with scope of Design and Manufacturing of Electrical Power Cables and Wires. BCC is certified by American Systems Registrar (ASR), ANAB Accredited.

5. Bahra Cables Company is frequently testing its products at internationally reputable labs, diversity of products have been tested and confirmed compliance to the international standard at KEMA, IPH, SAG(Berlin), BSI and BASEC Labs covers all the company product range.

6. Bahra Cables Company has UL Registration for wire types such as THHN., THWN, THW, XHHW-2, XHW, XHH, RHW-2, RHW & RHH, cables Type TC (Low voltage control cables and Low Voltage Power Cables for tray and direct buried applications) which only implies that Bahra Cables Company is committed to provide customer satisfaction through quality product and services.

TECHNICAL INFORMATION
DEFINITIONS

NOMINAL VALUE
Value by which a quantity is designated and which is often used in tables.
(Note: Usually, in IEC standards, nominal values give rise to values to be checked by measurements taking into account specified tolerances).

MEDIAN VALUE
When several test results have been obtained and ordered in an increasing (or decreasing) succession, the median value is the middle value if the number of available values is odd, and the mean of two middle values if the number is even.

APPROXIMATE VALUE
Value which is neither guaranteed nor checked, it is used, for example, for the calculation of other dimensional values.

ROUTINE TESTS
Tests made by the manufacturer on each manufactured length of cable to check that each length meets the specified requirements.

SAMPLE TESTS
Tests made by the manufacturer on samples of completed cable or components taken from a completed cable, at a specified frequency, so as to verify that the finished product meets the specified requirements.

TYPE TESTS
Tests made before supplying, on a general commercial basis, a type of cable covered by the standard, in order to demonstrate satisfactory performance characteristics to meet the intended application.
(Note: These tests are of such nature that, after they have been made, they need not be repeated, unless changes are made in the cable materials or design or manufacturing process whcihc might change the performance characteristices).

PREQUALIFICATION TEST
Test made before supplying, on a general commercial basis, a type of cable system covered by the standard, in order to demonstrate satisfactory long term performance of the complete cable system.

EXTENSION OF PREQUALIFICATION TEST
Test made before supplying, on a general commercial basis, a type of cable system covered by the standard, in order to demonstrate satisfactory long term performance of the complete cable system taking into account an already prequalification cable system.

ELECTRICAL TESTS AFTER INSTALLATION
Tests made to demonstrate the integrity of the cable and its accessories as installed.

CABLE SYSTEM
Cable with installed accessories.

NOMINAL ELECTRICAL STRESS
Electrical stress calculated at U0 using nominal dimensions.

VOLTAGE DESIGNATIONS

U_o: The rated r.m.s. power frequency voltage between each conductor and screen or sheath for which cables and accessories are designed.

U: The rated r.m.s. power frequency voltage between ant two conductors for which cables and accessories are designed.

U_m: The maximum r.m.s. power frequency voltage between any two conductors for which cables and accessories are designed. It is the highest voltage that can be sustained under normal operating conditions at any time and in any point in a system.

Cables are designed by U_o/U (U_m) to provide guidance on compatibility with switchgear and transformers.

The following table gives the relation between U_o, U and U_m in accordance with IEC 60183.

Table 1: Relationship between U_o, U and U_m

Rated Voltage of Cables (U_o)	Nominal System Voltage (U)			Highest Voltage for Equipment (U_m)
26.0	45.0		47.0	52.0
36.0	60.0	66.0	69.0	72.5
64.0	110.0		115.0	123.0
76.0	132.0		138.0	145.0
87.0	150.0		161.0	170.0
127.0	220.0		230.0	245.0

1. RESISTANCE

The values of conductor DC resistance are dependant on the temperature and it is calculated by the following formula:

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

where,

R_θ	:	The conductor DC resistance at θ°C	Ω/km
R_{20}	:	The conductor DC resistance at 20°C	Ω/km
θ	:	Operating temperature	°C
α	:	Temperature coefficient = 0.00393 for Copper = 0.00403 for Aluminum	1/°C

Generally the Dc resistance is based on IEC 60228 and to calculate the AC resistance of the conductor at the operating temperature the following

$$R_{AC} = R_\theta(1 + Y_S + Y_P) \qquad \Omega/km$$

where,

YS	:	Skin effect factor
YP	:	Proximity effect factor

2. INDUCTANCE

$$L = K + 0.2\ ln\ (2S/d) \qquad mh/km$$

where,

L	:	The Inductance	mh/km
K	:	Constant depend on number of wires	
d	:	Conductor diameter	
S	:	Axial Spacing =1.26 x axial spacing between cables in case of flat formation	

3. REACTANCE

$$X = 2\,\pi\,f\,L\,x\,10^{-3} \qquad \Omega/km$$

where,

X	:	The Cable Reactance	Ω/km
L	:	The Inductance	mh/km
f	:	Frequency	Hz

To calculate the cable impedance we should follow the below equation:

$$Z = \sqrt{X^2 + R^2_{AC}} \qquad \Omega/km$$

4. CAPACITANCE

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

where,

C	:	Capacitance	μF/Km
εr	:	Relative permitivity of insulation material	
D	:	Diameter over insulation	mm
d	:	Diameter under insulation	mm

5. CHARGING CURRENT

$$I_c = 2\pi f C U_o x 10^{-6}$$ A/Km

where,

C	:	Capacitance	μF/Km
f	:	Frequency	Hz
Uo	:	Rated Phase Voltage	V

6. DIELECTRIC LOSSES

$$W_d = 2\pi f C U^2_o \tan\delta \times 10^{-6}$$ watt/Km/Ph

where,

C	:	Capacitance	μF/Km
f	:	Frequency	Hz
Uo	:	Rated Phase Voltage	V
tanδ	:	Dielectric Power Factor	

7. SHORT CIRCUIT CURRENT

$$I_{sc@t} = \frac{I_{sc@1Sec}}{\sqrt{t}}$$ KA

where,

Isc@t	:	Short Circuit current for t seconds	KA
Isc@1	:	Short Circuit current for 1 seconds	KA
t	:	Duration	Sec

8. ELECTRIC STRESS

$$E = \frac{U_o}{X \ln\left(\frac{D_{INS}}{D_{ISC}}\right)}$$ KV/mm

where,

E	:	Electric Stress	KV/mm
Uo	:	Rated Phase Voltage	V
D_{INS}	:	Diameter after insulation	mm
D_{ISC}	:	Diameter after inner semi-conductor	mm
X	:	When substitute the X in the above equation by D_{ISC} this will give the electric stress at conductor surface which is the highest stress When substitute the X in the above equation by D_{INS} this will give the electric stress at insulation	

ELECTRICAL TECHNICAL INFORMATION

PROPERTIES FOR METALS

The following table shows some electrical and physical properties for the metals used in HV cables:

Table 2: Electrical and physical properties for metals

Property	Copper	Aluminum	Lead
IACS 100%	101.0	61.0	8.0
Electrical resistivity @ 20°C (Ω.m (10^{-8}))	1.707	2.8264	21.4
Temperature coefficient of Resistance per °C	0.00393	0.00403	0.004
Density @ 20 °C (Kg/m^3)	8890.0	2703.0	11340.0
Coefficient of thermal expansion($1/°C \times 10^{-6}$)	17.0	23.0	29.0
Melting point (°C)	1083.0	659.0	327.0
Ultimate tensile strength (Mn/mm^2)	225.0	70-90	-

SHORT CIRCUIT CURRENT RATING FOR CONDUCTORS

Table 3: Copper Conductor

CSA (mm^2)	Duration									
	0.1	0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0
150	68.0	48.1	39.3	34.0	30.4	21.5	15.2	12.4	10.8	9.6
185	83.8	59.3	48.4	41.9	37.5	26.5	18.7	15.3	13.3	11.9
240	108.5	76.7	62.6	54.2	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	201.5	164.5	142.5	127.4	90.1	63.7	52.0	45.1	40.3
800	362.1	256.0	209.0	181.0	161.9	114.5	81.0	66.1	57.3	51.2
1000	452.5	320.0	261.3	226.3	202.4	143.1	101.2	82.6	71.6	64.0
1200	543.0	383.9	313.5	271.5	242.8	171.7	121.4	99.1	85.9	76.8
1600	723.8	511.8	417.9	361.9	323.7	228.9	161.9	132.2	114.5	102.4
2000	905.0	640.0	522.5	452.5	404.7	286.2	202.4	165.2	143.1	128.0
2500	1131.1	799.8	653.1	565.6	505.9	357.7	252.9	206.5	178.9	160.0

Table 4: Aluminum Conductor

CSA (mm^2)	Duration									
	0.1	0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0
150	44.9	31.8	25.9	22.5	20.1	14.2	10.0	8.2	7.1	6.4
185	55.3	39.1	32.0	27.7	24.7	17.5	12.4	10.1	8.8	7.8
240	71.8	50.8	41.4	35.9	32.1	22.7	16.1	13.1	11.4	10.2
300	89.5	63.3	51.7	44.7	40.0	28.3	20.0	16.3	14.2	12.7
400	119.5	84.5	69.0	59.8	53.5	37.8	26.7	21.8	18.9	16.9
500	149.3	105.5	86.2	74.6	66.8	47.2	33.4	27.3	23.6	21.1
630	188.2	133.0	108.6	94.1	84.1	59.5	42.1	34.4	29.8	26.6
800	239.1	169.0	138.0	119.5	106.9	75.6	53.5	43.6	37.8	33.8
1000	298.8	211.3	172.5	149.4	133.6	94.5	66.8	54.6	47.3	42.3
1200	358.6	253.6	207.0	179.3	160.4	113.4	80.2	65.5	56.7	50.7
1600	478.1	338.1	276.1	239.1	213.8	151.2	106.9	87.3	75.6	67.6
2000	597.7	422.6	345.1	298.8	267.3	189.0	133.6	109.1	94.5	84.5
2500	746.9	528.2	431.2	373.5	334.0	236.2	167.0	136.4	118.1	105.6

There are 3 types of bonding for the metallic sheaths inside the cable and these types are as following:

1. BOTH END BOND

In this type of bonding, both sides of cable sheath will be connected to earth. With this method no induced voltage occur at cable ends, which makes it the most secure regarding safety aspects. But on the other hand circulating current will flow in the sheath as the loop between the two earthing points is closed through the ground. And these circulating currents are proportional to conductor current and therefor reduce cable ampacity significantly making it the most disadvantageous method regarding economic aspects. So this type of bonding is hardly applied for HV cables due to high losses, but it is the most common bonding type for MV and LV cables.

Fig. 1 shows the both end bond connection method
Fig. 2 shows the induced voltage distribution against cable length

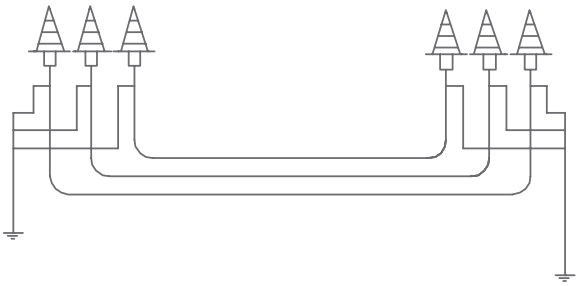
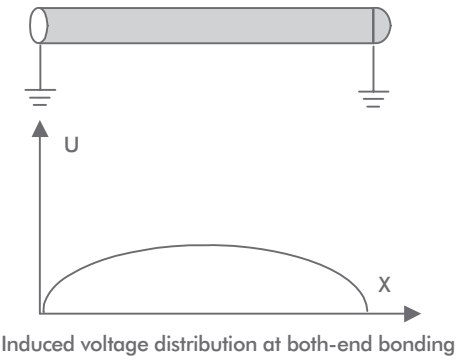


Fig. 1



Induced voltage distribution at both-end bonding

Fig. 2

2. SINGLE END BOND

In this type of bonding one side of the cable sheath will be connected to earth, so that at the other end "open end" the induced voltage will appear. Which will induced linearly along the cable length and it will increase as the length increases. So for safety requirements the open end of the sheath has to be protected with surge arrester (sheath voltage limiter). Also to avoid potential lifting in case of failure the both ends of cable sheath have to be connected additionally with an earth continuity conductor. This type is much better than the both end bonding system as when using single point bonding the losses approximately equal zero but due to the induced voltage on the free end this type is usually used for short lengths (less than 1 Km).

Fig. 3 shows the Single end bond connection method
Fig. 4 shows the induced voltage distribution against the cable length

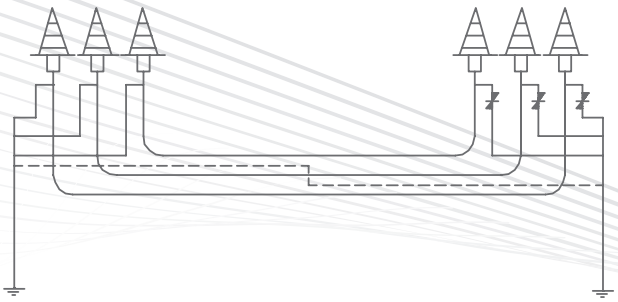
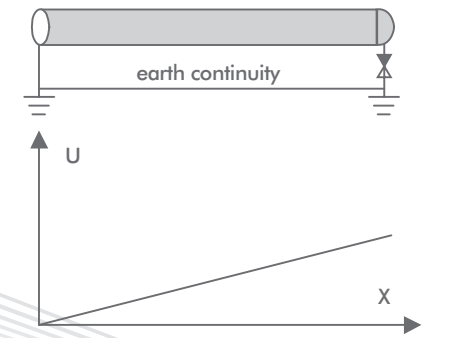


Fig. 3



Induced voltage distribution at single-end bonding

Fig. 4

3. CROSS BONDING

This earthing method shall be applied for longer route lengths where joints are required due to the limited cable delivery length. The cross bonding system consists of three equal sections with cyclic sheath crossing after each section. The termonation points shall be solidly bonded to earth.
In ideal cross bonding systems the three section lengths are equal, so that no residual voltage occurs and thus no sheath current flow.
Very long lengths can consists of several cross bonding systems in a row, so it is recommended to maintain solid bonding of the system ends in order to prevent travelling surges in case of fault.
Also in cross bonding systems the conductors can be transposed. And this solution is suited for very long cable length or parallel circuits.
This type of bonding is the most common used type for HV cables.

Fig. 5 shows the cross bonding connection method
Fig. 6 shows the induced voltage distribution against the cable length.

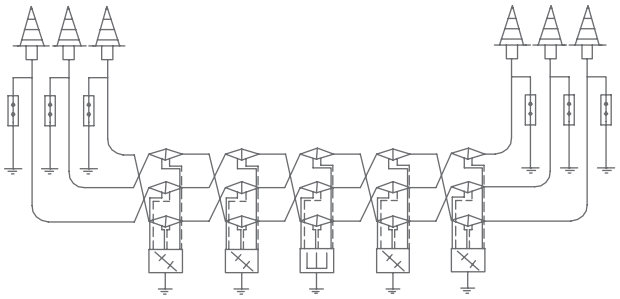
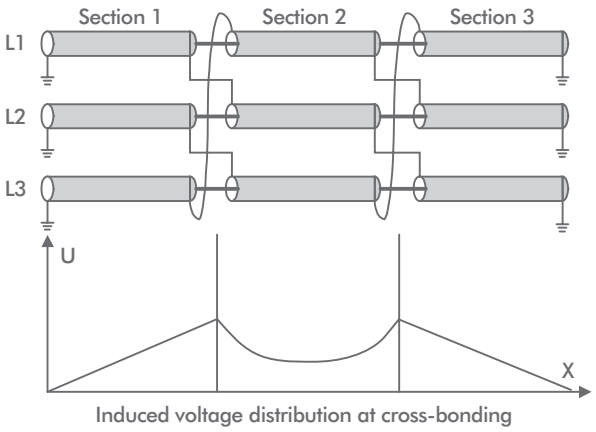


Fig. 5



Induced voltage distribution at cross-bonding

Fig. 6

LEGEND:


Earthing box

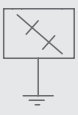

Sealing end

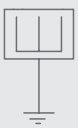

Cross bonding joint


Straight joint


Joint with ground connection

Earth continuity conductor


With earthing connection


Earthing box


Sheath voltage limiter

CONDUCTOR

The most important layer in cables as it is the current carrying capacity component and it may be Copper or Aluminum.
Conductor consists of stranded soft drawn wires wounded together, and it could have one of the following two shapes:

1. Circular compacted conductor for CSA up to and including 800 mm^2
2. Segmental conductor consists of 5 segments for CSA over than 800 mm^2

WATER TIGHT CONDUCTORS:
Upon request, the conductor may be water tight by using swelling powder, yarns, tapes inside it (between conductor layers).

CONDUCTOR SCREEN

It is an extruded thermoset semi-conducting compound to minimize the concentration of elctric stress at any points on the conductor surface due to the stranding.
Semi-conductive tape may be used before the conductor screen (it will be water blocked in case of water tight conductor).

INSULATION

The insulation material is an extruded and dry cured cross-linked polyethylene (XLPE), and it is the cable electrical protection.
The insulation should withstand the rated voltage, lightning over voltages and switching over voltage during its lifetime.
The insulation material is capable to withstand 90°C during normal operation and 250°C during short circuit conditions.

INSULATION SCREEN

It is an extruded thermoset semi-conducting compound over the insulation.
The three previous layers (conductor screen, insulation & insulation screen) are extruded simultaneously in one process and it is carried out on the CV lines with many measurements devices to control this process perfectly.

METALLIC SCREEN

This layer is the short circuit current carrying component and it may be one of the following type:

1. Copper wires with open helix copper tape as a binder
2. Lead alloy sheath
3. Combination of the previous

OUTER JACKET

This is the final prtection layer for all inside layers, and it may be one of the following types:

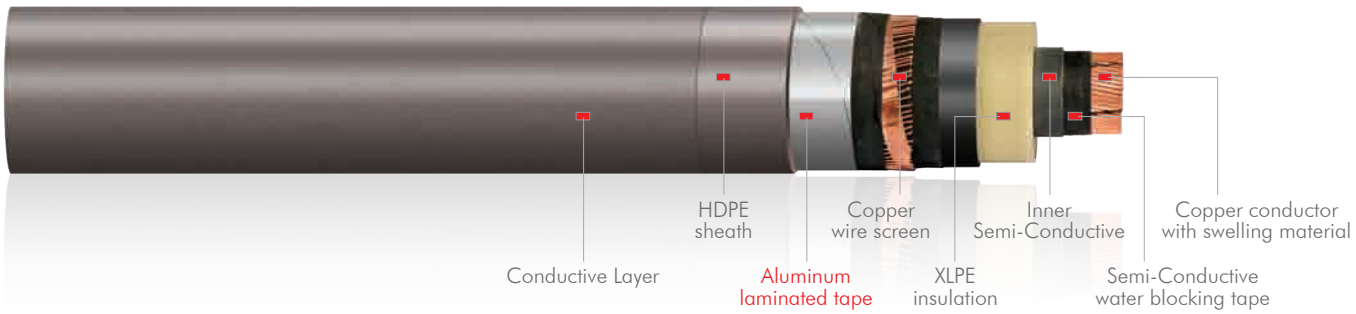
1. PE material (HDPE, LLDPE, MDPE)
2. PVC material
3. LS0H material

SEMI-CONDUCTIVE LAYER

A semi-conductive layer to be applied over the outer jacket for jacket field testing after installation and this layer may be graphite powder or extruded semi-conductive layer.

SINGLE CORE XLPE CABLE WITH ALUMINUM LAMINATED SHEATH

COPPER CONDUCTOR | 38/66(72.5)kV
CU/XLPE/CWS/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation “Triple extrusion”).
- Copper wires screen with water blocking tapes.
- Aluminum laminated sheath.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Copper wires screen: is the short circuit current carrying component.
- Water blocking tapes: is the longitudinal water barrier.
- Aluminum laminated Sheath: is the radial water barrier.

APPLICABLE STANDARDS

- IEC 60840 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

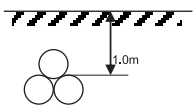
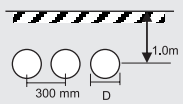
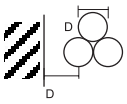
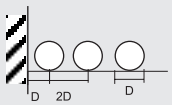
TECHNICAL INFORMATION

COPPER CONDUCTOR | 38/66(72.5)kV
CU/XLPE/CWS/HDPE

TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Cu wires screen	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	No. X diam	mm	mm	Kg/Km	Ω/Km	μf/Km
31010021	150	Compact, Round, Stranded	1.0	10	1.0	68x1.52	3.5	54.3	4220	0.1240	0.181
31010022	185		1.0	10	1.0	68x1.52	3.5	56	4625	0.0991	0.193
31010023	240		1.0	10	1.0	68x1.52	3.5	58.5	5270	0.0754	0.211
31010024	300		1.0	10	1.0	68x1.52	3.5	60.8	5930	0.0601	0.228
31010025	400		1.0	10	1.0	68x1.52	3.5	63.3	6850	0.0470	0.246
31010026	500		1.0	10	1.0	68x1.52	4.0	67.4	8025	0.0366	0.268
31010027	630		1.0	10	1.0	68x1.52	4.0	71.5	9535	0.0283	0.297
31010028	800		1.0	10	1.0	68x1.52	4.0	75.6	11395	0.0221	0.326
31010029	1000	Segmental. Stranded (Millikan)	1.4	10	1.4	68x1.52	4.0	80.5	13690	0.0176	0.365
31010030	1200		1.4	10	1.4	68x1.52	4.5	85.6	15635	0.0151	0.394
31010031	1600		1.4	10	1.4	68x1.52	4.5	92.5	19795	0.0113	0.442
31010032	2000		1.4	10	1.4	68x1.52	4.5	97.9	23445	0.0090	0.480
31010033	2500		1.4	10	1.4	68x1.52	4.5	104.7	28825	0.0072	0.528

CURRENT CARRYING CAPACITY

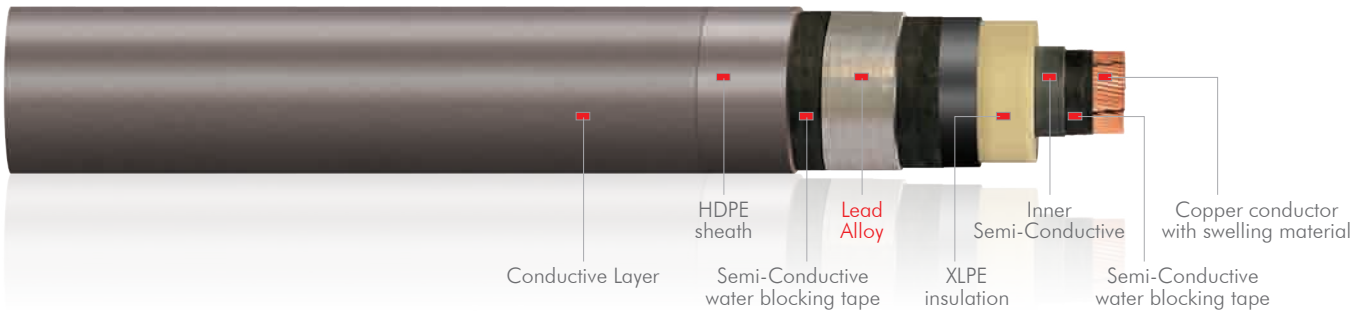
Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil 	Flat 			Trefoil 	Flat 
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	150	345	405	Cross Bonding or Single Point Bonding	150	447	508
	185	389	458		185	511	581
	240	451	532		240	602	687
	300	508	600		300	688	789
	400	575	683		400	792	912
	500	649	774		500	911	1055
	630	731	879		630	1047	1224
	800	810	984		800	1184	1400
	1000	983	1162		1000	1468	1704
	1200	1060	1255		1200	1606	1871
	1600	1208	1440		1600	1875	2208
	2000	1319	1607		2000	2088	2488
	2500	1430	1739		2500	2317	2792

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE WITH LEAD ALLOY SHEATH

COPPER CONDUCTOR | 38/66(72.5)kV

CU/XLPE/LC/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Lead Alloy Sheath with water blocking tapes.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Lead Alloy Sheath: is the short circuit current carrying component and also act as radial water barrier.
- Water blocking tapes: is the longitudinal water barrier.

APPLICABLE STANDARDS

- IEC 60840 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

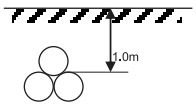
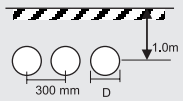
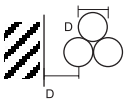
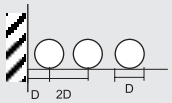
TECHNICAL INFORMATION

COPPER CONDUCTOR | 38/66(72.5)kV
CU/XLPE/LC/HDPE

TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Lead Alloy Thickness	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	mm	mm	mm	Kg/Km	Ω/Km	μf/Km
31030021	150	Compact, Round, Stranded	1.0	10.0	1.0	2.0	3.5	55.6	6240	0.1240	0.181
31030022	185		1.0	10.0	1.0	2.1	3.5	57.5	6940	0.0991	0.193
31030023	240		1.0	10.0	1.0	2.1	3.5	60.0	7765	0.0754	0.211
31030024	300		1.0	10.0	1.0	2.2	3.5	62.4	8790	0.0601	0.228
31030025	400		1.0	10.0	1.0	2.3	3.5	65.2	10110	0.0470	0.246
31030026	500		1.0	10.0	1.0	2.4	4.0	69.5	11750	0.0366	0.268
31030027	630		1.0	10.0	1.0	2.5	4.0	73.8	13830	0.0283	0.297
31030028	800		1.0	10.0	1.0	2.6	4.0	78.1	16295	0.0221	0.326
31030029	1000	Segmental. Stranded (Millikan)	1.4	10.0	1.4	2.8	4.0	83.3	19520	0.0176	0.365
31030030	1200		1.4	10.0	1.4	2.9	4.5	88.6	22145	0.0151	0.394
31030031	1600		1.4	10.0	1.4	3.1	4.5	95.9	27610	0.0113	0.442
31030032	2000		1.4	10.0	1.4	3.3	4.5	101.7	32500	0.0090	0.480
31030033	2500		1.4	10.0	1.4	3.5	4.5	108.9	39370	0.0072	0.528

CURRENT CARRYING CAPACITY

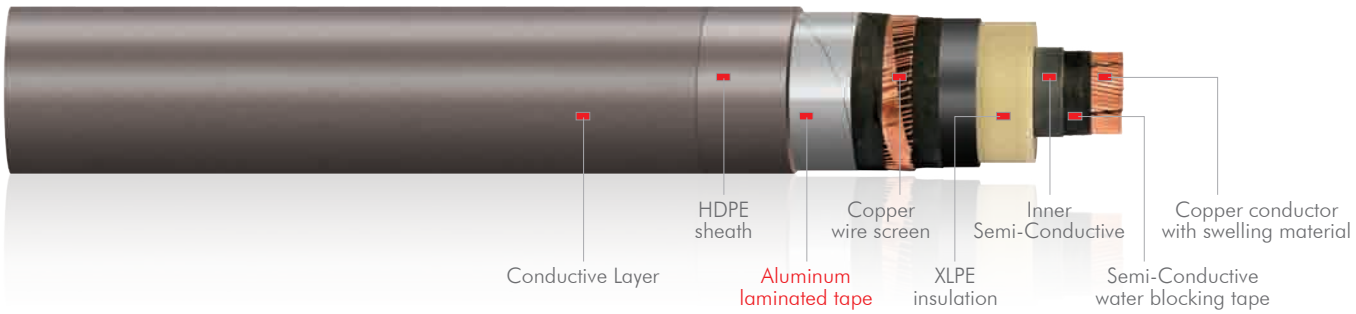
Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil 	Flat 			Trefoil 	Flat 
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	150	345	406	Cross Bonding or Single Point Bonding	150	449	510
	185	389	459		185	513	584
	240	450	533		240	603	690
	300	506	602		300	690	793
	400	573	685		400	794	917
	500	646	777		500	912	1060
	630	724	882		630	1046	1230
	800	799	987		800	1179	1405
	1000	955	1164		1000	1444	1700
	1200	1023	1256		1200	1573	1865
	1600	1142	1437		1600	1811	2192
	2000	1225	1579		2000	1989	2455
	2500	1296	1716		2500	2164	2731

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE WITH ALUMINUM LAMINATED SHEATH

COPPER CONDUCTOR | 76/132(145)kV

CU/XLPE/CWS/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Copper wires screen with water blocking tapes.
- Aluminum laminated sheath.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Copper wires screen: is the short circuit current carrying component.
- Water blocking tapes: is the longitudinal water barrier.
- Aluminum laminated Sheath: is the radial water barrier.

APPLICABLE STANDARDS

- IEC 60840 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

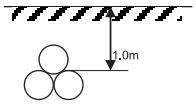
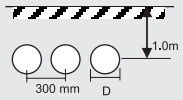
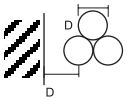
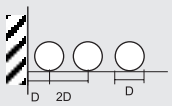
TECHNICAL INFORMATION

COPPER CONDUCTOR | 76/132(145)kV
CU/XLPE/CWS/HDPE

TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Cu wires screen	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	No. X diam	mm	mm	Kg/Km	Ω/Km	μf/Km
35010021	240	Compact, Round, Stranded	1.0	16	1.0	68x1.52	4.0	71.5	6445	0.0754	0.152
35010022	300		1.0	16	1.0	68x1.52	4.0	73.8	7150	0.0601	0.163
35010023	400		1.0	16	1.0	68x1.52	4.0	76.3	8120	0.0470	0.175
35010024	500		1.0	16	1.0	68x1.52	4.0	79.4	9250	0.0366	0.189
35010025	630		1.0	16	1.0	68x1.52	4.0	83.5	10830	0.0283	0.207
35010026	800		1.0	16	1.0	68x1.52	4.0	87.6	12770	0.0221	0.226
35010027	1000	Segmental. Stranded (Millikan)	1.4	16	1.4	68x1.52	4.0	93.5	15300	0.0176	0.251
35010028	1200		1.4	16	1.4	68x1.52	4.5	97.6	17195	0.0151	0.269
35010029	1600		1.4	16	1.4	68x1.52	4.5	104.5	21475	0.0113	0.299
35010030	2000		1.4	16	1.4	68x1.52	4.5	109.9	25220	0.0090	0.323
35010031	2500		1.4	16	1.4	68x1.52	4.5	116.7	30720	0.0072	0.353

CURRENT CARRYING CAPACITY

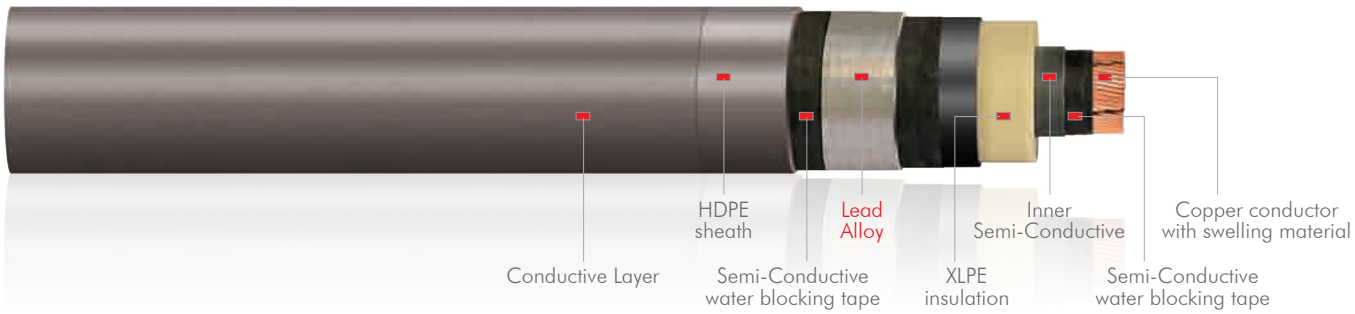
Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil 	Flat 			Trefoil 	Flat 
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	240	450	521	Cross Bonding or Single Point Bonding	240	600	669
	300	508	588		300	686	767
	400	576	669		400	789	886
	500	652	761		500	908	1025
	630	736	864		630	1044	1188
	800	817	968		800	1182	1358
	1000	987	1143		1000	1450	1640
	1200	1065	1237		1200	1589	1807
	1600	1214	1421		1600	1856	2133
	2000	1331	1570		2000	2070	2402
	2500	1445	1719		2500	2294	2694

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE WITH LEAD ALLOY SHEATH

COPPER CONDUCTOR | 76/132(145)kV

CU/XLPE/LC/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Lead Alloy Sheath with water blocking tapes.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Lead Alloy Sheath: is the short circuit current carrying component and also act as radial water barrier.
- Water blocking tapes: is the longitudinal water barrier.

APPLICABLE STANDARDS

- IEC 60840 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

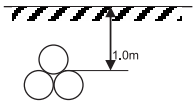
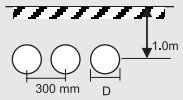
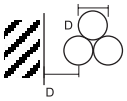
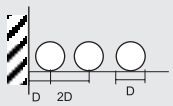
TECHNICAL INFORMATION

COPPER CONDUCTOR | 76/132(145)kV
CU/XLPE/LC/HDPE

TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Lead Alloy Thickness	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	mm	mm	mm	Kg/Km	Ω/Km	μf/Km
35030021	240	Compact, Round, Stranded	1.0	16	1.0	2.5	4.0	74.8	10850	0.0754	0.152
35030022	300		1.0	16	1.0	2.6	4.0	77.2	12000	0.0601	0.163
35030023	400		1.0	16	1.0	2.6	4.0	79.8	13205	0.0470	0.175
35030024	500		1.0	16	1.0	2.7	4.0	83.1	14890	0.0366	0.189
35030025	630		1.0	16	1.0	2.8	4.0	87.4	17130	0.0283	0.207
35030026	800		1.0	16	1.0	3.0	4.0	91.9	20055	0.0221	0.226
35030027	1000	Segmental. Stranded (Millikan)	1.4	16	1.4	3.1	4.0	96.9	23220	0.0176	0.251
35030028	1200		1.4	16	1.4	3.2	4.5	101.2	25885	0.0151	0.269
35030029	1600		1.4	16	1.4	3.4	4.5	108.5	31460	0.0113	0.299
35030030	2000		1.4	16	1.4	3.6	4.5	114.3	36770	0.0090	0.323
35030031	2500		1.4	16	1.4	3.8	4.5	121.5	43920	0.0072	0.353

CURRENT CARRYING CAPACITY

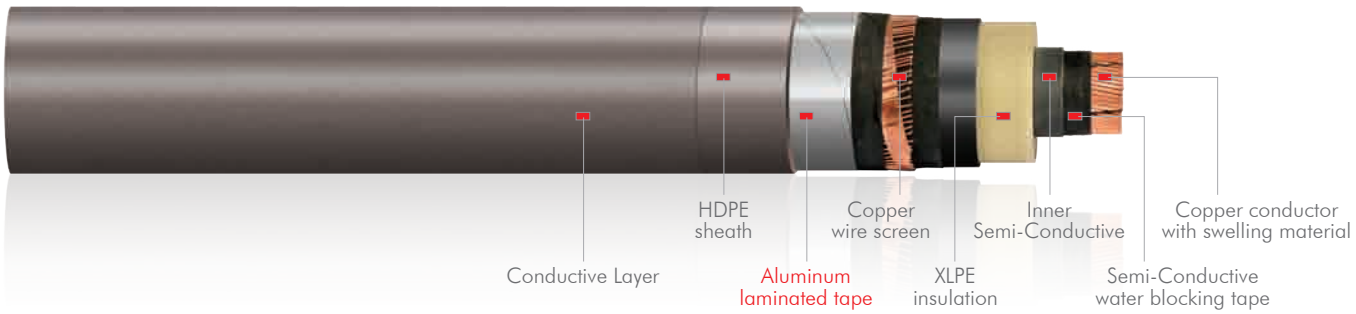
Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil 	Flat 			Trefoil 	Flat 
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	240	449	522	Cross Bonding or Single Point Bonding	240	602	672
	300	506	590		300	687	771
	400	572	671		400	789	889
	500	646	762		500	906	1029
	630	725	866		630	1039	1192
	800	800	969		800	1172	1360
	1000	950	1142		1000	1420	1636
	1200	1015	1234		1200	1546	1798
	1600	1132	1410		1600	1778	2108
	2000	1214	1548		2000	1952	2359
	2500	1284	1679		2500	2122	2622

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE WITH ALUMINUM LAMINATED SHEATH

COPPER CONDUCTOR | 127/220(245)kV

CU/XLPE/CWS/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Copper wires screen with water blocking tapes.
- Aluminum laminated sheath.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Copper wires screen: is the short circuit current carrying component.
- Water blocking tapes: is the longitudinal water barrier.
- Aluminum laminated Sheath: is the radial water barrier.

APPLICABLE STANDARDS

- IEC 62067 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

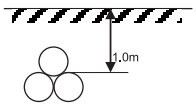
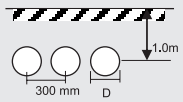
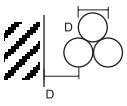
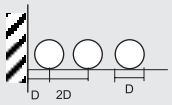
TECHNICAL INFORMATION

COPPER CONDUCTOR | 127/220(245)kV
CU/XLPE/CWS/HDPE

TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Cu wires screen	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	No. X diam	mm	mm	Kg/Km	Ω/Km	μf/Km
42010021	400	Compact, Round, Stranded	1.4	23	1.4	68x1.52	4.5	92.9	10125	0.0470	0.14
42010022	500		1.4	23	1.4	68x1.52	4.5	96.0	11330	0.0366	0.15
42010023	630		1.4	23	1.4	68x1.52	4.5	100.1	13020	0.0283	0.163
42010024	800		1.4	23	1.4	68x1.52	4.5	104.2	15050	0.0221	0.176
42010025	1000	Segmental. Stranded (Millikan)	1.4	23	1.4	68x1.52	5.0	108.5	17460	0.0176	0.192
42010026	1200		1.4	23	1.4	68x1.52	5.0	112.6	19445	0.0151	0.205
42010027	1600		1.4	23	1.4	68x1.52	5.0	119.5	23880	0.0113	0.226
42010028	2000		1.4	23	1.4	68x1.52	5.0	124.9	27740	0.0090	0.243
42010029	2500		1.4	23	1.4	68x1.52	5.0	131.7	33390	0.0072	0.264

CURRENT CARRYING CAPACITY

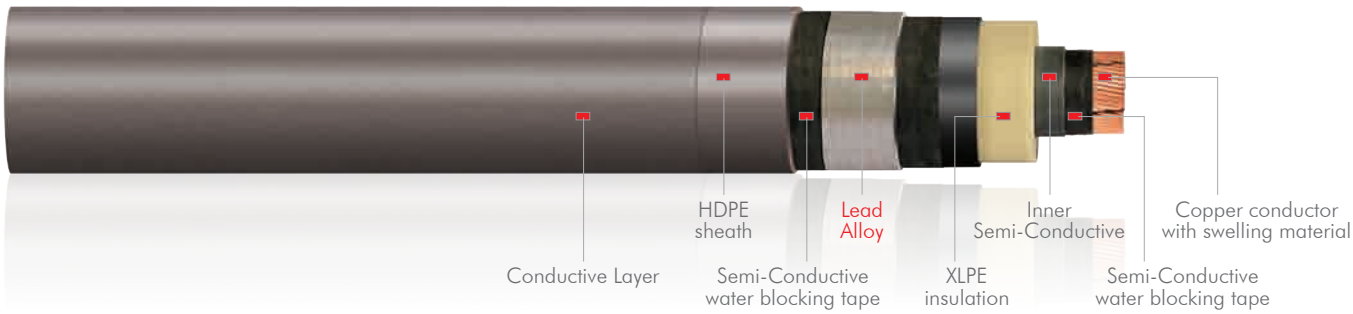
Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil	Flat			Trefoil	Flat
							
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	400	567	647	Cross Bonding or Single Point Bonding	400	775	853
	500	641	736		500	891	985
	630	725	835		630	1025	1141
	800	806	936		800	1161	1302
	1000	966	1107		1000	1416	1574
	1200	1043	1197		1200	1552	1732
	1600	1191	1374		1600	1813	2042
	2000	1306	1517		2000	2023	2298
	2500	1421	1660		2500	2244	2575

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE WITH LEAD ALLOY SHEATH

COPPER CONDUCTOR | 127/220(245)kV

CU/XLPE/LC/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Lead Alloy Sheath with water blocking tapes.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Lead Alloy Sheath: is the short circuit current carrying component and also act as radial water barrier.
- Water blocking tapes: is the longitudinal water barrier.

APPLICABLE STANDARDS

- IEC 62067 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

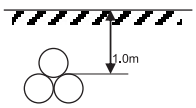
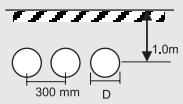
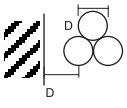
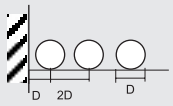
TECHNICAL INFORMATION

COPPER CONDUCTOR | 127/220(245)kV
CU/XLPE/LC/HDPE

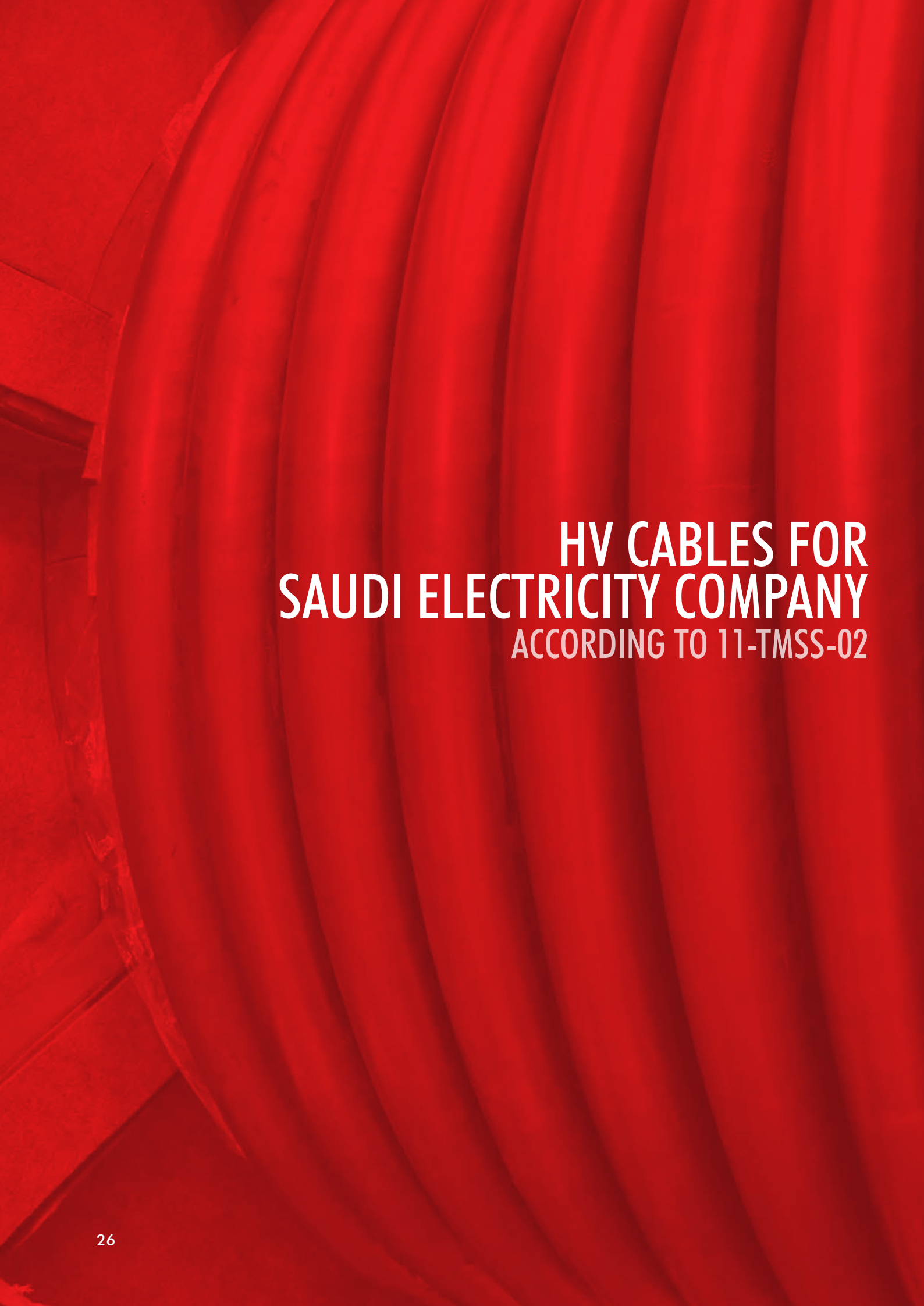
TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Lead Alloy Thickness	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	mm	mm	mm	Kg/Km	Ω/Km	μf/Km
42030021	400	Compact, Round, Stranded	1.4	23	1.4	3.1	4.5	96.4	18045	0.0470	0.14
42030022	500		1.4	23	1.4	3.2	4.5	99.7	19920	0.0366	0.15
42030023	630		1.4	23	1.4	3.3	4.5	104.0	22385	0.0283	0.163
42030024	800		1.4	23	1.4	3.4	4.5	108.3	25245	0.0221	0.176
42030025	1000	Segmental. Stranded (Millikan)	1.4	23	1.4	3.5	5.0	112.7	28350	0.0176	0.192
42030026	1200		1.4	23	1.4	3.7	5.0	117.2	31595	0.0151	0.205
42030027	1600		1.4	23	1.4	3.9	5.0	124.5	37730	0.0113	0.226
42030028	2000		1.4	23	1.4	4.0	5.0	130.1	42755	0.0090	0.243
42030029	2500		1.4	23	1.4	4.2	5.0	137.3	50260	0.0072	0.264

CURRENT CARRYING CAPACITY

Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil	Flat			Trefoil	Flat
							
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	400	560	648	Cross Bonding or Single Point Bonding	400	774	855
	500	632	736		500	887	987
	630	709	835		630	1016	1141
	800	782	934		800	1146	1300
	1000	920	1101		1000	1380	1566
	1200	980	1187		1200	1500	1718
	1600	1088	1352		1600	1721	2011
	2000	1167	1480		2000	1890	2248
	2500	1230	1599		2500	2054	2495

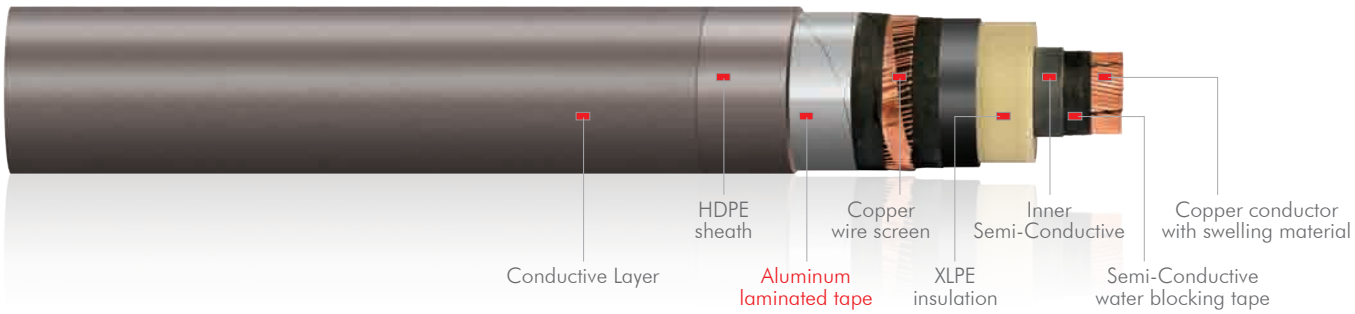
ρT: Soil Thermal Resistivity



HV CABLES FOR SAUDI ELECTRICITY COMPANY

ACCORDING TO 11-TMSS-02

SINGLE CORE XLPE CABLE
WITH COPPER WIRES SCREEN AND ALUMINUM LAMINATED SHEATH
COPPER CONDUCTOR | 110kV
CU/XLPE/CWS/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Copper wires screen with water blocking tapes.
- Aluminum laminated sheath.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Copper wires screen: is the short circuit current carrying component and designed to withstand 40 KA for 1 sec.
- Water blocking tapes: is the longitudinal water barrier.
- Aluminum laminated Sheath: is the radial water barrier.

APPLICABLE STANDARDS

- IEC 60840 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

APPLICABLE SEC SPECS

- 11-TMSS-02 Rev01

TECHNICAL INFORMATION

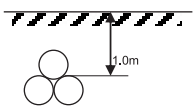
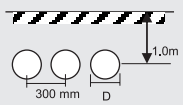
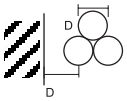
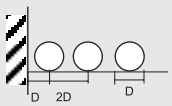
COPPER CONDUCTOR | 110kV

CU/XLPE/CWS/HDPE

TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Cu wires screen	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	No. X diam	mm	mm	Kg/Km	Ω/Km	μf/Km
33010004	400	Compact, Round, Stranded	0.64	20.32	1.75	72x2.22	4.0	87.9	10755	0.0470	0.149
33010006	630		0.64	20.32	1.75	72x2.22	4.0	93.6	12125	0.0283	0.175
33010007	800		0.76	20.32	1.75	72x2.22	4.0	99.1	15570	0.0221	0.190
33010008	1000	Segmental. Stranded (Millikan)	0.76	20.32	1.75	72x2.22	4.0	103.2	17920	0.0176	0.210
33010009	1200		0.76	20.32	1.75	72x2.22	4.0	107.3	19860	0.0151	0.224
33010010	1600		0.76	20.32	1.75	72x2.22	4.0	114.2	24225	0.0113	0.248
33010011	2000		0.76	20.32	1.75	72x2.22	4.0	119.6	28040	0.0090	0.267

CURRENT CARRYING CAPACITY

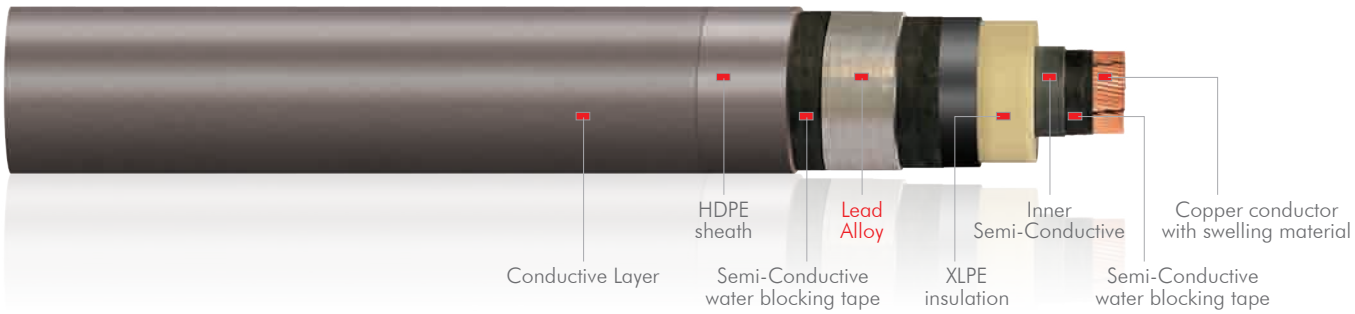
Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil 	Flat 			Trefoil 	Flat 
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	400	578	662	Cross Bonding or Single Point Bonding	400	787	871
	630	740	855		630	1042	1166
	800	824	959		800	1180	1331
	1000	990	1135		1000	1442	1612
	1200	1069	1229		1200	1580	1775
	1600	1220	1412		1600	1846	2094
	2000	1340	1559		2000	2060	2357

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE WITH LEAD ALLOY SHEATH

COPPER CONDUCTOR | 115kV

CU/XLPE/LC/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Lead Alloy Sheath with water blocking tapes.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Lead Alloy Sheath: is the short circuit current carrying component and designed to withstand 40 KA for 1 Sec and also act as radial water barrier.
- Water blocking tapes: is the longitudinal water barrier.

APPLICABLE STANDARDS

- IEC 62067 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

APPLICABLE SEC SPECS

- 11-TMSS-02 Rev01

TECHNICAL INFORMATION

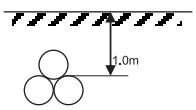
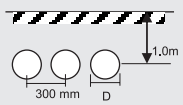
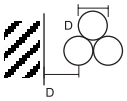
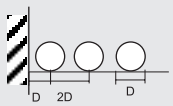
COPPER CONDUCTOR | 115kV

CU/XLPE/LC/HDPE

TECHNICAL DATA

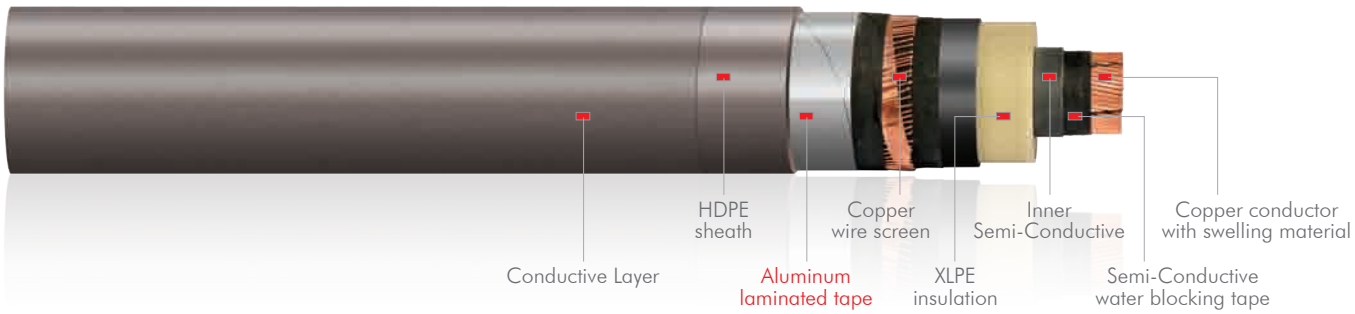
Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Lead Alloy Thickness	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	mm	mm	mm	Kg/Km	Ω/Km	μf/Km
34030004	400	Compact, Round, Stranded	0.64	20.32	1.75	6.3	4.0	96.3	26290	0.0470	0.149
34030006	630		0.64	20.32	1.75	5.8	4.0	102.5	29020	0.0283	0.175
34030007	800		0.76	20.32	1.75	5.5	4.0	106.0	30810	0.0221	0.190
34030008	1000	Segmental. Stranded (Millikan)	0.76	20.32	1.75	5.3	4.0	109.7	33265	0.0176	0.210
34030009	1200		0.76	20.32	1.75	5.1	4.0	113.4	35225	0.0151	0.224
34030010	1600		0.76	20.32	1.75	4.7	4.0	119.5	39250	0.0113	0.248
34030011	2000		0.76	20.32	1.75	4.5	4.0	124.5	43125	0.0090	0.267

CURRENT CARRYING CAPACITY

Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil 	Flat 			Trefoil 	Flat 
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	400	569	663	Cross Bonding or Single Point Bonding	400	790	879
	630	716	854		630	1032	1170
	800	790	925		800	1161	1331
	1000	925	1126		1000	1392	1601
	1200	987	1214		1200	1512	1755
	1600	1101	1385		1600	1737	2053
	2000	1184	1519		2000	1909	2295

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE
WITH COPPER WIRES SCREEN AND ALUMINUM LAMINATED SHEATH
COPPER CONDUCTOR | 132kV
CU/XLPE/CWS/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Copper wires screen with water blocking tapes.
- Aluminum laminated sheath.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Copper wires screen: is the short circuit current carrying component and designed to withstand 40 KA for 1 sec.
- Water blocking tapes: is the longitudinal water barrier.
- Aluminum laminated Sheath: is the radial water barrier.

APPLICABLE STANDARDS

- IEC 60840 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

APPLICABLE SEC SPECS

- 11-TMSS-02 Rev01

TECHNICAL INFORMATION

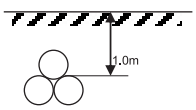
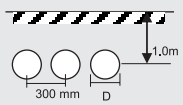
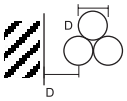
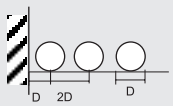
COPPER CONDUCTOR | 132kV

CU/XLPE/CWS/HDPE

TECHNICAL DATA

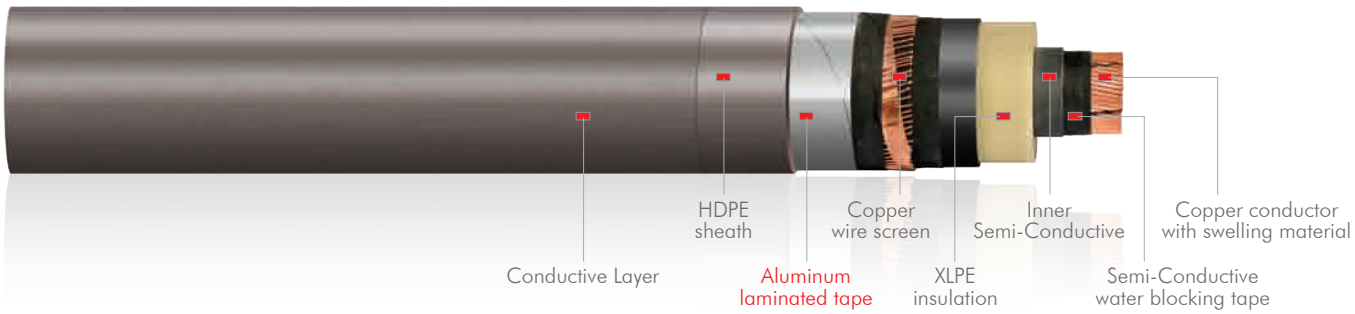
Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Cu wires screen	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	No. X diam	mm	mm	Kg/Km	Ω/Km	μf/Km
35010003	400	Compact, Round, Stranded	0.64	21.6	1.75	72x2.22	4.0	90.4	11070	0.0470	0.143
35010005	630		0.64	21.6	1.75	72x2.22	4.0	96.2	12470	0.0283	0.168
35010006	800		0.76	21.6	1.75	72x2.22	4.0	101.7	15930	0.0221	0.182
35010007	1000	Segmental. Stranded (Millikan)	0.76	21.6	1.75	72x2.22	4.0	105.8	18290	0.0176	0.200
35010008	1200		0.76	21.6	1.75	72x2.22	4.0	109.9	20250	0.0151	0.214
35010009	1600		0.76	21.6	1.75	72x2.22	4.0	116.8	24640	0.0113	0.237
35010010	2000		0.76	21.6	1.75	72x2.22	4.0	122.2	28475	0.0090	0.255

CURRENT CARRYING CAPACITY

Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil 	Flat 			Trefoil 	Flat 
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	400	577	660	Cross Bonding or Single Point Bonding	400	786	867
	630	740	853		630	1040	1160
	800	824	956		800	1178	1325
	1000	990	1132		1000	1438	1604
	1200	1069	1226		1200	1576	1765
	1600	1221	1408		1600	1842	2081
	2000	1341	1556		2000	2056	2343

ρT: Soil Thermal Resistivity

SINGLE CORE XLPE CABLE
WITH COPPER WIRES SCREEN AND ALUMINUM LAMINATED SHEATH
COPPER CONDUCTOR | 230kV
CU/XLPE/CWS/HDPE



CABLE CONSTRUCTION

- Copper conductor, stranded, with round shape for cross-sections up to and including 800 sqmm and segmental for cross-sections 1000 sqmm and above.
- Inner semiconductor layer firmly bonded to the XLPE insulation.
- XLPE insulation.
- Outer semiconductor layer firmly bonded to the XLPE insulation (the inner semiconductor, XLPE insulation and outer semiconductor are extruded in one operation "Triple extrusion").
- Copper wires screen with water blocking tapes.
- Aluminum laminated sheath.
- HDPE over sheath with semi-conductive layer.

SPECIAL FEATURES

- Copper wires screen: is the short circuit current carrying component and designed to withstand 63 KA for 1 sec.
- Water blocking tapes: is the longitudinal water barrier.
- Aluminum laminated Sheath: is the radial water barrier.

APPLICABLE STANDARDS

- IEC 60840 / ICEA S-108-720
- IEC 60949 & ICEA P-45-482

APPLICABLE SEC SPECS

- 11-TMSS-02 Rev01

TECHNICAL INFORMATION

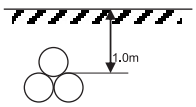
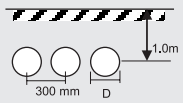
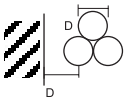
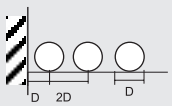
COPPER CONDUCTOR | 230kV

CU/XLPE/CWS/HDPE

TECHNICAL DATA

Item Code	Conductor		Thickness of ISC	Thickness of Insulation	Thickness of OSC	Cu wires screen	Thickness of outer sheath	Approx. outer diam.	Approx. cable weight	Max. DC resistance at 20 °C	Capacitance
	CSA	Shape									
	mm²		mm	mm	mm	No. X diam	mm	mm	Kg/Km	Ω/Km	μf/Km
43010003	630	Compact, Round, Stranded	1.0	24.0	2.0	72 X 2.82	4.0	104.9	16385	0.0283	0.159
43010004	800		1.0	24.0	2.0	72 X 2.82	4.0	109.0	18430	0.0221	0.171
43010005	1000	Segmental. Stranded (Millikan)	1.0	24.0	2.0	72 X 2.82	4.0	112.3	20700	0.0176	0.186
43010006	1200		1.0	24.0	2.0	72 X 2.82	4.0	116.4	22690	0.0151	0.198
43010008	1600		1.0	24.0	2.0	72 X 2.82	4.0	128.7	31010	0.0090	0.235
43010009	2000		1.0	24.0	2.0	72 X 2.82	4.0	135.5	36680	0.0072	0.255

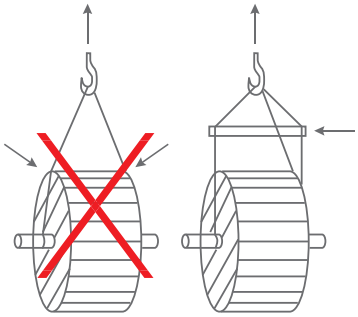
CURRENT CARRYING CAPACITY

Bonding System	CSA	Direct Burried		Bonding System	CSA	Installed in Air (shaded)	
		Trefoil	Flat			Trefoil	Flat
							
	mm²	ρT = 1.2, θ = 35 °C			mm²	θ = 40 °C	
Cross Bonding or Single Point Bonding	630	727	836	Cross Bonding or Single Point Bonding	630	1030	1143
	800	809	936		800	1167	1304
	1000	968	1108		1000	1420	1578
	1200	1045	1199		1200	1556	1736
	1600	1309	1518		1600	2029	2303
	2000	1423	1661		2000	2251	2580

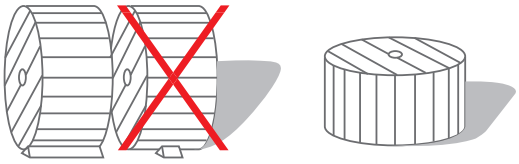
ρT: Soil Thermal Resistivity

DRUM HANDLING INSTRUCTIONS

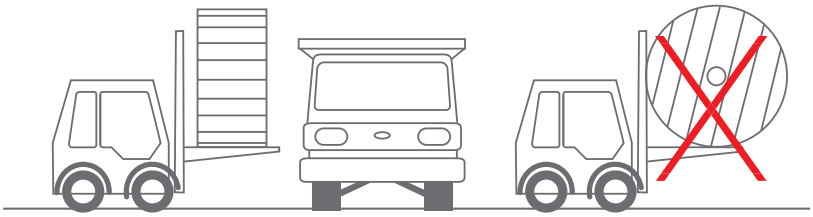
Cables and Conductors should be installed by trained personnel in accordance with good engineering practices, recognized codes of practise, statutory local requirements, IEE wiring regulations and where relevant, in accordance with any specific instructions issued by the company. Cables are often supplied in heavy cable reels and handling these reels can constitute a safety hazard. In particular, dangers may arise during the removal of steel binding straps and during the removal of retaining battens and timbers which may expose projecting nails.



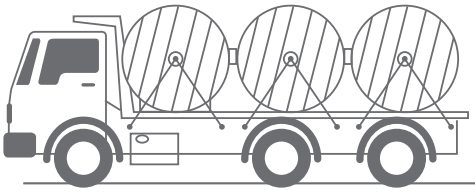
Lifting cable drums using crane.



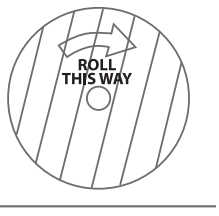
Do not lay drums flat on their sides, use proper stops to prevent drums roling.



Lift drums on fork trucks correctly.



Secure drums adequately before transportation.



Roll in the direction shown by the arrow.

RECOMMENDATIONS FOR CABLES INSTALLATION

INSTALLATION

- Precautions should be taken to avoid mechanical damage to the cables before and during installation.
- Exceeding the manufacturer's recommended maximum pulling tensions should be avoided as this can result in damage to the cable.
- If cables are to be installed in ducts, the correct size of duct should be used.
- The type of jointing and filling compounds employed should be chemically compatible with the cable materials.
- The cable support system should be such as to avoid damage to the cables.
- Cables specified in this catalogue are designed for fixed installations only; they are not intended for use as, for example, trailing or reeling cables.
- Repeated over-voltage testing can lead to premature failure of the cable.
- The selection of cable glands, accessories and any associated tools should take account of all aspects of intended use. Any semi-conducting coating present on the oversheath should be removed for a suitable distance from joints and terminations.
- Care should be exercised with single-core cables to ensure that the bonding and earthing arrangements are adequate to cater for circulating currents in screen(s).

ORDERING INFORMATION

To serve our customer in minimum time and high efficiency, our valuable customers are requested to provide the following details along with their enquiries and orders:

1. Conductor required cross sectional area.
2. Metallic screen type (copper tape or copper wire) and area or short circuit current (copper wire screen).
3. System Voltage Rate.
4. System Short Circuit required.
5. Applicable customer specification or International Standard / Norm.
6. Conductor material (Copper/Aluminum).
7. Insulation Material (XLPE), and if there is specified thickness from client.
8. Lead Alloy (required or not)
9. Cable jacketing material (PVC/PE) and its thickness if required
10. Cable special features required, e.g. Flame Retardant Type to IEC 60332-3, Anti-termite.
11. Required length of cables (drum schedules)