

Finolex
Cables Limited
AN IS/ISO 9001 CERTIFIED COMPANY



Finolex Power Cables

**Empowering
The Future,
Together**

FINOLEX CABLES LIMITED

Started in 1958, Finolex Cables Limited is India's largest and leading Electrical and Telecommunication cables manufacturer. Finolex Cables has always believed in enhancing capabilities and augmenting the product basket. In last few years, besides the cable business, the company has forayed into new segments and added new products under Finolex brand name. The company offers Total Electrical Solutions with products like Industrial /Electrical wires, Flexible Cables, Elevator Cables, 3 Core Flat Cables, Auto Cables, Communication Cables, Telecommunication Cables, Power Cables, Copper Rods, CFLs, LED Lighting Range, Premium modular Switches & Switchgear and soon to be launched elegant looking domestic Fans. Finolex Cables Limited has four manufacturing facilities viz. at Pimpri (Pune), Urse (near Pune), Verna (Goa) and Roorkee (Uttarakhand).

HIGH VOLTAGE CROSS-LINKED POLYETHYLENE (XLPE) INSULATED POWER CABLES

Finolex has developed a special grade XLPE compounds Finvul-X & Finopower to be used as the insulating material suitable for LT & HT cables. The increasing demand of Power Voltage Cables has necessitated the development of a cable insulant which has a combination of excellent dielectric properties, non hygroscopic nature of polyethylene and higher operating temperature. The XLPE (cross linked polyethylene) insulation meets all these necessary properties.

Finopower XLPE insulated HT Cables and **FINVUL-X** LT Power Cables have excellent dielectric, thermal, mechanical & chemical properties.

The various advantages of using **Finopower** and **FINVUL-X** Cables are given below:

- Higher current rating: withstands continuous conductor temperature of 90°C higher current carry capacity
- Higher Short Circuit Rating: can withstand conductor temperatures of up to 250°C during a short circuit
- Higher Overload Capacity: These cables can operate even at 130°C. during emergency, unlike PVC Cables which cannot operate beyond 120°C. Thus in case of emergency, cables can withstand overload for a limited time duration.
- Lighter in weight smaller bending radius, the cables require less support, lower installation
- Lower Di-electric constant and power factor - Results in saving in power losses which means saving in costs
- Better impact, Abrasion, corrosion
- Easier jointing and termination
- Discharge free HT cable: Negligible level of Partial Discharge values. We confirm PD value as < 1 pC (max), as against allowable limit of 5 pC as per IS 7098 Part II/2011
- True Triple Extrusion Line for HT cable: (Not 1+2 Tandem Extrusion Line) with single cross head in a most modern CCV (Continuous Centenary Vulcanizing) plant
- Preheating of conductor of HT cables to remove the dust and moisture before extrusion for proper bonding between semicon and XLPE Layers and also to avoid heat shock during extrusion.
- Completely Dry Curing Process for HT cables under inert gas (**Nitrogen**) for a contamination and void free cable
- SIKORA X-Ray: Most modern on line monitoring system for continuously measuring and controlling thickness of insulation, core diameter and eccentricity for a perfect HT cable with reduced stress levels
- Automatic pneumatic system for special contamination free material handling of insulating and semi-conducting compound in a dry and clinically clean environment for HT cables
- For HT cables, Special internal check like microscopic inspection for imperfections in Di-electric, optimization of curing of Di-electric and check for bonding strength of semi-conducting layers with XLPE.

TYPICAL PROPERTIES OF XLPE INSULATION

			IS:7098 (Part 1) IS:7098 (Part 2) 
Dielectric Constant		2.35	
Dielectric strength	kV/mm	22	
Volume Resistivity at 27 °C	Ohm-cm	10 ¹⁴	
Thermal Resistivity	°C cm/W	350	
Power factor at maximum conductor temperature	-	0.008	
Nominal conductor operating temperature	°C	90	
Emergency overload temperature	°C	130	

VOLTAGE GRADE

1. LT - Up to and including 1100V

2. HT - Earthed System : 3.8/6.6 kV, 6.35/11 kV, 12.7/22 kV & 19/33 kV, 1.9/3.3 kV

Unearthed System : 3.3/3.3 kV, 6.6/6.6 kV & 11/11 kV

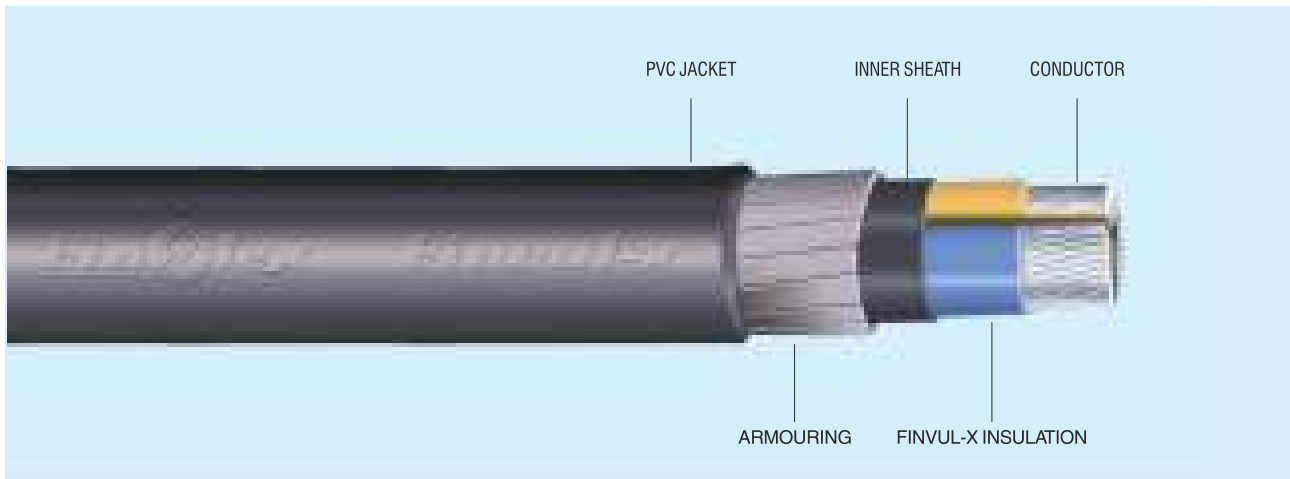
Cables of 6.35/11kV grade (Earthed System) are suitable for use on 6.6/6.6 kV (Unearthed System)

CABLE SPECIFICATION

Finopower XLPE Cables are manufactured and tested as per **IS: 7098 (Part 2): 2011**.

Finvul-X XLPE Cables are manufactured and tested as per **IS: 7098 (Part 1): 1988**.

TYPICAL CABLE CONSTRUCTION



As per IS : 7098 - (Part - 1) : 1988 for working voltage up to and including 1100V

CONDUCTOR :

Conductors are made from Electrolytic grade highly pure aluminium and copper conforming to IS 8130-2013 and are circular or compact circular/sector shaped. Upto 10 sq. mm conductor will be solid and above will be stranded.

INSULATION :

FINVUL-X cables are specially manufactured with high dielectric grade cross linked polyethylene for insulation and is applied by extrusion process.

CORE IDENTIFICATION :

The cores are identified by different colours :

Single core	Red/natural
Two core	Red, black
Three core	Red, yellow, blue
Three and half core	Red, yellow, blue and reduced neutral core in black
Four core	Red, yellow, blue, black
Five core	Red, Yellow, Blue, Black and Grey
Six core and above	Two adjacent cores (counting and direction core) in each layer blue and yellow, remaining cores Grey

LAYING UP :

In multicore cables, cores are laid up as per the above colour scheme.

INNER SHEATH :

Laid up cores are bedded over with thermoplastic material for protection against mechanical damage.

ARMOURING :

Armouring is provided over the inner sheath to guard against mechanical damage. Armouring is generally of galvanised steel wires or strips. In single core cables, used in AC system, armouring is by non-magnetic hard drawn aluminium wires. Round steel wires are used where the diameter over the inner sheath does not exceed 13 mm, above 13 mm flat steel strip armour is used. Round wire of different sizes can also be provided against specific request.

PVC JACKET :

Specially formulated heat resistant black PVC compound ST2 type as per IS 5831:1984 and is extruded to form the jacket. Finolex also offers specially formulated Flame Retardant (FR) / Flame Retardant Low Smoke (FRLS) compound for jacket used in fire hazardous environment.

TESTS :

In addition to all tests required as per IS 7098 (Part I) 1988, FINVUL-X cables are subjected to a number of in-house tests at every stage of production. Incoming raw material is also tested thoroughly to ensure consistency of quality.

PRODUCT CODE :

As per IS 7098 (Part I) & (Part II), the codes are :

Constituent Code	7098-1	7098-2
Aluminium conductor	A	A
Copper conductor	-	-
FINVUL-X insulation	2X	2X
Steel round wire armour	W	W
Steel strip armour	F	F
Steel double round wire armour	WW	WW
Steel double strip armour	FF	FF
PVC jacket	Y	Y
Copper tape/wire screening	-	CE
Non magnetic round wire armour	Wa	Wa
Non magnetic Strip armour	Fa	Fa
Polyethylene outer sheath	-	2Y

LENGTH :

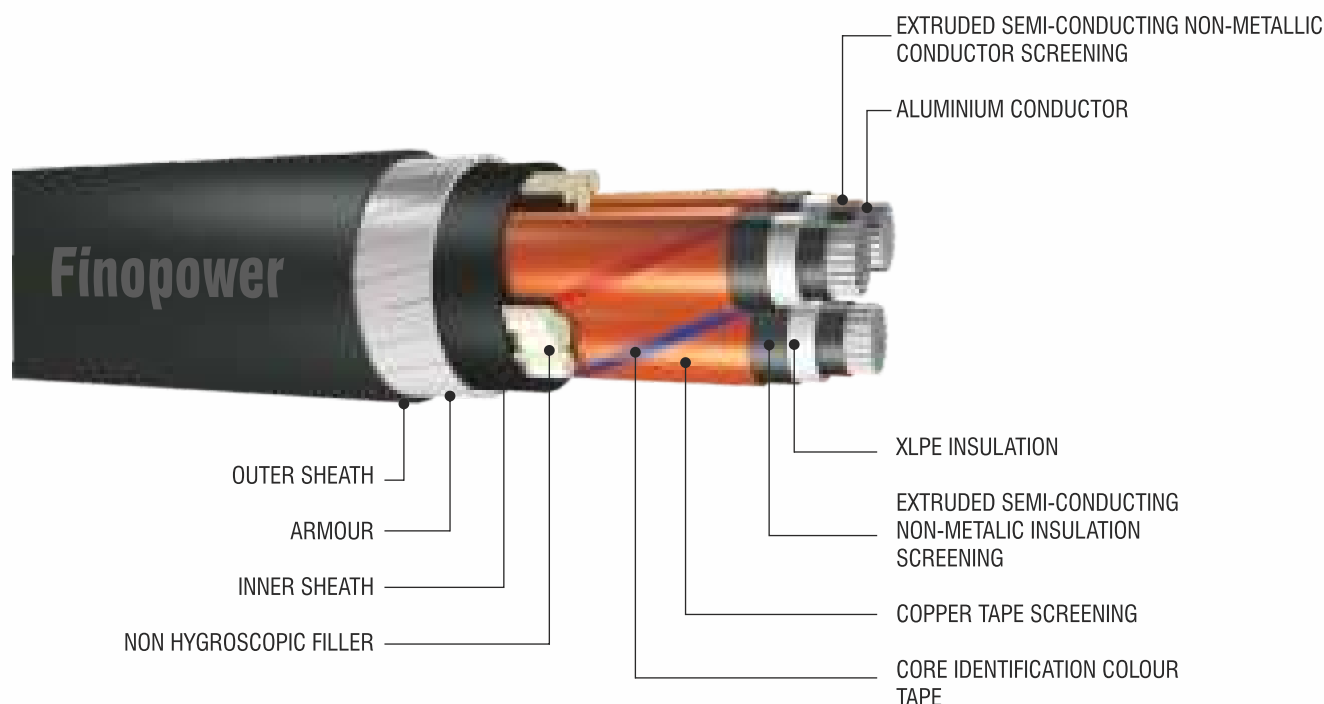
FINOLEX provides continuous length of 500/1000 meters $\pm$ 5% for single/multi-core armoured and unarmoured cables up to 400 sq.mm. Sizes above 400 sq.mm. are generally packed in 250 metres $\pm$ 5%. The cables are progressive sequentially marked on every 1 meter length for ease of length measurement.

PACKING AND MARKING :

FINVUL-X cables are wound on sturdy, non-returnable wooden drums built to withstand the weight of the cable as well as handling abuses. Each drum is marked with particulars required under IS 7098 (Part I) 1988.

Steel drums can be offered on special request.

FINOPOWER HIGH VOLTAGE CABLE CONSTRUCTION



TYPICAL CONSTRUCTION OF FINOPOWER THREE CORE ARMoured CABLE

As per IS : 7098 - (Part - 2) : 2011 for working voltage from 3.3 kV up to and including 33 kV

CONDUCTOR

Conductor is made of electrolytic grade high pure copper or Aluminum, conforming to IS 8130 - 2013. The conductor is circular, stranded with high compactness and smooth surface finish.

CONDUCTOR SCREENING

Each conductor is provided with an extruded layer of semi-conducting compound. This eliminates the chance of electrical discharge at the interface between conductor and insulation.

INSULATION

The natural coloured XLPE compound with high di-electric strength is extruded over semiconducting conductor screening with specified thickness **in contamination free climate. Cross linking is done by completely dry curing process.**

INSULATION SCREENING

The Insulated Core is further extruded with a layer of semi conducting compound to form the nonmetallic part of Insulation Screening.

The conductor screening, XLPE insulation and the non-metallic part of insulation screening are all extruded in one operation by a special process, **Triple Extrusion**. This process ensures perfect bonding between conductor screening and insulation screening with XLPE insulation. **This bond eliminates the formation of micro voids during extrusion & curing.**

This ensures **longer cable life under worst operating conditions.**

Non-magnetic copper tape is applied as metallic part of insulation screen over the non-metallic extruded part of the insulation screening.



CORE IDENTIFICATION

The core identification for three core cables is done by Coloured strips applied on the cores.

The core identification also offered with core numbering tapes as per requirement of customers.

LAYING UP

Three cores are laid up together to form the cable. The interstices are filled up with non-hygroscopic type fillers, to make the cable circular.

INNER SHEATH (COMMON COVERING)

The three core laid up cable is provided with a common covering of wrapped plastic tape/s or by an extruded PVC inner sheath, as per the requirement of customer.

ARMOURING

Armouring is applied over the inner sheath in case of three core cables. For single core cables it is applied over non-metallic part of insulation screening. Three core cables have either galvanised round steel wire or galvanised steel strip armour, conforming to IS 3975 – 1999. Single core cables

are armoured with hard drawn round aluminum wires. For mining and other special applications, double wire/strip armoured cables can also be offered.

OUTER SHEATH

The cables are provided with outer sheath of tough heat resisting PVC compound, Type ST 2 as per IS 5831-1984. The outer sheath is extruded over armouring in case of armoured cables. For Single Core Unarmoured Cables, outer sheath is extruded over the non-magnetic metallic part of Insulation Screening. Outer sheath in general is of Black colour.

QUALITY ASSURANCE AND TESTING

Finopower Cables are manufactured by using latest state of art machinery and testing facilities, guided by experienced and highly qualified engineers & technologists.

At Finolex Quality is ensured through out the manufacturing process. The quality checks are performed starting from raw material, right through every stage of manufacturing to the final testing. The SQC techniques are applied at various critical stages of manufacturing to ensure the consistency of quality.

For maintaining the highest quality of cable, Finolex have developed special internal additional checks. Some of the special checks conducted are as under:

- ✍ Microscopic inspection for imperfections in the dielectric.
- ✍ Degree of cross linking of the dielectric
- ✍ Bonding strength of semiconducting layers with insulation.



Diameter & Eccentricity Controller

Finolex CCV (Continuous Catenary Vulcanisation) line is equipped with most modern new generation X-Ray type diameter controller for measuring, monitoring & controlling of thickness, diameter and eccentricity throughout the length.

The Cables are tested in accordance with IS:7098 (Part 2)-2011 & IS 7098 (Part 1) 1988

The following Routine tests are carried out on every length of cable manufactured:

- a) Conductor resistance test
- b) Partial Discharge test (Applicable for HT Cables)
- c) High Voltage test

HIGH VOLTAGE TEST

The following test voltages are applied between conductors and screen/armour

Voltage rating of cable

- a) 1.1 kV
- b) 1.9/3.3 kV
- c) 3.3/3.3 kV
- d) 3.8/6.6 kV (E)
- e) 6.6/6.6 kV (UE)
- f) 6.35/11kV (E)
- g) 11/11kV (UE)
- h) 12.7/22 kV (E)
- i) 19/33 kV (E)

Test Voltage

- 3 kV (rms) for 5 minutes
- 10 kV (rms) for 5 minutes
- 10 kV (rms) for 5 minutes
- 13 kV (rms) for 5 minutes
- 21 kV (rms) for 5 minutes
- 21 kV (rms) for 5 minutes
- 35 kV (rms) for 5 minutes
- 42 kV (rms) for 5 minutes
- 63 kV (rms) for 5 minutes

In order to meet consistency in quality, the cables manufactured undergo stringent quality checks at each stages from raw material to finished cable. These cables also undergo stringent physical, dimensional and other checks for conformity to the required standards.

At Finolex, chemical and electrical laboratories are of the highest standard, possessing the most modern equipments for precision testing and quality control.

LONGER PACKING LENGTH

As per special requirements of the customers, the cables can **also be offered with longer lengths** other than standard packing length

The **Finopower & FINVUL-X** Cables are **provided with progressive sequential length marking** on outer jacket. The cables are also offered with FR/FRLS properties, as given in the adjoining table.

The conductor details, insulation thickness, dimension, weight and packing data along with electrical parameters are furnished in the respective tables.



Impulse Test

**FINVUL-X & FINOPOWER FLAME RETARDANT (FR)/FLAME RETARDANT CABLES
WITH REDUCED HALOGEN EVOLUTION AND SMOKE (FR-LSH)**

Test	Functions of the test	Specification	Specified values	Applicable for
Critical Oxygen Index	To determine the percentage of oxygen required for supporting combustion of sheathing material at room temperature	ASTM-D-2863 IS : 7098 - I & II	Min. Oxygen Index of 29 %	FR & FR-LSH
Temperature Index	To determine at what temperature oxygen content in air will support combustion of sheath material	ASTM-D-2863 BICC Hand Book chapter no.6 IS : 7098 - I & II	Min. Temperature Index of 250° C at 21% oxygen.	FR & FR-LSH
Smoke Density	To determine the density of smoke from the burning of sheath material	ASTM-D-2843 IS : 7098 - I & II	Smoke density rating shall be 60% max.	FR-LSH
Acid Gas Generation	To ascertain the amount of Halogen Acid Gas evolved during combustion of sheath material	IEC-60754-1 IS : 7098 - I & II	Max. Halogen acid gas released 20% by weight.	FR-LSH
Flammability test on group of cables	To determine flame propagation of cables in installed conditions	IEEE-383	In total 20 minutes of burning the 8 feet long cable samples at a temperature of 1500°F the burning of cables shall not go up to the top	FR-LSH
Flammability test	1) To determine ignition resistance and flame propagation under specified conditions.	1)Swedish Standard No. SS 4241475 Class F3 IS : 7098 - I & II	From test sample of 850 mm length, the unburnt portion shall be more than 300 mm from the top	FR-LSH
	2) To determine ignition resistance and flame propagation under specified conditions.	2)IEC 332-1 IS : 7098 - I & II	Period of burning after removal of flame shall not exceed 60 sec. and unaffected portion from the lower edge of the top clamp shall be at least 50 mm.	FR & FR-LSH
	3) To determine ignition resistance and resistance to flame propagation, especially for bunch of cables, under specified conditions.	3)IEC 332-3 IS : 7098 - I & II	From the test samples of 3.5 m length, the affected portion during burning, shall not reach 2.5 m or above from the bottom edge of the burner	FR & FR-LSH



OPERATING CONDITIONS

Electrical parameters of the cables furnished in Tables are based on the following assumptions:

	Aluminium	Copper
➤ Maximum permissible conductor temperature for continuous operation	90°C	90°C
➤ Ambient air temperature:	40°C	40°C
➤ Ground temperature:	30°C	30°C
➤ Thermal resistivity of soil:	1.5 k.m/w	1.5 k.m/w
➤ During short circuit max temp:	250°C	250°C
➤ Specific gravity:	2.703 g/cm ³	8.89 g/cm ³
➤ Resistivity at 20°C:	28.264 Ω mm ³ /km	17.241 Ω mm ³ /km
➤ Specific heat:	0.22 cal/gm°C	0.093 cal/gm°C
➤ Temperature coefficient of resistance at 20°C	0.00403/°C	0.00393/°C

RATING FACTORS

For installation conditions other than the standard conditions specified above, rating factors have to be applied as given in relevant tables.

1.0 Technical Data for 1100V LT Cables

TABLE 1.1: FINVUL – X 1100 V Grade Single Core, Aluminium Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm	Unarmoured				Armoured					Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating			
	Nom. Thickness of XLPE Insulation mm	Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Thickness of XLPE Insulation mm	Nom. Dia of Alu. Wire for Armour mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air		In Ground	
											2 Cables Amps	3 Cables Amps	2 Cables Amps	3 Cables Amps
10	0.70	1.80	9.70	106	1.00	1.4	1.24	12.10	176	3.08	64	55	69	59
16	0.70	1.80	10.70	134	1.00	1.4	1.24	13.20	211	1.91	84	72	89	76
25	0.90	1.80	12.30	185	1.20	1.4	1.24	14.80	276	1.20	112	98	115	98
35	0.90	1.80	13.40	223	1.20	1.4	1.24	15.90	321	0.868	137	119	137	116
50	1.00	1.80	15.00	277	1.30	1.4	1.24	17.50	387	0.641	165	145	161	137
70	1.10	1.80	17.20	363	1.40	1.4	1.24	19.70	487	0.443	209	185	198	168
95	1.10	1.80	18.70	444	1.40	1.6	1.40	21.90	617	0.320	264	235	243	202
120	1.20	1.80	20.50	538	1.50	1.6	1.40	23.60	726	0.253	308	276	276	230
150	1.40	2.00	22.70	666	1.70	1.6	1.40	25.50	850	0.206	350	314	308	256
185	1.60	2.00	24.90	797	1.90	1.6	1.40	27.70	999	0.164	406	366	349	290
240	1.70	2.00	27.30	985	2.00	1.6	1.40	30.10	1208	0.125	480	434	404	335
300	1.80	2.00	30.10	1186	2.10	1.6	1.56	33.20	1452	0.100	551	500	454	376
400	2.00	2.20	33.80	1511	2.40	2.0	1.56	37.50	1869	0.0778	647	589	518	429
500	2.20	2.20	37.20	1867	2.60	2.0	1.56	40.90	2261	0.0605	751	685	588	485
630	2.40	2.20	40.70	2321	2.80	2.0	1.72	44.70	2789	0.0469	868	793	663	546
800	2.60	2.40	46.40	2938	3.10	2.0	1.88	50.50	3473	0.0367	992	907	740	608
1000	2.80	2.60	50.70	3638	3.30	2.5	2.04	55.70	4364	0.0291	1117	1022	812	665

TABLE 1.2: FINVUL – X 1100 V Grade Two Core, Aluminium Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
4	0.70	1.80	11.80	183	1.4 (W)	1.24	14.00	341	7.41	38	42
6	0.70	1.80	12.90	215	1.4 (W)	1.24	15.00	396	4.61	50	55
10	0.70	1.80	17.30	132	1.4 (W)	1.24	18.10	530	3.08	64	68
16	0.70	1.80	19.00	147	1.4 (W)	1.40	20.40	643	1.91	83	89
25	0.90	2.00	19.60	166	4 x 0.8 (F)	1.40	19.30	582	1.20	109	114
35	0.90	2.00	21.20	181	4 x 0.8 (F)	1.40	20.90	680	0.868	133	136
50	1.00	2.00	23.70	204	4 x 0.8 (F)	1.40	23.40	821	0.641	162	161
70	1.10	2.00	27.10	236	4 x 0.8 (F)	1.56	27.10	1054	0.443	204	197
95	1.10	2.20	30.00	286	4 x 0.8 (F)	1.56	29.40	1271	0.320	251	235
120	1.20	2.20	32.70	314	4 x 0.8 (F)	1.56	32.10	1495	0.253	287	266
150	1.40	2.20	34.50	333	4 x 0.8 (F)	1.72	34.30	1769	0.206	328	296
185	1.60	2.40	38.30	401	4 x 0.8 (F)	1.72	37.90	2101	0.164	379	335
240	1.70	2.60	42.20	476	4 x 0.8 (F)	1.88	41.40	2534	0.125	448	385
300	1.80	2.80	46.70	566	4 x 0.8 (F)	2.04	46.30	3079	0.100	513	432
400	2.00	3.00	52.30	678	4 x 0.8 (F)	2.36	51.80	3834	0.0778	593	487

TABLE 1.3: FINVUL-X 1100 V Grade Three Core, Aluminium Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
4	0.70	1.80	12.40	210	1.4 (W)	1.24	14.60	376	7.41	32	35
6	0.70	1.80	13.60	250	1.4 (W)	1.24	15.70	432	4.61	42	46
10	0.70	1.80	18.20	294	1.4 (W)	1.24	18.90	659	3.08	54	57
16	0.70	1.80	18.40	372	4 x 0.8 (F)	1.24	18.20	540	1.91	69	74
25	0.90	2.00	21.50	528	4 x 0.8 (F)	1.40	21.20	727	1.20	93	95
35	0.90	2.00	23.50	640	4 x 0.8 (F)	1.40	23.20	863	0.868	114	114
50	1.00	2.00	26.70	819	4 x 0.8 (F)	1.40	26.00	1053	0.641	138	134
70	1.10	2.20	31.10	1101	4 x 0.8 (F)	1.56	30.50	1386	0.443	175	164
95	1.10	2.20	33.60	1359	4 x 0.8 (F)	1.56	33.00	1671	0.320	216	197
120	1.20	2.20	36.80	1633	4 x 0.8 (F)	1.56	36.20	1982	0.253	249	223
150	1.40	2.40	39.30	1995	4 x 0.8 (F)	1.72	38.90	2386	0.206	284	249
185	1.60	2.60	43.50	2428	4 x 0.8 (F)	1.88	43.00	2854	0.164	329	282
240	1.70	2.80	48.10	3043	4 x 0.8 (F)	2.04	47.70	3528	0.125	392	327
300	1.80	3.00	53.80	3760	4 x 0.8 (F)	2.20	52.80	4232	0.100	452	369
400	2.00	3.20	59.80	4723	4 x 0.8 (F)	2.52	59.30	5318	0.0778	526	420

TABLE 1.4: FINVUL – X 1100 V Grade 3.5 Core, Aluminium Conductor , XLPE Insulated , Unarmoured/Armoured , PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air	In Ground
										Amps	Amps
25	0.90	2.00	23.1	604	4 x 0.8 (F)	1.40	22.8	821	1.20	93	95
35	0.90	2.00	25.2	719	4 x 0.8 (F)	1.40	24.9	961	0.868	114	114
50	1.00	2.00	28.7	940	4 x 0.8 (F)	1.40	28.1	1195	0.641	138	134
70	1.10	2.20	33.6	1258	4 x 0.8 (F)	1.56	33.0	1569	0.443	175	164
95	1.10	2.20	36.4	1560	4 x 0.8 (F)	1.56	35.8	1903	0.320	216	197
120	1.20	2.20	39.2	1896	4 x 0.8 (F)	1.72	39.0	2303	0.253	249	223
150	1.40	2.40	43.3	2284	4 x 0.8 (F)	1.72	42.9	2720	0.206	284	249
185	1.60	2.60	48.0	2800	4 x 0.8 (F)	1.88	47.5	3276	0.164	329	282
240	1.70	2.80	53.1	3506	4 x 0.8 (F)	2.04	52.7	4048	0.125	392	327
300	1.80	3.00	59.3	4343	4 x 0.8 (F)	2.20	58.4	4872	0.100	452	369
400	2.00	3.40	66.4	5492	4 x 0.8 (F)	2.52	65.6	6101	0.0778	526	420

TABLE 1.5: FINVUL – X 1100 V Grade 4 Core, Aluminium Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air	In Ground
										Amps	Amps
4	0.70	1.80	13.4	242	1.4 (W)	1.24	15.6	414	7.41	32	35
6	0.70	1.80	14.7	291	1.4 (W)	1.24	16.8	479	4.61	42	46
10	0.70	1.80	19.7	367	1.4 (W)	1.40	21.1	713	3.08	54	57
16	0.70	1.80	20.0	449	4 x 0.8 (F)	1.40	20.2	653	1.91	69	74
25	0.90	2.00	24.0	652	4 x 0.8 (F)	1.40	23.7	882	1.20	93	95
35	0.90	2.00	26.2	798	4 x 0.8 (F)	1.40	26.0	1055	0.868	114	114
50	1.00	2.00	29.6	1002	4 x 0.8 (F)	1.56	29.7	1317	0.641	138	134
70	1.10	2.20	35.1	1387	4 x 0.8 (F)	1.56	34.6	1717	0.443	175	164
95	1.10	2.20	38.1	1726	4 x 0.8 (F)	1.56	37.6	2091	0.320	216	197
120	1.20	2.40	42.3	2123	4 x 0.8 (F)	1.72	42.0	2550	0.253	249	223
150	1.40	2.60	45.2	2597	4 x 0.8 (F)	1.88	44.8	3042	0.206	284	249
185	1.60	2.80	50.6	3203	4 x 0.8 (F)	2.04	49.7	3647	0.164	329	282
240	1.70	3.00	55.8	4016	4 x 0.8 (F)	2.20	55.0	4523	0.125	392	327
300	1.80	3.20	62.0	4900	4 x 0.8 (F)	2.36	61.4	5482	0.100	452	369
400	2.00	3.60	69.4	6223	4 x 0.8 (F)	2.68	68.6	6846	0.0778	526	420

TABLE 1.6: FINVUL – X 1100 V Grade Single Core , Copper Conductor , XLPE Insulated , Unarmoured / Armoured , PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm	Unarmoured				Armoured					Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating			
	Nom. Thickness of XLPE Insulation mm	Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Thickness of XLPE Insulation mm	Nom. Dia of Alu. Wire for Armour mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air		In Ground	
											2 Cables Amps	3 Cables Amps	2 Cables Amps	3 Cables Amps
10	0.70	1.80	9.70	168	1.00	1.4	1.24	12.10	238	1.83	83	71	90	77
16	0.70	1.80	10.70	233	1.00	1.4	1.24	13.20	310	1.15	108	94	115	98
25	0.90	1.80	12.30	348	1.20	1.4	1.24	14.80	439	0.727	144	126	148	126
35	0.90	1.80	13.40	445	1.20	1.4	1.24	15.90	543	0.524	176	154	177	150
50	1.00	1.80	15.00	578	1.30	1.4	1.24	17.50	688	0.387	212	187	208	177
70	1.10	1.80	17.20	776	1.40	1.4	1.24	19.70	900	0.268	269	238	255	216
95	1.10	1.80	18.70	1015	1.40	1.6	1.40	21.90	1188	0.193	340	303	312	260
120	1.20	1.80	20.50	1261	1.50	1.6	1.40	23.60	1449	0.153	396	354	355	295
150	1.40	2.00	22.70	1560	1.70	1.6	1.40	25.50	1745	0.124	450	403	396	329
185	1.60	2.00	24.90	1911	1.90	1.6	1.40	27.70	2114	0.0991	519	468	447	371
240	1.70	2.00	27.30	2451	2.00	1.6	1.40	30.10	2674	0.0754	613	553	515	427
300	1.80	2.00	30.10	3032	2.10	1.6	1.56	33.20	3298	0.0601	700	634	576	477
400	2.00	2.20	33.80	3871	2.40	2.0	1.56	37.50	4230	0.0470	813	737	651	537
500	2.20	2.20	37.20	4892	2.60	2.0	1.56	40.90	5286	0.0366	930	844	727	598
630	2.40	2.20	40.70	6207	2.80	2.0	1.72	44.70	6675	0.0283	1056	961	806	661
800	2.60	2.40	46.40	7672	3.10	2.0	1.88	50.50	8207	0.0221	1179	1077	877	721
1000	2.80	2.60	50.70	9763	3.30	2.5	2.04	55.70	10489	0.0176	1288	1188	935	772

TABLE 1.7: FINVUL – X 1100 V Grade Two Core, Copper Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
4	0.70	1.80	11.80	229	1.4 (W)	1.24	14.00	386	4.61	48	54
6	0.70	1.80	12.90	281	1.4 (W)	1.24	15.00	459	3.08	61	67
10	0.70	1.80	17.30	327	1.4 (W)	1.24	18.10	662	1.83	83	89
16	0.70	1.80	19.00	560	1.4 (W)	1.40	20.40	841	1.15	108	115
25	0.90	2.00	19.60	823	4 x 0.8 (F)	1.40	19.30	904	0.727	140	147
35	0.90	2.00	21.20	1023	4 x 0.8 (F)	1.40	20.90	1120	0.524	172	176
50	1.00	2.00	23.70	1349	4 x 0.8 (F)	1.40	23.40	1419	0.387	208	208
70	1.10	2.00	27.10	1757	4 x 0.8 (F)	1.56	27.10	1874	0.268	262	253
95	1.10	2.20	30.00	2308	4 x 0.8 (F)	1.56	29.40	2413	0.193	322	302
120	1.20	2.20	32.70	2819	4 x 0.8 (F)	1.56	32.10	2933	0.153	368	340
150	1.40	2.20	34.50	3391	4 x 0.8 (F)	1.72	34.30	3525	0.124	419	379
185	1.60	2.40	38.30	4186	4 x 0.8 (F)	1.72	37.90	4303	0.0991	482	425
240	1.70	2.60	42.20	5347	4 x 0.8 (F)	1.88	41.40	5446	0.0754	566	486
300	1.80	2.80	46.70	6693	4 x 0.8 (F)	2.04	46.30	6747	0.0601	644	541
400	2.00	3.00	52.30	8413	4 x 0.8 (F)	2.36	51.80	8510	0.0470	734	602

TABLE 1.8: FINVUL – X 1100 V Grade Three Core, Copper Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
4	0.70	1.80	12.40	278	1.4 (W)	1.24	14.60	444	4.61	41	45
6	0.70	1.80	13.60	348	1.4 (W)	1.24	15.70	528	3.08	52	56
10	0.70	1.80	18.20	480	1.4 (W)	1.24	18.90	845	1.83	70	74
16	0.70	1.80	18.40	669	4 x 0.8 (F)	1.24	18.20	837	1.15	89	95
25	0.90	2.00	21.50	1011	4 x 0.8 (F)	1.40	21.20	1210	0.727	119	122
35	0.90	2.00	23.50	1306	4 x 0.8 (F)	1.40	23.20	1529	0.524	147	146
50	1.00	2.00	26.70	1716	4 x 0.8 (F)	1.40	26.00	1950	0.387	179	173
70	1.10	2.20	31.10	2331	4 x 0.8 (F)	1.56	30.50	2616	0.268	226	212
95	1.10	2.20	33.60	3072	4 x 0.8 (F)	1.56	33.00	3384	0.193	279	254
120	1.20	2.20	36.80	3790	4 x 0.8 (F)	1.56	36.20	4139	0.153	320	287
150	1.40	2.40	39.30	4673	4 x 0.8 (F)	1.72	38.90	5064	0.124	365	321
185	1.60	2.60	43.50	5740	4 x 0.8 (F)	1.88	43.00	6166	0.0991	422	362
240	1.70	2.80	48.10	7405	4 x 0.8 (F)	2.04	47.70	7890	0.0754	500	418
300	1.80	3.00	53.80	9262	4 x 0.8 (F)	2.20	52.80	9734	0.0601	574	469
400	2.00	3.20	59.80	11749	4 x 0.8 (F)	2.52	59.30	12344	0.0470	662	528

TABLE 1.9: FINVUL – X 1100 V Grade 3.5 Core, Copper Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
25	0.90	2.00	23.1	1194	4 x 0.8 (F)	1.40	22.8	1411	0.727	119	122
35	0.90	2.00	25.2	1488	4 x 0.8 (F)	1.40	24.9	1730	0.524	147	146
50	1.00	2.00	28.7	2004	4 x 0.8 (F)	1.40	28.1	2259	0.387	179	173
70	1.10	2.20	33.6	2726	4 x 0.8 (F)	1.56	33	3037	0.268	226	212
95	1.10	2.20	36.4	3585	4 x 0.8 (F)	1.56	35.8	3928	0.193	279	254
120	1.20	2.20	39.2	4489	4 x 0.8 (F)	1.72	39	4896	0.153	320	287
150	1.40	2.40	43.3	5384	4 x 0.8 (F)	1.72	42.9	5820	0.124	365	321
185	1.60	2.60	48.0	6717	4 x 0.8 (F)	1.88	47.5	7193	0.0991	422	362
240	1.70	2.80	53.1	8618	4 x 0.8 (F)	2.04	52.7	9160	0.0754	500	418
300	1.80	3.00	59.3	10779	4 x 0.8 (F)	2.20	58.4	11308	0.0601	574	469
400	2.00	3.40	66.4	13686	4 x 0.8 (F)	2.52	65.6	14295	0.0470	662	528

TABLE 1.10: FINVUL – X 1100 V Grade 4 Core, Copper Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables

Nom. Cross Sectional Area Sq.mm.	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
4	0.70	1.80	13.4	333	1.4 (W)	1.24	15.6	504	4.61	41	45
6	0.70	1.80	14.7	422	1.4 (W)	1.24	16.8	607	3.08	52	56
10	0.70	1.80	19.7	615	1.4 (W)	1.40	21.1	961	1.83	70	74
16	0.70	1.80	20.0	849	4 x 0.8 (F)	1.40	20.2	1053	1.15	89	95
25	0.90	2.00	24.0	1308	4 x 0.8 (F)	1.40	23.7	1538	0.727	119	122
35	0.90	2.00	26.2	1690	4 x 0.8 (F)	1.40	26.0	1947	0.524	147	146
50	1.00	2.00	29.6	2202	4 x 0.8 (F)	1.56	29.7	2517	0.387	179	173
70	1.10	2.20	35.1	3047	4 x 0.8 (F)	1.56	34.6	3377	0.268	226	212
95	1.10	2.20	38.1	4026	4 x 0.8 (F)	1.56	37.6	4391	0.193	279	254
120	1.20	2.40	42.3	5027	4 x 0.8 (F)	1.72	42.0	5454	0.153	320	287
150	1.40	2.60	45.2	6177	4 x 0.8 (F)	1.88	44.8	6622	0.124	365	321
185	1.60	2.80	50.6	7659	4 x 0.8 (F)	2.04	49.7	8103	0.0991	422	362
240	1.70	3.00	55.8	9864	4 x 0.8 (F)	2.20	55.0	10371	0.0754	500	418
300	1.80	3.20	62.0	12288	4 x 0.8 (F)	2.36	61.4	12870	0.0601	574	469
400	2.00	3.60	69.4	15663	4 x 0.8 (F)	2.68	68.6	16286	0.0470	662	528

TABLE 1.11: FINVUL - X 100 V Grade 1.5 sq mm Solid Copper Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables, Multicore Control Cables

No. of cores	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
2	0.70	1.80	10.9	154	1.4 (W)	1.24	11.9	276	12.1	27	31
3	0.70	1.80	11.4	178	1.4 (W)	1.24	12.4	309	12.1	23	26
4	0.70	1.80	12.2	180	1.4 (W)	1.24	13.1	346	12.1	23	26
5	0.70	1.80	13.0	212	1.4 (W)	1.24	14.0	400	12.1	23	26
6	0.70	1.80	13.9	246	1.4 (W)	1.24	14.9	443	12.1	20	23
7	0.70	1.80	13.9	252	1.4 (W)	1.24	14.9	450	12.1	19	22
9	0.70	1.80	16.8	321	1.4 (W)	1.24	17.8	594	12.1	18	20
10	0.70	1.80	16.8	339	1.4 (W)	1.24	17.8	611	12.1	17	19
12	0.70	1.80	17.3	380	1.4 (W)	1.24	19.1	680	12.1	16	18
14	0.70	1.80	18.2	423	1.4 (W)	1.40	19.8	736	12.1	15	17
16	0.70	1.80	19.0	468	4 x 0.8 (F)	1.40	19.5	692	12.1	15	17
19	0.70	1.80	19.9	538	4 x 0.8 (F)	1.40	20.4	760	12.1	14	16
24	0.70	2.00	23.3	684	4 x 0.8 (F)	1.40	23.4	903	12.1	13	14
27	0.70	2.00	23.7	743	4 x 0.8 (F)	1.40	23.8	985	12.1	11	14
30	0.70	2.00	24.5	807	4 x 0.8 (F)	1.40	24.6	1046	12.1	11	12
37	0.70	2.00	26.2	954	4 x 0.8 (F)	1.40	26.3	1213	12.1	10	11
44	0.70	2.00	29.2	1117	4 x 0.8 (F)	1.40	29.3	1416	12.1	9	11
52	0.70	2.00	30.4	1275	4 x 0.8 (F)	1.56	30.8	1618	12.1	9	10
61	0.70	2.20	32.8	1506	4 x 0.8 (F)	1.56	32.9	1853	12.1	8	9

TABLE 1.12: FINVUL - X 1100 V Grade 2.5 sq mm Solid Copper Conductor, XLPE Insulated, Unarmoured/Armoured, PVC Type ST-2 Jacketed Cables, Multicore Control Cables

No. of cores	Nom. Thickness of XLPE Insulation mm	Unarmoured			Armoured				Max. DC Conductor Resistance at 20°C Ohm/km	A.C. Current Rating	
		Nom. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km	Nom. Steel Armour Size mm	Min. Thickness of Outer Sheath mm	Approx. Overall Dia. mm	Approx. Cable Weight kg/km		In Air Amps	In Ground Amps
2	0.70	1.80	11.7	183	1.4 (W)	1.24	12.7	299	7.41	36	41
3	0.70	1.80	12.2	216	1.4 (W)	1.24	13.2	342	7.41	30	34
4	0.70	1.80	13.1	226	1.4 (W)	1.24	14.1	401	7.41	30	34
5	0.70	1.80	14.1	269	1.4 (W)	1.24	15.0	453	7.41	30	34
6	0.70	1.80	15.1	313	1.4 (W)	1.24	16.0	506	7.41	26	29
7	0.70	1.80	15.1	328	1.4 (W)	1.24	16.0	522	7.41	25	27
9	0.70	1.80	18.4	420	1.4 (W)	1.40	20.2	776	7.41	22	25
10	0.70	1.80	18.4	446	4 x 0.8 (F)	1.24	19.0	633	7.41	21	24
12	0.70	1.80	18.9	505	4 x 0.8 (F)	1.40	19.5	705	7.41	20	22
14	0.70	1.80	19.9	568	4 x 0.8 (F)	1.40	20.4	790	7.41	19	21
16	0.70	2.00	21.3	653	4 x 0.8 (F)	1.40	21.4	853	7.41	18	20
19	0.70	2.00	22.3	755	4 x 0.8 (F)	1.40	22.4	976	7.41	17	19
24	0.70	2.00	25.6	932	4 x 0.8 (F)	1.40	25.7	1192	7.41	16	17
27	0.70	2.00	26.1	1019	4 x 0.8 (F)	1.40	26.2	1278	7.41	16	16
30	0.70	2.00	27.0	1111	4 x 0.8 (F)	1.40	27.1	1368	7.41	14	16
37	0.70	2.00	29.0	1325	4 x 0.8 (F)	1.40	29.1	1625	7.41	13	15
44	0.70	2.20	33.0	1604	4 x 0.8 (F)	1.56	33.1	1950	7.41	12	14
52	0.70	2.20	34.4	1839	4 x 0.8 (F)	1.56	34.5	2206	7.41	12	13
61	0.70	2.20	36.4	2110	4 x 0.8 (F)	1.56	36.5	2496	7.41	11	12

Note: Cables with round wire armour can also be supplied on request.

2.0 Technical Data for HT Cables

Table 2.1

Continuous current rating of Finopower XLPE Cables

for Voltage grade 1.9 / 3.3 kV to 3.8 / 6.6 kV with Aluminium / Copper conductor

Cross-sectional area	Single Core Armoured				Three Core Armoured			
	Aluminium conductor		Copper conductor		Aluminium conductor		Copper conductor	
	In ground	In Air	In ground	In Air	In ground	In Air	In ground	In Air
Sqmm	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
25	99	115	127	148	94	102	121	132
35	117	139	151	179	112	123	144	159
50	138	166	178	214	131	146	169	188
70	168	208	216	267	160	182	206	234
95	200	252	256	323	191	221	246	284
120	227	292	290	374	216	254	278	326
150	252	329	323	422	241	286	310	368
185	285	380	362	484	273	330	350	422
240	326	448	411	565	315	385	401	492
300	365	511	456	641	354	440	449	559
400	412	593	508	734	403	512	506	642
500	461	680	559	828	457	590	565	730
630	514	777	611	929	-	-	-	-
800	552	863	638	1002	-	-	-	-
1000	595	954	672	1083	-	-	-	-

Table 2.2**Continuous current rating of Finopower XLPE Cables**

for Voltage grade 6.6 / 6.6 kV to 11 / 11 kV with Aluminium / Copper conductor

Cross-sectional area	Single Core Armoured				Three Core Armoured			
	Aluminium conductor		Copper conductor		Aluminium conductor		Copper conductor	
	In ground	In Air	In ground	In Air	In ground	In Air	In ground	In Air
Sqmm	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
25	99	116	127	150	94	103	121	133
35	118	140	151	181	112	124	144	160
50	138	167	178	216	131	148	169	191
70	168	209	216	269	161	184	207	237
95	200	254	257	326	190	222	245	286
120	227	294	290	376	216	256	278	329
150	252	331	323	424	242	288	311	371
185	284	383	360	487	273	330	349	422
240	326	450	411	568	315	387	401	493
300	365	512	456	643	354	441	449	560
400	412	594	508	735	404	512	506	643
500	461	680	559	828	457	590	565	731
630	514	778	611	930	-	-	-	-
800	553	863	639	1003	-	-	-	-
1000	595	954	672	1083	-	-	-	-

Table 2.3**Continuous current rating of Finopower XLPE Cables**

for Voltage grade 12.7 / 22 kV to 19 / 33 kV with Aluminium / Copper conductor

Cross-sectional area	Single Core Armoured				Three Core Armoured			
	Aluminium conductor		Copper conductor		Aluminium conductor		Copper conductor	
	In ground	In Air	In ground	In Air	In ground	In Air	In ground	In Air
Sqmm	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
35	116	144	150	185	111	127	143	164
50	137	174	176	224	130	152	167	196
70	167	217	214	278	159	189	204	243
95	198	262	253	336	189	227	243	293
120	224	302	285	386	215	262	276	336
150	249	339	317	434	239	294	307	378
185	280	389	355	494	270	336	346	431
240	321	455	404	575	312	393	398	503
300	355	515	442	644	351	448	446	571
400	400	594	490	734	400	519	503	655
500	447	678	538	825	454	598	563	745
630	496	770	586	920	-	-	-	-
800	543	866	629	1014	-	-	-	-
1000	572	944	643	1074	-	-	-	-

Table 2.4

Approx reactance per phase at 50 Hz (ohms/km)

Cross-sectional area	6.6 kV (E)			6.6 kV(UE) & 11 kV (E)			11 kV (UE)			22 kV (E)			33 kV (E)		
	Single Core Cables		Three core	Single Core Cables		Three core	Single Core Cables		Three core	Single Core Cables		Three core	Single Core Cables		Three core
	Armoured	Unarmoured	Armoured	Armoured	Unarmoured	Armoured	Armoured	Unarmoured	Armoured	Armoured	Unarmoured	Armoured	Armoured	Unarmoured	Armoured
25	0.140	0.128	0.117	0.143	0.135	0.124	0.151	0.146	0.135	0.149	0.141	0.133	0.151	0.144	0.140
35	0.134	0.123	0.112	0.137	0.127	0.118	0.143	0.139	0.130	0.140	0.132	0.129	0.143	0.137	0.132
50	0.127	0.114	0.107	0.131	0.120	0.113	0.141	0.129	0.126	0.140	0.132	0.129	0.135	0.130	0.125
70	0.116	0.110	0.100	0.120	0.114	0.106	0.130	0.123	0.116	0.132	0.125	0.120	0.143	0.137	0.132
95	0.109	0.104	0.094	0.114	0.108	0.099	0.124	0.116	0.111	0.127	0.119	0.112	0.135	0.130	0.125
120	0.107	0.100	0.092	0.111	0.104	0.097	0.121	0.113	0.108	0.121	0.115	0.109	0.129	0.125	0.121
150	0.104	0.097	0.089	0.107	0.101	0.093	0.117	0.109	0.102	0.117	0.112	0.106	0.125	0.121	0.116
185	0.103	0.094	0.086	0.106	0.098	0.090	0.112	0.106	0.099	0.115	0.108	0.101	0.122	0.118	0.112
240	0.099	0.092	0.084	0.102	0.095	0.088	0.108	0.102	0.096	0.109	0.103	0.098	0.118	0.113	0.108
300	0.097	0.090	0.083	0.098	0.092	0.085	0.105	0.098	0.093	0.106	0.100	0.095	0.115	0.110	0.104
400	0.094	0.088	0.081	0.095	0.089	0.083	0.101	0.096	0.090	0.101	0.097	0.091	0.110	0.105	0.100
500	0.093	0.086	---	0.093	0.087	---	0.100	0.092	0.092	0.099	0.094	0.094	0.107	0.102	---
630	0.089	0.084	---	0.090	0.084	---	0.096	0.090	0.090	0.097	0.092	0.092	0.103	0.098	---
800	0.088	0.082	---	0.089	0.082	---	0.093	0.088	0.088	0.094	0.089	0.089	0.100	0.095	---
1000	0.087	0.081	---	0.087	0.081	---	0.091	0.085	0.085	0.091	0.087	0.087	0.098	0.093	---

Table 2.5

Approx. Capacitance for Single and multicore cables (microfarads/km)

Cross-sectional area	6.6 kV (E)			6.6 kV(UE) /11 kV (E)			11 kV (UE)			22 kV (E)			33 kV (E)		
	Single Core	Three core	Three core	Single Core	Three core	Three core	Single Core	Three core	Three core	Single Core	Three core	Three core	Single core	Three core	Three core
25	0.21	0.22	0.22	0.18	0.18	0.18	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.12	0.12
35	0.24	0.25	0.25	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.15	0.12	0.12	0.12
50	0.27	0.27	0.27	0.22	0.22	0.22	0.16	0.16	0.16	0.16	0.16	0.16	0.12	0.12	0.12
70	0.31	0.31	0.31	0.25	0.25	0.25	0.18	0.18	0.18	0.17	0.17	0.17	0.13	0.13	0.13
95	0.36	0.36	0.36	0.29	0.29	0.29	0.21	0.21	0.21	0.19	0.19	0.19	0.15	0.15	0.15
120	0.39	0.39	0.39	0.31	0.31	0.31	0.22	0.22	0.22	0.21	0.21	0.21	0.16	0.16	0.16
150	0.43	0.43	0.43	0.34	0.34	0.34	0.24	0.24	0.24	0.23	0.23	0.23	0.17	0.17	0.17
185	0.47	0.46	0.46	0.37	0.37	0.37	0.26	0.26	0.26	0.24	0.24	0.24	0.18	0.18	0.18
240	0.52	0.51	0.51	0.41	0.41	0.41	0.29	0.29	0.29	0.27	0.27	0.27	0.20	0.20	0.20
300	0.53	0.52	0.52	0.45	0.45	0.45	0.31	0.31	0.31	0.29	0.29	0.29	0.22	0.22	0.22
400	0.55	0.54	0.54	0.51	0.51	0.51	0.35	0.35	0.35	0.32	0.32	0.32	0.24	0.24	0.24
500	0.56	--	--	0.54	--	--	0.38	--	--	0.35	--	--	0.25	--	--
630	0.64	--	--	0.63	--	--	0.43	--	--	0.40	--	--	0.29	--	--
800	0.71	--	--	0.70	--	--	0.48	--	--	0.44	--	--	0.32	--	--
1000	0.78	--	--	0.78	--	--	0.52	--	--	0.48	--	--	0.35	--	--

Dimension, Weight & Packing data

Table 2.6 : SINGLE CORE CABLES

Cross-sectional area	3.8/6.6 kV (E) Grade, Unarmoured Cables, A2XCY						6.35/11 kV (E) or 6.6/6.6 kV (UE) Grade, Un-armoured Cables, A2XCY					
	Approx. Dia over insulation	Nom. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Mtr	Approx. Dia over insulation	Nom. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Mtr
	mm	mm	mm	Kg/Km	Mtr		mm	mm	mm	Kg/Km	Mtr	
25	13.0	1.8	18.5	370	1000	1000	14.5	2.0	20.5	440	1000	1000
35	14.0	2.0	20.0	430	1000	1000	15.5	2.0	21.5	490	1000	1000
50	15.5	2.0	21.5	510	1000	1000	17.0	2.0	23.0	560	1000	1000
70	17.0	2.0	23.0	600	500	500	18.5	2.0	24.5	660	500	500
95	19.0	2.0	24.5	710	500	500	20.5	2.0	26.5	780	500	500
120	20.5	2.0	26.0	820	500	500	22.0	2.0	27.5	885	500	500
150	22.0	2.0	27.5	930	500	500	23.5	2.0	29.0	1000	500	500
185	23.5	2.0	29.5	1070	500	500	25.0	2.2	31.0	1170	500	500
240	25.5	2.2	31.5	1300	500	500	27.0	2.2	33.0	1370	500	500
300	28.0	2.2	33.5	1530	500	500	29.5	2.2	35.0	1590	500	500
400	32.0	2.2	37.5	1890	500	500	32.5	2.2	38.0	1920	500	500
500	35.0	2.4	41.5	2340	500	500	35.0	2.4	42.0	2340	500	500
630	39.0	2.4	45.0	2800	500	500	39.5	2.4	45.5	2820	500	500
800	42.0	2.6	49.5	3460	500	500	42.0	2.6	49.5	3470	500	500
1000	49.0	2.8	54.0	4200	500	500	49.0	2.8	54.0	4200	500	500

Table 2.7 : SINGLE CORE CABLES

Cross-sectional area	11 /11 kV (UE) Grade, Un-armoured Cables, A2XCY						12.7/22 kV (E) Grade, Un-armoured Cables, A2XCY					
	Approx. Dia over insulation	Nom. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Mtr	Approx. Dia over insulation	Nom. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Mtr
	mm	mm	mm	Kg/Km	Mtr		mm	mm	mm	Kg/Km	Mtr	
25	18.5	2.0	24.5	580	1000	1000	20.5	2.0	26.5	670	1000	1000
35	19.5	2.0	25.5	640	1000	1000	22.0	2.0	28.0	760	1000	1000
50	21.0	2.0	26.5	720	1000	1000	23.5	2.0	29.5	870	500	500
70	22.5	2.0	28.5	830	500	500	25.5	2.2	31.5	1030	500	500
95	24.0	2.0	30.0	950	500	500	27.0	2.2	33.0	1150	500	500
120	26.0	2.2	32.0	1100	500	500	28.5	2.2	34.5	1280	500	500
150	27.5	2.2	33.5	1230	500	500	30.0	2.2	36.0	1440	500	500
185	29.0	2.2	35.0	1380	500	500	32.0	2.2	38.0	1650	500	500
240	31.0	2.2	36.5	1600	500	500	34.0	2.2	39.7	1880	500	500
300	33.0	2.2	39.0	1820	500	500	37.5	2.4	43.0	2270	500	500
400	36.5	2.4	42.0	2200	500	500	40.5	2.6	47.0	2730	500	500
500	39.5	2.4	46.0	2620	500	500	44.5	2.6	51.0	3250	500	500
630	43.5	2.6	49.5	3150	500	500	47.0	2.8	54.5	3930	500	500
800	46.0	2.8	53.5	3840	500	500	53.0	3.0	59.0	4680	500	500
1000	53.0	2.8	57.5	4520	500	500						

Table 2.8 : Single Core Cables

		19/33 kV (E) grade Unarmoured cables A2XCY					3.8/6.6 kV (E) Grade Armoured cables, A2XW4Y				
Cross-sectional area	Approx. Dia over insulation	Nom. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Approx. Dia over insulation	Nom. Dia. Of armour wire	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length
Sqmm	mm	mm	mm	Kg/Km	Mtr	mm	mm	mm	mm	Kg/Km	Mtr
25	---	---	---	---	---	13.0	1.6	1.4	21.0	480	1000
35	---	---	---	---	---	14.0	1.6	1.4	22.0	540	1000
50	27.5	2.2	33.5	1080	1000	15.5	1.6	1.4	23.5	610	1000
70	29.0	2.2	35.5	1210	500	17.0	1.6	1.4	25.0	710	500
95	31.0	2.2	37.0	1360	500	19.0	1.6	1.4	26.5	830	500
120	32.5	2.2	38.5	1480	500	20.5	1.6	1.4	28.0	930	500
150	34.0	2.2	40.0	1630	500	22.0	1.6	1.56	30.0	1070	500
185	35.5	2.4	42.0	1850	500	23.5	1.6	1.56	31.5	1230	500
240	37.5	2.4	44.0	2070	500	25.5	2.0	1.56	34.0	1510	500
300	39.5	2.6	46.3	2375	500	28.0	2.0	1.56	36.5	1760	500
400	43.0	2.6	49.2	2750	500	32.0	2.0	1.72	40.5	2160	500
500	45.5	2.8	53.2	3250	500	35.0	2.0	1.88	44.0	2630	500
630	50.0	2.8	56.5	3800	500	39.0	2.0	1.88	48.0	3160	500
800	52.5	3.0	60.5	4520	500	42.0	2.5	2.04	53.0	3930	500
1000	59.5	3.0	65.0	5320	500	49.0	2.5	2.2	58.0	4690	500

Table 2.9 : Single core Cables.

Cross-sectional area	6.35/11kV (E) or 6.6/6.6 kV (UE) grade Armoured Cables A2XW4Y						11/11kV (UE) Grade Armoured Cables, A2XW4Y					
	Approx. Dia over insulation	Nom. Dia. Of armour wire	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Approx. Dia over insulation	Nom. Dia. Of armour wire	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length
Sqmm	mm	mm	mm	mm	Kg/Km	Mtr	mm	mm	mm	mm	Kg/Km	Mtr
25	14.5	1.6	1.4	22.5	550	1000	18.5	1.6	1.4	26.5	720	500
35	15.5	1.6	1.4	23.5	610	1000	19.5	1.6	1.4	27.5	780	500
50	17.0	1.6	1.4	25.0	675	1000	21.0	1.6	1.56	29.0	885	500
70	18.5	1.6	1.4	26.5	790	500	22.5	1.6	1.56	30.5	1010	500
95	20.5	1.6	1.4	28.0	905	500	24.0	1.6	1.56	33.0	1210	500
120	22.0	1.6	1.56	30.0	1040	500	26.0	2.0	1.56	34.5	1325	500
150	23.5	1.6	1.56	31.5	1160	500	27.5	2.0	1.56	36.0	1455	500
185	25.0	2.0	1.56	34.0	1400	500	29.0	2.0	1.56	37.5	1635	500
240	27.0	2.0	1.56	35.5	1610	500	31.0	2.0	1.72	39.5	1890	500
300	29.5	2.0	1.56	37.5	1835	500	33.0	2.0	1.72	41.5	2135	500
400	32.5	2.0	1.72	41.2	2210	500	36.5	2.0	1.88	45.0	2530	500
500	35.0	2.0	1.72	44.5	2650	500	39.5	2.0	1.88	48.5	2990	500
630	39.5	2.0	1.88	48.0	3180	500	43.5	2.5	2.04	53.5	3690	500
800	42.0	2.5	2.04	53.5	3945	500	46.0	2.5	2.2	57.5	4360	500
1000	49.0	2.5	2.2	58.0	4690	500	53.0	2.5	2.2	61.5	5060	500

Table 2.10: Single core Cables

12.7/ 22kV (E) Armoured Cable. Type A2XWwY										19/33 kV (E) Armoured Cables, A2XWwY									
Cross-sectional area	Approx. Dia over insulation	Nom. Dia. Of armour wire	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Approx. Dia over insulation	Nom. Dia. Of armour wire	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	Approx. Dia over insulation	Nom. Dia. Of armour wire	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net weight of cable	Standard Packing Length	
Sqmm	mm	mm	mm	mm	Kg/Km	Mr	mm	mm	mm	mm	Kg/Km	Mtr	mm	mm	mm	mm	Kg/Km	Mtr	
35	20.5	1.6	1.40	28.5	830	500	--	--	--	--	--	--	--	--	--	--	--	--	--
50	22.0	1.6	1.56	30.0	940	500	27.5	2.0	1.56	36.5	1345	500	27.5	2.0	1.56	36.5	1345	500	500
70	23.5	1.6	1.56	31.5	1060	500	29.0	2.0	1.56	38.0	1485	500	29.0	2.0	1.56	38.0	1485	500	500
95	25.5	2.0	1.56	34.0	1270	500	31.0	2.0	1.72	40.0	1670	500	31.0	2.0	1.72	40.0	1670	500	500
120	27.0	2.0	1.56	35.6	1395	500	32.5	2.0	1.72	41.5	1801	500	32.5	2.0	1.72	41.5	1801	500	500
150	28.5	2.0	1.56	37.0	1520	500	34.0	2.0	1.72	42.5	1950	500	34.0	2.0	1.72	42.5	1950	500	500
185	30.0	2.0	1.56	39.0	1735	500	35.5	2.0	1.72	45.0	2185	500	35.5	2.0	1.72	45.0	2185	500	500
240	32.0	2.0	1.72	40.5	1960	500	37.5	2.0	1.88	46.5	2425	500	37.5	2.0	1.88	46.5	2425	500	500
300	34.0	2.0	1.72	42.5	2210	500	39.5	2.5	2.04	50.0	2860	500	39.5	2.5	2.04	50.0	2860	500	500
400	37.5	2.0	1.88	46.0	2600	500	43.0	2.5	2.04	53.0	3265	500	43.0	2.5	2.04	53.0	3265	500	500
500	40.5	2.5	2.04	50.5	3260	500	45.5	2.5	2.20	57.0	3825	500	45.5	2.5	2.20	57.0	3825	500	500
630	44.5	2.5	2.04	54.5	3790	500	49.5	2.5	2.20	61.0	4455	500	49.5	2.5	2.20	61.0	4455	500	500
800	47.0	2.5	2.20	58.5	4465	500	52.5	2.5	2.36	64.5	5100	500	52.5	2.5	2.36	64.5	5100	500	500
1000	54.0	2.5	2.36	62.5	5250	500	59.5	3.15	2.52	70.0	6185	400	59.5	3.15	2.52	70.0	6185	400	400

Table 2.11

Three Core Armoured Cables with Aluminium conductors (A2XCEFY):

3.8 / 6.6 kV (E)										6.35/11 kV (E) or 6.6 /6.6 kV (UE)									
Cross-sectional area	Approx. Dia over insulation	Min. thickness of inner sheath	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net Weight of cable	Standard Packing Length	Approx. Dia over insulation	Min. thickness of inner sheath	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net Weight of cable	Standard Packing Length	Approx. Dia over insulation	Min. thickness of inner sheath	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net Weight of cable	Standard Packing Length	
sqmm	mm	mm	mm	mm	Kg/Km	Mtr	mm	mm	mm	mm	Kg/Km	Mtr	mm	mm	mm	mm	Kg/Km	Mtr	
25	13.0	0.4	1.56	36.5	1680	500	14.5	0.4	1.72	40.5	1970	500	14.5	0.4	1.72	40.5	1970	500	500
35	14.0	0.4	1.72	39.5	1910	500	15.5	0.5	1.72	43.0	2180	500	15.5	0.5	1.72	43.0	2180	500	500
50	15.5	0.5	1.72	42.0	2200	500	17.0	0.5	1.88	46.0	2500	500	17.0	0.5	1.88	46.0	2500	500	500
70	17.0	0.5	1.88	46.0	2610	500	18.5	0.5	1.88	49.5	2890	500	18.5	0.5	1.88	49.5	2890	500	500
95	19.0	0.5	1.88	49.5	3060	500	20.5	0.6	2.04	54.0	3430	500	20.5	0.6	2.04	54.0	3430	500	500
120	20.5	0.6	2.04	53.5	3530	500	22.0	0.6	2.20	57.0	3890	500	22.0	0.6	2.20	57.0	3890	500	500
150	22.0	0.6	2.20	57.0	4020	500	23.5	0.6	2.20	60.5	4350	500	23.5	0.6	2.20	60.5	4350	500	500
185	23.5	0.6	2.20	60.5	4620	500	25.0	0.7	2.36	64.5	5040	500	25.0	0.7	2.36	64.5	5040	500	500
240	25.5	0.7	2.36	65.0	5530	500	27.0	0.7	2.52	69.0	5880	500	27.0	0.7	2.52	69.0	5880	500	500
300	28.0	0.7	2.52	70.5	6460	400	29.5	0.7	2.68	73.5	6720	350	29.5	0.7	2.68	73.5	6720	350	350
400	32.0	0.7	2.84	79.0	8040	300	32.5	0.7	2.84	80.5	8040	300	32.5	0.7	2.84	80.5	8040	300	300

Table 2.12 : Three Core Armoured Cables with Aluminium conductors (A2XCEFY):

11/11kV (UE) Grade							12.7/22 kV (E) Grade					
Cross-sectional area	Approx. Dia over insulation	Min. thickness of inner sheath	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net Weight of cable	Standard Packing Length	Approx. Dia over insulation	Min. thickness of inner sheath	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net Weight of cable	Standard Packing Length
sqmm	mm	mm	mm	mm	Kg/Km	Mtr	mm	mm	mm	mm	Kg/Km	Mtr
25	18.5	0.5	1.88	49.0	2710	500	-	-	-	-	-	-
35	19.5	0.5	2.04	52.0	2990	500	20.5	0.6	2.04	54.5	3190	500
50	21.0	0.6	2.20	55.5	3370	500	22.0	0.6	2.20	57.5	3580	500
70	22.5	0.6	2.20	59.0	3810	500	23.5	0.6	2.36	61.5	4080	500
95	24.0	0.6	2.36	62.5	4380	500	25.5	0.7	2.36	65.0	4670	500
120	26.0	0.7	2.36	66.0	4870	500	27.0	0.7	2.52	68.5	5170	500
150	27.5	0.7	2.52	69.5	5430	500	28.5	0.7	2.68	72.0	5745	400
185	29.0	0.7	2.68	73.5	6150	400	30.0	0.7	2.68	75.5	6440	350
240	31.0	0.7	2.84	78.0	7050	350	32.0	0.7	2.84	80.0	7330	300
300	33.0	0.7	3.00	82.5	7940	250	34.0	0.7	3.00	84.5	8260	250
400	36.5	0.7	3.00	89.0	9300	200	37.5	0.7	3.00	91.0	9620	200

Table 2.13 : 19/33 kV (E) grade three core Armoured Cables with Aluminium conductors (A2XCEFY):

Cross-sectional area	Approx. Dia over insulation	Min. thickness of inner sheath	Min. thickness of outer sheath	Approx. Overall Diameter	Approx. Net Weight of cable	Standard Packing Length
Sqmm	mm	mm	mm	mm	Kg/Km	Mtr
50	27.5	0.7	2.52	70.5	5090	500
70	29.0	0.7	2.68	74.5	5670	500
95	31.0	0.7	2.84	78.5	6340	500
120	32.5	0.7	2.84	81.5	6870	500
150	34.0	0.7	3.00	85.0	7510	500
185	35.5	0.7	3.00	88.5	8250	500
240	37.5	0.7	3.00	92.5	9170	500
300	39.5	0.7	3.00	97.0	10060	500
400	43.0	0.7	3.00	103.0	11530	500

Note: a) Nominal Thickness of Insulation for all the cables are as per Table 1

b) Tolerance on standard packing length: +/- 5%

Table 2.14

Conductor and Insulation Data

Conductor diameter and Nominal thickness of insulation for different cross-sectional area and different voltage grades with AC/DC Conductor resistance values

Cross-sectional area	Nominal thickness of insulation					Approx. Conductor diameter	Max. DC resistance at 20°C (Aluminium)	Approx. AC resistance at 90°C (Aluminium)	Max. DC resistance at 20° C (Copper)	Approx. AC resistance at 90° C (copper)
	3.8/6.6 kV	6.6/6.6 & 6.35/11 kV	11/11 kV	12.7/22 kV	19/33 kV					
(Sqmm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(Ohm/Km)	(Ohm/Km)	(Ohm/Km)	(Ohm/Km)
25	2.8	3.6	5.5	-	-	6.0	1.20	1.54	0.727	0.931
35	2.8	3.6	5.5	6.0	-	7.0	0.868	1.11	0.524	0.671
50	2.8	3.6	5.5	6.0	8.8	8.5	0.641	0.822	0.387	0.495
70	2.8	3.6	5.5	6.0	8.8	10.0	0.443	0.568	0.268	0.343
95	2.8	3.6	5.5	6.0	8.8	12.0	0.320	0.410	0.193	0.247
120	2.8	3.6	5.5	6.0	8.8	13.1	0.253	0.324	0.153	0.197
150	2.8	3.6	5.5	6.0	8.8	14.6	0.206	0.266	0.124	0.160
185	2.8	3.6	5.5	6.0	8.8	16.5	0.164	0.211	0.0991	0.127
240	2.8	3.6	5.5	6.0	8.8	18.5	0.125	0.161	0.0754	0.0973
300	3.0	3.6	5.5	6.0	8.8	20.5	0.100	0.129	0.0601	0.0774
400	3.3	3.6	5.5	6.0	8.8	23.5	0.0778	0.101	0.0470	0.0606
500	3.5	3.6	5.5	6.0	8.8	26.8	0.0605	0.0782	0.0366	0.0473
630	3.5	3.6	5.5	6.0	8.8	30.5	0.0469	0.0606	0.0283	0.0365
800	3.5	3.6	5.5	6.0	8.8	34.0	0.0367	0.0474	0.0221	0.0285
1000	3.6	3.6	5.5	6.0	8.8	38.0	0.0291	0.0376	0.0176	0.0227

3.0 SHORT CIRCUIT RATING

The conductor size in a cable for any type of insulation is governed by its ability to carry short circuit current of the system. The short circuit ratings are based on the assumption that the duration of short circuit is very small, and apparently there is no heat transmitted or produced during short circuit, through the insulation the heat produced if any, the entire amount is absorbed by the conductor.

The short circuit current ratings (r.m.s. values) of XLPE insulated cables are calculated as given below:

Formula for calculating the short circuit rating for other durations :

$$I_t = \frac{I_1}{\sqrt{t}}$$

where: I_1 = Short Circuit current for 1 sec

I_t = Short Circuit current for t sec

t = Duration in seconds

Nominal area of cross section	ALUMINIUM	COPPER
sqmm	kA for 1 Sec	
1.5	0.14	0.21
2.5	0.24	0.36
4	0.38	0.57
6	0.57	0.86
10	0.9	1.4
16	1.5	2.3
25	2.4	3.6
35	3.3	5.0
50	4.7	7.1
70	6.6	10.0
95	9	13.6
120	11.3	17.1
150	14.2	21.4
185	17.5	26.4
240	22.6	34.3
300	28.3	42.9
400	37.7	57.2
500	47.2	71.5
630	59.4	90.0
800	75.5	114.3
1000	94.4	142.9

4.0 RATING FACTORS:

Table 4.1 Rating factors for ambient air temperature variation

Ambient Temperature (°C)	25	30	35	40	45	50	55	60
Factor	1.14	1.10	1.05	1.0	0.95	0.89	0.84	0.77

Table 4.2 Rating factors for ambient ground temperature variation

Ground Temperature (°C)	15	20	25	30	35	40	45	50
Factor	1.12	1.08	1.04	1.00	0.96	0.91	0.87	0.82

Table 4.3: Rating factors for various depths of laying (for cables laid directly in ground)

LT cables:

Depth of laying cm	Up to 25 mm ²		Above 25 mm ² up to 300 sqmm		Above 300 mm ²	
	Single	Multi	Single	Multi	Single	Multi
75	1	1	1	1	1	1
90	0.98	0.98	0.98	0.98	0.98	0.98
105	0.97	0.98	0.96	0.97	0.96	0.96
120	0.96	0.97	0.95	0.95	0.94	0.95
150	0.94	0.95	0.93	0.93	0.92	0.93
180	0.93	0.93	0.91	0.92	0.9	0.91
200	0.92	0.93	0.9	0.91	0.89	0.9
250	0.9	0.92	0.89	0.89	0.87	0.88
300	0.9	0.9	0.87	0.88	0.86	0.87

HT Cables:

Depth of laying cm	3.3, 6.6, & 11kV			22 & 33 kV		
	Single core		Three core	Single core		Three core
	≤ 185 mm ²	> 185 mm ²		≤ 185 mm ²	> 185 mm ²	
90	1.00	1.00	1.00	-	-	-
105	0.98	0.98	0.99	1.00	1.00	1.00
120	0.97	0.97	0.98	0.99	0.98	0.99
150	0.95	0.94	0.96	0.96	0.96	0.97
180	0.93	0.92	0.95	0.95	0.94	0.96
200	0.92	0.91	0.94	0.94	0.93	0.95
250	0.90	0.89	0.93	0.92	0.90	0.94
300	0.89	0.88	0.91	0.91	0.89	0.92

Table 4.4: Rating factors for variations in soil thermal resistivities for single-core 3.3 kV, 6.6 kV and 11 kV cables laid direct in ground

Nominal area of conductor mm ²	Values of soil thermal resistivity K.m/W					
	1.0	1.2	1.5	2.0	2.5	3.0
25	1.17	1.09	1.00	0.89	0.80	0.74
35	1.18	1.10	1.00	0.89	0.80	0.74
50	1.18	1.10	1.00	0.88	0.80	0.74
70	1.19	1.10	1.00	0.88	0.80	0.73
95	1.19	1.10	1.00	0.88	0.79	0.73
120	1.19	1.10	1.00	0.88	0.79	0.73
150	1.19	1.10	1.00	0.88	0.79	0.73
185	1.19	1.11	1.00	0.88	0.79	0.73
240	1.19	1.11	1.00	0.88	0.79	0.73
300	1.20	1.11	1.00	0.88	0.79	0.72
400	1.20	1.11	1.00	0.87	0.79	0.72
500	1.20	1.11	1.00	0.87	0.79	0.72
630	1.20	1.11	1.00	0.87	0.79	0.72
800	1.20	1.11	1.00	0.87	0.78	0.72
1000	1.21	1.11	1.00	0.87	0.78	0.72

**Table 4.5: Rating factors for variations in soil thermal resistivities
for single-core 22 kV and 33 kV cables laid direct in ground**

Nominal area of conductor mm ²	Values of soil thermal resistivity K.m/W					
	1.0	1.2	1.5	2.0	2.5	3.0
35	1.17	1.09	1.00	0.89	0.81	0.74
50	1.17	1.09	1.00	0.89	0.81	0.74
70	1.17	1.09	1.00	0.89	0.80	0.74
95	1.17	1.09	1.00	0.89	0.80	0.74
120	1.18	1.10	1.00	0.89	0.80	0.74
150	1.18	1.10	1.00	0.88	0.80	0.74
185	1.18	1.10	1.00	0.88	0.80	0.74
240	1.18	1.10	1.00	0.88	0.80	0.73
300	1.19	1.10	1.00	0.88	0.79	0.73
400	1.19	1.10	1.00	0.88	0.79	0.73
500	1.19	1.10	1.00	0.88	0.79	0.73
630	1.19	1.10	1.00	0.88	0.79	0.73
800	1.20	1.10	1.00	0.88	0.79	0.72
1000	1.20	1.11	1.00	0.88	0.79	0.72

**Table 4.6: Rating factors for variations in soil thermal resistivities
for three-core 3.3 kV, 6.6 kV and 11 kV cables laid direct in ground**

Nominal area of conductor mm ²	Values of soil thermal resistivity K.m/W					
	1.0	1.2	1.5	2.0	2.5	3.0
25	1.15	1.08	1.00	0.90	0.82	0.76
35	1.15	1.08	1.00	0.90	0.82	0.76
50	1.15	1.08	1.00	0.90	0.82	0.76
70	1.15	1.08	1.00	0.89	0.82	0.76
95	1.15	1.09	1.00	0.89	0.82	0.76
120	1.15	1.09	1.00	0.89	0.82	0.76
150	1.15	1.09	1.00	0.89	0.81	0.75
185	1.16	1.09	1.00	0.89	0.81	0.75
240	1.16	1.09	1.00	0.89	0.81	0.75
300	1.16	1.09	1.00	0.89	0.81	0.75
400	1.16	1.09	1.00	0.89	0.81	0.75
500	1.16	1.09	1.00	0.89	0.81	0.75

**Table 4.7: Rating factors for variations in soil thermal resistivities
for three-core 22 kV and 33 kV cables laid direct in ground**

Nominal area of conductor mm ²	Values of soil thermal resistivity K.m/W					
	1.0	1.2	1.5	2.0	2.5	3.0
35	1.14	1.08	1.00	0.90	0.83	0.77
50	1.14	1.08	1.00	0.90	0.83	0.77
70	1.14	1.08	1.00	0.90	0.83	0.77
95	1.14	1.08	1.00	0.90	0.83	0.77
120	1.14	1.08	1.00	0.90	0.82	0.76
150	1.15	1.08	1.00	0.90	0.82	0.76
185	1.15	1.08	1.00	0.90	0.82	0.76
240	1.15	1.08	1.00	0.90	0.82	0.76
300	1.15	1.08	1.00	0.90	0.82	0.76
400	1.16	1.09	1.00	0.89	0.82	0.76
500	1.16	1.09	1.00	0.89	0.82	0.75

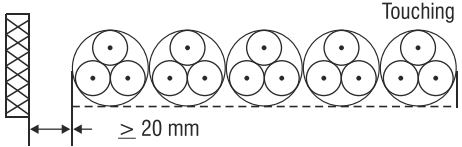
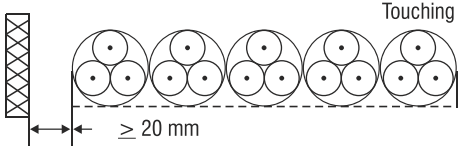
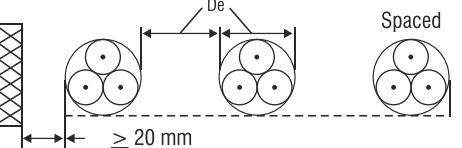
**Table 4.8 Group rating factors for circuits
of three single-core 3.3, 6.6, 11, 22 & 33 kV cables laid direct in the ground**

Number of Circuits	Spacing between group centres mm				
	Touching	200	400	600	800
2	0.73	0.83	0.88	0.90	0.92
3	0.60	0.73	0.79	0.83	0.86
4	0.54	0.68	0.75	0.80	0.84
5	0.49	0.63	0.72	0.78	0.82
6	0.46	0.61	0.70	0.76	0.81
7	0.43	0.58	0.68	0.75	0.80
8	0.41	0.57	0.67	0.74	-
9	0.39	0.55	0.66	0.73	-
10	0.37	0.54	0.65	-	-
11	0.36	0.53	0.64	-	-
12	0.35	0.52	0.64	-	-

Table 4.9 Group rating factors for three-core 3.3, 6.6, 11, 22 & 33 kV cables in horizontal formation laid direct in the ground

Number of cables	Spacing between cable centres mm				
	Touching	200	400	600	800
2	0.80	0.86	0.90	0.92	0.94
3	0.69	0.77	0.82	0.86	0.89
4	0.62	0.72	0.79	0.83	0.87
5	0.57	0.68	0.76	0.81	0.85
6	0.54	0.65	0.74	0.80	0.84
7	0.51	0.63	0.72	0.78	0.83
8	0.49	0.61	0.71	0.78	-
9	0.47	0.60	0.70	0.77	-
10	0.46	0.59	0.69	-	-
11	0.45	0.57	0.69	-	-
12	0.43	0.56	0.68	-	-

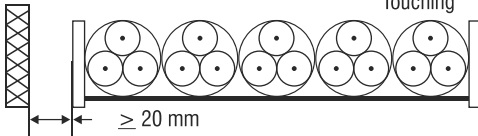
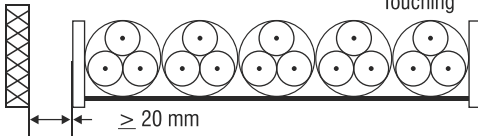
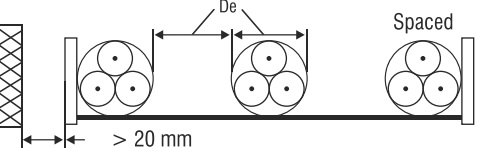
Table 4.10 Group rating factors for three-core 3.3, 6.6, 11, 22 & 33 kV cables in air on perforated trays

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	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
	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	-

NOTE: 1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

NOTE: 2 Factors are given for vertical spacings between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

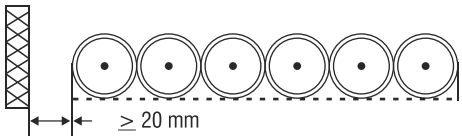
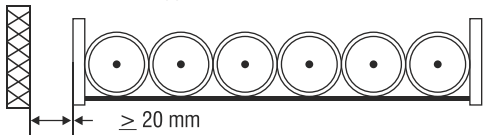
Table 4.11 Group rating factors for three-core 3.3, 6.6, 11, 22 & 33 kV cables in air on ladder supports, cleats, etc

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	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
	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	0.97	0.93	-

NOTE: 1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

NOTE: 2 Factors are given for vertical spacings between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

Table 4.12 Group rating factors to be applied for circuits of three single core 3.3, 6.6, 11, 22 & 33 kV cables in air flat touching

Cables on perforated trays 	Number of Trays	Number of three - phase circuits		
		1	2	3
	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 	1	1.00	0.97	0.96
	2	0.98	0.93	0.89
	3	0.97	0.90	0.86

NOTE: 1 Factors are given for single layers of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

NOTE: 2 Factors are given for vertical spacings between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

NOTE: 3 For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.

Table 4.13: Rating factors for variations in soil thermal resistivities for three single-core 1100V cables laid direct in ground

Nominal area of conductor mm ²	Values of soil thermal resistivity K.m/W					
	1.0	1.2	1.5	2.0	2.5	3.0
1.5	1.14	1.07	1.00	0.89	0.80	0.75
2.5	1.17	1.08	1.00	0.89	0.80	0.75
4	1.17	1.09	1.00	0.88	0.79	0.73
6	1.17	1.09	1.00	0.88	0.79	0.73
10	1.18	1.09	1.00	0.88	0.79	0.73
16	1.18	1.10	1.00	0.88	0.79	0.72
25	1.19	1.10	1.00	0.88	0.79	0.72
35	1.19	1.10	1.00	0.88	0.79	0.72
50	1.19	1.10	1.00	0.88	0.79	0.72
70	1.20	1.11	1.00	0.88	0.79	0.72
95	1.20	1.11	1.00	0.87	0.79	0.72
120	1.20	1.11	1.00	0.87	0.79	0.72
150	1.20	1.11	1.00	0.87	0.79	0.72
185	1.20	1.11	1.00	0.87	0.78	0.72
240	1.20	1.11	1.00	0.87	0.78	0.72
300	1.20	1.11	1.00	0.87	0.78	0.72
400	1.20	1.11	1.00	0.87	0.78	0.72
500	1.21	1.11	1.00	0.87	0.78	0.72
630	1.21	1.11	1.00	0.87	0.78	0.72
800	1.21	1.11	1.00	0.87	0.78	0.72
1000	1.21	1.11	1.00	0.87	0.78	0.72

Table 4.14: Rating factors for variations in soil thermal resistivities for multi-core 1100V cables laid direct in ground

Nominal area of conductor mm ²	Values of soil thermal resistivity K.m/W					
	1.0	1.2	1.5	2.0	2.5	3.0
1.5	1.14	1.08	1.00	0.90	0.83	0.77
2.5	1.15	1.08	1.00	0.90	0.82	0.76
4	1.15	1.08	1.00	0.89	0.82	0.76
6	1.16	1.09	1.00	0.89	0.81	0.75
10	1.16	1.09	1.00	0.89	0.81	0.75
16	1.17	1.09	1.00	0.89	0.80	0.74
25	1.18	1.09	1.00	0.89	0.80	0.74
35	1.18	1.10	1.00	0.88	0.80	0.74
50	1.18	1.10	1.00	0.88	0.80	0.74
70	1.18	1.10	1.00	0.88	0.80	0.74
95	1.18	1.10	1.00	0.88	0.80	0.73
120	1.18	1.10	1.00	0.88	0.80	0.73
150	1.18	1.10	1.00	0.88	0.80	0.73
185	1.19	1.10	1.00	0.88	0.80	0.73
240	1.19	1.10	1.00	0.88	0.80	0.73
300	1.19	1.10	1.00	0.88	0.80	0.73
400	1.19	1.10	1.00	0.88	0.80	0.73
500	1.19	1.10	1.00	0.88	0.80	0.73
630	1.19	1.10	1.00	0.88	0.80	0.73

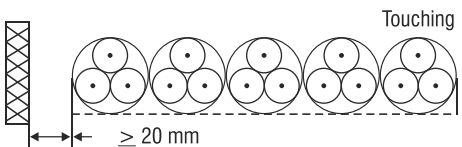
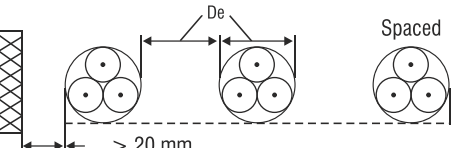
**Table 4.15: Group Rating factors for circuits of three single-core cables
1100V laid direct in the ground, horizontal formation**

Number of circuits	Spacing between group centres mm				
	Touching	150	300	450	600
2	0.77	0.81	0.86	0.88	0.89
3	0.67	0.71	0.78	0.81	0.83
4	0.61	0.64	0.72	0.76	0.80
5	0.57	0.60	0.69	0.74	0.77
6	0.53	0.57	0.66	0.72	0.75
7	0.51	0.55	0.64	0.70	0.74
8	0.49	0.53	0.63	0.69	0.73
9	0.47	0.52	0.62	0.68	0.73
10	0.45	0.51	0.61	0.67	0.72
11	0.44	0.50	0.60	0.66	0.72
12	0.43	0.49	0.59	0.65	0.71

**Table 4.16: Group Rating factors for multi-core 1100V cables
laid direct in the ground, in tier formation**

Number of cables	Number of tiers	Spacing between cable centres mm				
		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

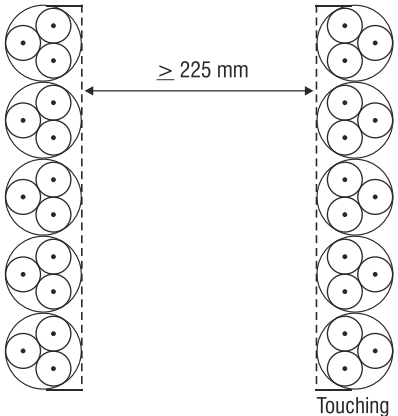
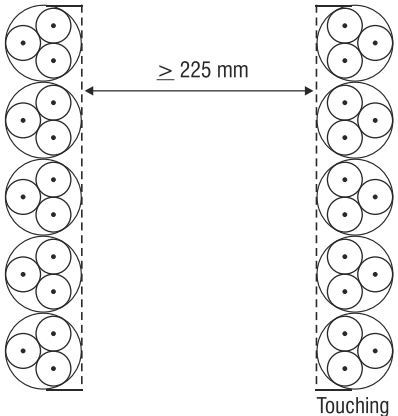
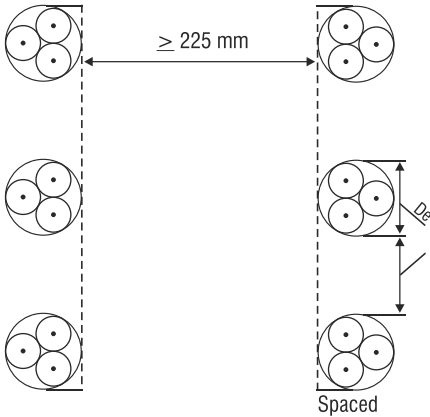
**Table 4.17 Group rating factors for multi-core 1100V cables
in air on perforated trays**

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	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
	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	-

NOTE: 1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

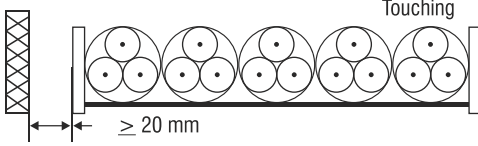
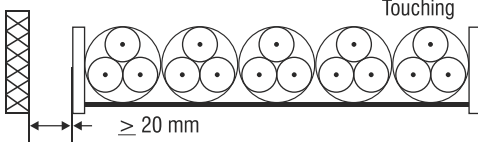
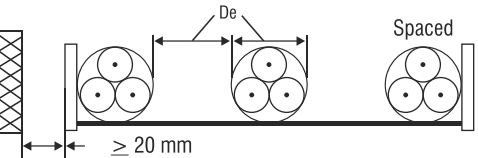
NOTE: 2 Factors are given for vertical spacings between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

Table 4.18 Group rating factors for multi-core 1100V cables in air on vertical perforated trays

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	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
	1	1.00	0.91	0.89	0.88	0.87	-
	2	1.00	0.91	0.88	0.87	0.85	-

NOTE: 1 Factors are given for horizontal spacing between trays of 225 mm with trays mounted back to back. For closer spacing, the factors should be reduced.

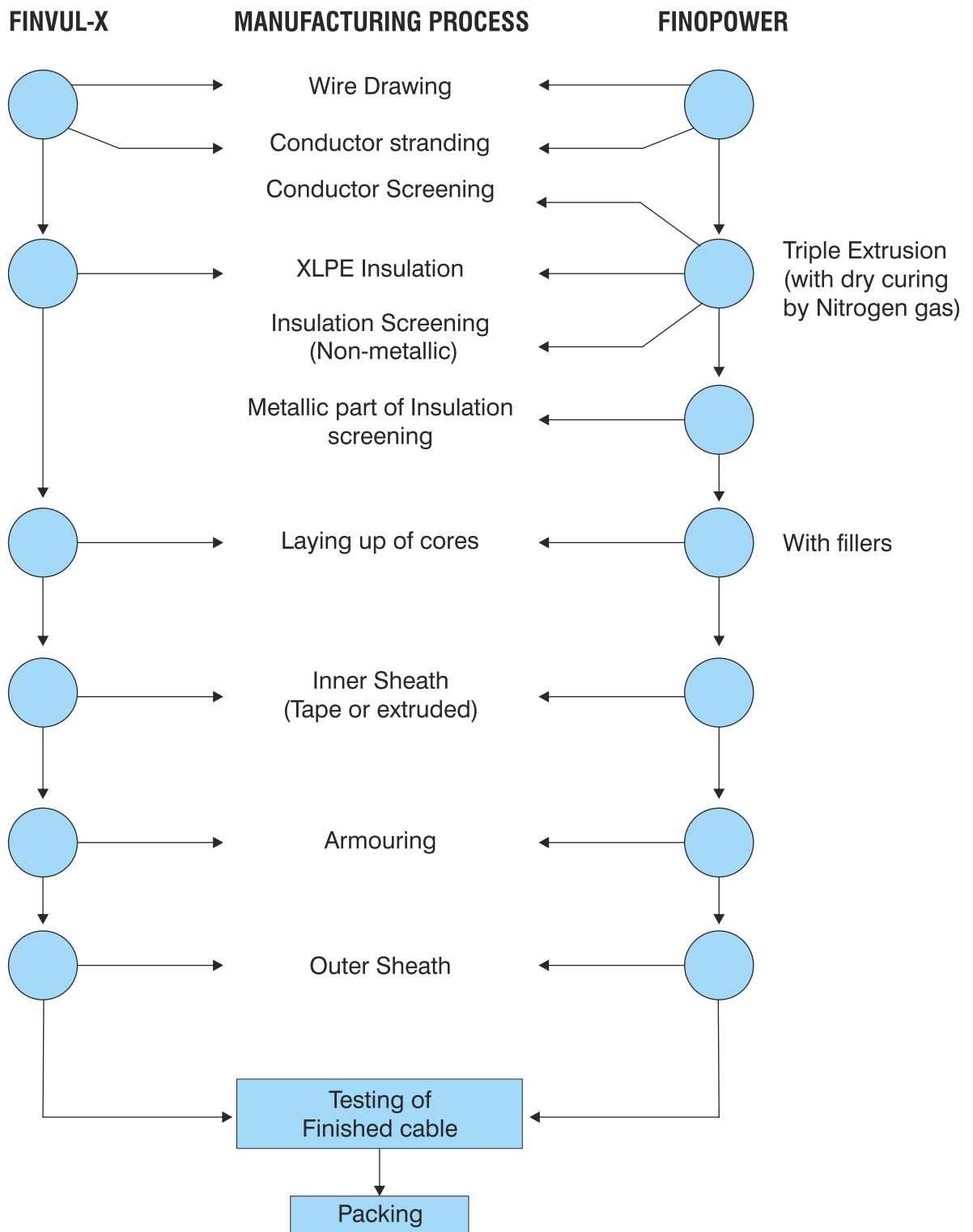
Table 4.19 Group rating factors for multi-core 1100V cables in air on ladder supports, cleats, etc

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	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
	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	-

NOTE: 1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

NOTE: 2 Factors are given for vertical spacings between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

TYPICAL FLOW CHART OF FINVUL-X AND FINOPOWER XLPE CABLES AS PER IS : 7098 - (PART - I & II)

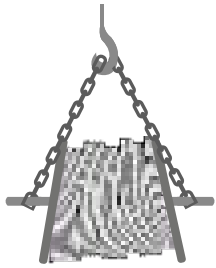


Materials: Aluminium/ Copper
 Semiconducting Compound
 XLPE Insulation
 Annealed Copper tape
 Non hygroscopic filler
 Armour Galvanised steel

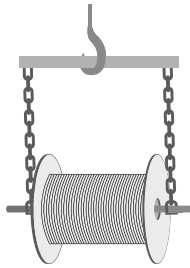
RECOMMENDATIONS FOR STORAGE & INSTALLATION OF CABLES

HANDLING & STORAGE

Handling at site: While unloading the cable drums certain precautions are to be taken for ensuring the safety of the cable.



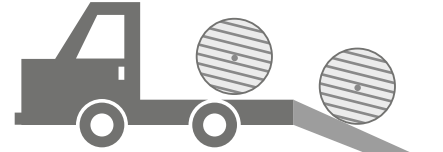
WRONG



CORRECT



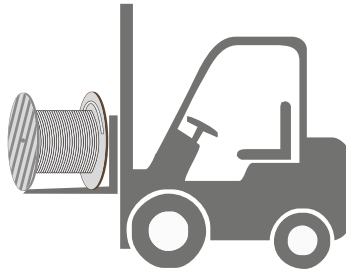
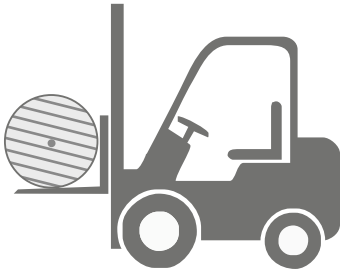
WRONG



CORRECT

When using a lift or crane use a spreader bar longer than the overall drum width just above the drum flanges. Without a spreader bar this will lead to bending of drum flanges crushing & damaging the cable.

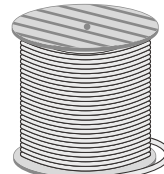
When unloading from the truck, inclined ramp should be used to lower the drum. Do not drop the drum directly from the truck, which may lead to damage of the drum & subsequently the cable.



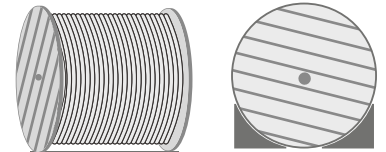
While using forklift for handling or shifting the drum, the drum should be perpendicular to the forks, rather than parallel. Do not allow the forks to be in contact with the cable.

Storage:

Cable drums should be stored on plain ground without any hard stones projecting above the surface and dry place away from direct sunlight and rain. All cable drums should be stored with the battens intact, with sufficient space in between the drums. Ensure stoppers for every drum to avoid the drum movement after storage. Cable drums should not be stored one above the other.



WRONG

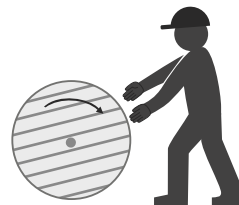


CORRECT

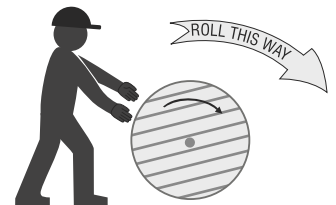
Installation and Laying:

While laying of cables special care to be taken. The cable end should be pulled with pulling eye only after mounting the drum on the Jacks. Do not keep the drum on its flange while pulling the cable. This will result in Bird Caging (Twists and deformation of cable) and armour swelling.

Roll the drum in only one direction as indicated by arrow marked on the drum.



WRONG



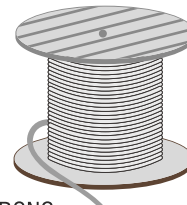
CORRECT

Minimum Bending Radius:

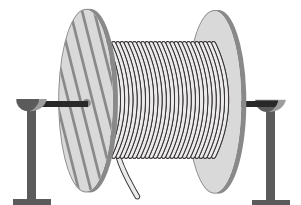
Cable Type	Single Core	Multi Core
HT Cable	20xD	15xD
LT Cable	15xD	12xD

Testing at site:

After the cable is installed before commissioning, it should be tested for DC High Voltage. The recommended voltage and duration will be as per IS:1255. Megger, continuity and cross continuity to be checked on each core before and after laying.



WRONG



CORRECT



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Cables Limited

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When decommissioned, these should be disposed using appropriate methods/process specified in respective state / location of use so as not to affect the environment adversely.