



LT XLPE Cables



APAR CABLE SOLUTIONS

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



Specialty 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.





APAR CABLE RANGE

ELECTRICAL 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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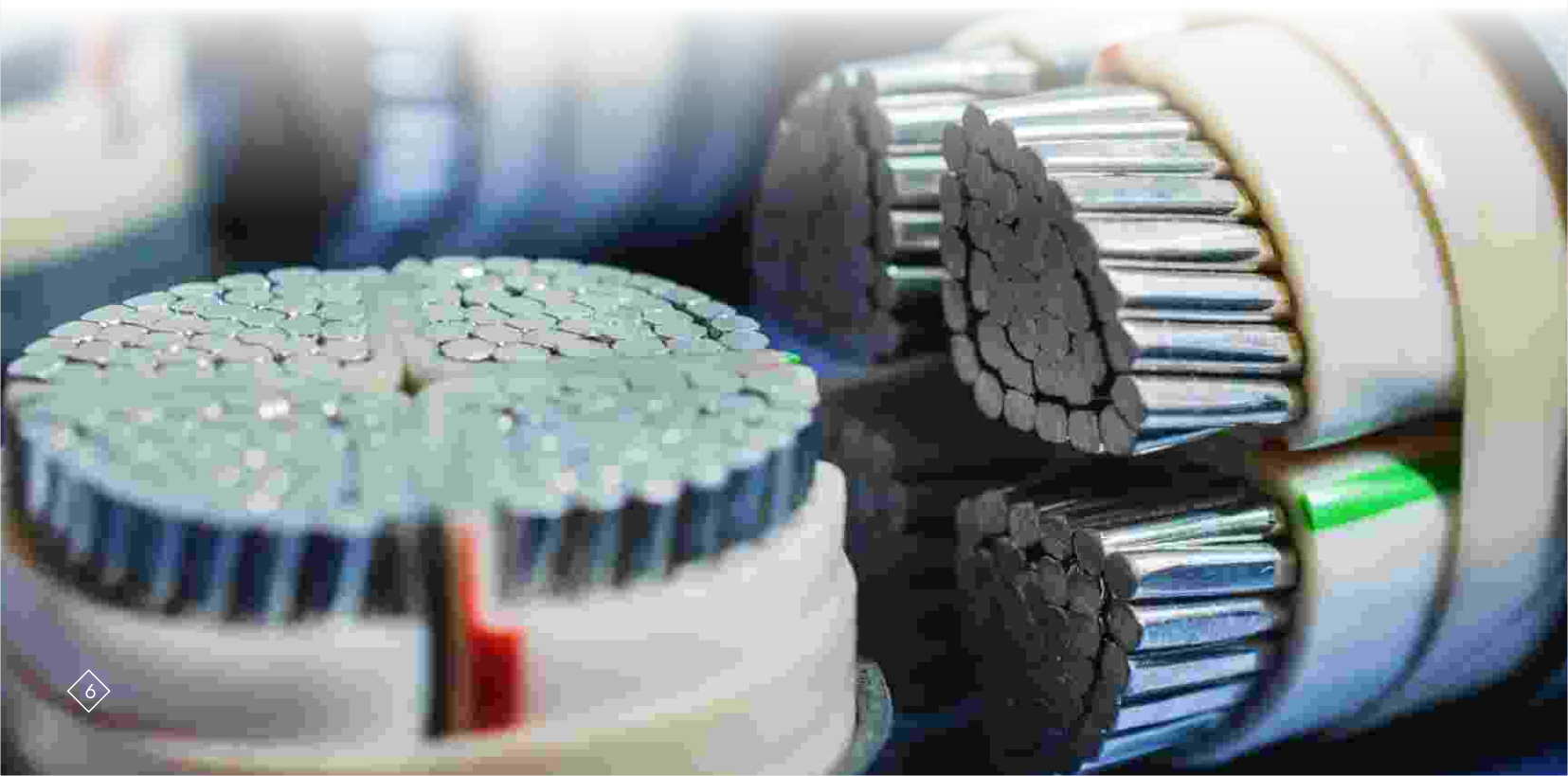
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COMPONENTS OF LT CABLES

Element	Components
Conductor	Electrolytic Copper (Plain or Tinned) and Aluminium conductor in form of Solid/Stranded Circular, Shaped as per IS 8130, IEC 60228 & BS EN 60228. The sector shaped conductor are manufactured with pre-spiral lay which gives compact shape to the cable with reduced diameter at laid up stage.
Insulation	90°C thermoset dielectric, is applied as insulation over the conductor by extrusion process. Cross Linked Polyethylene (XLPE) as per IS 7098-1, IEC 60502-1, BS 7655.
Laying up of Cores	The multi-cores are Laid-up with appropriate tooling to form a compact circular shape, PVC fillers can be applied (wherever necessary) to provide circular shape.
Innersheath	PVC / LSZH innersheath is applied as a protection over the laid up cores, Innersheath can be offered in two forms Extruded or Taped. Extruded PVC bedding of ST2/LSZH as per IS 5831, IEC 60502-1, BS 7655. Cables with special properties of FR and FRLS can be offered Taped Bedding of Thermoplastic tape to be compatible with temperature rating of the cable as per IS 7098-1, IEC 60502-1.
Armour	Galvanised Steel Round Wire as per IS 3975, IEC 60502-1, BS 10257. Galvanised Steel Flat Strip as per IS 3975, IEC 60502-1. For Single Core cables to be used in AC circuits Aluminium Round Wire or Flat Strip armour is provided to avoid magnetic hysteresis losses. *We also offer double sheathed and double wire armoured cables for special applications.
Outersheath	PVC / LSZH outersheath is applied by extrusion process generally black in colour with sequential length marking and required details printed with non-contact ink jet printer and also embossing can be provided. Cables with special properties of FR and FRLS can be offered. Poly-Vinyl Chloride (PVC) as per IS 5831, IEC 60502-1, BS 7655. Low Smoke Zero Halogen (LSZH) as per IEC 60502-1.

***We also offer cables with PVC insulation**





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



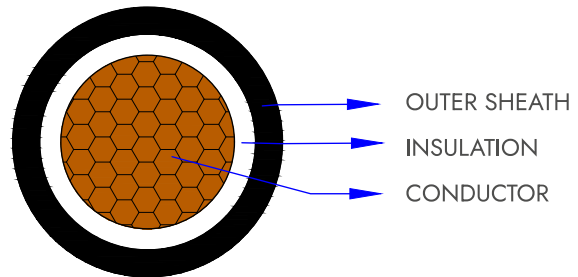
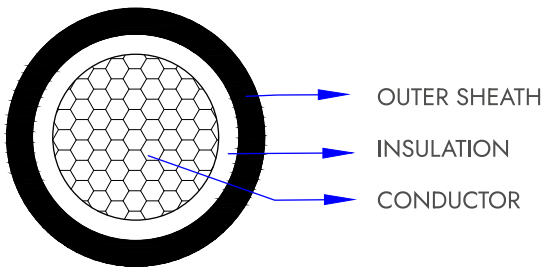
TYPICAL CROSS SECTION VIEW OF LT CABLES

SINGLE CORE CABLES

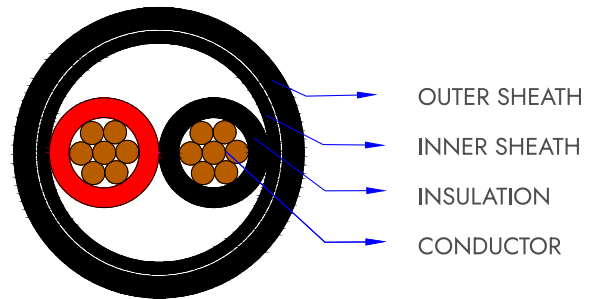
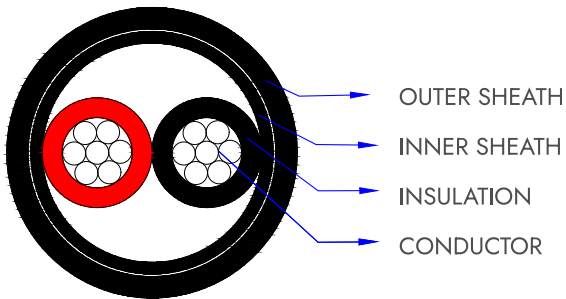


UNARMoured CABLES

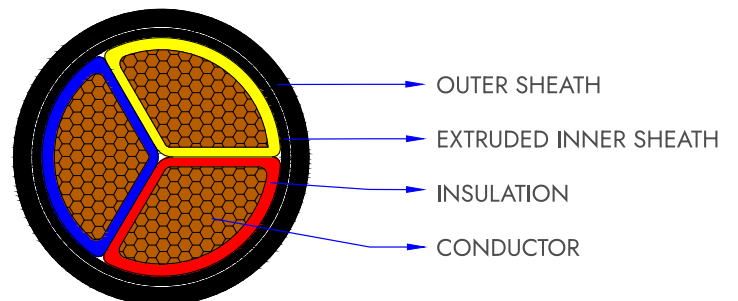
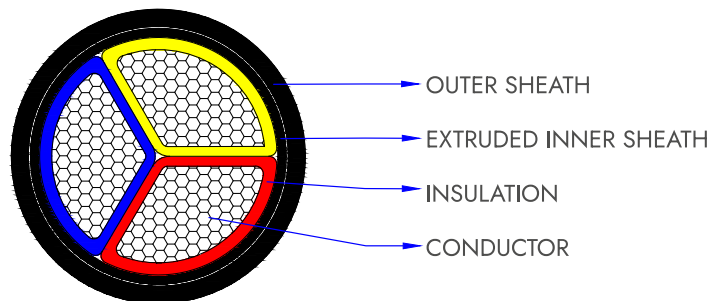
1 Core Unarmoured Cable – A2XY (ALUMINIUM) / 2XY (COPPER)



2 Core Unarmoured Cable – A2XY (ALUMINIUM) / 2XY (COPPER)



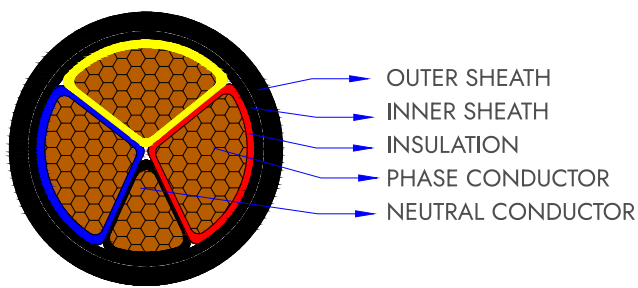
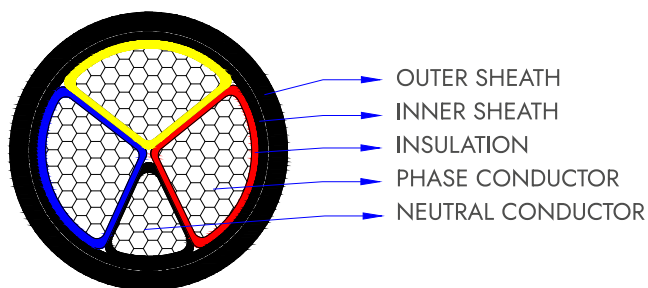
3 Core Unarmoured Cable – A2XY (ALUMINIUM) / 2XY (COPPER)



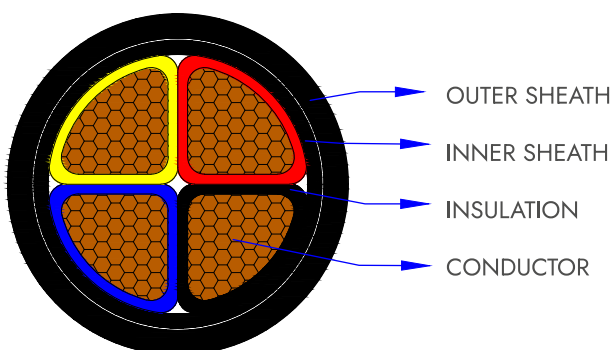
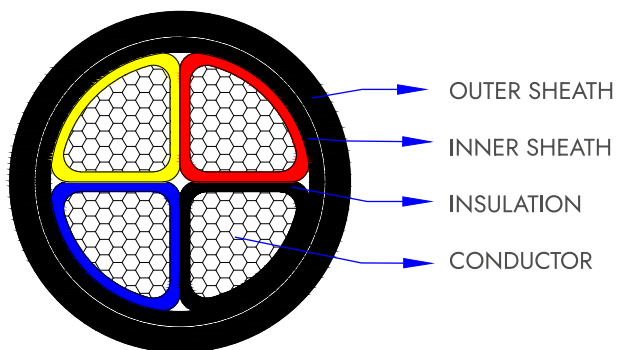


THREE CORE CABLES

3.5 Core Unarmoured Cable – A2XY (ALUMINIUM) / 2XY (COPPER)

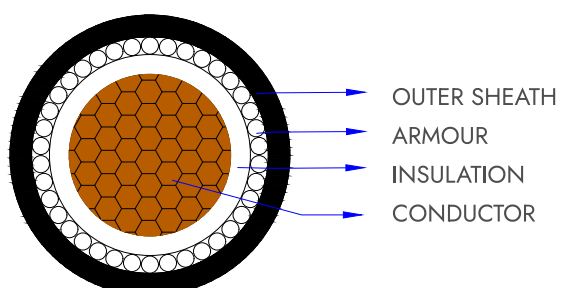
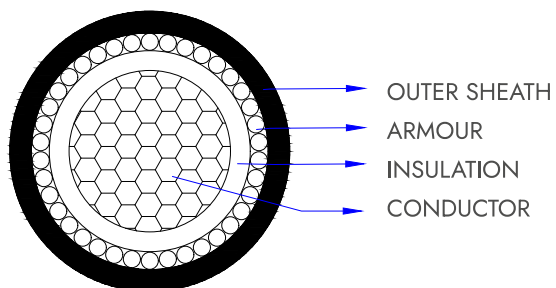


4 Core Unarmoured Cable – A2XY (ALUMINIUM) / 2XY (COPPER)



ARMOURED CABLES

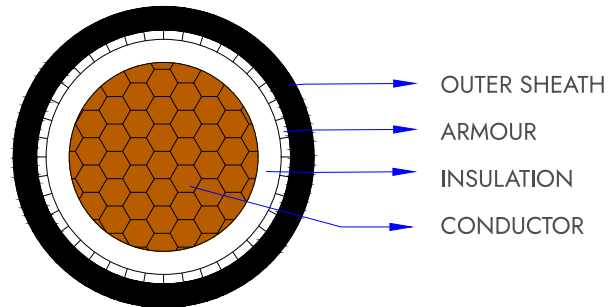
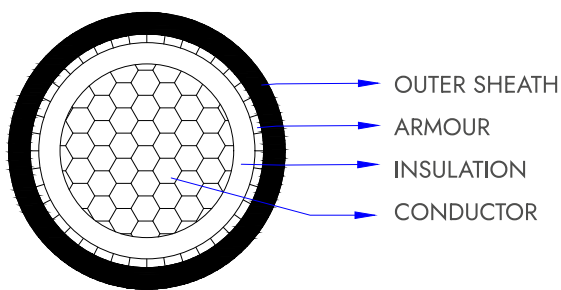
1 Core Round Wire Armoured Cable – A2XWαY (ALUMINIUM) / 2XWαY (COPPER)



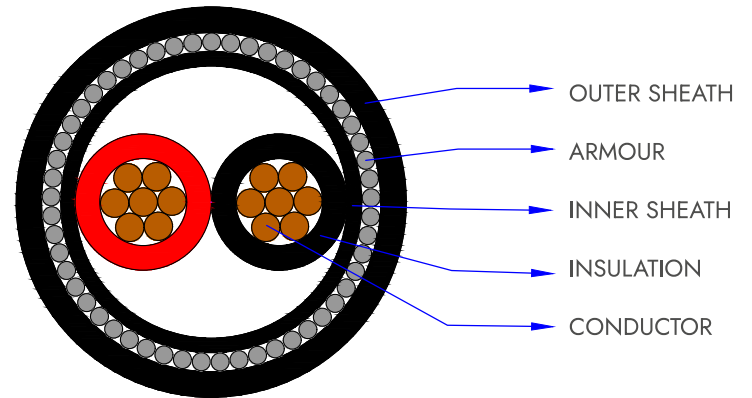
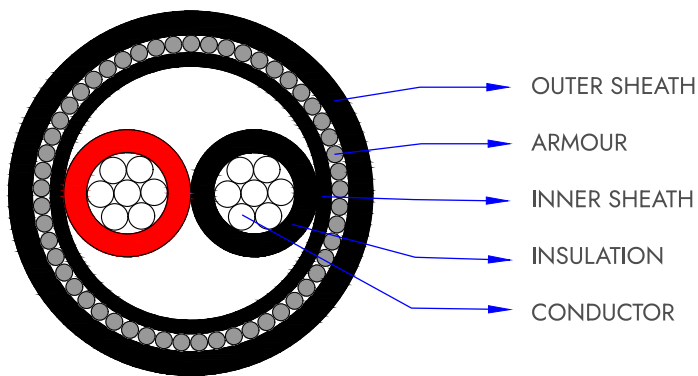


SINGLE CORE CABLES (UNSCREENED)

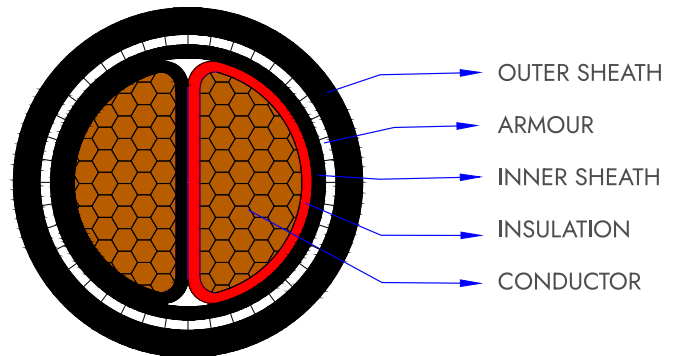
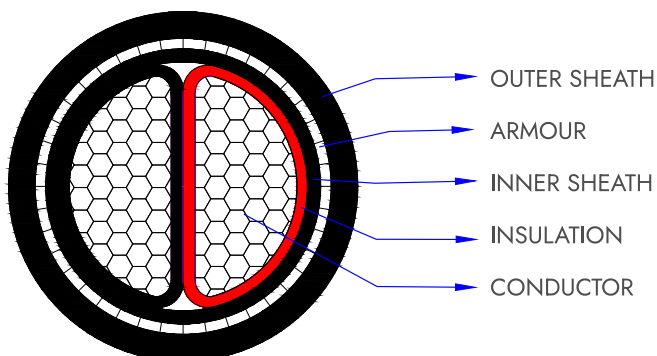
1 Core Flat Strip Armoured Cable – A2XFaY (ALUMINIUM) / 2XFaY (COPPER)



2 Core Round Wire Armoured Cable – A2XWY (ALUMINIUM) / 2XWY (COPPER)



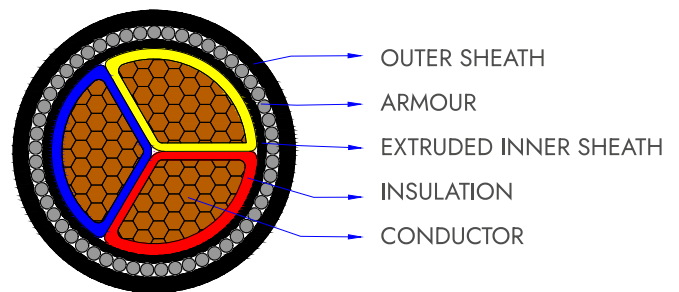
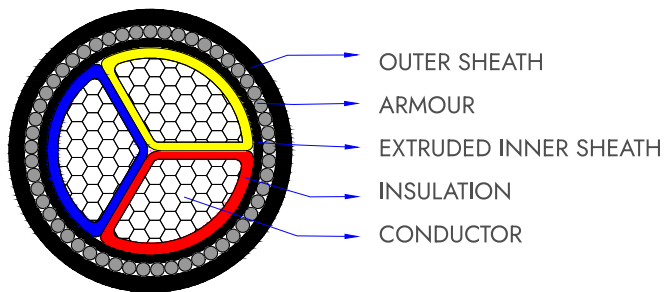
2 Core Flat Strip Armoured Cable – A2XFY (ALUMINIUM) / 2XFY (COPPER)



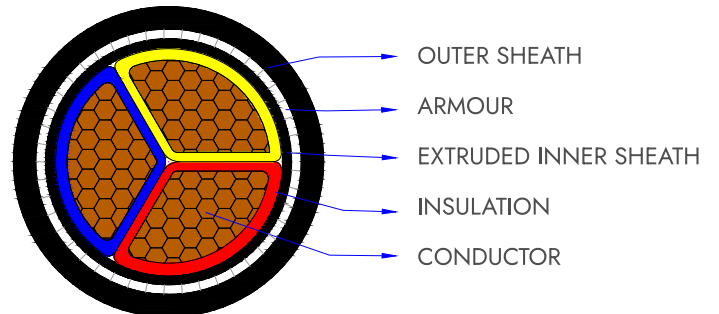
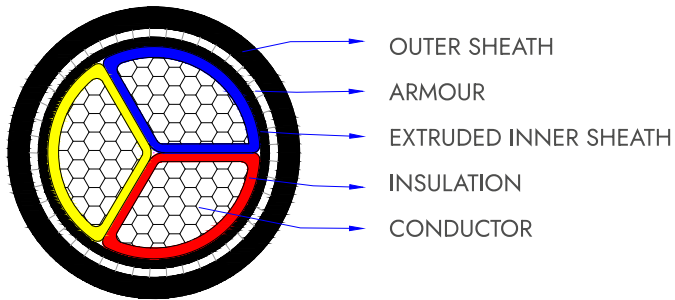


THREE CORE CABLES (UNSCREENED)

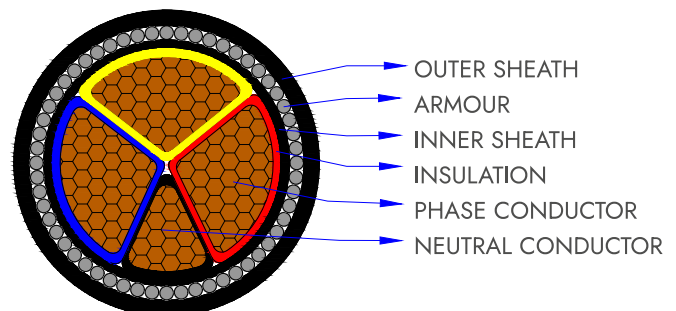
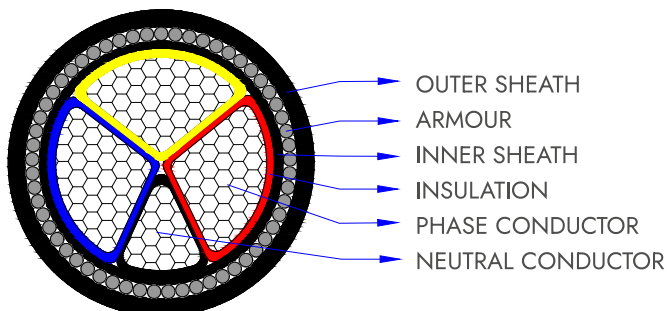
3 Core Round Wire Armoured Cable – A2XWY (ALUMINIUM) / 2XWY (COPPER)



3 Core Flat Strip Armoured Cable – A2XFY (ALUMINIUM) / 2XFY (COPPER)



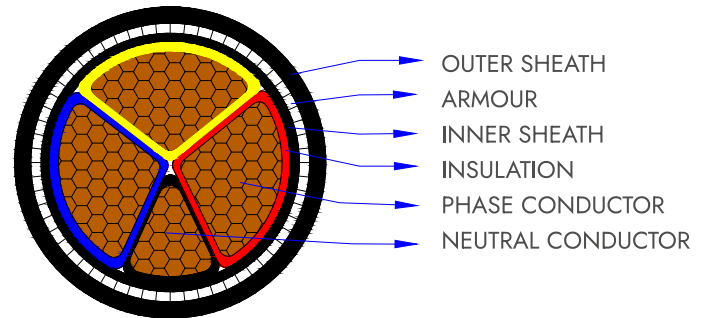
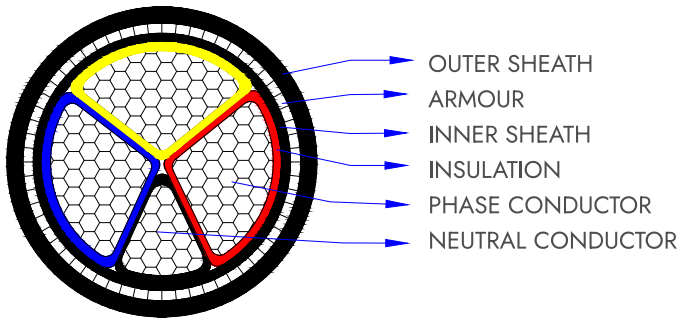
3.5 Core Round Wire Armoured Cable – A2XWY (ALUMINIUM) / 2XWY (COPPER)



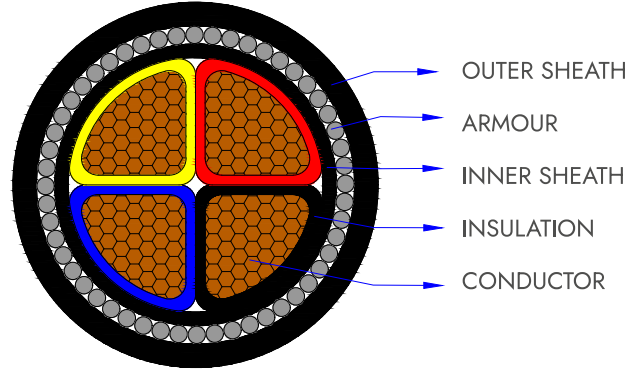
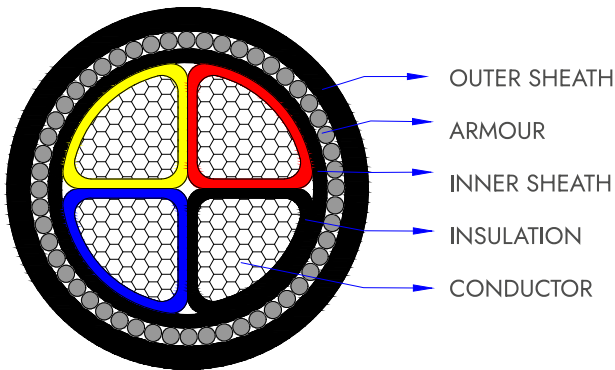


MULTICORE CABLES (UNSCREENED)

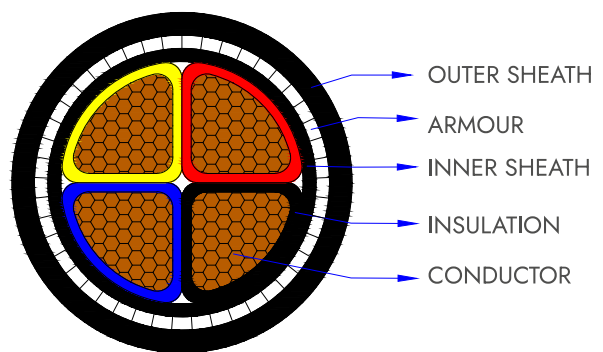
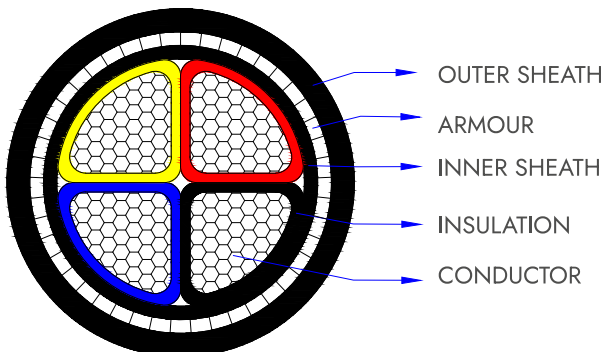
3.5 Core Flat Strip Armoured Cable – A2XFY (ALUMINIUM) / 2XFY (COPPER)



4 Core Round Wire Armoured Cable – A2XWY (ALUMINIUM) / 2XWY (COPPER)



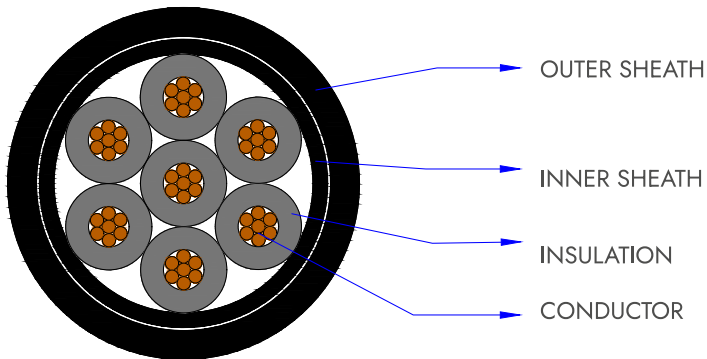
4 Core Flat Strip Armoured Cable – A2XFY (ALUMINIUM) / 2XFY (COPPER)



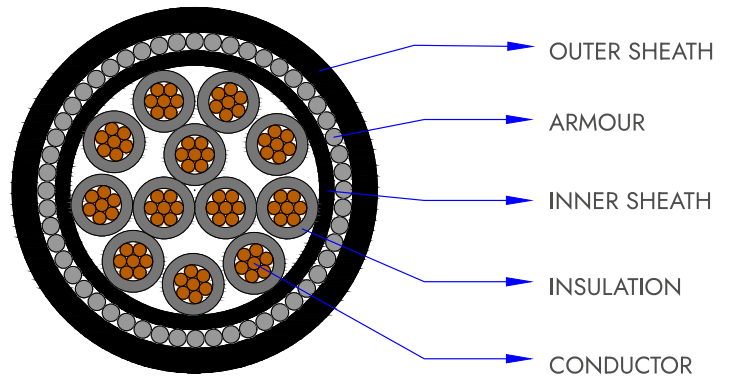


MULTICORE CONTROL CABLE

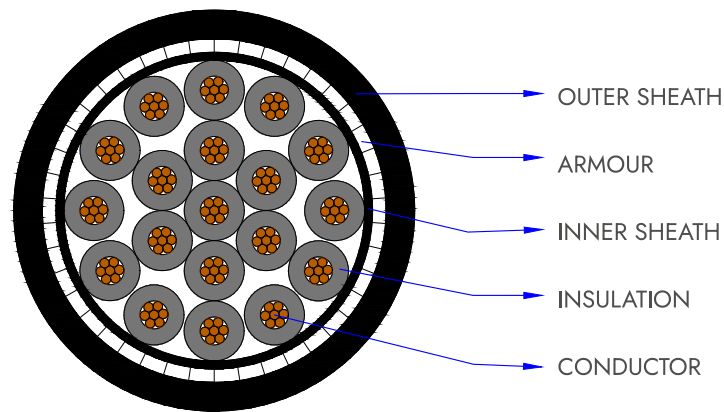
Unarmoured Cable – 2XY (COPPER)



Round Wire Armoured Cable – 2XWY (COPPER)



Flat Strip Armoured Cable – 2XFY (COPPER)





MANUFACTURING PROCESS

Conductor Wire drawing, annealing & Stranding	QC
Insulation Insulated with XLPE/ PVC Compound	QC
Laying Up/ Twisting All rebound course to be arranged to form a cable	QC
Inner Sheathing Innersheath or PVC through extrusion/ tape method	QC
Armouring Armour of steel wire/ stripped/ tape as per specifications & customer requirement	QC
Outer Sheathing Extruded PVC compound such as FR/ FRLS/ LSZH can be used for outersheath as per customer specification	QC
Final Testing Cables bound on drums and final tested as per applicable standards	QC
Packing/ Marking Marking Details, Lagging Coverage	QC
Storage/ Dispatch Cables stored and packed in drums for dispatched 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.
- 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, anti-rodent, UV resistant, etc.
- Bill of quantity/ required length of cables (drum schedules).

APAR LT 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 1: Single Core XLPE insulated armoured and unarmoured cable with Aluminium/ Copper Conductor confirming to IS 7098 P-1/ 1988

Area	Thickness of insulation (Nom.)		Dimension of armour (Nom.)		Thickness of outer sheath			Approx overall diameter			Approx net Weight of Cable					
	Arm	Unarm	Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-arm (Nom.)	For round wire arm	For flat strip srm	Un-srm	Round wire armoured		Flat strip armoured		Unarmoured	
											Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Al	Cu	Al	Cu	Al	Cu
4	*	0.7	*	*	*	*	1.8	*	*	8.5	*	*	*	*	80	100
6	*	0.7	*	*	*	*	1.8	*	*	9.0	*	*	*	*	95	120
10	1.0	0.7	1.4	*	1.24	*	1.8	12.0	*	9.5	165	225	*	*	110	165
16	1.0	0.7	1.4	*	1.24	*	1.8	13.0	*	10.5	200	290	*	*	135	225
25	1.2	0.9	1.4	*	1.24	*	1.8	14.5	*	12.0	250	400	*	*	175	325
35	1.2	0.9	1.4	*	1.24	*	1.8	15.5	*	13.0	300	500	*	*	215	415
50	1.3	1	1.4	*	1.24	*	1.8	16.5	*	14.0	350	630	*	*	260	540
70	1.4	1.1	1.4	*	1.24	*	1.8	18.5	*	16.0	445	840	*	*	340	740
95	1.4	1.1	1.6	4 X 0.8	1.4	1.4	1.8	20.5	19.5	17.5	580	1130	515	1070	425	980
120	1.5	1.2	1.6	4 X 0.8	1.4	1.4	1.8	22.5	21.0	19.0	675	1375	610	1310	510	1210
150	1.7	1.4	1.6	4 X 0.8	1.4	1.4	2	24.0	23.0	21.5	790	1670	715	1595	630	1510
185	1.9	1.6	1.6	4 X 0.8	1.4	1.4	2	26.0	25.0	23.5	945	2035	865	1960	765	1860
240	2	1.7	1.6	4 X 0.8	1.4	1.4	2	28.5	27.5	26.0	1150	2600	1060	2510	955	2405
300	2.1	1.8	1.6	4 X 0.8	1.56	1.56	2	31.0	30.0	28.0	1390	3210	1290	3120	1145	2970
400	2.4	2	2	4 X 0.8	1.56	1.56	2.2	35.5	33.5	32.0	1790	4115	1605	3925	1460	3785
500	2.6	2.2	2	4 X 0.8	1.56	1.56	2.2	39.5	37.5	36.0	2210	5185	1990	4970	1830	4810
630	2.8	2.4	2	4 X 0.8	1.72	1.72	2.2	43.5	41.5	39.5	2745	6585	2500	6360	2300	6150
800	3.1	2.6	2	4 X 0.8	1.88	1.72	2.4	48.5	46.5	44.5	3425	8335	3105	8040	2910	7835
1000	3.3	2.8	2.5	4 X 0.8	2.04	1.88	2.6	55.0	51.5	49.5	4300	10485	3825	10020	3600	9790

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	
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Direct in ground at 30° C		In duct at 30° C		In air at 40° C		KA(rms)	
							Amps	Amps	Amps	Amps	Amps	Amps	Al	Cu
mm ²	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
4	7.41	4.61	9.48	5.90	*	0.132	37	47	34	43	33	41	0.38	0.57
6	4.61	3.08	5.90	3.94	*	0.123	47	58	43	53	43	52	0.56	0.86
10	3.08	1.83	3.94	2.34	0.134	0.114	59	77	54	70	55	71	0.94	1.43
16	1.91	1.15	2.44	1.47	0.125	0.108	76	98	69	89	72	94	1.50	2.29
25	1.20	0.727	1.54	0.930	0.117	0.102	98	126	89	114	98	126	2.36	3.56
35	0.868	0.524	1.11	0.671	0.112	0.098	116	150	106	136	119	154	3.30	5.00
50	0.641	0.387	0.82	0.495	0.106	0.093	137	177	124	160	145	187	4.72	7.15
70	0.443	0.268	0.567	0.343	0.1	0.089	168	216	151	195	185	238	6.60	10.01
95	0.320	0.193	0.41	0.247	0.099	0.086	202	260	181	233	235	303	8.96	13.58
120	0.253	0.153	0.324	0.196	0.095	0.083	230	295	206	264	276	354	11.32	17.16
150	0.206	0.124	0.264	0.159	0.093	0.082	256	329	229	294	314	403	14.16	21.45
185	0.164	0.0991	0.210	0.127	0.092	0.082	290	371	258	330	366	468	17.46	26.45
240	0.125	0.0754	0.160	0.0965	0.089	0.08	335	427	298	379	434	553	22.65	34.32
300	0.100	0.0601	0.128	0.0769	0.087	0.079	376	477	333	422	500	634	28.32	42.90
400	0.0778	0.047	0.100	0.0604	0.086	0.078	429	537	378	473	589	737	37.76	57.25
500	0.0605	0.0366	0.0774	0.0468	0.084	0.077	485	598	426	525	685	844	47.20	71.50
630	0.0469	0.0283	0.0600	0.0362	0.083	0.076	546	661	477	578	793	961	59.45	90.10
800	0.0367	0.0221	0.0470	0.0283	0.082	0.075	608	721	528	626	907	1077	75.50	114.4
1000	0.0291	0.0176	0.0372	0.0225	0.081	0.071	665	772	575	668	1022	1188	94.40	143.00



TABLE 2: 2 Core XLPE insulated armoured and unarmoured cable with Aluminium/ Copper Conductor confirming to IS 7098 P-1/ 1988

Area	Thickness of XLPE insulation	Inner-sheath thickness	Dimension of armour (nom.)		Thickness of PVC outersheath			Approx overall diameter			Approx net weight of cable					
	(Nom)	(Min.)	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 ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
											Al	Cu	Al	Cu	Al	Cu
4	0.7	0.3	1.4	*	1.24	*	1.8	16.0	*	14.0	470	490	*	*	235	265
6	0.7	0.3	1.4	*	1.24	*	1.8	17.5	*	15.5	560	575	*	*	290	325
10	0.7	0.3	1.4	*	1.24	*	1.8	18.5	*	16.5	580	700	*	*	285	410
16	0.7	0.3	1.4	*	1.4	*	1.8	20.5	*	18.0	700	885	*	*	360	545
25	0.9	0.3	1.6	4 X 0.8	1.4	1.4	2.0	22.0	21.0	19.5	850	1150	660	960	420	740
35	0.9	0.3	1.6	4 X 0.8	1.4	1.4	2.0	23.5	22.0	21.0	955	1370	755	1175	510	940
50	1.0	0.3	1.6	4 X 0.8	1.4	1.4	2.0	25.5	24.5	23.5	1135	1700	895	1460	640	1210
70	1.1	0.3	1.6	4 X 0.8	1.56	1.56	2.0	28.5	27.5	26.0	1390	2210	1125	1950	810	1630
95	1.1	0.4	2.0	4 X 0.8	1.56	1.56	2.2	31.5	29.5	28.5	1800	2950	1320	2470	1010	2160
120	1.2	0.4	2.0	4 X 0.8	1.56	1.56	2.2	34.0	32.0	31.0	2070	3510	1560	3005	1210	2655
150	1.4	0.4	2.0	4 X 0.8	1.72	1.72	2.2	37.0	35.0	34.0	2415	4210	1850	3650	1440	3235
185	1.6	0.5	2.0	4 X 0.8	1.88	1.72	2.4	40.5	38.0	37.5	2850	5090	2190	4435	1770	4020
240	1.7	0.5	2.5	4 X 0.8	2.04	1.88	2.6	45.5	42.0	41.0	3710	6665	2660	5620	2210	5165
300	1.8	0.6	2.5	4 X 0.8	2.2	2.04	2.8	49.0	46.0	45.0	4345	8055	3200	6910	2700	6415
400	2.0	0.6	2.5	4 X 0.8	2.36	2.36	3.0	54.5	51.5	50.5	5195	9930	3955	8690	3375	8110

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	
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/km	Ohm/km	Direct in ground at 30° C		In duct at 30° c		In air at 40° c		KA(rms)	
							Amps	Amps	Amps	Amps	Amps	Amps	Al	Cu
mm ²	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
4	7.41	4.61	9.48	5.9	0.0927	0.0927	42	54	36	45	38	48	0.38	0.57
6	4.61	3.08	5.90	3.94	0.0884	0.0884	55	67	46	56	50	61	0.56	0.86
10	3.08	1.83	3.94	2.34	0.0837	0.0837	68	89	57	75	64	83	0.94	1.43
16	1.91	1.15	2.44	1.47	0.0808	0.0808	89	115	74	96	83	108	1.50	2.29
25	1.20	0.727	1.54	0.93	0.0802	0.0802	114	147	95	122	109	140	2.36	3.56
35	0.868	0.524	1.11	0.671	0.080	0.080	136	176	113	146	133	172	3.30	5.00
50	0.641	0.387	0.82	0.495	0.076	0.076	161	208	134	173	162	208	4.72	7.15
70	0.443	0.268	0.567	0.343	0.075	0.075	197	253	164	211	204	262	6.60	10.01
95	0.320	0.193	0.410	0.247	0.073	0.073	235	302	196	252	251	322	8.96	13.58
120	0.253	0.153	0.324	0.196	0.071	0.071	266	340	222	284	287	368	11.32	17.16
150	0.206	0.124	0.264	0.159	0.071	0.071	296	379	248	317	328	419	14.16	21.45
185	0.164	0.0991	0.210	0.127	0.071	0.071	335	425	281	357	379	482	17.46	26.45
240	0.125	0.0754	0.160	0.0965	0.071	0.071	385	486	324	409	448	566	22.65	34.32
300	0.100	0.0601	0.128	0.0769	0.071	0.071	432	541	364	456	513	644	28.32	42.90
400	0.0778	0.047	0.100	0.0604	0.070	0.070	487	602	412	508	593	734	37.76	57.25





TABLE 3: 3 Core XLPE insulated armoured and unarmoured cable with Aluminium/ Copper Conductor confirming to IS 7098 P-1/ 1988

Area	Thickness of XLPE insulation (Nom)	Inner-sheath thickness (Min.)	Dimension of armour (Nom.)		Thickness of PVC outersheath			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 ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
											Al	Cu	Al	Cu	Al	Cu
4	0.7	0.3	1.4	*	1.24	*	1.8	16.5	*	14.50	505	540	*	*	260	310
6	0.7	0.3	1.4	*	1.24	*	1.8	18.0	*	16.00	600	645	*	*	320	385
10	0.7	0.3	1.4	*	1.24	*	1.8	19.0	*	17.50	625	810	*	*	325	505
16	0.7	0.3	1.6	4 X 0.8	1.4	1.24	1.8	19.0	17.5	16.50	700	980	555	810	345	625
25	0.9	0.3	1.6	4 X 0.8	1.4	1.4	2.0	22.0	21.0	20.00	905	1360	715	1170	505	955
35	0.9	0.3	1.6	4 X 0.8	1.4	1.4	2.0	24.0	22.5	22.00	1060	1690	845	1470	615	1245
50	1.0	0.3	1.6	4 X 0.8	1.56	1.4	2.0	27.0	25.5	24.50	1320	2170	1045	1890	775	1625
70	1.1	0.4	2	4 X 0.8	1.56	1.56	2.2	31.0	29.0	28.00	1800	3030	1340	2580	1040	2270
95	1.1	0.4	2	4 X 0.8	1.56	1.56	2.2	34.0	32.0	31.00	2150	3875	1640	3365	1295	3020
120	1.2	0.4	2	4 X 0.8	1.72	1.56	2.2	37.5	35.0	34.00	2545	4710	1955	4120	1570	3740
150	1.4	0.5	2	4 X 0.8	1.88	1.72	2.4	41.0	38.5	38.00	3015	5710	2330	5025	1920	4620
185	1.6	0.5	2.5	4 X 0.8	2.04	1.88	2.6	46.0	42.5	42.00	3905	7275	2840	6210	2375	5745
240	1.7	0.6	2.5	4 X 0.8	2.2	2.04	2.8	50.5	47.5	47.00	4725	9160	3525	7960	3020	7450
300	1.8	0.6	2.5	4 X 0.8	2.36	2.2	3.0	55.5	52.0	51.50	5530	11095	4230	9800	3680	9250
400	2.0	0.7	3.15	4 X 0.8	2.68	2.52	3.2	63.5	59.0	58.00	7445	14550	5320	12425	4675	11780

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	
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/km	Direct in ground at 30° C		In duct at 30° C		In air at 40° C			
mm ²	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
4	7.41	4.61	9.48	5.90	0.0927	0.0927	35	45	30	38	32	41	0.38	0.57
6	4.61	3.08	5.9	3.94	0.0884	0.0884	46	56	38	47	42	52	0.56	0.86
10	3.08	1.83	3.94	2.34	0.0837	0.0837	57	74	48	62	54	70	0.94	1.43
16	1.91	1.15	2.44	1.47	0.0802	0.0802	74	95	61	79	69	89	1.50	2.29
25	1.20	0.727	1.54	0.930	0.08	0.08	95	122	79	102	93	119	2.36	3.56
35	0.868	0.524	1.11	0.671	0.079	0.079	114	146	94	122	114	147	3.30	5.00
50	0.641	0.387	0.82	0.495	0.078	0.078	134	173	112	144	138	179	4.72	7.15
70	0.443	0.268	0.567	0.343	0.077	0.077	164	212	137	177	175	226	6.60	10.01
95	0.320	0.193	0.410	0.247	0.077	0.077	197	254	164	212	216	279	8.96	13.58
120	0.253	0.153	0.324	0.196	0.072	0.072	223	287	187	240	249	320	11.32	17.16
150	0.206	0.124	0.264	0.159	0.072	0.072	249	321	209	269	284	365	14.16	21.45
185	0.164	0.0991	0.210	0.127	0.072	0.072	282	362	238	304	329	422	17.46	26.45
240	0.125	0.0754	0.160	0.0965	0.072	0.072	327	418	276	352	392	500	22.65	34.32
300	0.100	0.0601	0.128	0.0769	0.071	0.071	369	469	312	396	452	574	28.32	42.90
400	0.0778	0.047	0.100	0.0604	0.070	0.070	420	528	356	447	526	662	37.76	57.25



TABLE 4: 3 1/2 Core XLPE insulated armoured and unarmoured cable with Aluminium/ Copper Conductor confirming to IS 7098 P-1 /1988

Area	Thickness of XLPE insulation (P/N)	Inner-sheath thickness	Dimension of armour (Nom.)		Thickness of PVC outersheath			Approx overall diameter			Approx net weight of cable						
	(Nom)		(Min.)	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 ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
												Al	Cu	Al	Cu	Al	Cu
25/16	0.9 / 0.7	0.3	1.6	4 X 0.8	1.4	1.4	2.0	24	23	22	1030	1575	815	1360	585	1130	
35/16	0.9 / 0.7	0.3	1.6	4 X 0.8	1.4	1.4	2.0	26	25	24	1205	1925	970	1690	700	1420	
50/25	1.0 / 0.9	0.3	1.6	4 X 0.8	1.56	1.4	2.0	29.5	28	27	1500	2505	1210	2210	900	1900	
70/35	1.1 / 0.9	0.4	2	4 X 0.8	1.56	1.56	2.2	34	32	31	2050	3495	1540	2985	1200	2640	
95/50	1.1 / 1.0	0.4	2	4 X 0.8	1.56	1.56	2.2	37.5	35	34.5	2470	4480	1880	3890	1500	3515	
120/70	1.2 / 1.1	0.4	2	4 X 0.8	1.72	1.72	2.2	41	39	37.5	2935	5515	2290	4870	1850	4425	
150/70	1.4 / 1.1	0.5	2	4 X 0.8	1.88	1.72	2.4	45	43	42	3425	6530	2680	5785	2220	5325	
185/95	1.6 / 1.1	0.5	2.5	4 X 0.8	2.04	1.88	2.6	50.5	47	46.6	4455	8400	3265	7210	2745	6690	
240/120	1.7 / 1.2	0.6	2.5	4 X 0.8	2.2	2.04	2.8	56	52.5	52	5380	10535	4045	9200	3500	8650	
300/150	1.8 / 1.4	0.6	2.5	4 X 0.8	2.36	2.2	3.0	61	57.5	57	6320	12780	4850	11315	4260	10725	
400/185	2.0 / 1.6	0.7	3.15	4 X 0.8	2.68	2.52	3.4	70.5	65.5	65.5	8460	16690	6115	14340	5470	13700	

Area	Max DC resistance at 20° C						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 ²	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/km	Amps	Amps	Amps	Amps	Amps	Amps	KA(rms)	KA(rms)
		Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25/16	1.20	0.727	1.54	0.93	0.08	0.08	0.08	95	122	79	102	93	119	2.36	3.56
35/16	0.868	0.524	1.11	0.671	0.079	0.079	0.079	114	146	94	122	114	147	3.30	5.00
50/25	0.641	0.387	0.82	0.495	0.078	0.078	0.078	134	173	112	144	138	179	4.72	7.15
70/35	0.443	0.268	0.567	0.343	0.077	0.077	0.077	164	212	137	177	175	226	6.60	10.01
95/50	0.320	0.193	0.410	0.247	0.077	0.077	0.077	197	254	164	212	216	279	8.96	13.58
120/70	0.253	0.153	0.324	0.196	0.072	0.072	0.072	223	287	187	240	249	320	11.32	17.16
150/70	0.206	0.124	0.264	0.159	0.072	0.072	0.072	249	321	209	269	284	365	14.16	21.45
185/95	0.164	0.0991	0.210	0.127	0.072	0.072	0.072	282	362	238	304	329	422	17.46	26.45
240/120	0.125	0.0754	0.160	0.0965	0.072	0.072	0.072	327	418	276	352	392	500	22.65	34.32
300/150	0.100	0.0601	0.128	0.0769	0.071	0.071	0.071	369	469	312	396	452	574	28.32	42.90
400/185	0.0778	0.047	0.100	0.0604	0.070	0.070	0.070	420	528	356	447	526	662	37.76	57.25



TABLE 5: 4 Core XLPE insulated armoured and unarmoured cable with Aluminium/ Copper Conductor confirming to IS 7098 P-1 /1988

Area	Thickness of XLPE insulation	Inner-Sheath Thickness	Dimension of armour (Nom.)		Thickness of PVC outersheath			Approx overall diameter			Approx net weight of cable					
	(Nom)	(Min.)	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 ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM
											Al	Cu	Al	Cu	Al	Cu
4	0.7	0.3	1.4	*	1.24	*	1.8	17.0	*	16.0	565	625	*	*	300	365
6	0.7	0.3	1.4	*	1.24	*	1.8	18.5	*	17.5	690	760	*	*	375	465
10	0.7	0.3	1.4	*	1.4	*	1.8	21.0	*	19.0	730	974	*	*	385	625
16	0.7	0.3	1.6	4 X 0.8	1.4	1.4	1.8	21.5	20.0	21.0	830	1210	670	1050	490	860
25	0.9	0.3	1.6	4 X 0.8	1.4	1.4	2.0	25.5	24.0	23.0	1110	1710	885	1490	640	1240
35	0.9	0.3	1.6	4 X 0.8	1.4	1.4	2.0	27.5	26.5	25.5	1315	2150	1070	1905	785	1615
50	1.0	0.3	1.6	4 X 0.8	1.56	1.56	2.0	31.5	30.0	29.0	1640	2770	1345	2475	1000	2120
70	1.1	0.4	2	4 X 0.8	1.56	1.56	2.2	36.0	34.0	33.0	2250	3900	1715	3360	1335	2975
95	1.1	0.4	2	4 X 0.8	1.72	1.56	2.2	40.0	38.0	37.0	2735	5040	2090	4390	1675	3970
120	1.2	0.5	2	4 X 0.8	1.88	1.72	2.4	44.0	41.5	40.5	3260	6150	2515	5405	2075	4955
150	1.4	0.5	2.5	4 X 0.8	2.04	1.88	2.6	49.5	46.5	45.5	4215	7810	3040	6630	2545	6130
185	1.6	0.5	2.5	4 X 0.8	2.2	2.04	2.8	54.0	51.0	50.0	4945	9435	3670	8160	3135	7615
240	1.7	0.6	2.5	4 X 0.8	2.36	2.2	3.0	60.0	57.0	56.5	6050	11960	4580	10470	3990	9890
300	1.8	0.7	3.15	4 X 0.8	2.52	2.36	3.2	67.5	62.5	62.0	7790	15210	5525	12950	4905	12310
400	2.0	0.7	3.15	4 X 0.8	2.84	2.68	3.6	75.5	71.0	71.0	9520	19000	6945	16415	6245	15700

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	
	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/KM	Ohm/km	Direct in ground at 30° C		In duct at 30° C		In air at 40° C		Al	Cu
mm ²	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
4	7.41	4.61	9.48	5.9	0.0927	0.0927	35	45	30	38	32	41	0.38	0.57
6	4.61	3.08	5.90	3.94	0.0884	0.0884	46	56	38	47	42	52	0.56	0.86
10	3.08	1.83	3.94	2.34	0.0837	0.0837	57	74	48	62	54	70	0.94	1.43
16	1.91	1.15	2.44	1.47	0.0802	0.0802	74	95	61	79	69	89	1.50	2.29
25	1.20	0.727	1.54	0.93	0.08	0.08	95	122	79	102	93	119	2.36	3.56
35	0.868	0.524	1.11	0.671	0.079	0.079	114	146	94	122	114	147	3.30	5.00
50	0.641	0.387	0.82	0.495	0.078	0.078	134	173	112	144	138	179	4.72	7.15
70	0.443	0.268	0.567	0.343	0.077	0.077	164	212	137	177	175	226	6.60	10.01
95	0.320	0.193	0.410	0.247	0.077	0.077	197	254	164	212	216	279	8.96	13.58
120	0.253	0.153	0.324	0.196	0.072	0.072	223	287	187	240	249	320	11.32	17.16
150	0.206	0.124	0.264	0.159	0.072	0.072	249	321	209	269	284	365	14.16	21.45
185	0.164	0.0991	0.210	0.127	0.072	0.072	282	362	238	304	329	422	17.46	26.45
240	0.125	0.0754	0.16	0.0965	0.072	0.072	327	418	276	352	392	500	22.65	34.32
300	0.100	0.0601	0.128	0.0769	0.071	0.071	369	469	312	396	452	574	28.32	42.90
400	0.0778	0.047	0.100	0.0604	0.070	0.070	420	528	356	447	526	662	37.76	57.25



TABLE 6: XLPE insulated armoured and unarmoured cable with Copper Conductor of 1.5 sq.mm confirming to IS 7098 P-1/ 1988

No of cores	Thickness of XLPE insulation	Inner-sheath thickness	Dimension of armour (Nom.)		Thickness of PVC outersheath			Approx overall diameter			Approx net weight of cable						
											Round wire armoured		Flat strip armoured		Unarmoured		
											(Nom.)	(Min.)	Wire	Strip	For round wire arm (Min.)	For flat strip arm (Min.)	Un-arm (Nom.)
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	Kg/KM	
2	0.7	0.3	1.4	*	1.24	*	1.8	13.0	*	11.5	*	350	*	*	*	*	175
3	0.7	0.3	1.4	*	1.24	*	1.8	13.5	*	12.0	*	385	*	*	*	*	195
4	0.7	0.3	1.4	*	1.24	*	1.8	14.5	*	13.0	*	440	*	*	*	*	225
5	0.7	0.3	1.4	*	1.24	*	1.8	15.5	*	13.5	*	460	*	*	*	*	235
6	0.7	0.3	1.4	*	1.24	*	1.8	16.5	*	14.5	*	520	*	*	*	*	270
7	0.7	0.3	1.4	*	1.24	*	1.8	16.5	*	14.5	*	520	*	*	*	*	275
10	0.7	0.3	1.4	*	1.24	*	1.8	19.5	*	18.0	*	680	*	*	*	*	370
12	0.7	0.3	1.4	*	1.24	*	1.8	20.0	*	18.5	*	735	*	*	*	*	415
19	0.7	0.3	1.6	4 X 0.8	1.4	1.4	1.8	23.5	22	21.0	*	1030	*	835	*	575	
27	0.7	0.3	1.6	4 X 0.8	1.4	1.4	2	27.0	25.5	25.0	*	1330	*	1065	*	790	
37	0.7	0.3	1.6	4 X 0.8	1.4	1.4	2	29.5	28.5	28.0	*	1605	*	1325	*	1005	
44	0.7	0.3	1.6	4 X 0.8	1.56	1.4	2	33.0	31.5	31.0	*	1900	*	1530	*	1175	
52	0.7	0.3	1.6	4 X 0.8	1.56	1.56	2	34.5	33.5	32.0	*	2090	*	1745	*	1340	
61	0.7	0.4	2	4 X 0.8	1.56	1.56	2.2	37.5	35.5	34.5	*	2560	*	1995	*	1580	

No of cores	Max DC resistance at 20° C		Approx AC resistance at operating temp 90° C		Capacitance	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			
							Amps	Amps	Amps	Amps	Amps	Amps		
mm ²	Al	Cu	Al	Cu	μF/Km	Ohm/km	Al	Cu	Al	Cu	Al	Cu	Al	Cu
2	*	12.1	*	15.5	0.19	0.106	*	33	*	29	*	29	*	0.21
3	*	12.1	*	15.5	0.19	0.106	*	25	*	22	*	22	*	0.21
4	*	12.1	*	15.5	0.19	0.106	*	25	*	22	*	22	*	0.21
5	*	12.1	*	15.5	0.19	0.106	*	24	*	21	*	21	*	0.21
6	*	12.1	*	15.5	0.19	0.106	*	22	*	19	*	19	*	0.21
7	*	12.1	*	15.5	0.19	0.106	*	21	*	18	*	18	*	0.21
10	*	12.1	*	15.5	0.19	0.106	*	18	*	16	*	16	*	0.21
12	*	12.1	*	15.5	0.19	0.106	*	17	*	15	*	15	*	0.21
19	*	12.1	*	15.5	0.19	0.106	*	15	*	13	*	13	*	0.21
27	*	12.1	*	15.5	0.19	0.106	*	13	*	11	*	11	*	0.21
37	*	12.1	*	15.5	0.19	0.106	*	11	*	10	*	10	*	0.21
44	*	12.1	*	15.5	0.19	0.106	*	11	*	9	*	9	*	0.21
52	*	12.1	*	15.5	0.19	0.106	*	10	*	9	*	9	*	0.21
61	*	12.1	*	15.5	0.19	0.106	*	9	*	8	*	8	*	0.21



Table 7: XLPE insulated armoured and unarmoured cable with Copper Conductor of 2.5 sq.mm² confirming to IS 7098 P-1/ 1988

No of cores	Thickness of XLPE insulation (Nom)	Inner-sheath thickness (Min.)	Dimension of armour (Nom.)		Thickness of PVC outersheath			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 Al	Kg/KM Cu	Kg/KM Al	Kg/KM Cu	Kg/KM Al
2	0.7	0.3	1.4	*	1.24	*	1.8	14.0	*	12.5	*	410	*	*	*	210
3	0.7	0.3	1.4	*	1.24	*	1.8	14.5	*	13.0	*	450	*	*	*	240
4	0.7	0.3	1.4	*	1.24	*	1.8	15.5	*	14.0	*	520	*	*	*	285
5	0.7	0.3	1.4	*	1.24	*	1.8	16.5	*	15.0	*	545	*	*	*	300
6	0.7	0.3	1.4	*	1.24	*	1.8	17.5	*	16.0	*	630	*	*	*	350
7	0.7	0.3	1.4	*	1.24	*	1.8	17.5	*	16.0	*	640	*	*	*	360
10	0.7	0.3	1.6	4 X 0.8	1.4	1.24	1.8	21.5	20	19.5	*	915	*	710	*	485
12	0.7	0.3	1.6	4 X 0.8	1.4	1.4	1.8	22.5	21	20.0	*	995	*	790	*	550
19	0.7	0.3	1.6	4 X 0.8	1.4	1.4	2	25.5	24	23.5	*	1300	*	1060	*	800
27	0.7	0.3	1.6	4 X 0.8	1.4	1.4	2	29.5	28	27.5	*	1680	*	1400	*	1080
37	0.7	0.3	1.6	4 X 0.8	1.56	1.4	2	33.0	31	30.5	*	2105	*	1755	*	1400
44	0.7	0.4	2	4 X 0.8	1.56	1.56	2.2	37.5	35.5	35.0	*	2675	*	2110	*	1690
52	0.7	0.4	2	4 X 0.8	1.56	1.56	2.2	39.0	37	36.0	*	2965	*	2370	*	1935
61	0.7	0.4	2	4 X 0.8	1.56	1.56	2.2	41.0	39	38.5	*	3315	*	2670	*	2215

No of cores	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	μF/Km	Ohm/km	Amps	Amps	Amps	Amps	Amps	Amps	KA(rms)	KA(rms)
2	*	7.41	*	9.48	0.22	0.099	*	39	*	35	*	32	*	0.36
3	*	7.41	*	9.48	0.22	0.099	*	34	*	30	*	30	*	0.36
4	*	7.41	*	9.48	0.22	0.099	*	34	*	30	*	30	*	0.36
5	*	7.41	*	9.48	0.22	0.099	*	31	*	28	*	28	*	0.36
6	*	7.41	*	9.48	0.22	0.099	*	29	*	26	*	26	*	0.36
7	*	7.41	*	9.48	0.22	0.099	*	27	*	25	*	25	*	0.36
10	*	7.41	*	9.48	0.22	0.099	*	24	*	21	*	21	*	0.36
12	*	7.41	*	9.48	0.22	0.099	*	22	*	20	*	20	*	0.36
19	*	7.41	*	9.48	0.22	0.099	*	19	*	17	*	17	*	0.36
27	*	7.41	*	9.48	0.22	0.099	*	16	*	16	*	16	*	0.36
37	*	7.41	*	9.48	0.22	0.099	*	15	*	13	*	13	*	0.36
44	*	7.41	*	9.48	0.22	0.099	*	14	*	12	*	12	*	0.36
52	*	7.41	*	9.48	0.22	0.099	*	13	*	12	*	12	*	0.36
61	*	7.41	*	9.48	0.22	0.099	*	12	*	11	*	11	*	0.36



CURRENT RATING - INSTALLATION CONDITIONS & RATING FACTORS

Method of Installation

The current ratings are also based on the following methods of installation:

A) Single Core cables:	
Type of Installation	Method of Installation
Laid direct in the ground	<ul style="list-style-type: none"> • Three cables in close trefoil formation or • Two cables laid in Flat touching formation.
In Ducts	<ul style="list-style-type: none"> • Three cables in close trefoil formation or • Two cables laid in Flat touching formation.
In air	<ul style="list-style-type: none"> • Three cables in close trefoil formation or • Two cables laid in Flat touching formation.
B) Twin & Multi Core cables	
	Installed singly in ground, duct & in air.

A) RATING FACTORS

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

B) RATING FACTORS

I) For depth of laying (Cables laid direct in the ground)

Depth of laying Mm	Size					
	up to 25 sq.mm		above 25 sq.mm up to 300 sq.mm		above 300 sq.mm	
	Single Core	Multi Core	Single Core	Multi Core	Single Core	Multi Core
750	1.00	1.00	1.00	1.00	1.00	1.00
900	0.98	0.98	0.98	0.98	0.98	0.98
1050	0.97	0.98	0.96	0.97	0.96	0.96
1200	0.96	0.97	0.95	0.95	0.94	0.95
1500	0.94	0.95	0.93	0.93	0.92	0.93
1800	0.93	0.93	0.91	0.92	0.90	0.91
2000	0.92	0.93	0.90	0.91	0.89	0.90
2500	0.90	0.92	0.89	0.89	0.87	0.88
3000	0.90	0.90	0.87	0.88	0.86	0.87



I) For depth of laying (Cables laid in Duct)

Depth of laying Mm	Size					
	Up to 25 sq.mm		Above 25 sq.mm up to 300 sq.mm		Above 300 sq.mm	
	Single Core	Multi Core	Single Core	Multi Core	Single Core	Multi Core
750	1.00	1.00	1.00	1.00	1.00	1.00
900	0.98	0.98	0.98	0.99	0.98	0.98
1050	0.97	0.98	0.96	0.97	0.96	0.97
1200	0.96	0.97	0.95	0.97	0.94	0.96
1500	0.94	0.96	0.93	0.95	0.92	0.94
1800	0.93	0.95	0.91	0.94	0.90	0.93
2000	0.92	0.94	0.90	0.93	0.89	0.92
2500	0.90	0.93	0.88	0.92	0.87	0.91
3000	0.89	0.92	0.87	0.91	0.86	0.90

Rating factors for variation in thermal resistivity of soil for Two single core cables												
Nominal area of conductor mm ²	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
1.5	1.16	1.09	1	0.91	0.81	0.75	1.16	1.09	1	0.91	0.81	0.75
2.5	1.16	1.09	1	0.89	0.81	0.75	1.16	1.09	1	0.89	0.81	0.75
4	1.17	1.09	1	0.89	0.81	0.75	1.17	1.09	1	0.89	0.81	0.75
6	1.17	1.09	1	0.89	0.81	0.75	1.17	1.09	1	0.89	0.81	0.75
10	1.17	1.09	1	0.89	0.80	0.74	1.17	1.09	1	0.89	0.80	0.74
16	1.17	1.09	1	0.89	0.80	0.74	1.17	1.09	1	0.89	0.80	0.74
25	1.18	1.09	1	0.89	0.80	0.74	1.18	1.09	1	0.89	0.80	0.74
35	1.18	1.10	1	0.88	0.80	0.73	1.18	1.10	1	0.88	0.80	0.73
50	1.19	1.10	1	0.88	0.80	0.73	1.19	1.10	1	0.88	0.80	0.73
70	1.19	1.10	1	0.88	0.80	0.73	1.19	1.10	1	0.88	0.80	0.73
95	1.19	1.10	1	0.88	0.79	0.73	1.19	1.10	1	0.88	0.79	0.73
120	1.19	1.10	1	0.88	0.79	0.73	1.19	1.10	1	0.88	0.79	0.73
150	1.19	1.10	1	0.88	0.79	0.73	1.19	1.10	1	0.88	0.79	0.73
185	1.19	1.10	1	0.88	0.79	0.72	1.19	1.10	1	0.88	0.79	0.72
240	1.20	1.10	1	0.88	0.79	0.72	1.20	1.10	1	0.88	0.79	0.72
300	1.20	1.10	1	0.88	0.79	0.72	1.20	1.10	1	0.88	0.79	0.72
400	1.20	1.10	1	0.88	0.79	0.72	1.20	1.10	1	0.88	0.79	0.72
500	1.20	1.11	1	0.87	0.79	0.72	1.20	1.11	1	0.87	0.79	0.72
630	1.20	1.11	1	0.87	0.79	0.72	1.20	1.11	1	0.87	0.79	0.72
800	1.20	1.11	1	0.87	0.79	0.72	1.20	1.11	1	0.87	0.79	0.72
1000	1.20	1.11	1	0.87	0.79	0.72	1.20	1.11	1	0.87	0.79	0.72



Rating factors for variation in thermal resistivity of soil for Three single core cables

Nominal area of conductor mm ²	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
1.5	1.14	1.07	1	0.89	0.80	0.75	1.08	1.04	1	0.92	0.88	0.84
2.5	1.17	1.08	1	0.89	0.80	0.75	1.08	1.05	1	0.93	0.88	0.84
4	1.17	1.09	1	0.88	0.79	0.73	1.08	1.05	1	0.93	0.87	0.83
6	1.17	1.09	1	0.88	0.79	0.73	1.09	1.06	1	0.93	0.87	0.83
10	1.18	1.09	1	0.88	0.79	0.73	1.10	1.06	1	0.93	0.87	0.82
16	1.18	1.10	1	0.88	0.79	0.72	1.10	1.16	1	0.93	0.87	0.82
25	1.19	1.10	1	0.88	0.79	0.72	1.10	1.06	1	0.93	0.87	0.82
35	1.19	1.10	1	0.88	0.79	0.72	1.10	1.06	1	0.93	0.86	0.81
50	1.19	1.10	1	0.88	0.79	0.72	1.11	1.06	1	0.92	0.86	0.81
70	1.20	1.11	1	0.88	0.79	0.72	1.11	1.06	1	0.92	0.86	0.80
95	1.20	1.11	1	0.87	0.79	0.72	1.12	1.06	1	0.92	0.85	0.80
120	1.20	1.11	1	0.87	0.79	0.72	1.12	1.06	1	0.91	0.85	0.79
150	1.20	1.11	1	0.87	0.79	0.72	1.12	1.07	1	0.91	0.85	0.79
185	1.20	1.11	1	0.87	0.78	0.72	1.12	1.07	1	0.91	0.84	0.79
240	1.20	1.11	1	0.87	0.78	0.72	1.12	1.07	1	0.91	0.84	0.78
300	1.20	1.11	1	0.87	0.78	0.72	1.13	1.07	1	0.91	0.84	0.78
400	1.20	1.11	1	0.87	0.78	0.72	1.13	1.07	1	0.91	0.84	0.78
500	1.21	1.11	1	0.87	0.78	0.72	1.13	1.07	1	0.90	0.83	0.78
630	1.21	1.11	1	0.87	0.78	0.72	1.13	1.07	1	0.90	0.83	0.77
800	1.21	1.11	1	0.87	0.78	0.72	1.14	1.08	1	0.90	0.83	0.77
1000	1.21	1.11	1	0.87	0.78	0.72	1.14	1.08	1	0.90	0.82	0.77

Rating factors for variation in thermal resistivity of soil for Multi-core cables

Nominal area of conductor mm ²	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
1.5	1.14	1.08	1	0.90	0.83	0.77	1.05	1.03	1	0.96	0.92	0.88
2.5	1.15	1.08	1	0.90	0.82	0.76	1.05	1.03	1	0.95	0.91	0.88
4	1.15	1.08	1	0.89	0.82	0.76	1.06	1.03	1	0.95	0.91	0.87
6	1.16	1.09	1	0.89	0.81	0.75	1.06	1.03	1	0.95	0.91	0.87
10	1.16	1.09	1	0.89	0.81	0.75	1.06	1.04	1	0.95	0.90	0.86
16	1.17	1.09	1	0.89	0.80	0.74	1.06	1.04	1	0.95	0.90	0.86
25	1.17	1.09	1	0.89	0.80	0.74	1.07	1.04	1	0.95	0.90	0.86
35	1.18	1.10	1	0.88	0.80	0.74	1.07	1.04	1	0.94	0.90	0.85
50	1.18	1.10	1	0.88	0.80	0.74	1.07	1.04	1	0.94	0.89	0.85
70	1.18	1.10	1	0.88	0.80	0.74	1.07	1.04	1	0.94	0.89	0.84
95	1.18	1.10	1	0.88	0.80	0.73	1.08	1.04	1	0.94	0.89	0.84
120	1.18	1.10	1	0.88	0.80	0.73	1.08	1.05	1	0.94	0.88	0.84
150	1.18	1.10	1	0.88	0.80	0.73	1.08	1.05	1	0.93	0.88	0.83
185	1.18	1.10	1	0.88	0.80	0.73	1.08	1.05	1	0.93	0.88	0.83
240	1.19	1.10	1	0.88	0.80	0.73	1.09	1.05	1	0.93	0.87	0.83
300	1.19	1.10	1	0.88	0.80	0.73	1.09	1.05	1	0.93	0.87	0.82
400	1.19	1.10	1	0.88	0.80	0.73	1.09	1.05	1	0.93	0.87	0.82
500	1.19	1.10	1	0.88	0.80	0.73	1.09	1.05	1	0.93	0.87	0.82
630	1.19	1.10	1	0.88	0.80	0.73	1.10	1.06	1	0.92	0.86	0.81



A) GROUP RATING FACTORS

For Single Core cables laid in Trefoil formation

Group rating factors for circuits of two Single core cables in horizontal formation					
Number of circuits	Laid directly in ground				
	Spacing between group centres, mm				
	TOUCHING	150	300	450	600
2	0.80	0.85	0.90	0.92	0.95
3	0.70	0.78	0.85	0.88	0.91
4	0.64	0.73	0.81	0.86	0.89
5	0.59	0.70	0.79	0.84	0.88
6	0.55	0.67	0.77	0.83	0.87
7	0.53	0.65	0.76	0.82	0.86
8	0.51	0.64	0.75	0.82	0.86
9	0.49	0.63	0.74	0.81	0.85
10	0.48	0.63	0.74	0.81	0.85
11	0.47	0.62	0.73	0.80	0.84
12	0.46	0.61	0.73	0.80	0.84

Group rating factors for multi-core cables laid direct in the Ground in Tier Formation						
No. of Cables	No. of Tiers	Spacing between Group centre				
		Touching	150	300	450	600
2	1	0.80	0.84	0.87	0.90	0.91
3	1	0.68	0.74	0.79	0.83	0.86
4	2	0.60	0.66	0.73	0.77	0.79
5	2	0.55	0.61	0.68	0.71	0.73
6	2	0.51	0.57	0.63	0.67	0.69
7	3	0.48	0.54	0.59	0.63	0.64
8	3	0.46	0.51	0.56	0.60	0.61
9	3	0.44	0.48	0.53	0.57	0.58
10	4	0.42	0.47	0.52	0.55	0.56
11	4	0.41	0.46	0.50	0.54	0.55
12	4	0.40	0.45	0.49	0.53	0.54

Group rating factors for circuits of three Single core cables in horizontal formation										
Number of circuits	Laid directly in ground					Laid in single way ducts				
	Spacing Between Trefoil Group Centres, mm					Spacing Between Trefoil Group Centres, mm				
	TOUCHING	150	300	450	600	TOUCHING	150	300	450	600
2	0.77	0.81	0.86	0.88	0.89	0.78	0.83	0.87	0.90	0.91
3	0.67	0.71	0.78	0.81	0.83	0.66	0.73	0.78	0.82	0.85
4	0.61	0.64	0.72	0.76	0.80	0.59	0.67	0.74	0.78	0.82
5	0.57	0.60	0.69	0.74	0.77	0.55	0.63	0.70	0.76	0.80
6	0.53	0.57	0.66	0.72	0.75	0.51	0.61	0.68	0.74	0.78
7	0.51	0.55	0.64	0.70	0.74	0.48	0.58	0.66	0.73	0.77
8	0.49	0.53	0.63	0.69	0.73	0.46	0.57	0.65	0.72	0.76
9	0.47	0.52	0.62	0.68	0.73	0.44	0.55	0.64	0.71	0.76
10	0.45	0.51	0.61	0.67	0.72	0.43	0.54	0.63	0.70	-
11	0.44	0.50	0.60	0.66	0.72	0.42	0.53	0.62	0.69	-
12	0.43	0.49	0.59	0.65	0.71	0.40	0.51	0.61	0.69	-

Group rating factors for three-core cables laid in single way duct in horizontal Formation					
No. of cables	Spacing between group centre				
	Touching	150	300	450	600
2	0.85	0.87	0.90	0.92	0.94
3	0.75	0.79	0.83	0.86	0.88
4	0.69	0.74	0.79	0.83	0.86
5	0.65	0.7	0.76	0.80	0.84
6	0.62	0.67	0.73	0.79	0.83
7	0.59	0.65	0.72	0.78	0.82
8	0.57	0.63	0.70	0.77	0.81
9	0.55	0.62	0.69	0.76	0.8
10	0.54	0.61	0.68	0.75	-
11	0.52	0.60	0.68	0.75	-
12	0.51	0.59	0.67	0.74	-



Group rating factors for Multi-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	6	9
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	-

Group rating factors for Multi-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	6	9
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	0.88	0.81	0.76	0.71	0.70
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	-
	3	1.00	0.91	0.88	0.87	0.85	-

Group rating factors for Multi-core cables in Air on ladder supports, cleats, etc (vertical spacing between trays 300 mm & spacing between trays & wall at least 20 mm)							
	Number of trays	Number of cables					
		1	2	3	4	6	9
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	0.79	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	-

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 three phase circuits		
		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

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 three phase circuits		
		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

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 three phase circuits		
		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:

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

where f = frequency
L = Inductance

3. Impedance:

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

where R = A.C Resistance at operating temperature Ω/km
X = Reactance

4. Charging Current:

$$A = U_0 \times 2\pi \times f \times C \times 10^{-6} \text{ Amp/km}$$

C = Cable capacitance in nf/km

U₀ = Voltage in Voltes

5. Voltage Drop:

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

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

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:

$$2\pi f \times C \times U_0^2 \tan \delta \cdot 10^{-6} \text{ (watt / km per phase)}$$

where C = Capacitance in nf/km
U₀ = 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 = $2 \pi f M \times 10^{-3} \text{ } \Omega/\text{km}$
M = $0.2 \log_e \frac{2S}{d_m} \text{ (mH/km)}$
S = Distance between Cable Centres,
d_m = 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 mm²
0₁ = Final Temperature of Conductor or Armour
0₀ = Initial Temperature of Conductor or Armour
 ϕ_3 = 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)

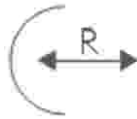
MINIMUM BENDING RADIUS OF LT CABLES

Type of cables	Minimum bending radius
Single core Cables	15 D
Multicore Cables	20 D

Where D is Overall Diameter of Cable *Source: BICC Hand Book



Where 'D' is the tabulated overall diameter of cable.



A) Maximum safe pulling force for cables (when pulled by pulling eye) :-

For Copper Conductor Cables = 5.0 Kgf x number of cores x conductor cross-section
= 50 N x number of cores x conductor cross-section

For Aluminium Conductor Cables = 3.0 Kgf x number of cores x conductor cross-section
= 30 N x number of cores x conductor cross-section
(Subjected to maximum of 2000kgf or 20,000 N)

**B) Side wall Pressure :- = (Maximum Pulling force(Kgf) x 100) / Minimum Bending Radius(mm)
(Subject to a maximum of 500kgf or 5,000 N/m)**

C) For cables pulled with stocking :-

Armoured cables P = 9 D²

Unrmoured cables P = 5 D²

Where, P = Pulling force in Newtons

D = Outer diameter of cables in mm





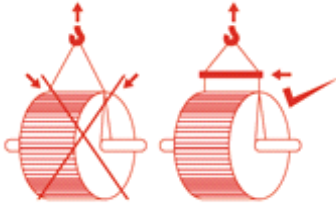
DRUM HANDLING

APAR's LT 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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