

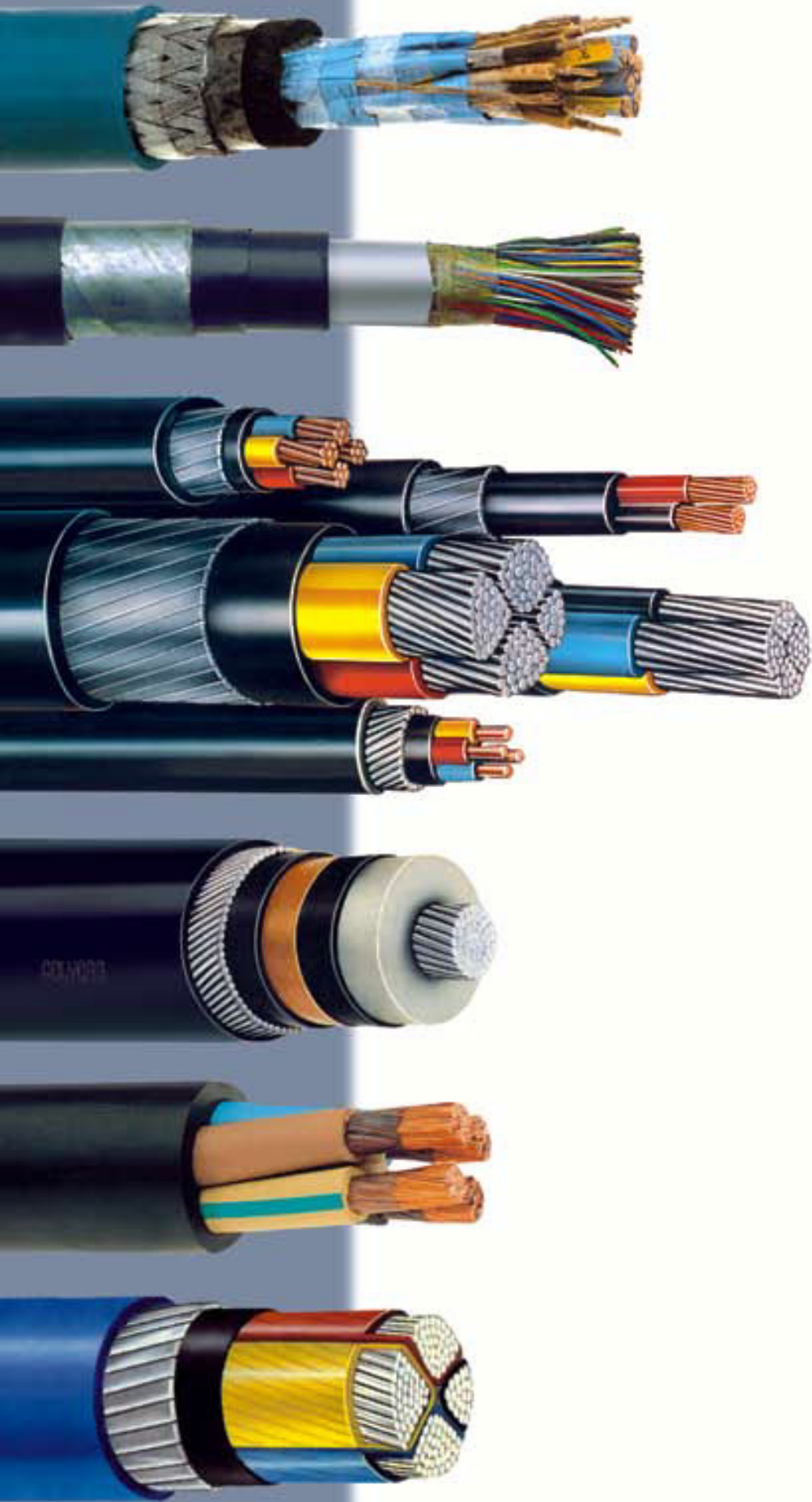
xLPE INSULATED HEAVY DUTY CABLES 650/1100 V.

POLYCHAB

ISO
9001:2000

IS : 694

Product range



- ‡ L.T. Pvc & xLPe Power cabLes wiTh coPPer / aLuminium conducTor (650 / 1100 v. uPTo 4 core x 630 sq. mm., 1 core x 1000 sq. mm.)
- ‡ L.T. Pvc & xLPe conTroL cabLes (650 / 1100 v. uPTo 61 core x 1.5 & 2.5 sq. mm.)
- ‡ h.T. xLPe cabLes uPTo 19/33 Kv.
- ‡ insTrumenTaTion cabLes screened / unscreened TyPe in Pvc / LdPe
- ‡ Thermo-couPLe comPensaTing & exTension cabLes
- ‡ frLs / fr / hr / hffr / hofr / rubber / LdPe –Power, conTroL & insTrumenTaTion cabLes
- ‡ fLexibLes & housewires (singLe & muLTicore)
- ‡ raiLway signaLLing cabLes
- ‡ fire survivaL, Zero haLogen cabLes
- ‡ TeLePhone cabLes – dry & jeLLy fiLLeD
- ‡ auTomobiLe cabLes & harnesses
- ‡ mining / weLding – rubber cabLes
- ‡ ePr / siLicone / high Temp. cabLes
- ‡ submersibLe cabLes / winding wires
- ‡ sTrucTured cabLes / co-axieL cabLes
- ‡ aeriaL bunched cabLes
- ‡ Lan caT-5/5e cabLes
- ‡ oPTicaL fibre cabLes*

(*under development)



Polycab 650/1100 Volts XLPE cables

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UNDERWRITERS LABORATORIES INC.
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3357 (US) : Drawing and Insulating of Non-ferrous Wire

The manufacture of low tension rigid and flexible cables for power, control, instrumentation, signal, thermocouple extensions, radio frequency and inhouse wire applications, and the manufacture of high tension power cables.

The off-site facility at Mumbai performs the following functions: contract review and purchasing.

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S. Joe Bhatia
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INTRODUCTION

POLYCAB has established its name in India and abroad for its quality and commitment to customer satisfaction.

To meet ever increasing demand of POLYCAB cables, POLYCAB has put up a new state of the art manufacturing unit at Daman (U.T.). The manufacturing of XLPE insulated heavy duty cables is by adoption of latest technology. The XLPE cables are manufactured as per IS-7098 Part-1 & Part-2 and can be manufactured to meet the requirements of any international standards like BS – 5467, IEC-60502, DIN etc.

The XLPE compound used is obtained from reputed international sources meeting all required parameters. The cables are manufactured in highly quality conscious environment with testing and inspection done from raw-materials to finished cable stage. The assurance to the quality is further ensured by ISI certification on cables and ISO-9002 certification by UL, USA.

XLPE Cables

The XLPE insulated heavy duty cables were introduced worldwide in mid sixties. These cables have overcome the limitations of PVC Insulated Cables, such as thermal degradation, poor moisture resistant and thermoplastic in nature.

The advantages of XLPE Insulated cables in comparison to those of PVC insulated cables are as under :-

(A) TECHNICAL ADVANTAGES :

- Higher current rating, higher short Circuit Rating. Approx. 1.2 times that of PVC.
- Thermosetting in nature.
- Higher insulation resistance – 1000 times more than PVC cables.
- Better Resistance to surge currents.
- Low Dielectric Losses.
- Better resistance to chemicals and corrosion.
- Longer service life.
- Comparatively higher cable operating temperature 90 °C and short circuit temperature 250 °C.

(B) COMMERCIAL ADVANTAGES :

- Lower laying cost because of comparatively smaller diameter of cable and lighter weight.*
- Requiring less size of cable trays / supports.
- One size lower cables can be used as compared to PVC insulated cable. **

**Density of XLPE is lower than PVC*

***For longer cable length voltage drop shall be considered.*

SELECTION Of POWER CABLES

Power cables are generally selected considering the application. However following factors are important for selection of suitable cable construction required to transport electrical energy from one end to the other.

- Maximum operating voltage.
- Insulation level.
- Frequency.
- Load to be carried.
- Possible overloading duration & magnitude.
- Route length and voltage drop.
- Mode of insulation considering installation environment such as ambient & ground temperature chemical & physical properties of soil.
- Flame retardant properties.
- Plant safety requirements.

All sizes of POLYCAB XLPE cables are designed to standard operating conditions in India and abroad. The standards adopted are considering the geographic / climatic conditions and general applications of power for utilities, distribution and general purposes.

The cables are manufactured conforming to Indian & International specification for XLPE Insulated cables. Customer specific requirements can also be met.

Polycab is manufacturers wide range of cables, it is therefore important that while enquiring orders, as much information as possible should be furnished, so that the orders and are dealt quickly and efficiently .

PARAMETERS REQUIRED ARE as UNDER

- Voltage Grade – 1100 Volts.
- Relevant Indian Standard – IS - 7098 (Part-1) – 1988 or International standard – IEC - 60502 & BS - 5467, DIN.
- Number of cores – Single, Two, Three, Three & Half or Four Cores.
- Conductor – Size, wherever applicable size of reduced neutral conductor.
- Conductor Material – Copper/Aluminium.
- Type of Insulation – XLPE.
- Type of Inner Sheathing – PVC Wrapped/PVC Extruded.
- Type of Armour – Unarmoured/Strip Armoured/Wire Armoured/ Tape Armoured.
- Type of Outer Sheath – PVC/Flame Retardant/Flame Retardant Low Smoke/Zero Halogen (LSOH).
- Length of cable required and drum lengths.

Table – 1

** Conductor Technical Information for Single Core and Multicore cables conforming to IS-8130/1984 (Stranded – Class-2) Copper & Aluminium Conductors.

Nominal Size of Conductor	Minimum no. of wires at 20				Max. D.C. Resistance		A.C. Resistance at 90 °C	
	Non Compacted Round	Compacted Round /Shaped	Plain Copper	Aluminium Copper	Plain Copper	Aluminium Copper	Plain Copper	Aluminium Copper
Sq.mm	CU.	ALU.	CU.	ALU.	Ohm/Km	Ohm/Km	Ohm/Km	Ohm/Km
1.5 *	3	3	-	-	12.1	18.10	15.5	23.17
2.5 *	3	3	-	-	7.41	12.10	9.48	15.50
4 *	7	3	-	-	4.61	7.41	5.90	9.48
6 *	7	3	-	-	3.08	4.61	3.94	5.90
10 *	7	7	6	-	1.83	3.08	2.34	3.94
16	7	7	6	6	1.15	1.91	1.47	2.44
25	7	7	6	6	0.727	1.20	0.930	1.54
35	7	7	6	6	0.524	0.868	0.671	1.11
50	19	19	6	6	0.387	0.641	0.495	0.82
70	19	19	12	12	0.268	0.443	0.343	0.567
95	19	19	15	15	0.193	0.320	0.247	0.410
120	37	37	18	15	0.153	0.253	0.196	0.324
150	37	37	18	15	0.124	0.206	0.159	0.264
185	37	37	30	30	0.0991	0.164	0.127	0.210
240	61	37	34	30	0.0754	0.125	0.0965	0.160
300	61	61	34	30	0.0601	0.100	0.0769	0.128
400	61	61	53	53	0.0470	0.0778	0.0602	0.100
500	61	61	53	53	0.0366	0.0605	0.0468	0.0774
630	91	91	53	53	0.0283	0.0469	0.0362	0.0600
800	91	91	53	53	0.0221	0.0367	0.0283	0.0470
1000	91	91	53	53	0.0176	0.0291	0.0225	0.0372

* These sizes can be manufactured with solid conductor having single strand.

** Conductor meeting requirements of IEC-228 and BS 6360 can also be manufactured.

Table – 2

Comparative Current Ratings of 650/1100 Volts Multicore heavy duty PVC Insulated Cables & XLPE Insulated Cables. (3, 3.5 & 4 Core Unarmoured / Armoured PVC Sheathed Cables with Aluminium Conductor.

Nominal Size of cable	3, 3.5 & 4 Core PVC Insulated & Sheathed Cables as per IS - 1554 (Part-1) 1988			3, 3.5 & 4 Core XLPE Insulated & Sheathed Cables as per IS - 7098 (Part-1) 1988		
	In Ground	In Air	Approx Voltage Drop	In Ground	In Air	Approx Voltage Drop
Sq.mm	Amp	Amp	Mv / amp / mtr	Amp	Amp	Mv / amp / mtr
16	60	51	4.0	73	70	4.20
25	76	70	2.5	94	96	2.70
35	92	86	1.8	113	117	1.90
50	110	105	1.3	133	142	1.40
70	135	130	0.93	164	179	0.99
95	165	155	0.68	196	221	0.72
120	185	180	0.54	223	257	0.58
150	210	205	0.46	249	292	0.48
185	235	240	0.38	282	337	0.39
240	275	280	0.28	326	399	0.31
300	305	315	0.25	367	455	0.26
400	335	375	0.20	420	530	0.21

Table – 3

Comparison of Short Circuit Rating for 1 Second duration for * PVC & XLPE Insulated Cables ** with Copper and Aluminium Conductors. (Current in kAmps)

Nominal Size	PVC Insulated		XLPE Insulated	
	Copper	Aluminium	Copper	Aluminium
1.5	0.173	–	0.21	–
2.5	0.283	–	0.36	–
4	0.46	0.303	0.57	0.38
6	0.690	0.455	0.86	0.57
10	1.15	0.758	1.40	0.94
16	1.84	1.21	2.30	1.50
25	2.88	1.90	3.60	2.40
35	4.03	2.65	5.00	3.30
50	5.75	3.79	7.10	4.70
70	8.05	5.31	10.00	6.60
95	10.90	7.20	13.60	9.00
120	13.80	9.10	17.10	11.30
150	17.30	11.40	21.40	14.20
185	21.30	14.02	26.40	17.50
240	27.60	18.20	34.30	22.60
300	34.50	22.80	42.90	28.30
400	46.00	30.40	57.10	37.70
500	57.50	38.00	71.40	47.20
630	72.50	47.25	90.00	59.40
800	92.00	60.00	114.30	75.50
1000	115.00	75.00	142.90	94.30

* PVC Type 'A' Insulation as per IS-5831 '84.

** PVC Cables as per IS-1554 (Part-1)-1988.

** XLPE Cables as per IS-7098 (Part-1)-1988.

1) Max. Conductor Temperature during operation
 PVC 70 °C XLPE 90 °C

2) Max. Conductor Temperature During Short circuit. 160 °C 250 °C

Formula relating Short Circuit Rating with duration

$I_t = I_{sh}$ Where

I_t = Short Circuit Rating for t Seconds.

t = duration in seconds

I_{sh} = Short Circuit rating for 1 second.

Table – 4

CAPACItAnCe				
APProXImAte	CAPACItAnCe (microfarads/km)			1.1 kV XLPe CABLEs.
Nominal Area of Conductor in sq. mm	Single Core Unarmoured	Four Core	Three, Three & Armoured Two Core	Half and
1.5	0.19	–	0.051	0.15
2.5	0.24	–	0.058	0.18
4	0.29	–	0.065	0.22
6	0.34	–	0.071	0.25
10	0.43	0.32	0.081	0.31
16	0.51	0.38	0.088	0.36
25	0.49	0.38	0.089	0.41
35	0.57	0.44	0.096	0.47
50	0.58	0.46	0.098	0.50
70	0.63	0.51	0.10	0.53
95	0.73	0.59	0.11	0.61
120	0.74	0.61	0.11	0.63
150	0.73	0.61	0.11	0.64
185	0.69	0.59	0.11	0.65
240	0.74	0.64	0.11	0.66
300	0.80	0.69	0.12	0.67
400	0.83	0.70	0.12	0.67
500	0.83	0.71	0.12	0.69
630	0.87	0.75	0.11	0.73
800	0.92	0.78	–	–
1000	0.94	0.81	–	–

Table – 5

reACtAnCe				
APProXImAte	reACtAnCe At 50 Hz (ohm/km)			1.1 kV XLPe CABLEs.
Nominal Area of Conductor in sq. mm	Single Core Unarmoured	Armoured	Multi Core	
1.5	0.155	–	0.107	
2.5	0.142	–	0.0985	
4	0.132	–	0.0927	
6	0.123	–	0.0884	
10	0.114	0.134	0.0837	
16	0.108	0.125	0.0808	
25	0.103	0.120	0.0805	
35	0.0986	0.114	0.0783	
50	0.0937	0.108	0.0750	
70	0.0900	0.102	0.0740	
95	0.0865	0.100	0.0724	
120	0.0841	0.0968	0.0712	
150	0.0839	0.0941	0.0716	
185	0.0836	0.0932	0.0718	
240	0.0813	0.0900	0.0710	
300	0.0795	0.0881	0.0705	
400	0.0787	0.0873	0.0704	
500	0.0779	0.0859	0.0702	
630	0.0785	0.0843	0.0698	
800	0.0755	0.0826	–	
1000	0.0752	0.0825	–	

CURRENT RATINGS

POLYCab RECOMMENDATIONS FOR CURRENT RATINGS:

The current rating of power cable is defined by the maximum intensity of current (amperes) which can flow continuously through the cable, under permanent loading conditions, without any risk of damaging the cable or deterioration of its electrical properties.

The value given in the tables are valid for one circuit in a three phase system under conditions specified. For grouping cables rating factors must be used.

The current carrying capacities mentioned in **PoLYCAB** technical data are intended as a guide, to assist operating engineers in selecting cables for safety and reliability.

Basic assumptions and conditions of installation :-

- Ambient Ground Temperature : 30° C.
- Ambient Air Temperature : 40° C.
- Depth of cable burial : 750 mm.
- Thermal resistivity of soil : 150° C. Cm/W
- Max. conductor Temperature for Continuous Operation : 90° C.
- Max. Conductor Temperature for Short Circuit : 250° C.

Single core cables are installed as indicated in the table. Spacing between cables in flat formation is as indicated.

For three and four core cables, it is usual to assume the same current carrying capacity for four cores cables as for three core cables. Our calculated values are based actually on three cores cables. These values are suitable with enough accuracy also for four core cables in most cases. Only for large four core cables in air the values may be found to be too conservative, due to the large cable surface and consequent high heat dissipation factor.

To obtain the maximum current carrying capacity of a cable operating at different conditions from the standard. Various rating factors are to be multiplied, as follows :-

$$I_a = K \times I_s \quad \text{in amperes}$$

Where ;

I_a : Current rating at actual operating conditions (amperes)

I_s : Current rating at standard operating conditions (amperes)

K : Rating factor as, applicable.

RaTING faCTORs

1) For Air AnD ground temPerature.

A. rating factors for variation in ambient air temperature

Ambient Temp (°C)	25	30	35	40	45	50
Rating Factors	1.14	1.10	1.04	1.00	0.95	0.90

B. rating factors for variation in ground temperature

Ground Temp (°C)	15	20	25	30	35	40
Rating Factors	1.12	1.08	1.03	1.00	0.96	0.91

2) For DePtH oF LAYIng (CABLEs LAID DIreCt In tHe ground).

Depth of laying	Size		
Cm	Upto 25 mm	Above 25 mm ² Upto 300 mm ²	Above 300 mm ²
75	1.0	1.00	1.00
90	0.99	0.98	0.97
105	0.98	0.97	0.96
120	0.97	0.96	0.95
150	0.96	0.94	0.92
180 or more	0.95	0.93	0.91

3) For VARIAtIonIn tHerMAL resIstIVItY oF soIL (t WoAnD tHree AnD muLt ICore CABLEs LAID DIreCt In tHe ground).

Nominal area of conductor mm ²	Two cables touching for values of Thermal Resistivity of soil in °C ² cm / W						
	100	120	150	200	250	300	
1.5	1.10	1.05	1.00	0.92	0.86	0.81	
2.5	1.10	1.05	1.00	0.92	0.86	0.81	
4	1.10	1.05	1.00	0.92	0.86	0.81	
6	1.10	1.05	1.00	0.92	0.86	0.81	
10	1.10	1.06	1.00	0.92	0.85	0.80	
16	1.12	1.06	1.00	0.91	0.84	0.79	
25	1.14	1.08	1.00	0.91	0.84	0.78	
35	1.15	1.08	1.00	0.91	0.84	0.77	
50	1.15	1.08	1.00	0.91	0.84	0.77	
70	1.15	1.08	1.00	0.90	0.83	0.76	
95	1.15	1.08	1.00	0.90	0.83	0.76	
120	1.17	1.09	1.00	0.90	0.82	0.76	
150	1.17	1.09	1.00	0.90	0.82	0.75	
185	1.18	1.09	1.00	0.89	0.81	0.75	
240	1.18	1.09	1.00	0.89	0.81	0.75	
300	1.18	1.09	1.00	0.89	0.81	0.75	
400	1.19	1.10	1.00	0.89	0.81	0.75	

GROUP RATING FACTORS

FOR SINGLE CORE CABLES

A) Cables laid direct in the ground in horizontal formation.

No. of Trefoils in Group	Distance between Trefoils			
	Touching	15 cm	30 cm	45 cm
2	0.78	0.81	0.85	0.88
3	0.68	0.71	0.77	0.81
4	0.61	0.65	0.72	0.76
5	0.56	0.61	0.68	0.73

B) Cables laid in ducts in horizontal formation.

No. of Trefoils in Group	Distance between Trefoils		
	Touching	45 cm	60 cm
2	0.87	0.90	0.91
3	0.79	0.83	0.86
4	0.74	0.79	0.82
5	0.71	0.76	0.80

C) Cables laid on racks/ trays in covered trench with having restricted air circulation. trefoils are separated by two cable diameter horizontally and the trays are in tiers having 30 cm distance.

No. racks / trays in tiers	No. of Trefoils in Horizontal Formation		
	1	2	3
1	0.95	0.90	0.88
2	0.90	0.85	0.83
3	0.88	0.83	0.81
6	0.86	0.81	0.79

D) as above C. but cables laid in open air.

No. racks / trays in tiers	No. of Trefoils in Horizontal Formation		
	1	2	3
1	1	0.98	0.96
2	1	0.95	0.93
3	1	0.94	0.92
6	1	0.93	0.90

FOR mULTI CORE CabLEs

A) Cables laid on cable trays exposed to air, the cables spaced by one cable diameter and trays are in tiers spaced by 30 cm. the clearance between the wall and the cable is 25 mm.

No. of cables trays in tier	Distance between Trefoils			
	1	2	3	6 9
1	1	0.98	0.96	0.93 0.92
2	1	0.95	0.93	0.90 0.89
3	1	0.94	0.92	0.89 0.88
6	1	0.93	0.90	0.87 0.86

B) Cables laid inside concrete trench with removable covers on cable trays having circulation. the cables spaced by one cable diameter and trays are in tiers spaced by 30 cm. the clearance between the wall and the cable is 25 mm.

No. of cables trays in tier	No. of cables				
	1	2	3	6	9
1	0.95	0.90	0.88	0.85	0.84
2	0.90	0.85	0.83	0.81	0.80
3	0.88	0.83	0.81	0.79	0.78
6	0.86	0.81	0.79	0.77	0.76

C) Cables laid on cable trays exposed to air, the cable touching and trays are in tiers spaced by 30 cm. the clearance between the wall and the cable is 25 mm.

No. of cables trays	No. of cables per tray				
	1	2	3	6	9
1	1	0.84	0.80	0.75	0.73
2	1	0.80	0.76	0.71	0.69
3	1	0.78	0.74	0.70	0.68
6	1	0.76	0.72	0.68	0.66

D) Cables laid direct in ground in horizontal formation.

No. of cables in Group	Distance of cables			
	Touching	15 cm	30 cm	45 cm
2	0.79	0.82	0.87	0.90
3	0.69	0.75	0.79	0.83
4	0.62	0.69	0.74	0.79
5	0.58	0.65	0.72	0.76
6	0.54	0.61	0.69	0.75

e) Cables laid in single way ducts/ pipes in horizontal formation.

No. of cables in Group	Distance of cables			
	Touching	30 cm	45 cm	60 cm
2	0.88	0.90	0.92	0.94
3	0.82	0.84	0.87	0.89
4	0.77	0.80	0.84	0.87
5	0.74	0.78	0.82	0.85
6	0.71	0.76	0.81	0.84

HaNDLING sTORaGE aND LaYING Of POLYCab XLPE CabLEs

- A) HAnDLIng** 1) The cable with or without drum shall not be thrown or dropped on the ground from the carriers such as trucks or railway wagons, during unloading.
- 2) The cable drum shall be unloaded with the help of cranes or fork lifts or using a proper ramp having inclination 1:3 to 1:4 in order to avoid mechanical damage to the outer layers of cables.
- 3) The cable drums shall be lifted or stored with its flanges always vertical.
- 4) The cable drum shall be rolled in the direction of arrow only, in order to avoid loosening of cable winding. The drum shall not be rolled on rocky, uneven surface and for longer distances, it may damage the drum and cable.
- B) storAge** : 1) The cables shall be stored in dry covered places having concrete / firm surface capable of bearing the load of drum.
- 2) The cable ends shall be sealed properly in order to prevent moisture ingress.
- 3) Antirodent / termite repulsion treatment shall be applied to the site where the drum are stored for very long period of time.
- C) LAYIng** : 1) Polycab recommends the laying and installation of cables as per IS:1255/84.
- 2) Care shall be taken during laying to avoid sharp bending, and twisting .
- 3) Cable shall be un wound from the drum by lifting the drum on the center shaft supported both ends with suitable jacks / stands.
- 4) Under no circumstances the cable winding shall be lifted off a coil or drum lying flat at the flanges. This would cause serious twist and damages.
- 5) Suitable protection shall be provided to the cables against mechanical damages, it includes covers, pipes etc.
- D) recommended minimum bending radius for 1100 volts heavy duty cables :**
- Single Core - $15 \times D$ Where D= Diameter of cable in mm
- MultiCore - $12 \times D$
- e) recommended safe Pulling force with stockings :**
- a) For Unarmoured Cable : $P = 5 D$ ² Where P= Pulling Force
- b) For Armoured Cable : $P = 9 D$ ² D= Diameter of cable in mm
- F) recommended safe pulling force when pulled with pulling eye :**
- a) For Aluminium Conductors : 30 N/mm^2
- b) For Copper Conductor : 50 N/mm^2

Note : All figures given in various tables are indicative only.



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