

GEMSCAB®
CABLES

THE RIGHT CONNECTION

HT-XLPE
C A B L E S



IS-7098
Part-2 (2011)

INTRODUCTION

“GEMSCAB” has been associated with marketing and manufacturing of Electric Cables for over a period 4 decades now. Customer satisfaction has been the prime focus of “GEMSCAB” and today it has established itself as a consistence, competent and a compatible manufacturer of LT Power, Control, Instrumentation and Flexible Cables.

“GEMSCAB” is proud to have succeeded in creating a pool of resources to provide quality products and services.

“GEMSCAB” has state-of-the-art manufacturing plants at Bhiwadi & Pathredi (Rajasthan) and has been supplying cables to Industries, Process Industries, Automobile, Power Generation, Transmission and Distribution, Housing and Commercial Projects.

“GEMSCAB” has state-of-the-art HT Cables manufacturing plant to meet the increasing demand in infrastructure projects like Power, Steel and Cement Industries etc. and to associate itself with the growing economy of the country.

“GEMSCAB” HT XLPE cables are being manufactured extruder and tested at its Bhiwadi / Pathredi Plant. The cables are manufactured by CCV extrusion process and provided with Normal PVC Outer Sheath / FR Outer Sheath / FRLS Outer Sheath / HDPE. These Cables are manufactured as per IS7098 / (Part-2) upto 33 KV voltage grade in both earthed and unearthed system.

“GEMSCAB” Bhiwadi / Pathredi Plants are an ISO-9001:2008 / 14001 / 18001 certified unit, where cables are manufactured as per National & International Standards and customers' specifications. A well-equipped Test Lab and modern instruments are constantly upgraded to carry out : quality checks and testing on all incoming and finished material.

‘GEMSCAB’ is approved by prestigious clients and consultants. It has established its name in providing LT range of cables to its customers. Team “GEMSCAB” is confident that it will provide the same service for HT range of cables also.

C CONSTRUCTION OF CABLES

Conductor:

The conductors made from E.C. grade aluminium / copper wires are stranded together and compacted. All sizes of conductors of single or three core cables for HT cable are circular compacted.

Conductor construction and testing comply to IS 8130-2013 as amended up to date & IEC: 60228. Cables with copper conductor are also manufactured by GEMSCAB.

Conductor Screening:

Conductor screening is provided for all cables above 3.3 KV grade in the form of an extruded layer of semi conducting extrusion or semi conducting tape over the conductor.

XLPE Insulation:

High quality XLPE unfilled insulating compound of natural colour is used for insulation. Insulation is applied by extrusion process and is as per IS:7098 / (Part-2), IEC: 60502 / (Part-2) & BS 6622.

Insulation Screening:

The cables rated above 3.3 KV are provided with insulation shielding over the insulation. The screening is provided with an extruded layer of semi conducting compound. Over the semi conducting covering, a metallic screen in the form of copper tape or wire is provided.

Core Shielding:

XLPE insulation and semi-conducting insulation shielding are all extruded in one operation by a special process called Triple Extrusion i.e. all three layers in one operation. This process ensures perfect bonding of inner and outer shielding with insulation. The formation of voids / protrusions at the interface of the semiconducting layer and insulation, too is eliminated in the triple extrusion process.

Core Identification:

The Core identification complies with the requirements of IS-7098 (Part II) as shown below:

By numerals (1,2,3) printed on cores.

OR

By colored strips applied on the cores.

Filler :

Non Hygroscopic / PVC / Poly Propylene filler is used to maintain roundness of Cable.

Inner Sheath (Common Covering):

In case of multi core cables, cores are laid up together with suitable non-hygroscopic fillers in the interstices and provided with common covering of plastic tapes wrapping. As an alternative to wrapped inner sheath, extruded PVC inner sheath is also provided.

Armouring:

Armouring is applied over the inner sheath and normally comprise of galvanized Steel Wire or galvanized Steel Strips for multi core Cables. For Mining use and other special applications, double Wire/Strip armoured cables with Tinned Copper wires can also be offered. Single core armoured cables are provided with non-magnetic armour consisting of hard drawn flat or round aluminum wires to avoid magnetic hysteresis losses on A.C. System.

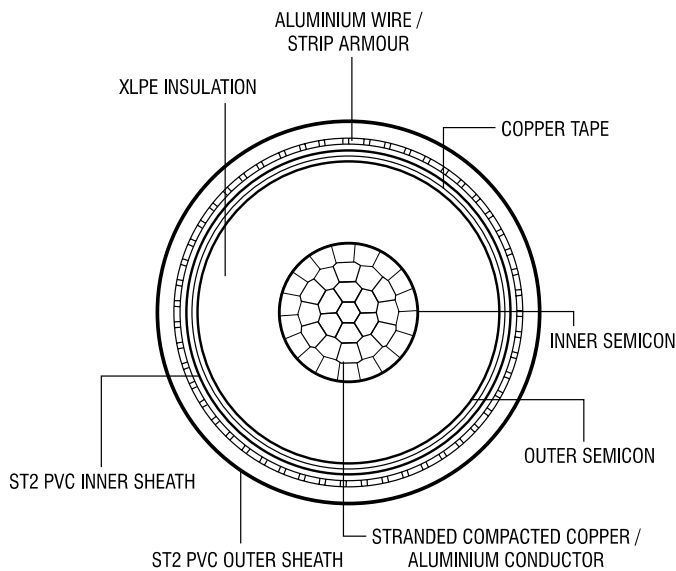
Outer Sheath:

A tough Outer Sheath of Heat Resisting PVC compound (Type ST2) FR / FRLS as per IS : 5831 is extruded over the armouring in case of armoured cables or over non-magnetic metallic tape covering the insulation or over the non-magnetic metallic part of insulation screening in case of unarmoured single core cables. This is always black in color for best resistance to outdoor exposure.

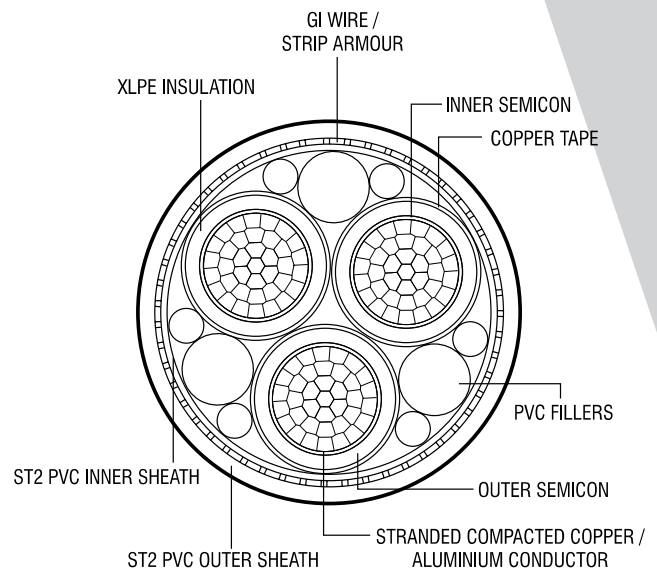
Marking on Outer Sheath:

The outer sheath is embossed with "GEMSCAB" voltage grade, cable size, and year of manufacturing as desired. Cables are also sequentially marked for length at every meter.

C CONSTRUCTION OF HT-XLPE CABLES



“GEMSCAB” 1 Core HT XLPE Cable



“GEMSCAB” 3 Core HT XLPE Cable

Testing and quality control:

XLPE Cables are manufactured under advanced manufacturing and testing facilities. The cables are type tested and routine tested in accordance with IS: 7098 (Part-2) 2011, IEC 60502 (Part-2) & BS 6622 / Relevant Standard.

The following tests are carried out as routine tests on every length of cables manufactured:

- Conductor resistance test
- Partial discharge test
- High voltage test

Test Voltages:

The following test voltage is applied between conductor and screen / armour.

Voltage Rating of Cables

1.9 / 3.3 KV(E)
3.8 / 6.6 KV (E)
6.35 / 11 KV (E)
11 / 11 KV (UE)
12.7 / 22 KV (E)
19 / 33 KV (E)
33 / 33 KV

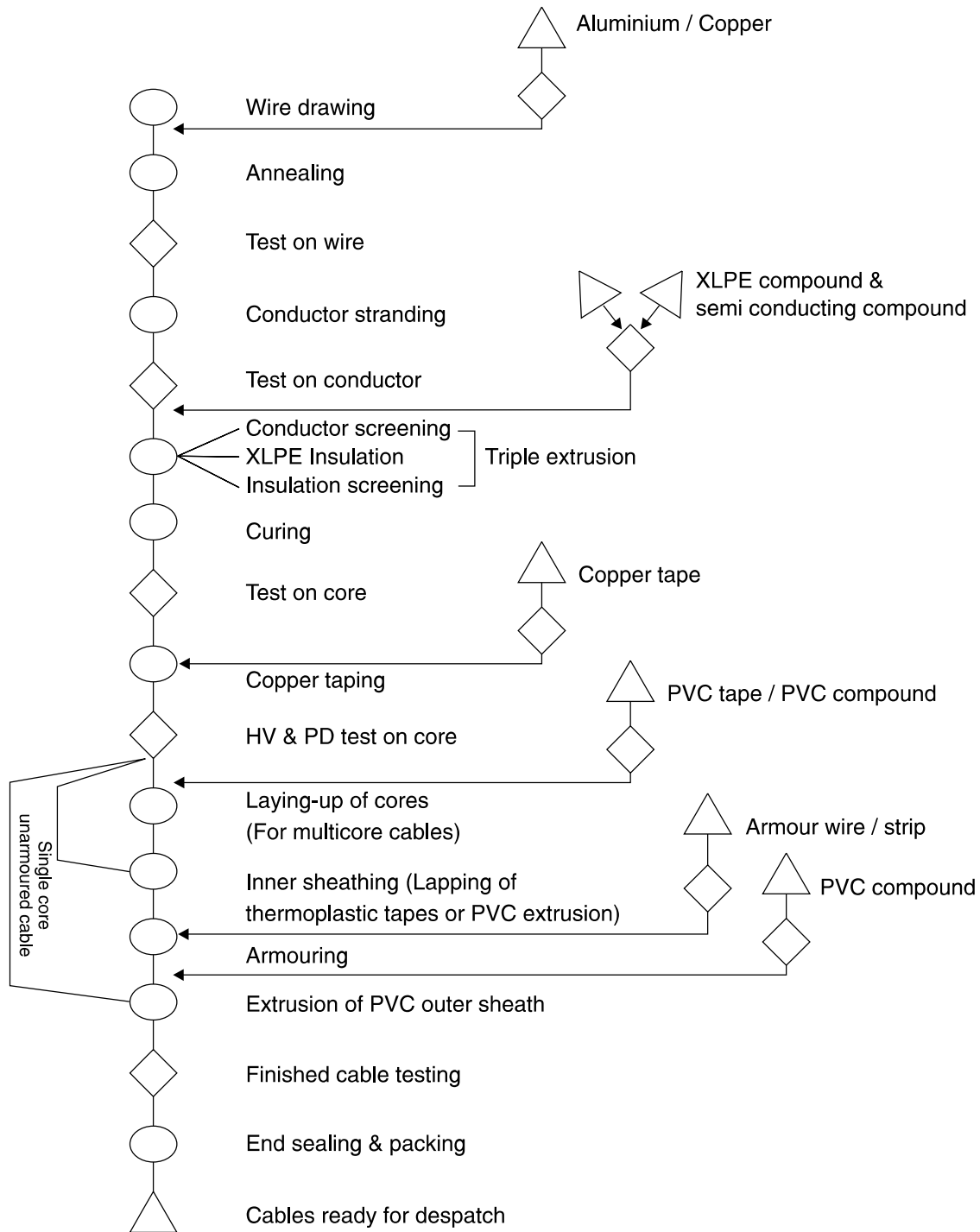
Test Voltage

10 KV (rms) for 5 Minutes
13 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
83 KV (rms) for 5 Minutes

In order to achieve consistency in quality, in addition to above tests, rigorous quality control measures are taken at every stage of production. Accordingly every batch of raw materials and process cables are tested to check for their physical and electrical properties.

FLOW CHART

FLOW CHART FOR MANUFACTURING PROCESS & QUALITY CONTROL CHECKS FOR XLPE CABLES CONFORMING TO IS:7098(PART-2) 2011



Note: Inprocess quality assurance checks are carried out at each stage of manufacturing as per our Quality Assurance Plan.



Stock



Process



Test

HT – XLPE CABLES				
CABLE TYPE	CONDUCTOR	GRADE	MFG. RANGE	RELEVANT SPECIFICATION
HT Cables	Aluminium or Copper Conductor	3.3 KV to 33 KV	Single core upto 1000 mm ² and MULTI CORE upto 400 mm ² Armoured / Unarmoured	IS:7098 / Part-2/2011/ I.EC 60502 (Part-2) / BS 6622

LT – XLPE CABLES				
CABLE TYPE	CONDUCTOR	GRADE	MFG. RANGE	RELEVANT SPECIFICATION
Power Cables	Aluminium or Copper Conductor	1.1 KV	S/core upto 1000 mm ² and MULTI CORE upto 630 mm ²	IS:7098 / Part-I / 1988
Control Cables	Copper Conductor (Tinned or Bare)	1.1 KV	Upto 61 Core	IS:7098 / Part-I / 1988

P.V.C CABLES				
CABLE TYPE	CONDUCTOR	GRADE	MFG. RANGE	RELEVANT SPECIFICATION
Power Cables	Aluminium or Copper Conductor	1.1 KV	Single core upto 1000 mm ² and MULTI CORE upto 630 mm ²	IS:1554 / Part-I/1988
Power Cables	Aluminium or Copper Conductor	3.3 KV	Single core upto 1000 mm ² and MULTI CORE upto 400 mm ²	IS:1554 / Part-I/1988
Control / Railway Signalling Screened / Unscreened Cables	Copper Conductor (Tinned or Bare)	1.1 KV	Upto 61 Core	IS:1554 / Part-I/1988
Mining Cables	Copper Conductor (Tinned or Bare)	3.3 KV	MULTI CORE upto 185 mm ²	IS:1554 / Part-I/1988
Mining Cables	Copper Conductor (Tinned or Bare)	1.1 KV	MULTI CORE upto 185 mm ²	IS:1554 / Part-I/1988
HR & FRLS Cables	Aluminium or Copper Conductor	1.1 KV	Single core upto 1000 mm ² and MULTI CORE upto 630 mm ² Control Cables upto 61 Cores	IS:1554 / Part-I/1988
Flexible Wires & Cables	Aluminium / Copper	1.1 KV	Different Sizes	IS:694/2010

P PRODUCT RANGE

HT-XLPE CABLES

- HT-XLPE Cables have longer life as compared to conventional PVC Cables
- HT-XLPE Cables have a higher operating temperature rating i.e. 90°C
- HT-XLPE Cables have higher emergency overload capacity 130°C
- Max. temperature limit under short circuit conditions for HT-XLPE Cables is 250°C and hence have higher short circuit rating
- Insulation resistance of HT-XLPE Cable is excellent & superior to Identical PVC / PILC Cables
- HT-XLPE Cables have high corrosion resistance in polluted atmosphere
- HT-XLPE Cables have better properties of resistance to chemical and corrosive gases
- HT-XLPE Cables have low installation cost because of light weight, dimensions and are far more flexible
- HT-XLPE Cables have better properties to withstand vibrations, hot impacts
- Jointing of HT-XLPE Cables is easier and quicker

PRODUCT CODE

As per IS:7098-Part:2

CONSTITUENT	CODE
Aluminium Conductor	A
XLPE Insulation	2X
Round Steel Wire	W
Flat Steel Strip Armour	F
Double Round Steel Wire Armour	WW
Double Flat Steel Strip Armour	FF
Non Magnetic (Al) Round Wire Armour	Wa
Non Magnetic (Al) Strip Armour	Fa
PVC Outer Sheath	Y
Polyethylene on Outer Sheath	2Y

C

ONTINUOUS CURRENT RATINGS OF XLPE CABLES

The current carrying capacity mentioned in the table are valid for one circuit in a three phase system under conditions specified. However while deciding the size of the cable the user should consider the group rating factors for cables in case of multiple circuits.

The current carrying capacity mentioned in table are given to assist engineers for selection of cables.

The current rating of XLPE cables given in the subsequent tables are based on the following standard installation conditions and calculated in accordance with the recommendations of IEC-287.

	Maximum conductor temperature at continuous load	90°C
	Ambient air temperature	40°C
BASIC	Ground temperature	30°C
ASSUMPTION	Thermal resistivity of soil	150°C cm/W
	Thermal resistivity of XLPE insulation	350°C cm/W
	Thermal Resistivity of PVC Sheath	650°C cm/W
	Depth of laying in ground	
	3.3, 3.8 / 6.6 & 11 KV cables	900 mm
	22 KV cables	1000 mm
	33 KV cables	1050

Method of installation:

- 1) MULTI CORE cables installed singly.
- 2) Single core cables:
 - (a) in trefoil touching
 - (b) 3 cables laid flat touching

R

ATING FACTORS

RATING FACTORES FOR OTHER CONDITIONS OF INSTALLATION ARE GIVEN IN TABLES

RATING FACTORES FOR VARIATION IN AMBIENT AIR TEMPERATURE:

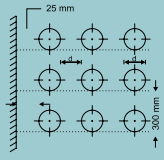
Air Temperature - °C		15	20	25	30	35	40	45	50	55	60
Rating Factors	Conductor Temp. 90°C	1.25	1.20	1.16	1.11	1.05	1.00	0.94	0.88	0.82	0.76

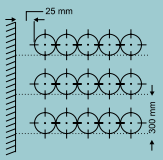
RATING FACTORES FOR VARIATION IN GROUND TEMPERATURE:

Air Temperature - °C		15	20	25	30	35	40	45	50	55	60
Rating Factors	Conductor Temp. 90°C	1.12	1.08	1.04	1.00	0.96	0.91	0.87	0.82	0.82	0.76

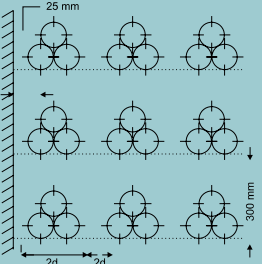
RATING FACTORS

RATING FACTORES FOR MULTI CORE CABLES LAID ON OPEN RACKS IN AIR :

Arrangement 1	No of racks	No of cable per rack				
		1	2	3	6	9
	1	1.00	0.98	0.96	0.93	0.92
	2	1.00	0.95	0.93	0.90	0.89
	3	1.00	0.94	0.92	0.89	0.88
	4	1.00	0.93	0.90	0.87	0.86

Arrangement 2	No of racks	No of cable per rack				
		1	2	3	6	9
	1	1.00	0.84	0.80	0.75	0.76
	2	1.00	0.80	0.76	0.71	0.69
	3	1.00	0.78	0.74	0.70	0.68
	4	1.00	0.76	0.72	0.68	0.66

RATING FACTORS FOR SINGLE CORE CABLE IN TREFOIL CIRCUITS LAID ON OPEN RACKS IN AIR :

Arrangement	No of racks	No of circuits per rack		
		1	2	3
	1	1.00	0.98	0.96
	2	1.00	0.95	0.93
	3	1.00	0.94	0.92
	6	1.00	0.93	0.90

MULTI CORE CABLE LAID INSIDE CONCRETE TRENCH WITH REMOVABLE COVERS, ON CABLE TRAYS WHERE AIR CIRCULATION IS RESTRICTED.

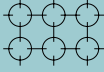
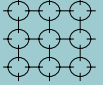
No of cables trays in tier	No. of cables				
	1	2	3	6	9
1	0.95	0.90	0.88	0.85	0.84
2	0.90	0.85	0.83	0.81	0.80
3	0.88	0.83	0.81	0.79	0.78
6	0.86	0.81	0.79	0.77	0.76

RATING FACTORS FOR GROUPING OF MULTI CORE CABLES LAID DIRECT IN GROUND, IN HORIZONTAL FORMATION:

Spacing Diagram	No. of cables in group					
	2	3	4	6	8	10
						
Cables touching	0.79	0.69	0.62	0.54	0.50	0.46
15cm	0.82	0.72	0.66	0.59	0.54	0.51
30cm	0.86	0.76	0.72	0.65	0.62	0.59

RATING FACTORS

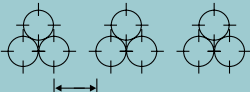
RATING FACTORS FOR GROUPING OF MULTI CORE CABLES LAID DIRECT IN GROUND, IN TIER FORMATION:

Spacing	Formation of cables		
			
Cables touching	0.60	0.51	0.43
15cm	0.64	0.55	0.46
30cm	0.69	0.60	0.50

SINGLE CORE CABLES LAID ON RACKS / TRAYS IN COVERED TRENCH WITH REMOVABLE COVERS, WHERE AIR CIRCULATION IS RESTRICTED.

No of 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

RATING FACTORS FOR GROUPING OF SINGLE CORE CABLES LAID IN TREFOIL CIRCUITS LAID DIRECT IN GROUND, IN HORIZONTAL FORMATION:

Spacing		No. of Circuits in Group					
		2	3	4	6	8	10
Cables touching		0.78	0.68	0.61	0.53	0.48	0.45
15cm		0.81	0.71	0.65	0.57	0.53	0.50
30cm		0.85	0.76	0.71	0.64	0.60	0.58

RATING FACTORS FOR DEPTH OF LAYING FOR CABLES LAID DIRECT IN THE GROUND:

Depth of laying (cm)	90	105	120	150	180 or more
	1.00	0.99	0.98	0.96	0.95
	-	1.00	0.99	0.97	0.96
	0.85	0.76	0.71	0.64	0.60

RATING FACTORS

RATING FACTORS FOR VARIATION IN THERMAL RESISTIVITY OF SOIL (MULTI CORE CABLES LAID DIRECT IN THE GROUND)

Nominal area of conductor sq. mm.	Rating Factors for value of Thermal Resistivity of Soil in °C cm/ watt					
	100	120	150	200	250	300
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	0.76
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
500	1.21	1.10	1.00	0.89	0.81	0.75
630	1.22	1.10	1.00	0.89	0.81	0.74

RATING FACTORS FOR VARIATION IN THERMAL RESISTIVITY OF SOIL, THREE SINGLE CORE CABLES LAID DIRECT IN THE GROUND (THREE CABLES IN TREFOIL TOUCHING)

Nominal area of conductor sq. mm.	Rating Factors for value of Thermal Resistivity of Soil in °C cm/ watt					
	100	120	150	200	250	300
25	1.19	1.09	1.00	0.88	0.80	0.74
35	1.20	1.09	1.00	0.88	0.80	0.74
50	1.20	1.09	1.00	0.88	0.80	0.74
70	1.21	1.10	1.00	0.88	0.80	0.74
95	1.22	1.10	1.00	0.88	0.80	0.74
120	1.22	1.10	1.00	0.88	0.79	0.74
150	1.22	1.10	1.00	0.88	0.79	0.73
185	1.22	1.10	1.00	0.88	0.79	0.73
240	1.22	1.10	1.00	0.88	0.79	0.73
300	1.22	1.10	1.00	0.88	0.79	0.72
400	1.24	1.11	1.00	0.88	0.79	0.72
500	1.24	1.11	1.00	0.88	0.79	0.72
630 to 1000	1.24	1.11	1.00	0.88	0.79	0.72

DIMENSIONS

UNARMoured / ARMoured TYPE

AA : HT - SINGLE CORE CABLES

3.3 KV, SINGLE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, UNSCREENED, ARMoured / UNARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098/(PART-2)/2011

Nominal area of conductor	Nominal thickness of insulation	UNARMoured CABLE		HARD DRAWN ALUMINIUM WIRE ARMOUR				CURRENT RATING					
		Nominal thickness of sheath	Approx Overall dia of cable	Nominal Thickness	Nominal dia of Aluminium wire	Minimum thickness of sheath	Approx Overall dia of cable	ALUMINIUM			COPPER		
								In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	2.2	1.80	14.0	2.5	1.40	1.24	17.0	97	86	104	125	110	130
35	2.2	1.80	15.0	2.5	1.40	1.24	18.0	115	100	127	150	130	160
50	2.2	1.80	17.0	2.5	1.40	1.40	19.0	136	120	153	175	155	195
70	2.2	1.80	18.0	2.5	1.60	1.40	21.0	166	145	192	215	190	245
95	2.2	2.00	20.0	2.5	1.60	1.40	23.0	196	175	237	255	225	300
120	2.2	2.00	22.0	2.5	1.60	1.40	24.0	225	200	275	290	255	350
150	2.2	2.00	23.0	2.5	1.60	1.40	26.0	253	220	317	320	285	400
185	2.2	2.00	25.0	2.5	1.60	1.40	28.0	285	250	362	365	320	460
240	2.2	2.00	27.0	2.5	1.60	1.56	30.0	330	285	433	420	370	550
300	2.2	2.00	29.0	2.5	1.60	1.56	33.0	373	325	504	470	410	630
400	2.2	2.20	33.0	2.6	2.00	1.56	36.0	427	370	598	530	465	740
500	2.4	2.20	36.0	2.8	2.00	1.56	40.0	485	420	694	600	520	860
630	2.6	2.20	40.0	3.0	2.00	1.72	44.0	551	470	815	670	580	980
800	2.8	2.40	45.0	3.3	2.00	1.88	50.0	625	530	969	740	640	1120
1000	3	2.60	50.0	3.5	2.50	2.04	55.0	692	580	1103	800	690	1250

3.8 / 6.6 KV, SINGLE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, SCREENED, ARMoured / UNARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098/(PART-2)/2011

Nominal area of conductor	Nominal thickness of insulation	UNARMoured CABLE		HARD DRAWN ALUMINIUM WIRE ARMOUR			CURRENT RATING					
		Nominal thickness of sheath	Approx Overall dia of cable	Nominal dia of Aluminium wire	Minimum thickness of sheath	Approx Overall dia of cable	ALUMINIUM			COPPER		
							In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	2.8	1.80	18.0	1.60	1.40	21.0	97	86	106	125	110	140
35	2.8	2.00	19.0	1.60	1.40	22.0	118	105	130	155	140	185
50	2.8	2.00	20.0	1.60	1.40	23.0	136	125	156	185	160	220
70	2.8	2.00	22.0	1.60	1.40	26.0	166	155	196	225	195	275
95	2.8	2.00	23.0	1.60	1.40	27.0	197	180	239	265	235	340
120	2.8	2.00	25.0	1.60	1.40	29.0	224	205	277	300	265	390
150	2.8	2.00	26.0	1.60	1.56	31.0	252	230	312	335	295	440
185	2.8	2.00	28.0	1.60	1.56	33.0	284	260	368	380	330	510
240	2.8	2.20	31.0	2.00	1.56	36.0	329	300	440	435	380	600
300	3.0	2.20	33.0	2.00	1.56	38.0	372	335	509	490	425	680
400	3.3	2.20	37.0	2.00	1.72	43.0	427	380	602	550	480	790
500	3.5	2.40	41.0	2.00	1.72	46.0	485	430	699	610	530	910
630	3.5	2.40	44.0	2.00	1.88	50.0	551	480	817	680	580	1030
800	3.5	2.60	51.0	2.50	2.04	57.0	624	530	965	740	630	1140
1000	3.6	2.80	56.0	2.50	2.20	61.0	692	580	1096	790	670	1250

DIMENSIONS

UNARMoured / ARMoured TYPE

AA : HT - SINGLE CORE CABLES

6.35 / 11 KV, SINGLE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, SCREENED, ARMoured / UNARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098/PART-2/2011

Nominal area of conductor	Nominal thickness of insulation	UNARMoured CABLE		HARD DRAWN ALUMINIUM WIRE ARMOUR			CURRENT RATING					
		Nominal thickness of sheath	Approx Overall dia of cable	Nominal dia of Aluminium wire	Minimum thickness of sheath	Approx Overall dia of cable	ALUMINIUM			COPPER		
							In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	3.6	2.00	20.0	1.60	1.40	22.0	97	86	107	125	110	140
35	3.6	2.00	21.0	1.60	1.40	24.0	115	105	134	155	140	185
50	3.6	2.00	22.0	1.60	1.40	25.0	135	125	160	185	160	220
70	3.6	2.00	24.0	1.60	1.40	27.0	165	155	200	225	195	275
95	3.6	2.00	26.0	1.60	1.40	29.0	197	180	245	265	235	340
120	3.6	2.00	27.0	1.60	1.56	31.0	224	205	286	300	265	390
150	3.6	2.00	29.0	1.60	1.56	32.0	251	230	324	335	295	440
185	3.6	2.20	31.0	1.60	1.56	35.0	283	260	373	380	330	510
240	3.6	2.20	34.0	2.00	1.56	36.0	328	300	445	435	380	600
300	3.6	2.20	36.0	2.00	1.56	39.0	371	335	513	490	425	680
400	3.6	2.20	39.0	2.00	1.72	43.0	425	380	603	550	480	790
500	3.6	2.40	43.0	2.00	1.72	46.0	484	430	705	610	530	910
630	3.6	2.40	46.0	2.00	1.88	50.0	550	480	821	680	580	1030
800	3.6	2.60	52.0	2.50	2.04	55.0	623	530	964	740	630	1140
1000	3.6	2.80	56.0	2.50	2.20	60.0	690	580	1094	790	670	1250

11 / 11 KV, SINGLE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, SCREENED, ARMoured / UNARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098/PART-2/2011

Nominal area of conductor	Nominal thickness of insulation	UNARMoured CABLE		HARD DRAWN ALUMINIUM WIRE ARMOUR			CURRENT RATING					
		Nominal thickness of sheath	Approx Overall dia of cable	Nominal dia of Aluminium wire	Minimum thickness of sheath	Approx Overall dia of cable	ALUMINIUM			COPPER		
							In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	5.5	2.00	24.0	1.60	1.40	26.0	97	86	112	125	110	140
35	5.5	2.00	25.0	1.60	1.40	27.0	115	100	137	150	130	175
50	5.5	2.00	26.0	1.60	1.56	29.0	136	120	165	175	155	205
70	5.5	2.00	28.0	1.60	1.56	31.0	166	155	206	225	195	275
95	5.5	2.00	30.0	1.60	1.56	32.0	198	180	250	265	235	340
120	5.5	2.20	32.0	2.00	1.56	35.0	225	205	291	300	265	390
150	5.5	2.20	33.0	2.00	1.56	36.0	252	230	330	335	295	440
185	5.5	2.20	35.0	2.00	1.56	38.0	285	260	379	380	330	510
240	5.5	2.20	37.0	2.00	1.72	41.0	350	300	450	435	380	600
300	5.5	2.20	39.0	2.00	1.72	43.0	373	335	518	490	425	680
400	5.5	2.40	43.0	2.00	1.88	47.0	427	380	608	550	480	790
500	5.5	2.40	46.0	2.00	1.88	50.0	486	430	709	610	530	910
630	5.5	2.60	50.0	2.50	2.04	54.0	553	480	822	680	580	1030
800	5.5	2.80	55.0	2.50	2.20	60.0	628	530	964	740	630	1140
1000	5.5	2.80	60.0	2.50	2.20	63.0	697	580	1090	790	670	1250

AA : HT - SINGLE CORE CABLES

12.7 / 22 KV, SINGLE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, SCREENED, ARMoured / UNARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098/PART-2/2011

Nominal area of conductor	Nominal thickness of insulation	UNARMoured CABLE		HARD DRAWN ALUMINIUM WIRE ARMOUR			CURRENT RATING					
		Nominal thickness of sheath	Approx Overall dia of cable	Nominal dia of Aluminium wire	Minimum thickness of sheath	Approx Overall dia of cable	ALUMINIUM			COPPER		
							In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
35	6.0	2.00	26.0	1.60	1.40	29.0	114	100	143	150	130	180
50	6.0	2.00	27.0	1.60	1.56	30.0	134	120	167	175	150	215
70	6.0	2.00	28.0	1.60	1.56	32.0	164	145	207	210	185	270
95	6.0	2.20	31.0	2.00	1.56	35.0	195	180	253	265	230	345
120	6.0	2.20	33.0	2.00	1.56	36.0	221	200	291	300	260	400
150	6.0	2.20	34.0	2.00	1.56	38.0	250	225	333	330	290	450
185	6.0	2.20	36.0	2.00	1.56	40.0	280	255	380	375	325	510
240	6.0	2.20	38.0	2.00	1.72	42.0	326	290	450	430	370	600
300	6.0	2.40	40.0	2.00	1.72	44.0	367	325	521	480	415	690
400	6.0	2.40	43.0	2.00	1.88	48.0	429	370	616	540	465	790
500	6.0	2.60	47.0	2.50	2.04	52.0	478	420	709	600	520	910
630	6.0	2.80	50.0	2.50	2.04	56.0	545	470	828	660	570	1020
800	6.0	2.80	55.0	2.50	2.20	61.0	618	520	975	720	620	1140
1000	6.0	3.00	60.0	2.50	2.36	65.0	685	560	1107	760	660	1240

19 / 33 KV, SINGLE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, SCREENED, ARMoured / UNARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098/PART-2/2011

Nominal area of conductor	Nominal thickness of insulation	UNARMoured CABLE		HARD DRAWN ALUMINIUM WIRE ARMOUR			CURRENT RATING					
		Nominal thickness of sheath	Approx Overall dia of cable	Nominal dia of Aluminium wire	Minimum thickness of sheath	Approx Overall dia of cable	ALUMINIUM			COPPER		
							In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
50	8.8	2.20	34.0	2.00	1.56	37.0	135	120	170	175	150	215
70	8.8	2.20	36.0	2.00	1.56	39.0	165	145	212	210	185	270
95	8.8	2.20	37.0	2.00	1.72	41.0	196	180	258	265	230	345
120	8.8	2.20	39.0	2.00	1.72	42.0	223	200	297	300	260	400
150	8.8	2.20	41.0	2.00	1.72	44.0	250	225	339	330	290	450
185	8.8	2.40	43.0	2.00	1.72	46.0	282	255	386	375	325	510
240	8.8	2.40	45.0	2.00	1.88	48.0	326	290	464	430	370	600
300	8.8	2.60	48.0	2.50	2.04	52.0	369	325	526	480	415	690
400	8.8	2.60	51.0	2.50	2.04	55.0	423	370	617	540	465	790
500	8.8	2.80	55.0	2.50	2.20	59.0	481	420	713	600	520	910
630	8.8	3.00	58.0	2.50	2.20	63.0	549	470	832	660	570	1020
800	8.8	3.00	63.0	2.50	2.36	67.0	620	520	978	720	620	1140
1000	8.8	3.20	67.0	3.15	2.52	72.0	686	560	1110	760	660	1240

DIMENSIONS

ARMoured TYPE

BB : HT - MULTI CORE CABLES

1.9 / 3.3 KV & 3.3 / 3.3 KV, THREE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, ARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098 (PART-2) / 2011

Nominal area of conductor	Nominal thickness of insulation	Minimum thickness of inner sheath	ROUND GALVANISED STEEL WIRE ARMoured			FLAT GALVANISED STEEL STRIP ARMoured			CURRENT RATING					
			Nominal diameter of round wire	Minimum thickness of outer sheath	Approx overall diameter of cable	Nominal dimention of flat strip	Minimum thickness of outer sheath	Approx Overall diametre of cable	ALUMINIUM			COPPER		
									In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm		mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	2.2	0.3	1.60	1.56	32.0	4.0 x 0.80	1.40	27.0	93	80	97	120	100	125
35	2.2	0.3	1.60	1.56	34.0	4.0 x 0.80	1.56	29.0	111	97	119	145	125	165
50	2.2	0.4	2.00	1.56	36.0	4.0 x 0.80	1.56	32.0	132	115	148	170	150	195
70	2.2	0.4	2.00	1.56	39.0	4.0 x 0.80	1.56	35.0	160	140	179	210	180	240
95	2.2	0.4	2.00	1.72	42.0	4.0 x 0.80	1.72	38.0	192	165	219	250	215	295
120	2.2	0.5	2.00	1.88	47.0	4.0 x 0.80	1.72	41.0	218	190	253	280	240	335
150	2.2	0.5	2.50	2.04	51.0	4.0 x 0.80	1.88	43.0	245	210	290	310	270	380
185	2.2	0.5	2.50	2.04	55.0	4.0 x 0.80	2.04	47.0	275	240	330	350	305	430
240	2.2	0.6	2.50	2.20	61.0	4.0 x 0.80	2.20	51.0	318	275	391	400	350	500
300	2.2	0.6	2.50	2.36	66.0	4.0 x 0.80	2.20	55.0	360	310	453	445	390	510
400	2.2	0.7	3.15	2.68	73.0	4.0 x 0.80	2.52	61.0	410	350	530	500	440	650

3.8 / 6.6 KV, THREE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, ARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098 / (PART-2) / 2011

Nominal area of conductor	Nominal thickness of insulation	Minimum thickness of inner sheath	ROUND GALVANISED STEEL WIRE ARMoured			FLAT GALVANISED STEEL STRIP ARMoured			CURRENT RATING					
			Nominal diameter of round wire	Minimum thickness of outer sheath	Approx overall diameter of cable	Nominal dimention of flat strip	Minimum thickness of outer sheath	Approx Overall diametre of cable	ALUMINIUM			COPPER		
									In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm		mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	2.8	0.4	2.00	1.72	40.0	4.0 x 0.80	1.56	37.0	94	82	100	120	105	135
35	2.8	0.4	2.00	1.72	42.0	4.0 x 0.80	1.72	40.0	111	97	121	145	125	165
50	2.8	0.5	2.00	1.88	46.0	4.0 x 0.80	1.72	43.0	130	115	145	170	150	195
70	2.8	0.5	2.00	1.88	49.0	4.0 x 0.80	1.88	47.0	160	140	181	210	180	240
95	2.8	0.5	2.50	2.04	54.0	4.0 x 0.80	1.88	50.0	191	165	221	250	215	295
120	2.8	0.6	2.50	2.20	57.0	4.0 x 0.80	2.04	54.0	217	190	254	280	240	335
150	2.8	0.6	2.50	2.20	61.0	4.0 x 0.80	2.20	58.0	243	210	290	310	270	380
185	2.8	0.6	2.50	2.36	66.0	4.0 x 0.80	2.20	61.0	274	240	330	350	305	430
240	2.8	0.7	3.15	2.52	72.0	4.0 x 0.80	2.36	68.0	317	275	390	400	350	500
300	3.0	0.7	3.15	2.68	78.0	4.0 x 0.80	2.52	73.0	358	310	450	445	390	570
400	3.3	0.7	4.00	3.00	88.0	4.0 x 0.80	2.84	82.0	408	350	525	500	440	650

DIMENSIONS

ARMOURED TYPE

BB : HT - MULTI CORE CABLES

6.6 / 6.6 KV & 6.35 / 11 KV, THREE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, ARMOURED AND PVC SHEATHED CABLES CONFORMING TO IS:7098 / (PART-2) / 2011

Nominal area of conductor	Nominal thickness of insulation	Minimum thickness of inner sheath	ROUND GALVANISED STEEL WIRE ARMOURED			FLAT GALVANISED STEEL STRIP ARMOURED			CURRENT RATING					
			Nominal diameter of round wire	Minimum thickness of outer sheath	Approx overall diameter of cable	Nominal dimensions of flat strip	Minimum thickness of outer sheath	Approx Overall diameter of cable	ALUMINIUM			COPPER		
									In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm		mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	3.6	0.4	2.00	1.72	43.0	4.0 x 0.80	1.72	41.0	93	82	100	120	105	135
35	3.6	0.5	2.00	1.88	46.0	4.0 x 0.80	1.72	43.0	111	97	121	145	125	165
50	3.6	0.5	2.50	2.04	50.0	4.0 x 0.80	1.88	46.0	130	115	145	170	150	195
70	3.6	0.5	2.50	2.04	54.0	4.0 x 0.80	1.88	50.0	160	140	181	210	180	240
95	3.6	0.6	2.50	2.20	58.0	4.0 x 0.80	2.04	54.0	191	165	221	250	215	295
120	3.6	0.6	2.50	2.20	61.0	4.0 x 0.80	2.20	58.0	217	190	254	280	240	335
150	3.6	0.6	2.50	2.36	65.0	4.0 x 0.80	2.20	61.0	243	210	290	310	270	380
185	3.6	0.7	3.15	2.52	71.0	4.0 x 0.80	2.36	65.0	274	240	330	350	305	430
240	3.6	0.7	3.15	2.68	76.0	4.0 x 0.80	2.52	70.0	317	275	390	400	350	500
300	3.6	0.7	3.15	2.84	82.0	4.0 x 0.80	2.68	76.0	357	310	450	445	390	570
400	3.6	0.7	4.00	3.00	89.0	4.0 x 0.80	2.84	83.0	408	350	525	500	440	650

11 / 11 KV, THREE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, ARMOURED AND PVC SHEATHED CABLES CONFORMING TO IS:7098 / (PART-2) / 2011

Nominal area of conductor	Nominal thickness of insulation	Minimum thickness of inner sheath	ROUND GALVANISED STEEL WIRE ARMOURED			FLAT GALVANISED STEEL STRIP ARMOURED			CURRENT RATING					
			Nominal diameter of round wire	Minimum thickness of outer sheath	Approx overall diameter of cable	Nominal dimensions of flat strip	Minimum thickness of outer sheath	Approx Overall diameter of cable	ALUMINIUM			COPPER		
									In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm		mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
25	5.5	0.5	2.50	2.04	55.0	4.0 x 0.80	1.88	50.0	94	82	110	120	105	135
35	5.5	0.5	2.50	2.20	57.0	4.0 x 0.80	2.04	53.0	112	97	133	145	125	165
50	5.5	0.6	2.50	2.20	59.0	4.0 x 0.80	2.20	56.0	131	115	158	170	150	195
70	5.5	0.6	2.50	2.36	63.0	4.0 x 0.80	2.20	60.0	160	140	197	210	180	240
95	5.5	0.6	3.15	2.52	69.0	4.0 x 0.80	2.36	64.0	191	165	237	250	215	295
120	5.5	0.7	3.15	2.52	72.0	4.0 x 0.80	2.36	67.0	217	190	257	280	240	335
150	5.5	0.7	3.15	2.68	76.0	4.0 x 0.80	2.52	71.0	248	210	292	310	270	380
185	5.5	0.7	3.15	2.84	80.0	4.0 x 0.80	2.68	75.0	273	240	331	350	305	430
240	5.5	0.7	3.15	3.00	86.0	4.0 x 0.80	2.84	80.0	316	275	390	400	350	500
300	5.5	0.7	4.00	3.00	92.0	4.0 x 0.80	3.00	85.0	367	310	448	445	390	570
400	5.5	0.7	4.00	3.00	98.0	4.0 x 0.80	3.00	92.0	408	350	523	500	440	650

DIMENSIONS

ARMoured TYPE

BB : HT - MULTI CORE CABLES

12.7 / 22 KV, THREE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, ARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098 / (PART-2) / 2011

Nominal area of conductor	Nominal thickness of insulation	Minimum thickness of inner sheath	ROUND GALVANISED STEEL WIRE ARMoured			FLAT GALVANISED STEEL STRIP ARMoured			CURRENT RATING					
			Nominal diameter of round wire	Minimum thickness of outer sheath	Approx overall diameter of cable	Nominal dimentions of flat strip	Minimum thickness of outer sheath	Approx Overall diametre of cable	ALUMINIUM			COPPER		
									In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm		mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
35	6.0	0.6	2.5	2.20	59.0	4.0 x 0.80	2.04	56.0	110	98	132	145	125	165
50	6.0	0.6	2.5	2.36	62.0	4.0 x 0.80	2.20	58.0	129	115	157	170	150	200
70	6.0	0.6	2.5	2.36	65.0	4.0 x 0.80	2.36	62.0	158	140	194	205	180	245
95	6.0	0.7	3.15	2.52	70.0	4.0 x 0.80	2.36	66.0	189	170	224	245	215	300
120	6.0	0.7	3.15	2.68	74.0	4.0 x 0.80	2.52	70.0	213	190	257	275	245	340
150	6.0	0.7	3.15	2.68	78.0	4.0 x 0.80	2.68	73.0	239	215	292	305	275	385
185	6.0	0.7	3.15	2.84	82.0	4.0 x 0.80	2.68	77.0	269	240	332	345	305	435
240	6.0	0.7	4.0	3.00	89.0	4.0 x 0.80	2.84	82.0	312	275	390	395	350	510
300	6.0	0.7	4.0	3.00	94.0	4.0 x 0.80	3.00	87.0	352	310	448	440	390	580
400	6.0	0.7	4.0	3.00	100.0	4.0 x 0.80	3.00	94.0	402	355	523	495	440	660

19 / 33 KV, THREE CORE, ALUMINIUM / COPPER CONDUCTOR, XLPE INSULATED, ARMoured AND PVC SHEATHED CABLES CONFORMING TO IS:7098 / (PART-2) / 2011

Nominal area of conductor	Nominal thickness of insulation	Minimum thickness of inner sheath	ROUND GALVANISED STEEL WIRE ARMoured			FLAT GALVANISED STEEL STRIP ARMoured			CURRENT RATING					
			Nominal diameter of round wire	Minimum thickness of outer sheath	Approx overall diameter of cable	Nominal dimentions of flat strip	Minimum thickness of outer sheath	Approx Overall diametre of cable	ALUMINIUM			COPPER		
									In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq cm	mm		mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
50	8.8	0.7	3.15	2.68	76.0	4.0 x 0.80	2.52	72.0	130	115	152	170	150	200
70	8.8	0.7	3.15	2.84	80.0	4.0 x 0.80	2.68	76.0	158	140	198	205	180	245
95	8.8	0.7	3.15	3.00	84.0	4.0 x 0.80	2.84	80.0	188	170	236	245	215	300
120	8.8	0.7	4.0	3.00	89.0	4.0 x 0.80	2.84	83.0	214	190	270	275	245	340
150	8.8	0.7	4.0	3.00	91.0	4.0 x 0.80	3.00	86.0	239	215	293	305	275	385
185	8.8	0.7	4.0	3.00	96.0	4.0 x 0.80	3.00	89.0	270	240	348	345	305	435
240	8.8	0.7	4.0	3.00	101.0	4.0 x 0.80	3.00	95.0	312	275	408	395	350	510
300	8.8	0.7	4.0	3.00	106.0	4.0 x 0.80	3.00	100.0	352	310	449	440	390	580
400	8.8	0.7	4.0	3.00	112.0	4.0 x 0.80	3.00	106.0	402	355	522	495	440	660

DIMENSIONS

UNARMOURED / ARMoured TYPE

AA : SINGLE CORE CABLES

33 / 33 KV (UE) HT XLPE SINGLE CORE ALUMINIUM / COPPER CONDUCTOR CABLES CONFORMING TO IS:7098 (PART-2) / 2011

Nominal Size of Conductor	Nominal Thickness of XLPE Insulation	UNARMoured CABLE		Minimum Thickness of PVC Inner Sheath	STRIP ARMoured CABLE			ROUND WIRE ARMoured CABLE			CURRENT CARRYING CAPACITY					
		Nominal Thickness of PVC Outer Sheath	Approx Overall Diameter of Cable		Nominal Dimension of Strip	Minimum Thickness of PVC Outer Sheath	Approx Overall Diameter of Cable	Nominal Dimension of Round Wire	Minimum Thickness of PVC Outer Sheath	Approx Overall Diameter of Cable	ALUMINIUM			COPPER		
											In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Ground at 30°C	In Duct at 30°C	In Air at 40°C
Sq. mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
120	9.5	2.2	41.5	0.40	0.8	1.72	43.0	2.0	1.72	45.5	230	200	310	300	260	400
150	9.5	2.4	43.0	0.40	0.8	1.72	44.5	2.0	1.88	47.5	260	225	350	330	290	450
185	9.5	2.4	45.0	0.50	0.8	1.72	46.5	2.0	1.88	49.5	290	255	400	375	325	510
240	9.5	2.4	47.5	0.50	0.8	1.88	49.5	2.5	2.04	53.0	335	290	470	430	370	600
300	9.5	2.6	50.0	0.50	0.8	1.88	51.5	2.5	2.04	55.0	380	325	540	480	415	690
400	9.5	2.6	53.0	0.50	0.8	2.04	55.0	2.5	2.2	58.5	430	370	630	540	465	790
500	9.5	2.8	56.5	0.60	0.8	2.04	58.0	2.5	2.2	62.0	485	420	730	600	520	910
630	9.5	3.0	60.0	0.60	0.8	2.2	61.5	2.5	2.36	65.5	550	470	840	660	570	1020
800	9.5	3.0	64.0	0.60	0.8	2.36	66.0	3.15	2.52	71.0	610	520	950	720	620	1140
1000	9.5	3.2	69.0	0.70	0.8	2.52	71.0	3.15	2.68	76.0	660	560	1060	760	660	1240

BB : MULTI CORE CABLES

33 / 33 KV (UE) HT XLPE THREE CORE ALUMINIUM / COPPER CONDUCTOR CABLES CONFORMING TO IS:7098 (PART-2) / 2011

Nominal Size of Conductor	Nominal Thickness of XLPE Insulation	Minimum Thickness of PVC Inner Sheath	UNARMoured CABLE		FORMED WIRE / STRIP ARMoured CABLE			ROUND WIRE ARMoured CABLE			CURRENT CARRYING CAPACITY					
			Nominal Thickness of PVC Outer Sheath	Approx Overall Diameter of Cable	Nominal Dimension of GI Flat Strip	Minimum Thickness of PVC Outer Sheath	Approx Overall Diameter of Cable	Nominal Dimension of GI Round Wire	Minimum Thickness of PVC Outer Sheath	Approx Overall Diameter of Cable	ALUMINIUM			COPPER		
											In Ground at 30°C	In Duct at 30°C	In Air at 40°C	In Air at 40°C	In Duct at 30°C	In Air at 40°C
Sq. mm	mm	mm	mm	Kg/Km	mm	mm	mm	mm	mm	mm	Amps	Amps	Amps	Amps	Amps	Amps
120	9.5	0.7	4.0	88.5	0.8	3.0	88.5	4.0	3.0	94.5	215	190	265	275	245	340
150	9.5	0.7	4.0	91.0	0.8	3.0	91.0	4.0	3.0	97.0	240	215	300	305	275	385
185	9.5	0.7	4.0	95.5	0.8	3.0	95.5	4.0	3.0	101.0	270	240	340	345	305	435
240	9.5	0.7	4.0	100.5	0.8	3.0	100.5	4.0	3.0	106.0	310	275	400	395	350	510
300	9.5	0.7	4.0	105.0	0.8	3.0	105.0	4.0	3.0	110.5	350	310	455	440	390	580
400	9.5	0.7	4.0	111.5	0.8	3.0	111.5	4.0	3.0	117.0	395	355	530	495	440	660

C CONDUCTOR RESISTANCE

CONDUCTOR TECHNICAL DATA FOR SINGLE CORE AND MULTI CORE CABLES CONFORMING TO IS:8130/1984 (STRANDED - CLASS-2) COPPER & ALUMINIUM CONDUCTORS.

Nominal Size of Conductor	MINIMUM NO OF WIRE		MAX D.C. RESISTANCE AT 20° C		A.C.RESISTANCE AT 90° C	
	Compacted Round / Shaped		Plain Copper	Aluminium	Plain Copper	Aluminium
Sq. mm	CU.	ALU.	Ohm / Km	Ohm / Km	Ohm / KM	Ohm / KM
25	6	6	0.727	1.20	0.930	1.54
35	6	6	0.524	0.868	0.671	1.11
50	6	6	0.387	0.641	0.495	0.82
70	12	12	0.268	0.443	0.343	0.567
95	15	15	0.193	0.320	0.247	0.410
120	18	15	0.153	0.253	0.196	0.324
150	18	15	0.124	0.206	0.159	0.264
185	30	30	0.0991	0.164	0.127	0.210
240	34	30	0.0754	0.125	0.0965	0.160
300	34	30	0.0601	0.100	0.0769	0.130
400	53	53	0.0407	0.0778	0.0602	0.10
500	53	53	0.0366	0.0605	0.0468	0.0774
630	53	53	0.0283	0.0469	0.0362	0.060
800	53	53	0.0221	0.0367	0.0283	0.0470
1000	53	53	0.0176	0.0291	0.0225	0.0372

C CAPACITANCE

APPROXIMATE CAPACITANCE (MICROFARADS/KM) FOR SINGLE / THREE CORE CABLES

Size	Voltage Grade (KV)						
Sq. mm	1.9 / 3.3 & 3.3 / 3.3	3.8 / 6.6	6.6 / 6.6 & 6.35 / 11	11 / 11	12.7 / 22	19 / 33	33 / 33
25	0.22	0.21	0.19	0.13	-	-	-
35	0.25	0.24	0.22	0.15	0.14	-	-
50	0.30	0.27	0.23	0.16	0.15	0.12	-
70	0.34	0.31	0.27	0.18	0.17	0.14	-
95	0.39	0.34	0.31	0.20	0.19	0.15	0.14
120	0.43	0.37	0.33	0.22	0.20	0.16	0.15
150	0.49	0.42	0.36	0.24	0.22	0.17	0.16
185	0.52	0.44	0.39	0.25	0.24	0.18	0.17
240	0.59	0.50	0.43	0.28	0.26	0.20	0.19
300	0.67	0.53	0.48	0.32	0.30	0.23	0.20
400	0.76	0.55	0.53	0.36	0.33	0.25	0.23
500	0.77	0.57	0.50	0.39	0.36	0.27	0.25
630	0.81	0.64	0.69	0.43	0.40	0.29	0.28
800	0.86	0.73	0.79	0.49	0.45	0.33	0.30
1000	0.88	0.80	0.88	0.53	0.49	0.35	0.33

APPROXIMATE REACTANCE AT 50 Hz (OHMS/KM) FOR THREE CORE CABLES

Size	Voltage Grade (KV)						
Sq. mm	1.9 / 3.3 & 3.3 / 3.3	3.8 / 6.6	6.6 / 6.6 & 6.35 / 11	11 / 11	12.7 / 22	19 / 33	33 / 33
25	0.098	0.109	0.116	0.152	-	-	-
35	0.094	0.104	0.111	0.144	0.147	-	-
50	0.087	0.098	0.104	0.137	0.140	0.133	-
70	0.084	0.094	0.100	0.129	0.132	0.125	-
95	0.081	0.090	0.095	0.123	0.125	0.121	0.131
120	0.078	0.087	0.092	0.117	0.120	0.116	0.125
150	0.076	0.085	0.089	0.114	0.116	0.112	0.122
185	0.750	0.083	0.087	0.110	0.113	0.110	0.116
240	0.730	0.081	0.085	0.106	0.108	0.105	0.112
300	0.072	0.079	0.082	0.103	0.105	0.100	0.108
400	0.071	0.078	0.079	0.099	0.101	0.097	0.103

APPROXIMATE REACTANCE AT 50 Hz (OHMS/KM) FOR SINGLE CORE CABLES

Size	Voltage Grade (KV)													
Sq. mm	1.9 / 3.3 & 3.3 / 3.3		3.8 / 6.6		6.6 / 6.6 & 6.35 / 11		11 / 11		12.7 / 22		19 / 33		33 / 33	
	Arm	Un-Arm	Arm	Un-Arm	Arm	Un-Arm	Arm	Un-Arm	Arm	Un-Arm	Arm	Un-Arm	Arm	Un-Arm
35														
50	0.115	0.104	0.119	0.110	0.133	0.127	0.133	0.125	0.137	0.130	0.147	0.140		
70	0.109	0.098	0.113	0.105	0.123	0.118	0.126	0.119	0.130	0.123	0.141	0.133		
95	0.104	0.095	0.108	0.100	0.116	0.111	0.120	0.114	0.124	0.116	0.135	0.127	0.143	0.137
120	0.100	0.092	0.104	0.101	0.112	0.107	0.117	0.110	0.119	0.112	0.130	0.122	0.137	0.131
150	0.096	0.088	0.101	0.093	0.109	0.104	0.112	0.106	0.115	0.107	0.126	0.118	0.134	0.129
185	0.094	0.087	0.099	0.091	0.107	0.101	0.110	0.103	0.114	0.105	0.124	0.115	0.128	0.122
240	0.091	0.084	0.096	0.089	0.104	0.097	0.106	0.100	0.110	0.101	0.118	0.110	0.124	0.118
300	0.088	0.081	0.093	0.086	0.100	0.094	0.102	0.096	0.105	0.097	0.112	0.105	0.120	0.114
400	0.086	0.079	0.091	0.085	0.096	0.091	0.098	0.092	0.101	0.093	0.119	0.102	0.115	0.109
500	0.085	0.078	0.088	0.083	0.093	0.089	0.095	0.090	0.099	0.091	0.105	0.099	0.111	0.106
630	0.083	0.077	0.087	0.081	0.092	0.086	0.094	0.087	0.095	0.089	0.101	0.096	0.108	0.103
800	0.082	0.076	0.085	0.077	0.089	0.084	0.091	0.085	0.092	0.086	0.097	0.092	0.106	0.099
1000	0.081	0.075	0.084	0.076	0.087	0.082	0.088	0.083	0.090	0.085	0.096	0.090	0.102	0.096

Nominal Size	XLPE Insulated	
Sq. mm	Copper	Aluminium
25	3.58	2.35
35	5.0	3.29
50	7.15	4.7
70	10.0	6.58
95	13.6	8.93
120	17.2	11.3
150	21.5	14.1
185	26.5	17.4
240	34.3	22.6
300	42.9	28.2
400	57.2	37.6
500	71.5	47.0
630	90.1	59
800	114.4	75.2
1000	143.0	94.0

RATING FOR ANY OTHER DURATION:

XLPE Cable as per IS:7098/ (Part-2)/2011

- 1) Max Conductor Temperature during operation : 90° C
- 2) Max Conductor Temperature during Short Circuit : 250° C

Formula relating short circuit rating with duration

$$I_{sh} : KA \sqrt{t}$$

Ish : Short circuit current in KA

K : Constant 0.094 for Aluminium & 0.143 for copper conductor

A : Area of cross section in Sq.mm.

t : Duration of short circuit in seconds

HANDLING, STORAGE AND LAYING OF CABLES

A. CABLE INSPECTION

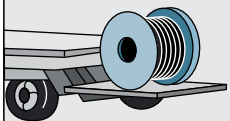
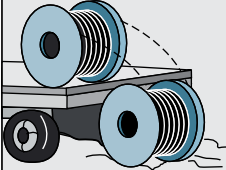
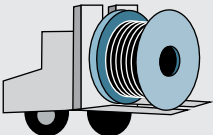
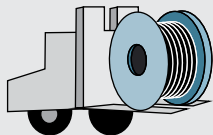
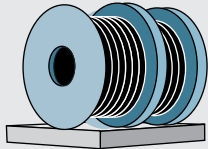
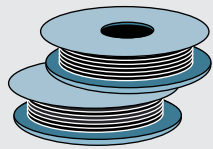
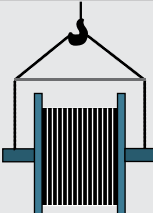
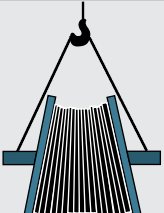
Inspect every cable reel for damage before accepting the shipment. Be particularly alert for cable damage if:

1. A reel is laying flat on its side
2. Several reels are stacked
3. Other freight is stacked on a reel
4. Nails have been driven into reel flanges to secure shipping blocks
5. A reel flange is damaged
6. A cable covering is removed, stained or damaged
7. A cable end seal is removed or damaged. A reel has been dropped (hidden damage likely)

B. CABLE HANDLING & STORAGE

Damage to cables can occur due to the incorrect handling to which the drums and cables may be subjected; causing breakdown of the drum flanges and in exceptional cases, movement of the drum barrel takes place. Once this breakdown of the drum occurs, the cable is immediately exposed to damage. Cables damaged during handling & storage can cause service failures when the subject cable is out to use.

Thus the following is a list of Do's and Don'ts that should be followed while handling and storing the cables before it is put to use.

Do's ✓		Don'ts ✗	
	When off loading reels from a truck, lower reels carefully using a hydraulic gate, hoist or forklift truck.		Never drop reels. If reels must be rolled, roll in opposite direction of the cable wraps to keep cable from loosening on the reel.
	If a forklift is used, approach the reel from the flange side. Position the forks such that the reel is lifted by both reel flanges. Also consideration should be given to, traffic patterns during off-loading & damage during the time in storage.		Do not allow the lift forks to contact the cable. Care must be taken by the forklift operator not to make sudden turns or stops.
	Cable reels should be stored on hard surface resting on the flanges edge (flanges vertical). Align reel flange to flange and, if possible, arrange so that first in is first out.		Multiple reels stacked on top of each other ("Pancake" storage) is not recommended for cable drums. The weight of the stack can total thousands of kgs creating an enormous load on the bottom reel. Also, damage to the reel and/or cable will likely occur when the reel is flipped for transit. A concentration of stress on the reel flange may cause it to break and subsequently damage the cable.
	When using a hoist, install a mandrel through the reel arbor holes and attach a sling. Using a spreader bar approximately 6 inches longer than the overall reel width placed between the sling ends just above the reel flanges.		This may lead to the bending of the reel flanges and mashing the cable.

HANDLING, STORAGE AND LAYING OF CABLES

C. PRE-INSTALLATION

To ensure safety during cable installation, following shall be checked prior to installation.

1. The cable selected is proper for designed application
2. The cable has not been damaged in transit or storage.

Review all applicable state and national codes to verify that the cable chosen is appropriate for the job. Also consult your local electricity authority. Next, you must identify any existing cable damage and prevent any further damaged from occurring. This is done through proper cable inspection, handling and storage.

D. INSTALLATION & LAYING

Mechanical stresses during installation are generally more severe than those encountered while in service. Thus care should be taken as regards to the following while installation and laying of cables.

1. Gemscab recommend the laying and installation of cables as per IS: 1255/83.
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.
4. Shaft supported both ends with suitable jacks /stands

5. 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

6. Suitable protection shall be provided to the cables against mechanical damages, it includes covers, pipes etc.

E. RECOMMENDED MINIMUM BENDING RADIUS FOR HEAVY DUTY CABLES

Single Core : 20xD

Multicore : 15xD

Where D = Diameter of cable in mm

F. RECOMMENDED SAFE PULLING FORCE WITH STOCKINGS:

- a) For Unarmoured Cable: $P = 5 D^2$

Where P = Pulling Force

- b) For Armoured Cable: $P = 9 D^2$

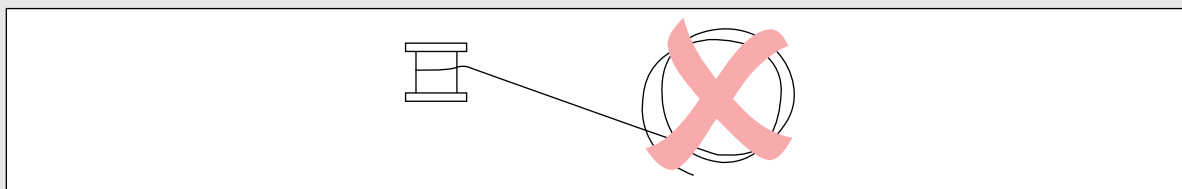
Where D = Diameter of cable in mm

G. RECOMMENDED SAFE PULLING FORCE WHEN PULLED WITH PULLING EYE:

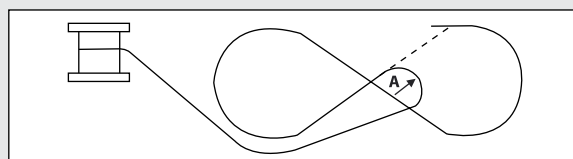
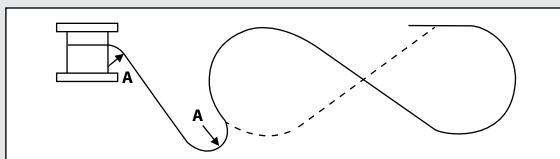
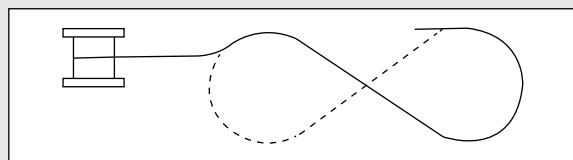
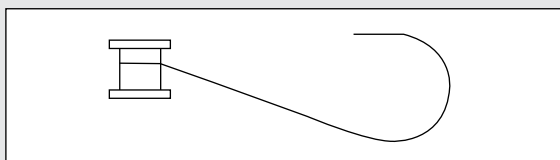
- a) For Aluminium Conductors : 30 N/mm²

- b) For Copper Conductor : 50 N/mm²

DO NOT ATTEMPT "COILING" OF CABLE ON THE GROUND



ON THE GROUND CABLE CAN BE FLAKED IN A FIGURE OF EIGHT FORMATION



IMPORTANT FORMULAE

IMPORTANT FORMULAE * TO BE CALCULATE VARIOUS ELECTRICAL PARAMETERS OF CABLES

1) Inductance :

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

where K = constant for different stranded conductors

S = Axial Spacing between Cables & Conductors in mm

d = Conductor in Diameter

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

2) Reactance :

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

Where f = frequency

L = Inductance

3) Impedance :

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

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

X = Reactance

4) Charging Current:

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

C = Cable capacitance in $\mu\text{f/km}$

5) Voltage Drop

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

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

where Z = Impedance in ohm/km

6) Capacitance :

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

where Er = Relative Permittivity for XLPE : 2.3

D = Dia over Insulation in mm

d = Dia over conductor screen in mm

7) Dielectric loss in watts per km/phase :

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

where C = Capacitance in $\mu\text{f/km}$

U_o = Power frequency voltage between conductor & earth –V

Tan = Dielectric power factor

= 0.0004 for XLPE

8) Voltage Induced in Sheath :

$$E_s = I X_m$$

Where I = conductor current (A)

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

M = $0.2 \log_e (25 / d_m)$ (mH/km)

S = Distance between Cable Centres

d_m = Mean Diameter of Sheath

9) Short Circuit Rating :

$$I^2 = \frac{K^2 S^2}{T} \log_e \left(\frac{\theta_1 + \beta}{\theta_o + \beta} \right)$$

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

T = Duration of short circuit in second

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

S = Area of Conductor in mm^2

θ_1 = Final Temperature of Conductor or Armour

θ_o = Initial Temperature of Conductor or Armour

β = Reciprocal of the temperature coefficient of resistance of the conductor per $^\circ\text{C}$ at 0°C (228 for Aluminium, 202 for Steel, & 234.5 for Copper)

10) Zero Sequence Impedance (Ω/km) :

$$Z_i = (R_i^2 + X_i^2)^{1/2} \Omega/\text{km}$$

' X_i ' = Zero Sequence Reactance

' R_i ' = Zero Sequence AC Resistance

11) Dielectric Stress (Kv/mm) :

$$E_{\text{Max.}} = 2.U_o/d \log_e (D/d) \text{ Kv/km}$$

$$E_{\text{Min.}} = 2.U_o/D \log_e (D/d) \text{ Kv/km}$$

Where, U_o = Phase Voltage to Earth (Kv)

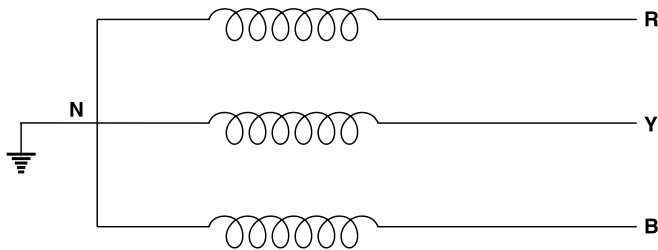
D = Diameter over XLPE Insulation (mm)

d = Diameter over Inner Conducting Semicon (mm)

DIFFERENCE BETWEEN EARTHED / UNEARTHED SYSTEM

EARTHED SYSTEM:

In the initial years, the generators and transformers were having capacities of few MVA and hence fault current was also less. The star point or neutral point was solidly grounded and this is called earthed system.

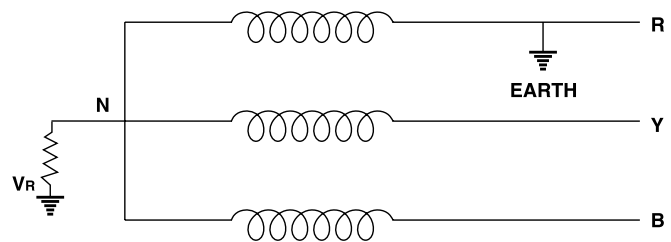


In this system if an earth fault occurs on any of the phases, the voltages of other two healthy phases with respect to the earth remain the same.

UNEARTHED SYSTEM:

Today generators of 500 MVA capacity are in commercial use. More over several mega power stations are connected to grid. Due to this, the fault level has increased tremendously. In case of an earth fault, a heavy current flows in to the fault and this may damage the costly generators and power transformers.

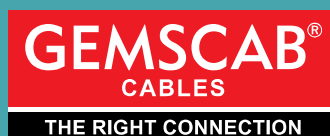
To reduce the fault current, the star point is connected to the earth through a resistance or a reactance as under:



In this case if an earth fault occurs on R phase, the voltage of the faulty phase with respect to the earth (R) appears across the current limiting resistance or reactance in the earth circuit of the star point, which was at earth potential under normal conditions rises to V_R . Due to this the voltages of other two healthy phases (B and Y) with respect to the earth rises by 1.7 times (Vector sum of V_T and V_B). If the insulation of these phases are not designed for these increased voltages they may develop earth fault. This is called Unearthed System.

This image shows a blank sheet of white paper with horizontal ruling lines. The top right corner has a gray triangular graphic element pointing downwards, and the bottom left corner has a similar gray triangular graphic element pointing upwards. The rest of the page is white with evenly spaced horizontal lines.





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