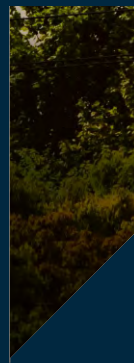




# HT XLPE Cables



**APAR**

Tomorrow's solutions today



# APAR CABLE SOLUTIONS

Leading the innovation curve as one of the world's largest manufacturers of specialised cables

- We have been growing at 25% CAGR in the last decade.
- Footprints in 100+ countries.
- Exports contribute to 30% of revenue.
- Our factories and products have been accredited and certified by the global standards of ISO, NABL, ABS, TUV, UL and more.
- Capability to manufacture cables as per IS, IEC, BS, VDE, AS & NZS and as per other International Standards.
- We cater to various speciality sectors like railway locomotive, coaches, naval ships, submarines, solar plants, windmills, hybrid cables and harnesses. We also supply fibre optic cables and general-purpose wires & cables (fixed and flexible) such as LV, MV and XLPE.



Electrical Power & Control Cables



Light Duty Cable & Wires



Elastomer & E-Beam Cables



Fibre Optic Cables



Speciality Cables & Products



# WORLD-CLASS MANUFACTURING CAPABILITIES

## World-class equipment, facilities and expertise

- 2 cable manufacturing facilities, in South Gujarat, India.
- Facilities are strategically located 150 Km from the Mumbai seaport for quick export shipments.
- Vast manufacturing infrastructure of 250,000 SQM.
- Both our facilities are well equipped with advanced manufacturing infrastructure and accredited with ISO 9001, ISO 14001 and OHSAS 45001
- India's only cable company with 3 E-Beam irradiation facilities i.e. 1.5 MeV, 2.5 MeV & 3.0 MeV.
- Annual production capacity for 30,000 MT aluminum & 10,000 MT copper cables.
- In-house facility to produce nearly all the insulation and sheathing compounds (used for manufacturing cables).
- Latest plant & machinery sourced from world-renowned suppliers to achieve maximum output without compromising cable quality.
- Wire drawing machines are from Niehoff, Germany and the electroplating tinning facility is from OTOMEC, Italy.
- Royale USA & Scholz/ Supermac, Troester CCV Line for cables up to 66kV and state of the art extruders from Troester, Covema, Royale, Rosendahl, Maillefer, etc.





# QUALITY ASSURANCE & TESTING FACILITIES

- Our both facilities are well equipped with advanced testing infrastructure, and accredited with ISO 9001, ISO 14001 & OHSAS 45001.
- Our cable testing laboratories are accredited by National Accreditation Board Laboratories (NABL).
- Manufacturing certified cables as per IEC, UL, BS EN, TUV, etc.
- High quality test & measuring equipment and laboratory equipment, manned by highly experienced technical personnel ensure that each cable drum is thoroughly tested before getting dispatched.
- Our cables have successfully been type tested from various international and national labs like KEMA, NABL, ERDA, etc.



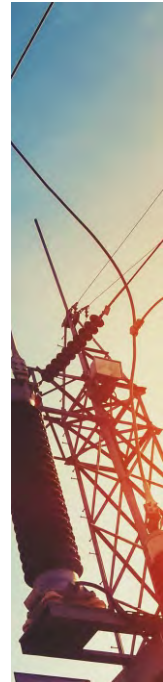




# HT XLPE CABLE RANGE

## ELECTRICAL POWER & CONTROL CABLES

- We manufacture electrical cables up to 66 kV as per various Indian and International Standards.
- Cables are designed after detailed engineering to meet the specific requirements and provide high performance.
- Manufacturing facilities are supported by a NABL accredited laboratory, which ensures that every cable manufactured, passes stringent quality checks and meets testing requirements.
- The ranges of cables offered are suitable for a variety of applications and industries across the globe.



### Product Line

- XLPE Power Cables up to 1000 sqmm
- XLPE Power Cables up to 66 kV
- XLPE Control Cables up to 61 Core
- Covered Conductors as per EN/ASTM/AS Standards from 1.1kV to 132kV
- LV & MV ABC Cables
- EHV/ MV Overhead Covered Conductors
- Screened & Instrumentation Cables
- Concentric Core (Anti-Theft) Cables
- FR/FRLSH/FR-LSZH Fire Performance Cables
- Fire Resistance Cables & Wires
- Subsea Underwater LV/MV Cables
- Railway Signalling Cables
- High Ampacity XLPE Cables (105°C.)





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## COMPONENTS OF HT CABLES

Element	Construction / Purpose	Material	Standards
Conductor	Stranded compacted circular conductors to carry continuous load and short circuit current.	Compacted stranded - Class 2, Annealed/ Plain Copper/ Aluminium	IS:8130/ IEC: 60228/ BS EN 60228
Conductor Screen/ Shield	Conductors for cables rated above 3.3 kV are screened with an extruded layer of semiconducting compound. This eliminates the chance of electrical discharge at the interface between conductor and insulation.	Extruded Semiconducting Compound	IS:7098-Part 2/ IEC: 60502- Part 2/ BS:6622/ BS:7835
Insulation	The insulation which is of natural, Cross Linked Polyethylene with high di-electric strength is extruded over semiconducting conductor screening. Thickness of insulation is as per the relevant tables.	XLPE	IS:7098-Part 2/ IEC: 60502- Part 2/ BS:6622/ BS:7835
Non-metallic Insulation screen	Cables rated above 3.3 kV will have a screening consisting of non-metallic part, in combination with a metallic part over the insulation. The non-metallic part of the screening consists of either a semiconducting tape applied helically or a layer of extruded semi-conducting compound or both. The conductor screening, XLPE insulation and the non-metallic part of insulation screening are all extruded in one operation by Triple Extrusion which eliminates the formation of micro voids during the extrusion and curing resulting in longer life of cables.	Extruded Semiconducting Compound	IS:7098-Part 2/ IEC: 60502- Part 2/ BS:6622/ BS:7835
Metallic Insulation screen	Bare annealed copper tape/ copper wire are applied over insulation screen to carry fault current.	Copper Tape/ Wire	IS:7098-Part 2/ IEC: 60502- Part 2/ BS:6622/ BS:7835
Laying up	Insulated cores are laid up together, interstices filled up with non-hygroscopic fillers to make the cable circular. The phase identification of three core cable is done either by colored strips / numbered applied on the cores.	Non Hygroscopic PVC/ Polypropylene Fiber	-
Inner Sheath	The cable cores are provided with a common covering of extruded PVC/PE sheath or wrapped plastic tapes as per the requirement of the customer.	PVC/ Polyethylene/ Halogen Free	IS:7098-Part 2/ IEC: 60502- Part 2/ BS:6622/ BS:7835
Armour	GI Round wire / Flat wire (Strip) / Double steel tape armouring is applied over the inner sheath in case of three core cables. For single core cables non-magnetic armouring is applied over the inner sheath.	GI/ Aluminium – Round wire/ Flat strip/ Double steel tape/ Double Aluminium tape	IS:7098-Part 2/ IS:3975/ IEC: 60502- Part 2/ BS:6622/ BS:7835
Outer sheath	The cables are provided with an extruded PVC / PE / LSZH / FR / FRLS outer sheath over the armour. Outer sheath is generally of Black color, but any other color as per customer requirement can be provided.	PVC/ FR PVC/ FRLS PVC/ Polyethylene/ Halogen Free	IS:7098-Part 2/ IEC: 60502- Part 2/ BS:6622/ BS:7835



## FLAME RETARDANT LOW SMOKE CABLES

All XLPE Cables have an outer sheath of PVC. PVC by itself is flame retarding; it produces highly toxic and corrosive fumes in the event of fire. This is a great concern to all electrical engineers/consultants involve in generation, transmission & distribution of electricity.

### FR-LSH PVC compound can:

- Minimise smoke emission.
- Produce very low toxic and corrosive fumes emission.
- Fire retardant characteristics.



### Our laboratory is well equipped with the latest test equipment to carry out the following test requirements:

- The oxygen index and temperature index of the sheath as per ASTM-D 2863.
- Flammability characteristics of cable as per IEC: 60332 (Pt. I) & IEC: 60332 (Pt. III)
- Determination of the amount of halogen acid gas evolved during combustion of outer sheath materials as per IEC: 60754 (Pt. I & II)
- Determination of smoke generation of outer sheath material under fire as per applicable BS Standards and IEC: 61034(Part-2)
- The measurement of smoke density as per ASTM D2843

### Understanding properties of different varieties of outer sheath materials:

Specifications	Ordinary PVC	FR	FRLS	LSZH / LSOH /HFFR	Fire survival
Test	Specified values	Specified values	Specified values	Specified values	Specified values
Critical Oxygen Index	23%	> 29 %	> 29 %	> 30%	> 30%
Temperature Index	160°C	> 250°C	> 250°C	> 280°C	> 280°C
Smoke Density	≈ 85%	≈ 75 %	< 60 %	< 20 %	< 20 %
Acid Gas Generation	≈ 50%	≈ 40 %	< 20 %	< 0.5 %	< 0.5 %
Fire Survival Test	NA	NA	NA	NA	IEC: 60331 -2
Fire Survival Test	NA	NA	NA	NA	BS: 6387



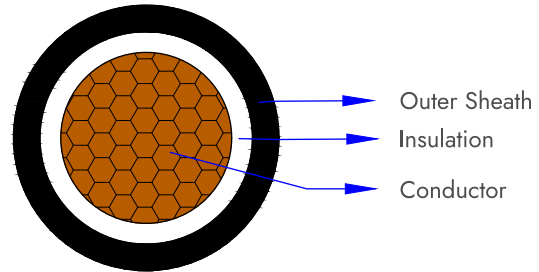
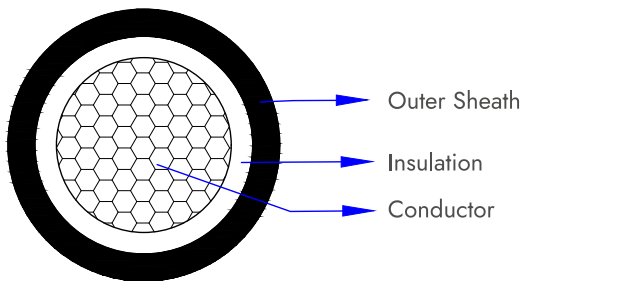


# TYPICAL CROSS SECTION VIEW OF HT CABLES

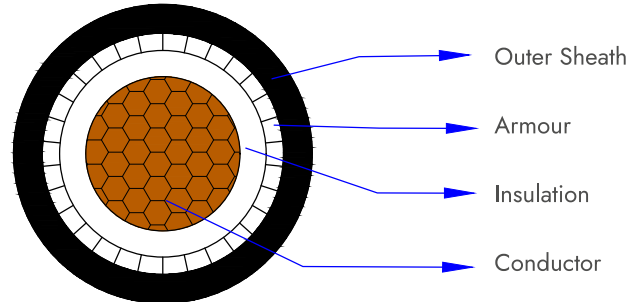
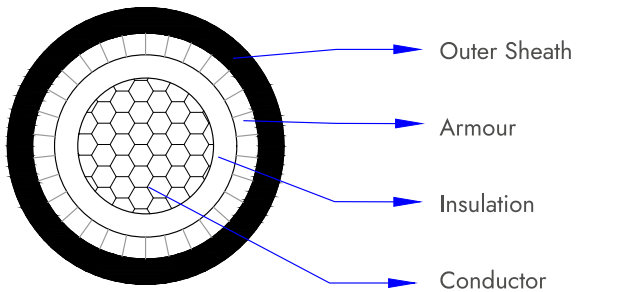
## SINGLE CORE CABLES (UNSCREENED)



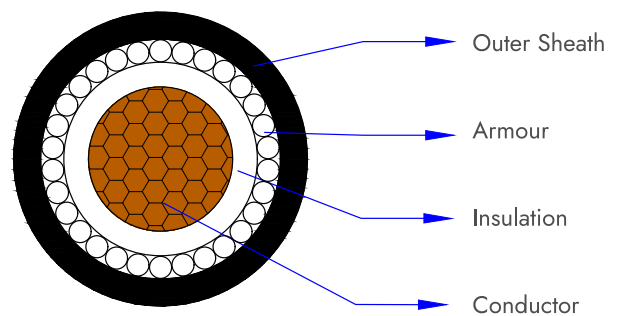
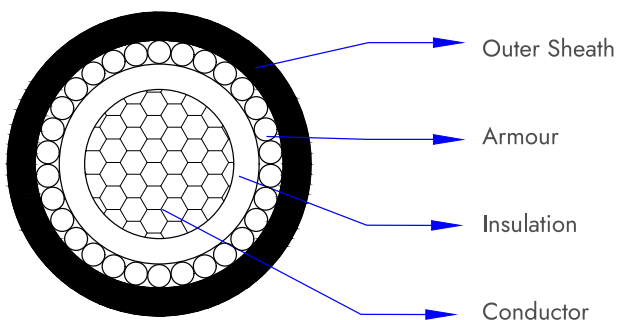
1 Core Unscreened Unarmoured - A2XY (Aluminium) / 2XY (Copper) – 1.9/3.3 KV



1 Core Unscreened Flat strip Armoured - A2XFaY (Aluminium) / 2XFaY (Copper) – 1.9/3.3 KV



1 Core Unscreened Round Wire Armoured - A2XWαY (Aluminium) / 2XWαY (Copper) – 1.9/3.3 KV

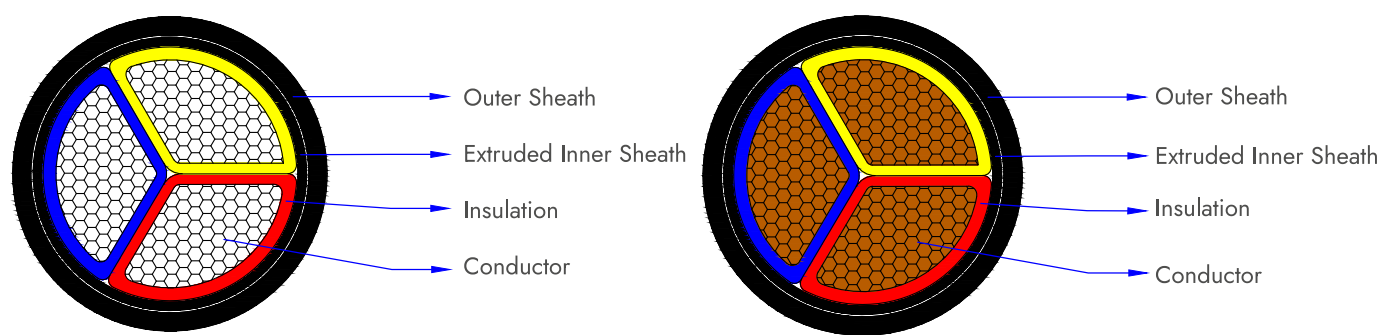




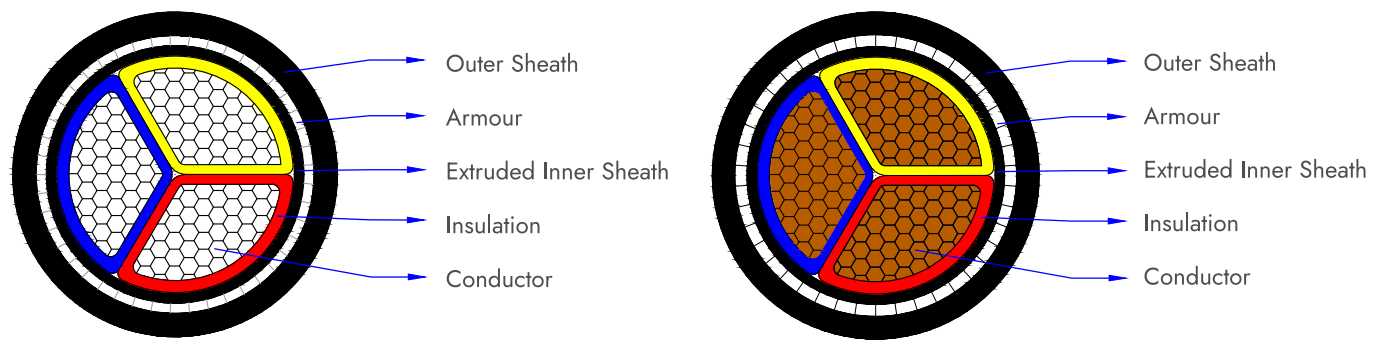
# THREE CORE CABLES (UNSCREENED)



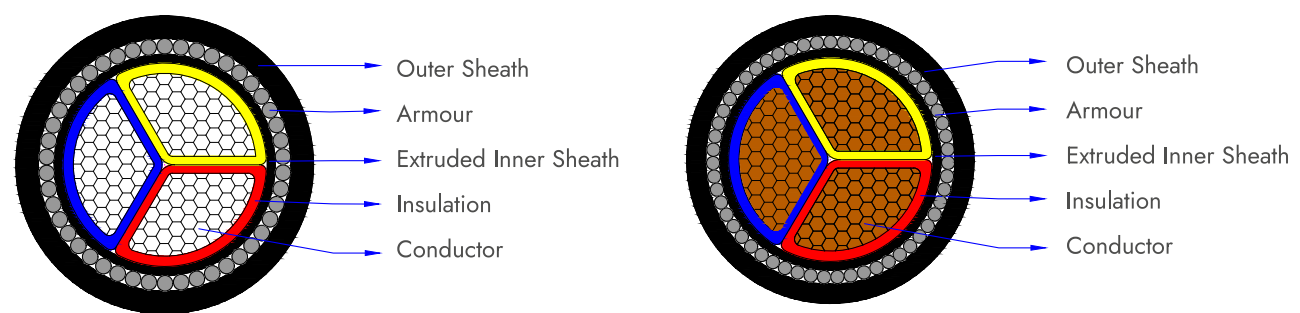
3 Core Unscreened Unarmoured - A2XY (Aluminium) / 2XY (Copper) – 1.9/3.3 KV



3 Core Unscreened Flat strip Armoured - A2XFY (Aluminium) / 2XFY (Copper) – 1.9/3.3 KV



3 Core Unscreened Round Wire Armoured - A2XWY (Aluminium) / 2XWY (Copper) – 1.9/3.3 KV

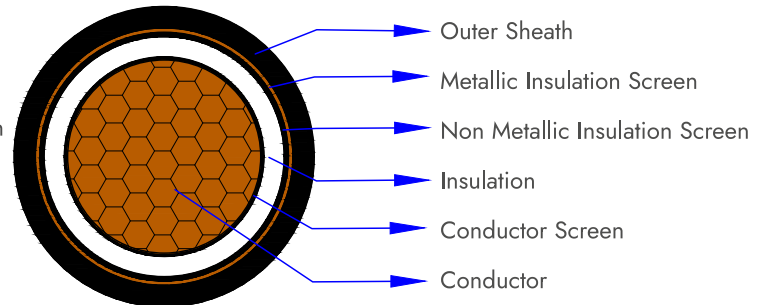
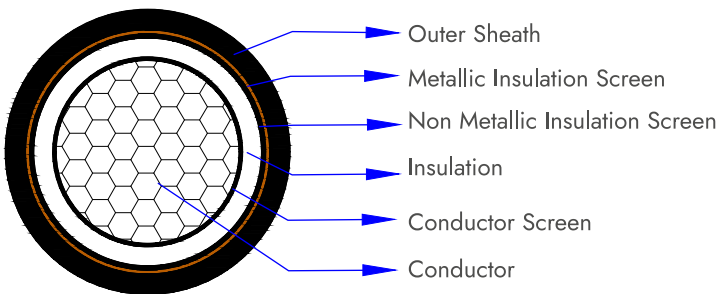




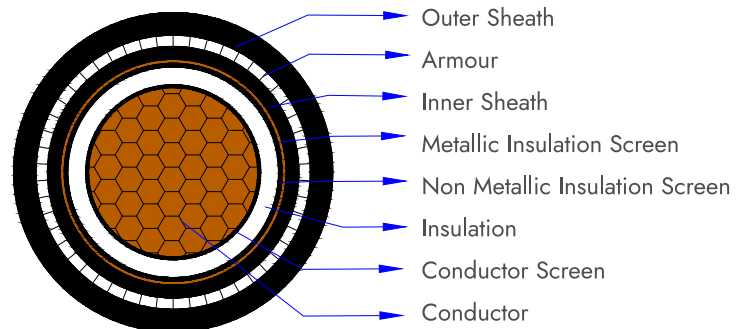
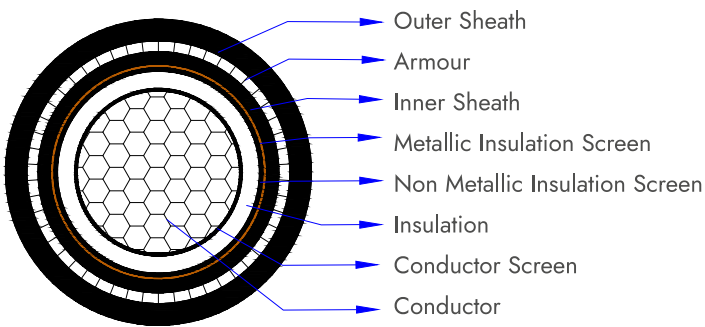
## SINGLE CORE CABLES (SCREENED)



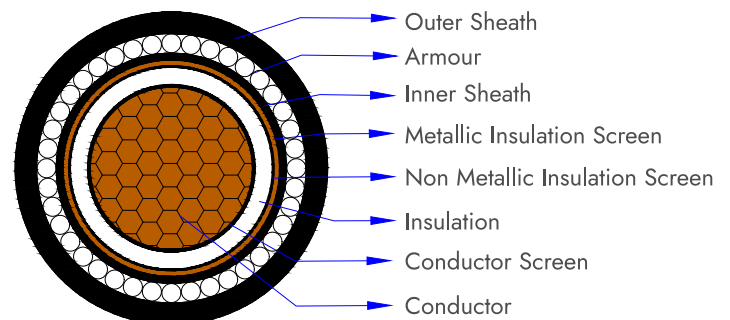
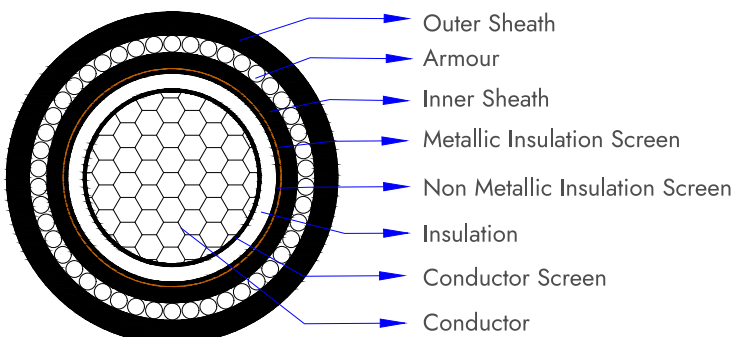
1 Core Screened Unarmoured - A2XCEY (Aluminium) / 2XCEY (Copper) –  
3.8/6.6 KV, 6.35/11 KV, 11/11 KV, 12.7/22 KV, 19/33 KV



1 Core Screened Flat Strip Armoured - A2XCEFaY (Aluminium) / 2XCEFaY (Copper) –  
3.8/6.6 KV, 6.35/11 KV, 11/11 KV, 12.7/22 KV, 19/33 KV



1 Core Screened Round Wire Armoured - A2XCEWaY (Aluminium) / 2XCEWaY (Copper) –  
3.8/6.6 KV, 6.35/11 KV, 11/11 KV, 12.7/22 KV, 19/33 KV

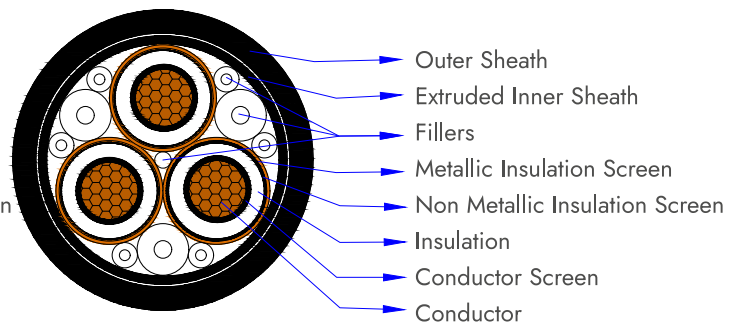
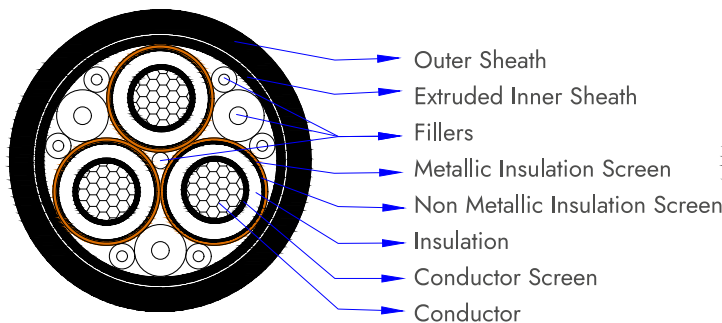




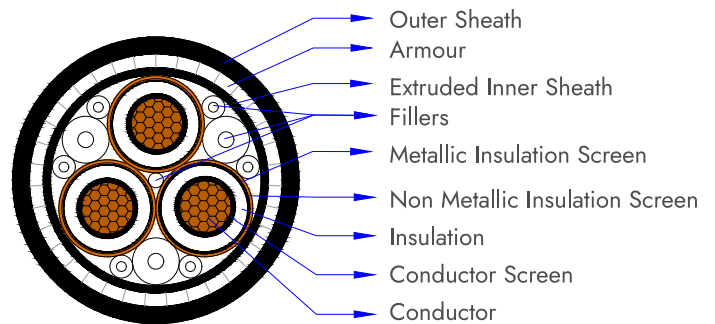
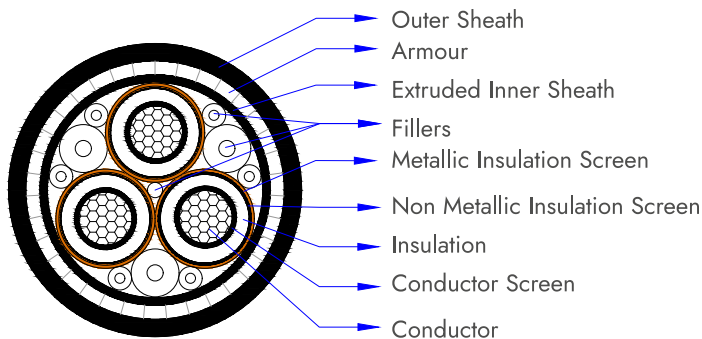
# THREE CORE CABLES (SCREENED)



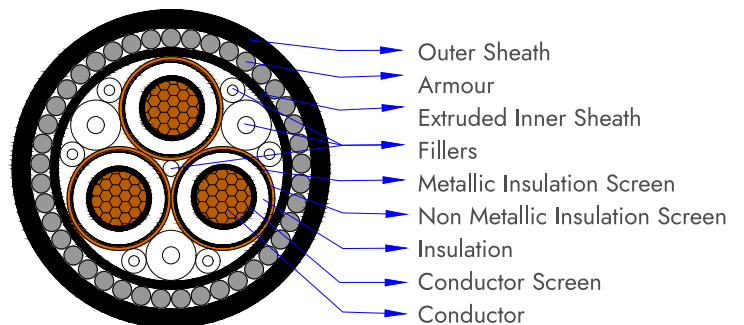
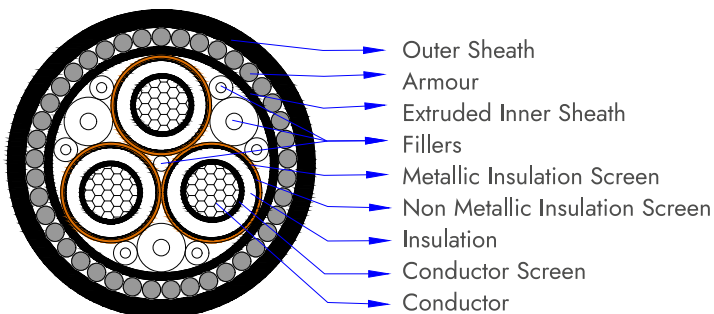
3 Core Screened Unarmoured - A2XCEY (Aluminium) / 2XCEY (Copper) –  
3.8/6.6 KV, 6.35/11 KV, 11/11 KV, 12.7/22 KV, 19/33 KV



3 Core Screened Flat Strip Armoured - A2XCEF Y (Aluminium) / 2XCEF Y (Copper) –  
3.8/6.6 KV, 6.35/11 KV, 11/11 KV, 12.7/22 KV, 19/33 KV



3 Core Screened Round Wire Armoured - A2XCEW Y (Aluminium) / 2XCEW Y (Copper) –  
3.8/6.6 KV, 6.35/11 KV, 11/11 KV, 12.7/22 KV, 19/33 KV







## MANUFACTURING PROCESS FLOW CHART

<b>Conductor</b> Wire drawing, aneling & Stranding	QC
<b>Triple Extrusion (Inner Semicon, XLPE Outer Semicon)</b> Type of Compunds, Batch no., Thickness, Core Dia, Electricity, Surface finish, Hot Set Test	QC
<b>Copper Taping</b> Size & Type of Tape, Market/Lot no. Overlap, Dia over Tape, Continuity, Tape Jointing, Core Identification	QC
<b>Laying Up/ Twisting</b> All rebound course to be arranged to form a cable	QC
<b>Inner Sheathing</b> Innersheath of PVC through extrusion/ tape method	QC
<b>Armouring</b> Armour of steel (wire/ stripped/ tape) as per specifications & customer requirement	QC
<b>Outer Sheathing</b> Extruded PVC compound such as FR/ FRLS/ LSZH can be used for outersheath as per customer specification	QC
<b>Final Testing</b> Cables bound on drums and final tested as per applicable standards	QC
<b>Packing/ Markeing</b> Marking Details, Lagging Coverage	QC
<b>Storage/ Dispatch</b> Cables stored and packed in drums for dispatch to specific locations	QC



## ORDERING INFORMATION & GUIDELINES FOR SELECTION OF CABLES

### Ordering Information

**For prompt and effective service, we request our customers to provide the following details along with their enquiries:**

- Number of phases or cores.
- Required cross-sectional area of the conductor/ system load current.
- Metallic screen type (copper tape/ copper wire) and area (copper wire screen).
- System Voltage-Rate.
- Earth-Fault current.
- Applicable product specification/ International Standard.
- Conductor material (copper/aluminium).
- Insulation Material (XLPE).
- Bedding/ inner sheathing (inner jacketing - PVC/ PE, etc.).
- Armouring type (SWA, FSA, AWA or STA).
- Cable jacketing material (PVC/ PE/ LSZH).
- Cable special features required, e.g. anti-termite, etc.
- Bill of quantity/ required length of cables (drum schedules).

### Guidelines For Selection Of Cables

**Power Cables are generally selected considering the application. Following factors are important for suitable selection of cable for cable construction for smooth transition of electrical energy.**

- Maximum operating voltage grade
- Maximum fault current and its duration under fault condition
- Load to be carried
- Possible overloading duration & magnitude
- Route length and voltage drop
- Mode of installation considering installation environment such as ambient & ground temperature
- Chemical & physical properties of soil
- Requirement of fire performance cable

APAR HT XLPE Cables are designed and manufactured by standard operating conditions in India and abroad. The standards adopted consider the geographical and climatically conditions and general power applications for transmission, distribution and general purposes. The cables are manufactured conforming to Indian & international standards for XLPE Insulated Cables. We also manufacture customised cables as per specific requirements.



# TECHNICAL PARAMETERS AND DATA SHEET

**TABLE 1A: 1.9/3.3 kV Single Core XLPE Insulated Unscreened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of insulation (Nom.)		Dimension of armour (nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
	Arm	Un-arm	Wire	Strip	For Round Wire Arm (Min.)	For Flat Strip Arm (Min.)	Un-Arm (Nom.)	For Round Wire Arm	For Flat Strip Arm	Un-Arm	Round Wire Armoured		Flat Strip Armoured		Unarmoured	
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	Mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
25	2.5	2.2	1.4	*	1.24	*	1.8	17.0	*	14.5	Al 330	Cu 475	*	*	Al 235	Cu 380
35	2.5	2.2	1.4	*	1.24	*	1.8	18.0	*	15.5	380	580	*	*	275	480
50	2.5	2.2	1.4	*	1.4	*	1.8	19.0	*	16.5	445	720	*	*	325	600
70	2.5	2.2	1.6	4 X 0.8	1.4	1.4	1.8	20.5	20.0	18.0	535	930	500	890	400	800
95	2.5	2.2	1.6	4 X 0.8	1.4	1.4	2.0	23.0	21.5	20.5	665	1215	600	1145	515	1065
120	2.5	2.2	1.6	4 X 0.8	1.4	1.4	2.0	24.5	23.0	21.5	760	1460	680	1380	600	1300
150	2.5	2.2	1.6	4 X 0.8	1.4	1.4	2.0	25.5	24.5	23.0	865	1740	780	1660	700	1565
185	2.5	2.2	1.6	4 X 0.8	1.4	1.4	2.0	27.0	26.0	24.5	1000	2090	920	2015	810	1910
240	2.5	2.2	1.6	4 X 0.8	1.56	1.4	2.0	30.0	28.5	27.0	1230	2670	1100	2560	1000	2450
300	2.5	2.2	1.6	4 X 0.8	1.56	1.56	2.0	32.0	31.0	29.0	1430	3250	1340	3160	1180	3010
400	2.6	2.2	2.0	4 X 0.8	1.56	1.56	2.2	36.0	34.0	32.5	1820	4140	1620	3945	1480	3810
500	2.8	2.4	2.0	4 X 0.8	1.56	1.56	2.2	40.0	38.0	36.5	2230	5200	2025	5000	1850	4830
630	3.0	2.6	2.0	4 X 0.8	1.72	1.72	2.2	44.0	42.0	40.0	2770	6605	2525	6380	2325	6170
800	3.3	2.8	2.0	4 X 0.8	1.88	1.88	2.4	49.0	47.0	45.0	3460	8365	3180	8120	2940	7860
1000	3.5	3.0	2.5	4 X 0.8	2.04	1.88	2.6	55.0	52.0	50.0	4345	10520	3855	10050	3630	9820

Area	Max DC resistance at 20°C		Approx. AC resistance at operating temp 90°C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec		
					Arm	Un-Arm	Direct in ground at 30°C		In duct at 30°C		In air at 40°C				
mm <sup>2</sup>	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	KA(rms)
	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	
25	1.20	0.727	1.54	0.926	0.128	0.118	99	127	88	113	115	148	2.36	3.56	
35	0.868	0.524	1.11	0.670	0.122	0.113	117	151	104	135	139	179	3.30	5.00	
50	0.641	0.387	0.820	0.494	0.117	0.108	138	178	123	158	166	214	4.72	7.15	
70	0.443	0.268	0.567	0.342	0.109	0.100	168	216	149	192	208	267	6.60	10.01	
95	0.320	0.193	0.410	0.246	0.106	0.098	200	256	177	227	252	323	8.96	13.58	
120	0.253	0.153	0.324	0.195	0.102	0.094	227	290	201	257	292	374	11.32	17.16	
150	0.206	0.124	0.264	0.158	0.098	0.092	252	323	223	285	329	422	14.16	21.45	
185	0.164	0.0991	0.210	0.126	0.094	0.088	285	362	251	319	380	484	17.46	26.45	
240	0.125	0.0754	0.160	0.0962	0.092	0.085	326	411	286	361	448	565	22.65	34.32	
300	0.100	0.0601	0.129	0.0767	0.089	0.083	365	456	319	400	511	641	28.32	42.9	
400	0.0778	0.0470	0.101	0.0601	0.088	0.081	412	508	359	443	593	734	37.76	57.25	
500	0.0605	0.0366	0.0781	0.0467	0.085	0.080	461	559	401	486	680	828	47.20	71.5	
630	0.0469	0.0283	0.0606	0.0361	0.083	0.077	514	611	445	529	777	929	59.45	90.1	
800	0.0367	0.0221	0.0473	0.0282	0.082	0.076	552	638	476	549	863	1002	75.50	114.4	
1000	0.0291	0.0176	0.0375	0.0224	0.082	0.076	595	672	509	575	954	1083	94.40	143.0	



**Table 1B: 1.9/3.3 kV Three Core XLPE Insulated Unscreened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom.)	Inner-sheath thickness (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-Arm (Nom)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
25	2.2	0.3	1.6	4 X 0.8	1.56	1.4	2.0	28.0	26.5	25.5	1250	1705	980	1435	640	1165
35	2.2	0.3	1.6	4 X 0.8	1.56	1.56	2.0	30.0	28.5	27.5	1425	2050	1155	1780	820	1465
50	2.2	0.4	2	4 X 0.8	1.56	1.56	2.2	33.0	31.0	30.0	1840	2690	1330	2180	1010	1875
70	2.2	0.4	2	4 X 0.8	1.56	1.56	2.2	35.5	33.5	33.0	2145	3380	1610	2845	1245	2500
95	2.2	0.4	2	4 X 0.8	1.72	1.72	2.2	39.0	37.0	36.0	2585	4310	1965	3695	1545	3290
120	2.2	0.5	2	4 X 0.8	1.88	1.72	2.4	42.0	39.5	39.0	2970	5135	2280	4450	1855	4040
150	2.2	0.5	2.5	4 X 0.8	2.04	1.88	2.6	46.0	42.5	41.5	3710	6405	2650	5345	2180	4895
185	2.2	0.5	2.5	4 X 0.8	2.04	2.04	2.6	49.0	46.0	44.5	4200	7570	3095	6465	2560	5950
240	2.2	0.6	2.5	4 X 0.8	2.2	2.2	2.8	53.0	50.0	49.0	4970	9405	3750	8185	3200	7650
300	2.2	0.6	2.5	4 X 0.8	2.36	2.2	3.0	57.0	54.0	52.5	5755	11325	4400	9970	3845	9430
400	2.2	0.7	3.15	4 X 0.8	2.68	2.52	3.2	65.0	60.0	59.5	7605	14710	5445	12550	4785	11910

Area	Max DC resistance at 20°C		Approx. AC resistance at operating Temp 90°C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec	
							Direct in ground at 30°C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	Al	Cu
mm <sup>2</sup>	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	1.20	0.727	1.54	0.926	0.095	0.095	94	121	81	104	102	132	2.36	3.56
35	0.868	0.524	1.11	0.670	0.091	0.091	112	144	96	124	123	159	3.30	5.00
50	0.641	0.387	0.820	0.494	0.0817	0.0817	131	169	113	146	146	188	4.72	7.15
70	0.443	0.268	0.567	0.342	0.084	0.084	160	206	138	178	182	234	6.60	10.01
95	0.320	0.193	0.410	0.246	0.082	0.082	191	246	165	212	221	284	8.96	13.58
120	0.253	0.153	0.324	0.195	0.079	0.079	216	278	187	240	254	326	11.32	17.16
150	0.206	0.124	0.264	0.158	0.078	0.078	241	310	208	268	286	368	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.074	0.074	273	350	236	302	330	422	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.073	0.073	315	401	277	353	385	492	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.072	0.072	354	449	312	395	440	559	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.071	0.071	403	506	355	445	512	642	37.76	57.25





**TABLE 2A: 3.8/6.6 kV Single Core XLPE Insulated Screened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom.)	Inner-sheath thickness (For armoured cables) (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-Arm (Nom)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
25	2.8	0.3	1.6	4 X 0.8	1.4	1.4	1.8	21.50	20.0	17.5	540	690	480	630	345	495
35	2.8	0.3	1.6	4 X 0.8	1.4	1.4	2.0	22.50	21.5	19.0	600	810	530	740	410	620
50	2.8	0.3	1.6	4 X 0.8	1.4	1.4	2.0	23.50	22.5	20.5	665	950	595	885	470	745
70	2.8	0.3	1.6	4 X 0.8	1.4	1.4	2.0	25.00	24.0	21.5	775	1170	695	1095	560	955
95	2.8	0.3	1.6	4 X 0.8	1.4	1.4	2.0	27.00	25.5	23.5	895	1450	810	1365	660	1220
120	2.8	0.3	1.6	4 X 0.8	1.4	1.4	2.0	28.00	27.0	25.0	1000	1700	915	1615	760	1460
150	2.8	0.3	1.6	4 X 0.8	1.56	1.4	2.0	30.00	28.5	26.5	1150	2030	1025	1905	860	1740
185	2.8	0.3	1.6	4 X 0.8	1.56	1.56	2.0	31.50	30.5	28.0	1300	2390	1200	2290	995	2090
240	2.8	0.4	2	4 X 0.8	1.56	1.56	2.2	34.50	32.5	30.5	1595	3050	1420	2870	1220	2675
300	3.0	0.4	2	4 X 0.8	1.56	1.56	2.2	37.00	35.0	33.0	1845	3680	1650	3480	1440	3270
400	3.3	0.4	2	4 X 0.8	1.72	1.56	2.2	41.00	38.5	36.5	2250	4375	2005	4330	1770	4095
500	3.5	0.5	2	4 X 0.8	1.88	1.72	2.4	46.00	43.5	41.5	2800	5775	2500	5480	2225	5205
630	3.5	0.5	2	4 X 0.8	1.88	1.88	2.4	49.50	47.5	44.5	3315	7175	3040	6905	2700	6555
800	3.5	0.5	2.5	4 X 0.8	2.04	1.88	2.6	55.00	51.5	49.5	4130	9075	3650	5290	3325	8255
1000	3.6	0.6	2.5	4 X 0.8	2.2	2.04	2.8	60.00	56.5	54.5	4955	11150	4415	10610	4040	10240

Area	Max DC resistance at 20°C		Approx. AC resistance at operating temp 90°C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec	
							Direct in ground at 30 °C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	KA(rms)	KA(rms)
mm <sup>2</sup>	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	1.20	0.727	1.54	0.926	0.144	0.133	99	127	88	113	115	148	2.36	3.56
35	0.868	0.524	1.11	0.670	0.137	0.128	117	151	104	135	139	179	3.30	5.00
50	0.641	0.387	0.820	0.494	0.131	0.123	138	178	123	158	166	214	4.72	7.15
70	0.443	0.268	0.567	0.342	0.12	0.114	168	216	149	192	208	267	6.60	10.01
95	0.320	0.193	0.410	0.246	0.115	0.107	200	256	177	227	252	323	8.96	13.58
120	0.253	0.153	0.324	0.195	0.111	0.104	227	290	201	257	292	374	11.32	17.16
150	0.206	0.124	0.264	0.158	0.109	0.100	252	323	223	285	329	422	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.103	0.096	285	362	251	319	380	484	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.101	0.094	326	411	286	361	448	565	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.099	0.092	365	456	319	400	511	641	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.096	0.089	412	508	359	443	593	734	37.76	57.25
500	0.0605	0.0366	0.0781	0.0467	0.095	0.088	461	559	401	486	680	828	47.20	71.5
630	0.0469	0.0283	0.0606	0.0361	0.09	0.085	514	611	445	529	777	929	59.45	90.1
800	0.0367	0.0221	0.0473	0.0282	0.089	0.083	552	638	476	549	863	1002	75.50	114.4
1000	0.0291	0.0176	0.0375	0.0224	0.088	0.082	595	672	509	575	954	1083	94.40	143.0



**Table 2B: 3.8/6.6 kV Three Core XLPE Insulated Screened Armoured/Unarmoured Cable with Aluminium / Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom.)	Inner-sheath thickness (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-Arm (Nom.)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
			mm	mm	mm	mm	mm	mm	mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
25	2.8	0.4	2	4 X 0.8	1.72	1.56	2.2	39.5	37.0	36.0	2380	2850	1735	2205	1340	1810
35	2.8	0.4	2	4 X 0.8	1.72	1.72	2.2	42.0	40.0	38.5	2655	3280	2010	2630	1550	2165
50	2.8	0.5	2	4 X 0.8	1.88	1.72	2.4	44.5	42.5	41.5	3020	3865	2275	3120	1815	2655
70	2.8	0.5	2	4 X 0.8	1.88	1.88	2.4	48.0	46.0	44.5	3455	4670	2695	3910	2160	3365
95	2.8	0.5	2.5	4 X 0.8	2.04	1.88	2.6	53.0	50.0	49.0	4400	6080	3170	4850	2620	4300
120	2.8	0.6	2.5	4 X 0.8	2.20	2.04	2.8	56.5	53.0	52.5	4975	7110	3625	5760	3060	5190
150	2.8	0.6	2.5	4 X 0.8	2.20	2.2	2.8	59.5	56.5	55.5	5480	8155	4100	6775	3455	6125
185	2.8	0.6	2.5	4 X 0.8	2.36	2.2	3.0	63.0	60.0	59.5	6190	9530	4650	7990	4025	7360
240	2.8	0.7	3.15	4 X 0.8	2.52	2.36	3.2	70.0	65.5	64.5	7895	12400	5555	9990	4900	9330
300	3	0.7	3.15	4 X 0.8	2.68	2.52	3.4	75.5	71.0	70.5	9115	14705	6545	12130	5840	11415
400	3.3	0.7	4	4 X 0.8	3.00	2.84	3.8	85.5	79.5	79.0	11970	19060	8070	15155	7310	14385

Area	Max DC resistance at 20°C		Approx. AC resistance at operating temp 90°C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec	
							Direct in ground at 30°C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	KA(rms)	
mm <sup>2</sup>	Al	Cu	Al	Cu	Al	CU	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	1.20	0.727	1.54	0.926	0.125	0.144	94	121	81	104	102	132	2.36	3.56
35	0.868	0.524	1.11	0.670	0.12	0.137	112	144	96	124	123	159	3.30	5.00
50	0.641	0.387	0.820	0.494	0.116	0.131	131	169	113	146	146	188	4.72	7.15
70	0.443	0.268	0.567	0.342	0.11	0.12	160	206	138	178	182	234	6.60	10.01
95	0.320	0.193	0.410	0.246	0.105	0.115	191	246	165	212	221	284	8.96	13.58
120	0.253	0.153	0.324	0.195	0.101	0.111	216	278	187	240	254	326	11.32	17.16
150	0.206	0.124	0.264	0.158	0.099	0.109	241	310	208	268	286	368	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.093	0.103	273	350	236	302	330	422	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.091	0.101	315	401	277	353	385	492	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.089	0.099	354	449	312	395	440	559	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.086	0.096	403	506	355	445	512	642	37.76	57.25





**Table 3A: 6.35/11 kV Single Core XLPE Insulated Screened Armoured/Unarmoured Cable with Aluminium / Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom)	Inner-sheath thickness (For armoured cables) (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-Arm (Nom)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
25	3.6	0.3	1.6	4 X 0.8	1.4	1.4	2.0	23.0	22.0	19.5	610	765	540	695	415	565
35	3.6	0.3	1.6	4 X 0.8	1.4	1.4	2.0	24.0	23.0	21.0	670	880	595	800	470	675
50	3.6	0.3	1.6	4 X 0.8	1.4	1.4	2.0	25.0	24.0	22.0	740	1015	660	940	525	805
70	3.6	0.3	1.6	4 X 0.8	1.4	1.4	2.0	27.0	25.5	23.5	850	1250	765	1165	620	1015
95	3.6	0.3	1.6	4 X 0.8	1.4	1.4	2.0	28.5	27.5	25.0	975	1530	885	1440	725	1280
120	3.6	0.3	1.6	4 X 0.8	1.56	1.4	2.0	30.5	28.5	26.5	1110	1815	990	1690	825	1525
150	3.6	0.3	1.6	4 X 0.8	1.56	1.56	2.0	31.5	30.5	28.0	1235	2110	1135	2015	930	1810
185	3.6	0.4	2	4 X 0.8	1.56	1.56	2.2	34.0	32.0	30.0	1460	2555	1280	2380	1100	2190
240	3.6	0.4	2	4 X 0.8	1.56	1.56	2.2	36.5	34.5	32.5	1695	3150	1505	2960	1300	2455
300	3.6	0.4	2	4 X 0.8	1.56	1.56	2.2	38.5	36.5	34.5	1925	3755	1720	3550	1510	3335
400	3.6	0.4	2	4 X 0.8	1.72	1.72	2.2	41.5	39.5	37.0	2290	4620	2070	4395	1810	4130
500	3.6	0.5	2	4 X 0.8	1.88	1.72	2.4	46.5	44.0	41.5	2810	5790	2515	5495	2240	5220
630	3.6	0.5	2	4 X 0.8	1.88	1.88	2.4	49.5	48.0	45.0	3335	7190	3055	6910	2710	6570
800	3.6	0.5	2.5	4 X 0.8	2.04	1.88	2.6	55.0	52.0	49.5	4155	9090	3665	8610	3340	8275
1000	3.6	0.6	2.5	4 X 0.8	2.2	2.04	2.8	60.0	57.0	54.5	4950	11150	4410	10610	4045	10240

Area	Max DC Resistance at 20°C		Approx. AC Resistance at Operating Temp 90°C		Approx. reactance at 50 HZ		Current Rating						Short Circuit Rating for 1 Sec	
					Arm	Un-Arm	Direct in Ground at 30°C		In Duct at 30°C		In Air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	Al	Cu
mm <sup>2</sup>	AL	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	1.20	0.727	1.54	0.926	0.148	0.139	99	127	88	113	116	150	2.36	3.56
35	0.868	0.524	1.11	0.670	0.142	0.133	118	151	104	134	140	181	3.30	5.00
50	0.641	0.387	0.820	0.494	0.135	0.127	138	178	122	158	167	216	4.72	7.15
70	0.443	0.268	0.567	0.342	0.124	0.117	168	216	149	191	209	269	6.60	10.01
95	0.320	0.193	0.410	0.246	0.118	0.112	200	257	177	227	254	326	8.96	13.58
120	0.253	0.153	0.324	0.195	0.114	0.107	227	290	200	256	294	376	11.32	17.16
150	0.206	0.124	0.264	0.158	0.112	0.104	252	323	223	285	331	424	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.109	0.101	284	360	250	317	383	487	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.104	0.097	326	411	286	361	450	568	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.101	0.094	365	456	319	399	512	643	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.097	0.091	412	508	359	443	594	735	37.76	57.25
500	0.0605	0.0366	0.0781	0.0467	0.095	0.089	461	559	401	486	680	828	47.20	71.5
630	0.0469	0.0283	0.0606	0.0361	0.09	0.085	514	611	445	529	778	930	59.45	90.1
800	0.0367	0.0221	0.0473	0.0282	0.089	0.083	553	639	476	550	863	1003	75.50	114.4
1000	0.0291	0.0176	0.0375	0.0224	0.088	0.082	595	672	509	575	954	1083	94.40	143.0





**Table 3B: 6.35/11 kV Three Core XLPE Insulated Screened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom.)	Inner-sheath thickness (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	Round wire arm (Min.)	Flat strip arm (Min.)	Un-Arm (Nom)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
25	3.6	0.4	2	4.0 X 0.8	1.72	1.72	2.2	43.0	41.0	40.0	2715	3190	2040	2515	1560	2030
35	3.6	0.5	2	4.0 X 0.8	1.88	1.72	2.4	46.0	43.5	42.5	3070	3690	2325	2945	1845	2465
50	3.6	0.5	2.5	4.0 X 0.8	2.04	1.88	2.6	49.5	46.0	45.0	3740	4580	2600	3445	2105	2945
70	3.6	0.5	2.5	4.0 X 0.8	2.04	1.88	2.6	52.5	49.5	48.5	4250	5460	3000	4210	2470	3680
95	3.6	0.6	2.5	4.0 X 0.8	2.2	2.04	2.8	57.0	53.5	52.5	4900	6585	3555	5235	2990	4665
120	3.6	0.6	2.5	4.0 X 0.8	2.2	2.2	2.8	60.0	57.0	55.5	5390	7520	4010	6145	3365	5495
150	3.6	0.6	2.5	4.0 X 0.8	2.36	2.2	3.0	63.0	60.0	59.0	5995	8675	4460	7135	3835	6500
185	3.6	0.7	3.15	4.0 X 0.8	2.52	2.36	3.2	68.5	64.0	63.0	7405	10745	5105	8440	4465	7800
240	3.6	0.7	3.15	4.0 X 0.8	2.68	2.52	3.4	74.0	69.0	69.0	8500	13005	6035	10475	5340	9770
300	3.6	0.7	3.15	4.0 X 0.8	2.84	2.68	3.6	78.5	74.0	73.5	9590	15180	6915	12500	6210	11790
400	3.6	0.7	4	4.0 X 0.8	3	2.84	3.8	87.0	80.5	80.0	12230	19320	8250	15340	7475	14550

Area	Max DC resistance at 20°C		Approx. AC resistance at operating Temp 90°C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec	
							Direct in ground at 30°C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Cu	Ohm/KM	Cu	Ohm/KM	CU	Amps	Amps	Amps	Amps	Amps	Amps	Al	Cu
mm <sup>2</sup>	Al	Cu	Al	Cu	Al	CU	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	1.20	0.727	1.54	0.926	0.123	0.123	94	121	81	105	103	133	2.36	3.56
35	0.868	0.524	1.11	0.670	0.118	0.118	112	144	97	125	124	160	3.30	5.00
50	0.641	0.387	0.820	0.494	0.113	0.113	131	169	114	146	148	191	4.72	7.15
70	0.443	0.268	0.567	0.342	0.103	0.103	161	207	139	179	184	237	6.60	10.01
95	0.320	0.193	0.410	0.246	0.099	0.099	190	245	165	213	222	286	8.96	13.58
120	0.253	0.153	0.324	0.195	0.095	0.095	216	278	188	241	256	329	11.32	17.16
150	0.206	0.124	0.264	0.158	0.093	0.093	242	311	209	269	288	371	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.089	0.089	273	349	240	308	330	422	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.086	0.086	315	401	278	354	387	493	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.084	0.084	354	449	312	396	441	560	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.082	0.082	404	506	356	446	512	643	37.76	57.25





**Table 4A: 11 /11 kV Single Core XLPE Insulated Screened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of xlpe insulation (nom) mm	Inner-sheath thickness (for armoured cables) (min.) mm	Dimension of armour (nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire mm	Strip mm	For round wire arm (min.) mm	For flat strip arm (min.) mm	Un-arm (nom) mm	For round wire arm mm	For flat strip arm mm	Un-arm mm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
25	5.5	0.3	1.6	4 X 0.8	1.4	1.4	2.0	27.0	25.5	23.5	785	935	710	860	550	705
35	5.5	0.3	1.6	4 X 0.8	1.4	1.4	2.0	28.0	27.0	24.5	855	1060	770	975	610	815
50	5.5	0.3	1.6	4 X 0.8	1.56	1.4	2.0	29.5	28.0	25.5	955	1235	840	1120	675	950
70	5.5	0.3	1.6	4 X 0.8	1.56	1.56	2.0	31.0	30.0	27.0	1070	1470	980	1380	775	1175
95	5.5	0.3	2	4 X 0.8	1.56	1.56	2.0	33.5	31.5	29.0	1280	1835	1110	1665	895	1450
120	5.5	0.4	2	4 X 0.8	1.56	1.56	2.2	35.0	33.0	30.5	1400	2105	1225	1925	1030	1730
150	5.5	0.4	2	4 X 0.8	1.56	1.56	2.2	36.5	34.5	32.0	1535	2415	1345	2225	1140	2020
185	5.5	0.4	2	4 X 0.8	1.56	1.56	2.2	38.0	36.0	33.5	1700	2800	1505	2600	1290	2385
240	5.5	0.4	2	4 X 0.8	1.72	1.56	2.2	40.5	38.5	36.0	1975	3440	1730	3190	1510	2960
300	5.5	0.4	2	4 X 0.8	1.72	1.72	2.2	42.5	40.5	38.0	2220	4050	1995	3825	1725	3555
400	5.5	0.5	2	4 X 0.8	1.88	1.72	2.4	46.0	43.5	41.5	2650	4975	2350	4680	2080	4405
500	5.5	0.5	2.5	4 X 0.8	2.04	1.88	2.4	51.5	48.5	45.5	3295	6275	2840	5820	2490	5470
630	5.5	0.5	2.5	4 X 0.8	2.04	1.88	2.6	55.0	51.5	49.5	3840	7710	3360	7225	3025	6890
800	5.5	0.6	2.5	4 X 0.8	2.2	2.04	2.8	59.5	56.0	54.0	4590	9540	4050	8990	3690	8620
1000	5.5	0.6	2.5	4 X 0.8	2.36	2.2	2.8	64.0	61.0	58.0	5390	11595	4805	11005	4365	10560

Area	Max DC resistance at 20°C		Approx. AC resistance at operating temp 90°C		Approx. reactance at 50 Hz		Current rating						Short circuit rating for 1 sec KA(rms)	
					Arm	Un-arm	Direct in ground at 30°C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
mm <sup>2</sup>	Al	Cu	Al	Cu	Al/Cu	Al/Cu	AL	Cu	Al	Cu	Al	Cu	Al	Cu
25	1.20	0.727	1.54	0.926	0.158	0.151	99	127	88	113	116	150	2.36	3.56
35	0.868	0.524	1.11	0.670	0.151	0.144	118	151	104	134	140	181	3.30	5.00
50	0.641	0.387	0.820	0.494	0.145	0.137	138	178	122	158	167	216	4.72	7.15
70	0.443	0.268	0.567	0.342	0.134	0.126	168	216	149	191	209	269	6.60	10.01
95	0.320	0.193	0.410	0.246	0.128	0.120	200	257	177	227	254	326	8.96	13.58
120	0.253	0.153	0.324	0.195	0.124	0.116	227	290	200	256	294	376	11.32	17.16
150	0.206	0.124	0.264	0.158	0.120	0.113	252	323	223	285	331	424	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.115	0.108	284	360	250	317	383	487	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.111	0.104	326	411	286	361	450	568	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.107	0.100	365	456	319	399	512	643	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.103	0.097	412	508	359	443	594	735	37.76	57.25
500	0.0605	0.0366	0.0781	0.0467	0.102	0.094	461	559	401	486	680	828	47.20	71.5
630	0.0469	0.0283	0.0606	0.0361	0.097	0.090	514	611	445	529	778	930	59.45	90.1
800	0.0367	0.0221	0.0473	0.0282	0.094	0.089	553	639	476	550	863	1003	75.50	114.4
1000	0.0291	0.0176	0.0375	0.0224	0.092	0.086	595	672	509	575	954	1083	94.40	143.0



**Table 4B: 11 /11 kV Three Core XLPE Insulated Screened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of xlpe insulation (nom)	Inner-sheath thickness (min.)	Dimension of armour (nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (min.)	For flat strip arm (min.)	Un-arm (nom)	For round wire arm	For flat strip arm	Un-arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
25	5.5	0.5	2.5	4 X 0.8	2.04	1.88	2.6	53.0	50.0	49.0	4050	4565	2800	3275	2270	2745
35	5.5	0.5	2.5	4 X 0.8	2.2	2.04	2.8	56.0	52.5	51.5	4460	5080	3125	3750	2575	3195
50	5.5	0.6	2.5	4 X 0.8	2.2	2.2	2.8	58.0	55.0	54.0	4845	5690	3480	4330	2855	3695
70	5.5	0.6	2.5	4 X 0.8	2.36	2.2	3.0	61.5	58.5	57.5	5405	6620	3920	5140	3315	4525
95	5.5	0.6	3.15	4 X 0.8	2.52	2.36	3.2	67.0	62.5	61.5	6755	8435	4495	6175	3870	5540
120	5.5	0.7	3.15	4 X 0.8	2.52	2.36	3.2	70.0	65.5	65.0	7380	9520	4975	7115	4325	6455
150	5.5	0.7	3.15	4 X 0.8	2.68	2.52	3.4	73.5	69.0	68.5	8005	10685	5515	8195	4845	7515
185	5.5	0.7	3.15	4 X 0.8	2.84	2.68	3.4	77.5	72.5	72.0	8825	12165	6210	9550	5430	8760
240	5.5	0.7	3.15	4 X 0.8	3.0	2.84	3.6	82.5	78.0	77.5	9995	14505	7190	11660	6375	10810
300	5.5	0.7	4	4 X 0.8	3.0	3.0	3.8	88.5	82.5	82.5	12260	17860	8160	13780	7305	12890
400	5.5	0.7	4	4 X 0.8	3.0	3.0	4.0	95.0	89.0	89.0	13910	21000	9500	16585	8665	15740

Area	Max DC resistance at 20°C		Approx. AC resistance at operating temp 90°C		Approx reactance at 50 hz		Current rating						Short circuit rating for 1 sec	
							Direct in ground at 30°C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	KA(rms)	
mm <sup>2</sup>	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	1.20	0.727	1.54	0.926	0.137	0.137	94	121	81	105	103	133	2.36	3.56
35	0.868	0.524	1.11	0.670	0.131	0.131	112	144	97	125	124	160	3.30	5.00
50	0.641	0.387	0.820	0.494	0.125	0.125	131	169	114	146	148	191	4.72	7.15
70	0.443	0.268	0.567	0.342	0.115	0.115	161	207	139	179	184	237	6.60	10.01
95	0.320	0.193	0.410	0.246	0.109	0.109	190	245	165	213	222	286	8.96	13.58
120	0.253	0.153	0.324	0.195	0.105	0.105	216	278	188	241	256	329	11.32	17.16
150	0.206	0.124	0.264	0.158	0.102	0.102	242	311	209	269	288	371	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.098	0.098	273	349	240	308	330	422	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.094	0.094	315	401	278	354	387	493	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.092	0.092	354	449	312	396	441	560	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.088	0.088	404	506	356	446	512	643	37.76	57.25



**Table 5A: 12.7 /22 kV Single Core XLPE Insulated Screened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation	Inner-sheath thickness (For armoured cables)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-arm (Nom)	For round wire arm	For flat strip arm	Un-arm	Round wire armoured		Flat strip armoured		Unarmoured	
	(Nom)	(Min.)	mm	mm	mm	mm	mm	mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm									Al	Cu	Al	Cu	Al	Cu
35	6.0	0.3	1.6	4 X 0.8	1.56	1.4	2.0	29.5	28.0	25.5	935	1145	820	1025	655	860
50	6.0	0.3	1.6	4 X 0.8	1.56	1.56	2.0	30.5	29.5	26.5	1005	1285	910	1190	715	995
70	6.0	0.3	1.6	4 X 0.8	1.56	1.56	2.0	32.0	31.0	28.0	1130	1530	1025	1425	820	1220
95	6.0	0.4	2	4 X 0.8	1.56	1.56	2.2	34.5	32.5	30.5	1345	1900	1160	1710	970	1525
120	6.0	0.4	2	4 X 0.8	1.56	1.56	2.2	36.0	34.0	31.5	1470	2175	1275	1975	1080	1780
150	6.0	0.4	2	4 X 0.8	1.56	1.56	2.2	37.5	35.5	33.0	1605	2485	1400	2280	1195	2075
185	6.0	0.4	2	4 X 0.8	1.72	1.56	2.2	39.5	37.0	34.5	1800	2900	1560	2655	1345	2440
240	6.0	0.4	2	4 X 0.8	1.72	1.56	2.2	41.5	39.5	37.0	2050	3510	1800	3255	1565	3020
300	6.0	0.4	2	4 X 0.8	1.72	1.72	2.2	43.5	41.5	39.0	2300	4130	2060	3890	1785	3615
400	6.0	0.5	2	4 X 0.8	1.88	1.88	2.4	47.0	45.0	42.5	2725	5050	2460	4790	2145	4470
500	6.0	0.5	2.5	4 X 0.8	2.04	1.88	2.6	52.5	49.0	46.5	3380	6365	2920	5900	2605	5585
630	6.0	0.5	2.5	4 X 0.8	2.04	2.04	2.6	56.0	53.0	50.5	2930	7805	3475	7340	3100	6965
800	6.0	0.6	2.5	4 X 0.8	2.2	2.04	2.8	60.5	57.0	55.0	4690	9645	4145	9085	3770	8705
1000	6.0	0.6	2.5	4 X 0.8	2.36	2.2	3.0	65.0	62.0	59.5	5500	11700	4905	11105	4510	10705

Area	Max DC resistance at 20°C		Approx. AC resistance at operating temp 90 °C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec	
					Arm	Un-Arm	Direct in ground at 30 °C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	Al	Cu
mm <sup>2</sup>	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
35	0.868	0.524	1.11	0.670	0.154	0.146	116	150	102	132	144	185	3.30	5.00
50	0.641	0.387	0.820	0.494	0.147	0.14	137	176	120	154	174	224	4.72	7.15
70	0.443	0.268	0.567	0.342	0.136	0.128	167	214	146	187	217	278	6.60	10.01
95	0.320	0.193	0.410	0.246	0.13	0.123	198	253	172	221	262	336	8.96	13.58
120	0.253	0.153	0.324	0.195	0.125	0.118	224	285	195	249	302	386	11.32	17.16
150	0.206	0.124	0.264	0.158	0.121	0.114	249	317	217	276	339	434	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.117	0.11	280	355	243	308	389	494	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.113	0.106	321	404	278	350	455	575	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.109	0.102	355	442	307	382	515	644	28.32	42.90
400	0.0778	0.0470	0.101	0.0601	0.105	0.099	400	490	345	422	594	734	37.76	57.25
500	0.0605	0.0366	0.0781	0.0467	0.103	0.096	447	538	384	462	678	825	47.20	71.50
630	0.0469	0.0283	0.0606	0.0361	0.098	0.091	496	586	424	501	770	920	59.45	90.10
800	0.0367	0.0221	0.0473	0.0282	0.096	0.09	543	629	475	550	866	1014	75.50	114.4
1000	0.0291	0.0176	0.0375	0.0224	0.092	0.088	572	643	498	560	944	1074	94.40	143.0





**Table 5B: 12.7 /22 kV Three Core XLPE Insulated Screened Armoured /Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom)	Inner-sheath thickness (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-Arm (Nom)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
35	6.0	0.6	2.5	4 X 0.8	2.2	2.04	2.8	58.0	55.0	54.0	4785	5410	3380	4000	2795	3410
50	6.0	0.6	2.5	4 X 0.8	2.36	2.2	3.0	60.5	57.5	56.5	5160	6005	3700	4540	3105	3945
70	6.0	0.6	2.5	4 X 0.8	2.36	2.36	3.0	64.0	61.0	60.0	5685	6900	4190	5410	3525	4730
95	6.0	0.7	3.15	4 X 0.8	2.52	2.36	3.2	69.5	65.0	64.0	7125	8810	4785	6465	4130	5800
120	6.0	0.7	3.15	4 X 0.8	2.68	2.52	3.4	72.5	68.0	67.5	7720	9860	5295	7435	4620	6750
150	6.0	0.7	3.15	4 X 0.8	2.68	2.68	3.4	75.5	71.5	70.5	8365	11050	5850	8530	5090	7760
185	6.0	0.7	3.15	4 X 0.8	2.84	2.68	3.6	79.5	75.0	74.5	9200	12540	6480	9820	5755	9085
240	6.0	0.7	4	4 X 0.8	3.0	2.84	3.8	86.5	80.0	80.0	11480	15930	7500	11945	6720	11160
300	6.0	0.7	4	4 X 0.8	3.0	3.0	4.0	91.0	85.0	85.0	12640	18240	8460	14060	7675	13260
400	6.0	0.7	4	4 X 0.8	3.0	3.0	4.0	97.5	91.5	91.0	14310	21400	9840	16930	8975	16050

Area	Max DC resistance at 20 ° C		Approx. AC resistance at operating temp 90°C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec	
							Direct in ground at 30°C		In duct at 30°C		In air at 40°C			
	mm <sup>2</sup>	Al	Cu	Al	Cu	Al	Cu	Amps	Amps	Amps	Amps	Amps	Amps	Al
35	0.868	0.524	1.11	0.670	0.134	0.134	111	143	97	125	127	164	3.30	5.00
50	0.641	0.387	0.820	0.494	0.128	0.128	130	167	116	150	152	196	4.72	7.15
70	0.443	0.268	0.567	0.342	0.117	0.117	159	204	142	183	189	243	6.60	10.01
95	0.320	0.193	0.410	0.246	0.112	0.112	189	243	169	217	227	293	8.96	13.58
120	0.253	0.153	0.324	0.195	0.107	0.107	215	276	192	246	262	336	11.32	17.16
150	0.206	0.124	0.264	0.158	0.104	0.104	239	307	214	275	294	378	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.100	0.100	270	346	245	313	336	431	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.096	0.096	312	398	282	360	393	503	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.093	0.093	351	446	317	403	448	571	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.090	0.090	400	503	361	453	519	655	37.76	57.25





**Table 6A: 19 /33 kV Single Core XLPE Insulated Screened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom.)	Inner-sheath thickness (For armoured cables) (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-Arm (Nom)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
50	8.8	0.4	2	4 X 0.8	1.56	1.56	2.2	37.0	35.0	32.5	1415	1695	1220	1505	1015	1290
70	8.8	0.4	2	4 X 0.8	1.56	1.56	2.2	38.5	36.5	34.0	1550	1950	1345	1745	1130	1530
95	8.8	0.4	2	4 X 0.8	1.72	1.56	2.2	40.5	38.0	36.0	1735	2290	1490	2050	1270	1820
120	8.8	0.4	2	4 X 0.8	1.72	1.72	2.2	42.0	39.5	37.5	1870	2575	1645	2350	1390	2090
150	8.8	0.4	2	4 X 0.8	1.72	1.72	2.2	43.0	41.0	38.5	2020	2900	1785	2665	1515	2390
185	8.8	0.5	2	4 X 0.8	1.88	1.72	2.4	45.5	43.0	40.5	2275	3370	1980	3075	1715	2810
240	8.8	0.5	2	4 X 0.8	1.88	1.88	2.4	47.5	45.5	43.0	2545	4000	2285	3740	1960	3410
300	8.8	0.5	2.5	4 X 0.8	2.04	1.88	2.6	51.0	47.5	45.5	2975	4810	2530	4365	2240	4070
400	8.8	0.5	2.5	4 X 0.8	2.04	2.04	2.6	54.0	51.0	48.5	3370	5700	2935	5260	2585	4910
500	8.8	0.6	2.5	4 X 0.8	2.2	2.04	2.8	58.5	55.5	52.5	3975	6960	3455	6440	3085	6065
630	8.8	0.6	2.5	4 X 0.8	2.36	2.2	2.8	62.5	59.0	56.5	4615	8485	4050	7915	3615	7480
800	8.8	0.6	2.5	4 X 0.8	2.36	2.36	3.0	66.5	63.5	61.0	5325	10290	4780	9735	4325	9265
1000	8.8	0.7	3.15	4 X 0.8	2.52	2.36	3.2	72.5	68.0	65.5	6485	12690	5570	11780	5110	11305

Area	Max DC resistance at 20°C		Approx. AC resistance at operating temp 90°C		Approx. reactance at 50 HZ		Current Rating						Short circuit rating for 1 Sec	
					Arm	Un-Arm	Direct in Ground at 30°C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	KA(rms)	KA(rms)
mm <sup>2</sup>	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
50	0.641	0.387	0.820	0.494	0.159	0.152	137	176	120	154	174	224	4.72	7.15
70	0.443	0.268	0.567	0.342	0.147	0.14	167	214	146	187	217	278	6.60	10.01
95	0.320	0.193	0.410	0.246	0.14	0.134	198	253	172	221	262	336	8.96	13.58
120	0.253	0.153	0.324	0.195	0.135	0.129	224	285	195	249	302	386	11.32	17.16
150	0.206	0.124	0.264	0.158	0.131	0.125	249	317	217	276	339	434	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.126	0.12	280	355	243	308	389	494	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.121	0.115	321	404	278	350	455	575	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.119	0.112	355	442	307	382	515	644	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.113	0.107	400	490	345	422	594	734	37.76	57.25
500	0.0605	0.0366	0.0781	0.0467	0.11	0.103	447	538	384	462	678	825	47.20	71.5
630	0.0469	0.0283	0.0606	0.0361	0.105	0.098	496	586	424	501	770	920	59.45	90.1
800	0.0367	0.0221	0.0473	0.0282	0.101	0.096	543	629	475	550	866	1014	75.50	114.4
1000	0.0291	0.0176	0.0375	0.0224	0.099	0.094	572	643	498	560	944	1074	94.40	143.0





**Table 6B: 19 /33 kV Three Core XLPE Insulated Screened Armoured/ Unarmoured Cable with Aluminium/ Copper Conductor Confirming to IS 7098 P 2**

Area	Thickness of XLPE insulation (Nom.)	Inner sheath thickness (Min.)	Dimension of armour (Nom.)		Thickness of outer sheath			Approx. overall diameter			Approx. net weight of cable					
			Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-Arm (Nom)	For round wire arm	For flat strip arm	Un-Arm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
50	8.8	0.7	3.15	4 X 0.8	2.68	2.52	3.4	75.0	70.0	69.5	7725	8575	5200	6045	4510	5350
70	8.8	0.7	3.15	4 X 0.8	2.84	2.68	3.6	78.5	73.5	73.5	8445	9665	5765	6985	5060	6270
95	8.8	0.7	3.15	4 X 0.8	3.0	2.84	3.6	82.5	78.0	77.0	9270	10950	6565	8145	5650	7315
120	8.8	0.7	4	4 X 0.8	3.0	2.84	3.8	87.0	81.0	80.5	11065	13205	6980	9120	6205	8335
150	8.8	0.7	4	4 X 0.8	3.0	3.0	4.0	90.0	84.0	84.0	11780	14465	7600	10285	6815	9480
185	8.8	0.7	4	4 X 0.8	3.0	3.0	4.0	93.5	87.5	87.5	12630	15975	8320	11665	7480	10810
240	8.8	0.7	4	4 X 0.8	3.0	3.0	4.0	98.5	92.5	92.5	13895	18350	9350	13805	8465	12905
300	8.8	0.7	4	4 X 0.8	3.0	3.0	4.0	103.0	97.0	97.0	15130	20840	10325	15930	9415	15010
400	8.8	0.7	4	4 X 0.8	3.0	3.0	4.0	109.5	103.5	103.0	17015	24110	11820	18910	10830	17905

Area	Max DC resistance at 20°C		Approx AC resistance at operating temp 90°C		Approx. reactance at 50 HZ		Current rating						Short circuit rating for 1 Sec	
							Direct in ground at 30°C		In duct at 30°C		In air at 40°C			
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Amps	Amps	Amps	Amps	Amps	Amps	Al	Cu
mm <sup>2</sup>	AL	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
50	0.641	0.387	0.820	0.494	0.142	0.142	130	167	116	150	152	196	4.72	7.15
70	0.443	0.268	0.567	0.342	0.130	0.130	159	204	142	183	189	243	6.60	10.01
95	0.320	0.193	0.410	0.246	0.124	0.124	189	243	169	217	227	293	8.96	13.58
120	0.253	0.153	0.324	0.195	0.119	0.119	215	276	192	246	262	336	11.32	17.16
150	0.206	0.124	0.264	0.158	0.115	0.115	239	307	214	275	294	378	14.16	21.45
185	0.164	0.0991	0.210	0.126	0.111	0.111	270	346	245	313	336	431	17.46	26.45
240	0.125	0.0754	0.160	0.0962	0.106	0.106	312	398	282	360	393	503	22.65	34.32
300	0.100	0.0601	0.129	0.0767	0.103	0.103	351	446	317	403	448	571	28.32	42.9
400	0.0778	0.0470	0.101	0.0601	0.099	0.099	400	503	361	453	519	655	37.76	57.25





# CURRENT RATING - INSTALLATION CONDITIONS & RATING FACTORS

## 1. Continuous current carrying Capacity

Continuous current carrying capacity is an important factor for the selection of the optimum size of conductor in a cable. The current ratings given in Tables 2 to 30 are on the following standard installation conditions:

1. Maximum Conductor Temperature	90°C
2. Thermal Resistivity of Soil	1.5 K.m/W
3. Ground Temperature	30°C
4. Ambient Air Temperature	40°C
5. Depth of Laying - to the highest point of cables laid direct or to top surface of ducts, is taken to be as follows:	
a) 3.3kV, 6.6kV and 11kV cables	900 mm
b) 22kV and 33kV cables	1050 mm
6. Method of Installation :	
a) Single core cables:	Three single core cables in trefoil touching
b) Three core cables	Installed single

## 2. Short circuit rating

The conductor size in a cable for an installation is also governed by its ability to carry short circuit current of the system.

Short circuit rating are based on the assumption that the duration of short circuit is so small and apparently there is no transmission of heat, produced during short circuit, through the insulation and the whole of it is absorbed by the conductor.

The short circuit current ratings (r.m.s. values) of XLPE insulated cables with aluminium / copper conductors for one second duration are given in table 1. These ratings have been calculated on the following assumptions.

Parametres	Aluminium	Copper
1. Conductor temperature prior to short circuit	90°C	90°C
2. Maximum permissible conductor temperature during short circuit	250°C	250°C
3. Specific gravity of aluminium	2.703	8.89
4. Resistivity of aluminium at 20 °C (ohm / km / mm <sup>2</sup> )	28.264	17.241
5. Temperature coefficient of resistance at 20°C	0.00403/°C	0.00393/°C

With the above assumptions, the maximum short circuit current is calculated with the following formula.

$$I_{sh} = \frac{k \times A}{\sqrt{t}} \text{ (kA)}$$

Where  $I_{sh}$  = r.m.s. value of short circuit current (kA)  $k$  = a constant (Aluminium-0.0944, Copper-0.143)

$A$  = nominal area of conductor (mm<sup>2</sup>)

$t$  = duration of short circuit (sec)

## 3. Combinations of duct and cable dimensions assumed are shown below.

### Duct Dimesions corresponding to cable diametre

Overall Cable Diameter	Inside Duct Diameter	Outside Duct Diameter
mm	mm	mm
Up to and including 65	100	130
Above 65 and including 90	125	160
Above 90 and including 115	150	190

## 4. RATING FACTORS

In actual practice, conditions of installation may be different from the standard installation conditions given above. Hence to determine the continuous current rating for the actual conditions, the tabulated current ratings should be multiplied by the appropriate ratings factors or factors given Below tables.

a) Cable Laid Direct in the Ground	Refer Table No.
i) For Depth of laying	1
ii) For variation in ground temperature	2
iii) For variation in thermal resistivity of soil	3
iv) For group rating factors	4-5
b) Cables Installed in Ducts	Refer Table No.
i) For Depth of laying	1
ii) For variation in ground temperature	2
iii) For variation in thermal resistivity of soil	3
iv) For group rating factors	4-5
c) Cables Installed in Air	Refer Table No.
i) For variation in ambient air temperature	2
d) Group Rating	Refer Table No.
i) Group Rating factors for cables laid in Trays/ Racks (1core & 3 core)	6-7



**TABLE 1: RATING FACTORS FOR DEPTH OF LAYING**

Depth of laying(mm)	For cables laid direct in the ground						For single or three core cables in single way ducts.					
	3.3kV,6.6kV & 11 kV Cables			22kV & 33kV Cables			3.3,6.6 &11 kV Cables			22kV & 33kV Cables		
	Single Core ≤185	Single Core >185	Three Core	Single Core ≤185	Single Core >185	Three Core	Single Core ≤185	Single Core >185	Three Core	Single Core ≤185	Single Core >185	Three Core
900	1	1	1	-	-	-	1	1	1	-	-	-
1050	0.99	0.98	0.98	1	1	1	0.98	0.98	0.99	1	1	1
1200	0.97	0.96	0.97	0.99	0.98	0.99	0.97	0.97	0.98	0.99	0.98	0.99
1500	0.95	0.94	0.95	0.97	0.96	0.97	0.95	0.94	0.96	0.96	0.96	0.97
1800	0.93	0.92	0.94	0.95	0.94	0.95	0.93	0.92	0.95	0.95	0.94	0.96
2000	0.92	0.91	0.93	0.94	0.93	0.94	0.92	0.91	0.94	0.94	0.93	0.95
2500	0.91	0.89	0.91	0.92	0.91	0.92	0.90	0.89	0.93	0.91	0.90	0.94
3000	0.89	0.87	0.90	0.90	0.89	0.91	0.89	0.88	0.91	0.91	0.89	0.92

**TABLE 2**

Rating factors for variation in ground temperature (maximum conductor temperature 90°C)										
Ground Temperature (°C)	15	20	25	30	35	40	45	50		
For cables laid direct in the ground	1.12	1.08	1.04	1	0.96	0.91	0.87	0.82		
For cables laid in duct	1.12	1.08	1.04	1	0.96	0.91	0.87	0.82		
Rating factors for variation in ambient air temperature (maximum conductor temperature 90°C)										
Air Temperature (°C)	25	30	35	40	45	50	55	60		
Rating factors	1.14	1.10	1.05	1.00	0.95	0.89	0.84	0.77		

**TABLE 3**

Rating factors for variation in thermal resistivity of soil for three single core cables For 3.3 kV, 6.6 kV & 11 kV cables												
Nominal Area of Conductor mm <sup>2</sup>	Laid directly in ground						Laid in ducts					
	Value of thermal resistivity of soil Km / W						Value of thermal resistivity of soil Km / W					
	1	1.2	1.5	2	2.5	3	1	1.2	1.5	2	2.5	3
25	1.17	1.90	1	0.89	0.80	0.74	1.11	1.06	1	0.92	0.86	0.81
35	1.18	1.10	1	0.89	0.80	0.74	1.11	1.06	1	0.92	0.86	0.81
50	1.18	1.10	1	0.88	0.80	0.74	1.11	1.06	1	0.91	0.85	0.80
70	1.19	1.10	1	0.88	0.80	0.73	1.11	1.07	1	0.92	0.85	0.80
95	1.19	1.10	1	0.88	0.79	0.73	1.11	1.07	1	0.91	0.85	0.79
120	1.19	1.10	1	0.88	0.79	0.73	1.12	1.07	1	0.91	0.84	0.79
150	1.19	1.10	1	0.88	0.79	0.73	1.12	1.07	1	0.91	0.84	0.79
185	1.19	1.11	1	0.88	0.79	0.73	1.12	1.07	1	0.91	0.84	0.78
240	1.19	1.11	1	0.88	0.79	0.73	1.13	1.07	1	0.91	0.84	0.78
300	1.20	1.11	1	0.88	0.79	0.72	1.13	1.07	1	0.91	0.83	0.78
400	1.20	1.11	1	0.87	0.79	0.72	1.13	1.07	1	0.90	0.83	0.77
500	1.20	1.11	1	0.87	0.79	0.72	1.14	1.08	1	0.90	0.83	0.77
630	1.20	1.11	1	0.87	0.79	0.72	1.14	1.08	1	0.90	0.83	0.77
800	1.20	1.11	1	0.87	0.78	0.72	1.14	1.08	1	0.90	0.82	0.76
1000	1.21	1.11	1	0.87	0.78	0.72	1.15	1.08	1	0.90	0.82	0.76



**TABLE 4**

Rating factors for variation in thermal resistivity of soil for three single core cables For 22 kV & 33 kV cables												
Nominal area Of conductor mm <sup>2</sup>	Laid directly in ground						Laid in ducts					
	Value of thermal resistivity of soil Km / W						Value of thermal resistivity of soil Km / W					
	1	1.2	1.5	2	2.5	3	1	1.2	1.5	2	2.5	3
35	1.17	1.09	1.0	0.89	0.81	0.74	1.11	1.06	1.0	0.92	0.85	0.80
50	1.17	1.09	1.0	0.89	0.81	0.74	1.11	1.06	1.0	0.92	0.85	0.80
70	1.17	1.09	1.0	0.89	0.80	0.74	1.11	1.06	1.0	0.91	0.84	0.79
95	1.17	1.09	1.0	0.89	0.80	0.74	1.12	1.06	1.0	0.91	0.84	0.79
120	1.18	1.10	1.0	0.89	0.80	0.74	1.12	1.07	1.0	0.91	0.84	0.79
150	1.18	1.10	1.0	0.88	0.80	0.74	1.12	1.07	1.0	0.91	0.84	0.79
185	1.18	1.10	1.0	0.88	0.80	0.74	1.13	1.07	1.0	0.91	0.84	0.78
240	1.18	1.10	1.0	0.88	0.80	0.73	1.13	1.07	1.0	0.91	0.83	0.78
300	1.19	1.10	1.0	0.88	0.79	0.73	1.13	1.07	1.0	0.90	0.83	0.77
400	1.19	1.10	1.0	0.88	0.79	0.73	1.14	1.08	1.0	0.90	0.83	0.77
500	1.19	1.10	1.0	0.88	0.79	0.73	1.14	1.08	1.0	0.90	0.83	0.77
630	1.19	1.10	1.0	0.88	0.79	0.73	1.14	1.08	1.0	0.90	0.82	0.77
800	1.20	1.10	1.0	0.88	0.79	0.72	1.14	1.08	1.0	0.90	0.82	0.77
1000	1.20	1.11	1.0	0.88	0.79	0.72	1.15	1.08	1.0	0.90	0.82	0.76

**TABLE 5**

Rating factors for variation in thermal resistivity of soil for three core cables For 3.3 kV, 6.6 kV & 11 kV cables												
Nominal area Of conductor mm <sup>2</sup>	Laid directly in ground						Laid in ducts					
	Value of thermal resistivity of soil Km / W						Value of thermal resistivity of soil Km / W					
	1	1.2	1.5	2	2.5	3	1	1.2	1.5	2	2.5	3
25	1.15	1.08	1.0	0.90	0.82	0.76	1.08	1.04	1.0	0.94	0.89	0.84
35	1.15	1.08	1.0	0.90	0.82	0.76	1.08	1.04	1.0	0.94	0.88	0.84
50	1.15	1.08	1.0	0.90	0.82	0.76	1.08	1.04	1.0	0.94	0.88	0.84
70	1.15	1.08	1.0	0.89	0.82	0.76	1.08	1.04	1.0	0.93	0.88	0.83
95	1.15	1.09	1.0	0.89	0.82	0.76	1.08	1.05	1.0	0.93	0.88	0.83
120	1.15	1.09	1.0	0.89	0.82	0.76	1.09	1.05	1.0	0.93	0.88	0.83
150	1.15	1.09	1.0	0.89	0.81	0.75	1.09	1.05	1.0	0.93	0.87	0.83
185	1.16	1.09	1.0	0.89	0.81	0.75	1.09	1.05	1.0	0.93	0.87	0.83
240	1.16	1.09	1.0	0.89	0.81	0.75	1.09	1.05	1.0	0.93	0.87	0.82
300	1.16	1.09	1.0	0.89	0.81	0.75	1.09	1.05	1.0	0.93	0.87	0.82
400	1.16	1.09	1.0	0.89	0.81	0.75	1.09	1.05	1.0	0.93	0.87	0.82
500	1.16	1.09	1.0	0.89	0.81	0.75	1.10	1.06	1.0	0.92	0.86	0.81



**TABLE 6**

Rating factors for variation in thermal resistivity of soil for three core cables For 22 kV & 33 kV cables												
Nominal area of conductor mm <sup>2</sup>	Laid directly in ground						Laid in ducts					
	Value of thermal resistivity of soil K.m / W						Value of thermal resistivity of soil K.m / W					
	1	1.2	1.5	2	2.5	3	1	1.2	1.5	2	2.5	3
35	1.14	1.08	1.0	0.90	0.83	0.77	1.08	1.05	1.0	0.94	0.88	0.83
50	1.14	1.08	1.0	0.90	0.83	0.77	1.08	1.05	1.0	0.93	0.88	0.83
70	1.14	1.08	1.0	0.90	0.83	0.77	1.08	1.05	1.0	0.93	0.87	0.83
95	1.14	1.08	1.0	0.90	0.83	0.77	1.09	1.05	1.0	0.93	0.87	0.83
120	1.14	1.08	1.0	0.90	0.82	0.76	1.09	1.05	1.0	0.93	0.87	0.83
150	1.15	1.08	1.0	0.90	0.82	0.76	1.09	1.05	1.0	0.93	0.87	0.82
185	1.15	1.08	1.0	0.90	0.82	0.76	1.09	1.05	1.0	0.93	0.87	0.82
240	1.15	1.08	1.0	0.90	0.82	0.76	1.09	1.05	1.0	0.93	0.87	0.82
300	1.15	1.08	1.0	0.90	0.82	0.76	1.09	1.05	1.0	0.93	0.87	0.82
400	1.16	1.09	1.0	0.89	0.82	0.76	1.10	1.06	1.0	0.92	0.86	0.81
500	1.16	1.09	1.0	0.89	0.82	0.75	1.10	1.06	1.0	0.92	0.86	0.81

**TABLE 7**

Group rating factors for three Single core cables in trefoil formation										
Number of cables In group	Laid directly in ground					Laid in single way ducts				
	Spacing between trefoil group centres, mm					Spacing between trefoil group centres, mm				
	TOUCHING	200	400	600	800	TOUCHING	200	400	600	800
2	0.73	0.83	0.88	0.90	0.92	0.78	0.85	0.89	0.91	0.93
3	0.6	0.73	0.79	0.83	0.86	0.66	0.75	0.81	0.85	0.88
4	0.54	0.68	0.75	0.80	0.84	0.59	0.70	0.77	0.82	0.86
5	0.49	0.63	0.72	0.78	0.82	0.55	0.66	0.74	0.80	0.84
6	0.46	0.61	0.70	0.76	0.81	0.51	0.64	0.72	0.78	0.83
7	0.43	0.58	0.68	0.75	0.80	0.48	0.61	0.71	0.77	0.82
8	0.41	0.57	0.67	0.74	-	0.46	0.60	0.70	0.76	-
9	0.39	0.55	0.66	0.73	-	0.44	0.58	0.69	0.76	-
10	0.37	0.54	0.65	-	-	0.43	0.57	0.68	-	-
11	0.36	0.53	0.64	-	-	0.42	0.56	0.67	-	-
12	0.35	0.52	0.64	-	-	0.40	0.55	0.67	-	-

**TABLE 8**

Group rating factors for three core cables in horizontal formation										
Number of Cables In Group	Laid direct in the ground					Laid in single way ducts				
	Spacing Between Group Centers, mm					Spacing Between Group Centers, mm				
	TOUCHING	200	400	600	800	TOUCHING	200	400	600	800
2	0.80	0.86	0.90	0.92	0.94	0.85	0.88	0.92	0.94	0.95
3	0.69	0.77	0.82	0.86	0.89	0.75	0.80	0.85	0.88	0.91
4	0.62	0.72	0.79	0.83	0.87	0.69	0.75	0.82	0.86	0.89
5	0.57	0.68	0.76	0.81	0.85	0.65	0.72	0.79	0.84	0.87
6	0.54	0.65	0.74	0.80	0.84	0.62	0.69	0.77	0.83	0.87
7	0.51	0.63	0.72	0.78	0.83	0.59	0.67	0.76	0.82	0.86
8	0.49	0.61	0.71	0.78	-	0.57	0.65	0.75	0.81	-
9	0.47	0.60	0.70	0.77	-	0.55	0.64	0.74	0.80	-
10	0.46	0.59	0.69	-	-	0.54	0.63	0.73	-	-
11	0.45	0.57	0.69	-	-	0.52	0.62	0.73	-	-
12	0.43	0.56	0.68	-	-	0.51	0.61	0.72	-	-





**TABLE 9**

Group rating factors for Three core cables in Air on perforated Trays (vertical spacing between trays 300 mm & spacing between trays & wall at least 20 mm)							
	Number of trays	Number of cables					
		1	2	3	4	5	6
TOUCHING	1	1.00	0.88	0.82	0.79	0.76	0.73
	2	1.00	0.87	0.80	0.77	0.73	0.68
	3	1.00	0.86	0.79	0.76	0.71	0.66
SPACED (space between cables 1 X cable diameter)	1	1.00	1.00	0.98	0.95	0.91	-
	2	1.00	0.99	0.96	0.92	0.87	-
	3	1.00	0.98	0.95	0.91	0.85	-

**TABLE 10**

Group rating factors for Three core cables in Air on vertical perforated Trays (horizontal spacing between trays 225 mm & spacing between trays)							
	Number of trays	Number of cables					
		1	2	3	4	5	6
TOUCHING	1	1.00	0.88	0.82	0.78	0.73	0.72
	2	1.00	0.88	0.81	0.76	0.71	0.70
	3	1.00	0.91	0.89	0.88	0.87	-
SPACED (space between cables 1 X cable diameter)	1	1.00	0.91	0.89	0.88	0.87	-
	2	1.00	0.91	0.88	0.87	0.85	-

**TABLE 11**

Group rating factors for Three core cables in Air on ladder supports, cleats, etc (vertical spacing between trays 300mm & spacing between trays & wall at least 20mm)							
	Number of Trays	Number of Cables					
		1	2	3	4	5	6
TOUCHING	1	1.00	0.87	0.82	0.80	0.79	0.78
	2	1.00	0.86	0.80	0.78	0.76	0.73
	3	1.00	0.85	0.78	0.76	0.73	0.70
SPACED (space between cables 1 X cable diameter)	1	1.00	1.00	1.00	1.00	1.00	-
	2	1.00	0.99	0.98	0.97	0.96	-
	3	1.00	0.98	0.97	0.96	0.93	-



**TABLE 12**

Group rating factors to be applied for circuits of Three single core cables in Air flat touching (vertical spacing between trays 300 mm & spacing between trays & wall at least 20 mm)				
	Number of trays	Number of cables		
		1	2	3
Cables on perforated trays in touching	1	0.98	0.91	0.87
	2	0.96	0.87	0.81
	3	0.95	0.85	0.78
Cables on ladder supports, cleats etc in touching	1	1.00	0.97	0.96
	2	0.98	0.93	0.89
	3	0.97	0.90	0.86

**TABLE 13**

Group rating factors to be applied for circuits of Three single core cables in Air in trefoil formation (vertical spacing between trays 300 mm & spacing between trays & wall at least 20 mm)				
	Number of trays	Number of cables		
		1	2	3
Cables on perforated trays with spacing between trefoils $\geq 2 \times$ Cable Diameter	1	1.00	0.98	0.96
	2	0.97	0.93	0.89
	3	0.96	0.92	0.86
Cables on ladder supports, cleats, etc. spacing between trefoils $\geq 2 \times$ Cable Diameter	1	1.00	1.00	1.00
	2	0.97	0.95	0.93
	3	0.96	0.94	0.90

**TABLE 14**

Group rating factors to be applied for circuits of Three single core cables in Air in trefoil formation on vertical perforated trays (Horizontal spacing between trays 225 mm)				
	Number of trays	Number of cables		
		1	2	3
Cables on perforated trays with spacing between trefoils $\geq 2 \times$ Cable Diameter	1	1.00	0.91	0.89
	2	1.00	0.90	0.86



# IMPORTANT FORMULAE

## Ordering Information

IMPORTANT FORMULAE \* TO CALCULATE VARIOUS ELECTRICAL PARAMETERS OF CABLES

### 1. Inductance:

$$L = K + 0.2 \log_e \frac{2S}{d} \text{ (mH/km)}$$

where K = Constant for different stranded Conductor

S = Axial Spacing between Cables Conductor in mm.

d = Conductor Diameter

No. of wires in Conductor	K
7	0.0642
19	0.0554
37	0.0528
61 and above	0.0514
1(Solid)	0.0500

### 2. Reactance:

$$X = 2\pi f \times L \times 10^{-3} \text{ Q/km}$$

where f = frequency

L = Inductance

### 3. Impedance:

$$Z = (R^2 + X^2)^{1/2} \text{ Q/km}$$

where R = A.C Resistance at operating temperature Q/km

X = Reactance

### 4. Charging Current:

$$A = U_o \times 2\pi \times f \times C \times 10^{-6} \text{ Amp/km}$$

C = Cable capacitance in nf/km

U<sub>o</sub> = Voltage in Voltes

### 5. Voltage Drop:

For 3 Core Cables :  $\sqrt{3} \times Z \text{ mv/A/mtr}$

For 1 Core Cables :  $2 \times Z \text{ mv/A/mtr}$

where Z = Impedance in ohm/km

### 6. Capacitance:

$$C = \frac{Er}{18 \log_e (D/d)} \text{ ( nf / km)}$$

where Er = Relative Permittivity for XLPE : 2.3

D = Dia over Insulation in mm

d = Dia over conductor screen in mm

### 7. Dielectric loss in watts per km/phase:

$$2\pi f \times C \times U_o^2 \tan \delta \cdot 10^{-6} \text{ (watt / km per phase)}$$

where C = Capacitance in nf/km

U<sub>o</sub> = Power frequency voltage between conductor & earth -V

Tan δ = Dielectric power factor = 0.004 for XLPE

### 8. Voltage Induced in Sheath:

$$E_s = I \times X_m$$

where I = conductor current (A)

$$X_m = 2\pi f M \times 10^{-3} \text{ (Q / km)}$$

$$M = 0.2 \log_e \frac{2S}{d_m} \text{ (mH/km)}$$

S = Distance between Cable Centres,

d<sub>m</sub> = Mean Diameter of Sheath

### 9. Short Circuit Rating:

$$I^2 = \frac{K^2 S^2}{T} \log_e \left( \frac{0_1 + \phi_3}{0_0 + \phi_3} \right)$$

where I = Short circuit (R.M.S over duration) in Amps.

T = Duration of short circuit in second

K = Constant – 226 for Copper, 148 for Aluminium, 78 for Steel

S = Area of Conductor in mm<sup>2</sup>

0<sub>1</sub> = Final Temperature of Conductor or Armour

0<sub>0</sub> = Initial Temperature of Conductor or Armour

φ<sub>3</sub> = Reciprocal of the temperature coefficient of resistance of the conductor per°C at 0°C (228 for Aluminium, 202 for Steel, & 234.5 for Copper)

### MINIMUM BENDING RADIUS OF HT CABLES AS PER IS 1255

Voltage grade	1 core cable	Multicore Cable
3.3 kV to 11 kV (E)	15 x D	15 x D
Above 11 kV (E)	20 x D	15 x D

Where D is Overall Diameter of Cable

\*Source: BICC Hand Book



## DRUM HANDLING

APAR's HT XLPE cables should be installed by trained professional in accordance with good engineering practices, recognised codes of practices, local statutory requirement and IEEE wiring regulations.

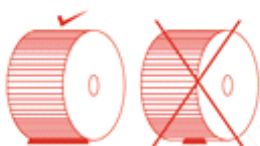
Electrical cables are often supplied in heavy drums and handling these drums can constitute a safety hazard and proper handling of cable drums decreases the probability of accidental damage of cable, material and personnel.

Following are the number of key safety issues to keep in mind while handling the cable drums:

**Lifting the cable drum by crane**



**Use proper stops to prevent drum rolling**



**Drum rolling as shown direction**



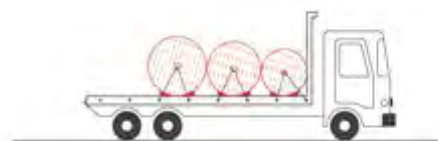
**Lifting drums correctly on fork truck**



**Do not lay drum on flanges**



**Secure drums adequately before transportation**







## CABLE LAYING & INSTALLATION PROCEDURES

- Take proper precautions to avoid any mechanical damage to the cables before and during installation.
- Exceeding the manufacturer's recommended maximum pulling tensions should be avoided as this can damage the cables.
- If cables are being installed in ducts, the correct size of the duct should be consulted and used.
- The type of jointing and filling compounds employed should be chemically compatible with the cable materials.
- The cable support system must be apt to avoid damage to the cables.
- The cables specified in this catalogue are designed for fixed installation only, and they are not intended for uses such as trailing or reeling cables, etc.
- 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 on the over sheath should be removed from a suitable distance for joints and terminations.
- Exercise proper care with single-core cables to ensure that the bonding and earthing arrangements are adequate to cater for circulating currents in screen(s).





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