



# ABHAR CABLE CO.



ISO 9002  
Certificate No.  
QS-1147HH



Accredited by the  
Dutch Council for  
Accreditation

**AC** ABHAR  
CABLE



## Extra High Voltage& High Voltage cables

Extra high Voltage and High Voltage cables are manufactured with copper or Aluminum conductors, XLPE insulation at rated voltages of more than 36 KV.

The XLPE Insulation is applied to the conductor in computer-controlled CCV extrusion lines. It must have a highly homogeneous crystallite structure and be free of any impurity or voids, and strict quality control procedures are enforced at all strategic points in the CCV line.

XLPE insulation is prone to the physical–chemical phenomenon of water treeing. If water or water vapor exists in the insulation layer, water trees can start to form and lower the dielectric resistance of the insulation.

In line with leading cable manufacturers worldwide, **AC** applies aluminum laminated sheath, lead sheath or swellable material to radially and longitudinally water proof the screen.

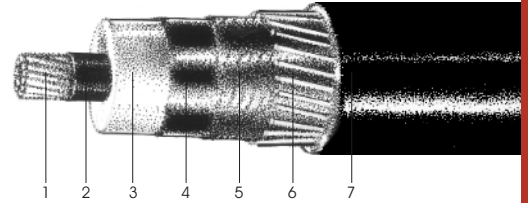


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**Cu/SC/XLPE/SC/SCT/CWS/PVC****IEC 60840**

Wire screened, single core high voltage power cable with copper conductor and XLPE insulation.

**38/66 (72) kV**

Number of Cores & Cross Section mm <sup>2</sup>	Insulation Thickness mm	Sheath Thickness mm	Cable Diameter Approx. mm	Total Weight Approx. kg/km
1x 95 RM/50	13.0	2.6	49.4	2864
1x 120 RM/50	13.0	2.6	50.9	3167
1x 150 RM/50	12.0	2.5	53.8	3620
1x 185 RM/50	12.0	2.5	55.6	4043
1x 240 RM/50	11.0	2.5	56.0	4520
1x 300 RM/50	11.0	2.6	58.4	5181
1x 400 RM/50	11.0	2.7	61.9	6114
1x 500 RM/50	10.0	2.7	63.3	7081
1x 630 RM/50	10.0	2.9	66.7	8561
1x 800 RM/50	10.0	3.0	70.4	10272
1x 1000 RM/50	9.5	3.3	71.3	12208
1x 1200* RMS/50	9.0	3.4	73.8	14163
1x 1400* RMS/50	9.0	3.5	77.6	16166
1x 1600* RMS/50	9.0	3.8	80.1	18099

1-Stranded Circular Conductor 2-Semi-conductive Conductor Screen 3-XLPE Insulation 4-Semi-conductive Insulation Screen 5-Semi-conductive Tape

6-Copper Wire Screen 7-PVC Overall Sheath

\* Segmental conductor

Maximum conductor temperature: 90°C

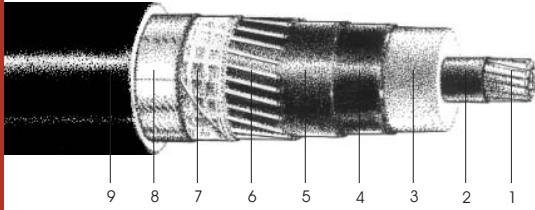
Also available with aluminium conductor (maximum cross-section 2000 mm) and PE sheath.

**Electrical Data**

Number of cores	AC resistance (Ohm/km)		REACTANCE (Ohm/km)		CAPACITANCE (micro F/km)
	Trefoil	Flat	Trefoil	Flat	
1 x 95 RM / 50	0.247	0.246	0.151	0.222	0.14
1 x 120 RM / 50	0.196	0.196	0.144	0.215	0.15
1 x 150 RM / 50	0.159	0.159	0.140	0.209	0.15
1 x 185 RM / 50	0.1273	0.1270	0.135	0.203	0.16
1 x 240 RM / 50	0.0974	0.0970	0.128	0.194	0.18
1 x 300 RM / 50	0.0783	0.0778	0.125	0.189	0.19
1 x 400 RM / 50	0.0621	0.0614	0.119	0.182	0.22
1 x 500 RM / 50	0.0496	0.0485	0.114	0.175	0.24
1 x 630 RM / 50	0.0398	0.0385	0.111	0.170	0.26
1 x 800 RM / 50	0.0328	0.0312	0.107	0.165	0.28
1 x 1000 RM / 50	0.0281	0.0261	0.103	0.159	0.31
1 x 1200 RMS / 50	0.0255	0.0234	0.100	0.152	0.36
1 x 1600 RMS / 50	0.0216	0.0193	0.101	0.152	0.39

**AC ABHAR CABLE**

**38/66 (72) kV****HIGH VOLTAGE CABLES****1**



IEC 60840

Cu/SC/XLPE/SC/SCT/CWS/WBT/AIC/PE

Wire screened, water blocked, single core high voltage power cable with copper conductor and XLPE insulation.

38/66 (72) kV

Number of Cores & Cross Section mm <sup>2</sup>	Insulation Thickness mm	Sheath Thickness mm	Cable Diameter Approx. mm	Total Weight Approx. kg/km
1x 95 RM/50	13.0	2.7	52.4	2709
1x 120 RM/50	13.0	2.7	53.9	3006
1x 150 RM/50	12.0	2.5	55.9	3418
1x 185 RM/50	12.0	2.6	58.2	3833
1x 240 RM/50	11.0	2.6	58.6	4308
1x 300 RM/50	11.0	2.6	60.5	4952
1x 400 RM/50	11.0	2.7	64.0	5851
1x 500 RM/50	10.0	2.8	65.6	6835
1x 630 RM/50	10.0	2.9	68.8	8271
1x 800 RM/50	10.0	3.0	72.5	10045
1x 1000 RM/50	9.5	3.4	74.3	11898
1x 1200* RMS/50	9.0	3.5	76.8	13830
1x 1400* RMS/50	9.0	3.6	80.6	15802
1x 1600* RMS/50	9.0	3.7	83.1	17709

1-Stranded Circular Conductor 2-Semi-conductive Conductor Screen 3-XLPE Insulation 4-Semi-conductive Insulation Screen 5-Semi-conductive Tape 6-Copper Wire Screen 7-Water Blocking Tape 8-Aluminium Copolymer Layer 9-PE Overall Sheath  
\* Segmental conductor

Maximum conductor temperature: 90°C

Also available with aluminium conductor (maximum cross-section 2000 mm).

## Electrical Data

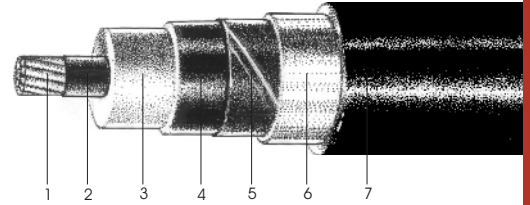
Number of cores	AC resistance (Ohm/km)		REACTANCE (Ohm/km)		CAPACITANCE (micro F/km)
	Trefoil	Flat	Trefoil	Flat	
1 x 95 RM / 50	0.247	0.246	0.153	0.223	0.14
1 x 120 RM / 50	0.196	0.196	0.147	0.216	0.15
1 x 150 RM / 50	0.159	0.159	0.142	0.21	0.15
1 x 185 RM / 50	0.1273	0.1270	0.137	0.204	0.16
1 x 240 RM / 50	0.0974	0.0970	0.131	0.196	0.18
1 x 300 RM / 50	0.0782	0.0778	0.127	0.190	0.19
1 x 400 RM / 50	0.0621	0.0614	0.121	0.183	0.22
1 x 500 RM / 50	0.0495	0.485	0.116	0.176	0.24
1 x 630 RM / 50	0.0397	0.0385	0.112	0.171	0.26
1 x 800 RM / 50	0.0327	0.0312	0.109	0.166	0.28
1 x 1000 RM / 50	0.0279	0.0261	0.105	0.160	0.31
1 x 1200 RMS / 50	0.0254	0.0234	0.101	0.153	0.36
1 x 1600 RMS / 50	0.0215	0.0193	0.103	0.152	0.39

**AC** ABHAR  
CABLE

Cu/SC/XLPE/SC/SCWBT/LSH/PVC

IEC 60840

Lead sheathed, single core high voltage power cable with copper conductor and XLPE insulation.



### 38/66 (72) kV

Number of Cores & Cross Section mm <sup>2</sup>	Insulation Thickness mm	Lead Thickness mm	Sheath Thickness mm	Cable Diameter Approx. mm	Total Weight Approx. kg/km
1x 95 RM	13.0	2.1	2.5	51.6	5950
1x 120 RM	13.0	2.2	2.6	53.5	6565
1x 150 RM	12.0	2.1	2.6	55.5	6743
1x 185 RM	12.0	2.1	2.7	57.9	7329
1x 240 RM	11.0	2.1	2.7	58.3	7836
1x 300 RM	11.0	2.2	2.8	60.6	8837
1x 400 RM	11.0	2.3	2.9	64.3	10232
1x 500 RM	10.0	2.3	2.9	65.7	11315
1x 630 RM	10.0	2.4	3.0	69.0	13229
1x 800 RM	10.0	2.5	3.1	73.0	15479
1x 1000 RM	9.5	2.7	3.2	74.4	18012
1x 1200* RMS	9.0	2.8	3.3	77.2	20452
1x 1400* RMS	9.0	2.9	3.5	81.4	23123
1x 1600* RMS	9.0	3.0	3.5	84.0	25546

1-Stranded Circular Conductor 2-Semi-conductive Conductor Screen 3-XLPE Insulation 4-Semi-conductive Insulation Screen 5-Semi-conductive

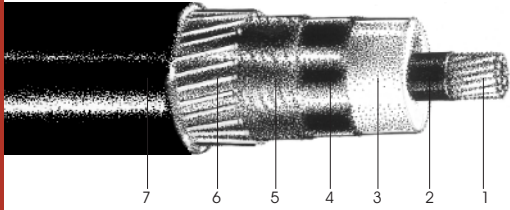
Water-blocking Tape 6-Lead sheath 7-PVC Overall Sheath  
\*Segmental conductor

Maximum conductor temperature: 90°C  
Also available with aluminium conductor & PE sheath.

### Electrical Data

Number of cores	AC resistance (Ohm/km)		REACTANCE (Ohm/km)		CAPACITANCE (micro F/km)
	Trefoil	Flat	Trefoil	Flat	
1 x 95 RM	0.247	0.246	0.153	0.223	0.14
1 x 120 RM	0.196	0.196	0.147	0.215	0.15
1 x 150 RM	0.159	0.159	0.142	0.21	0.15
1 x 185 RM	0.1273	0.1270.	0.137	0.204	0.16
1 x 240 RM	0.0974	0.0970.	0.131	0.196	0.18
1 x 300 RM	0.0782	0.0778	0.128	0.191	0.19
1 x 400 RM	0.0621	0.0614	0.121	0.183	0.22
1 x 500 RM	0.0495	0.0485	0.116	0.176	0.24
1 x 630 RM	0.0397	0.0385	0.113	0.172	0.26
1 x 800 RM	0.0324	0.0312	0.110.	0.166	0.28
1 x 1000 RM	0.0278	0.0261	0.106	0.160.	0.31
1 x 1200 RMS	0.0253	0.0234	0.103	0.154	0.36
1 x 1600 RMS	0.0213	0.0193	0.104	0.153	0.39





IEC 60840

Cu/SC/XLPE/SC/SCT/CWS/PVC

Wire screened, single core high voltage power cable with copper conductor and XLPE insulation.

## 76/132 (145) kV

Number of Cores & Cross Section mm <sup>2</sup>	Insulation Thickness mm	Sheath Thickness mm	Cable Diameter Approx. mm	Total Weight Approx. kg/km
1x 185 RM/95	18.0	3.0	70.5	5781
1x 240 RM/95	18.0	3.1	73.2	6506
1x 300 RM/95	18.0	3.1	75.1	7188
1x 400 RM/95	18.0	3.2	78.5	8207
1x 500 RM/95	18.0	3.3	82.2	9479
1x 630 RM/95	18.0	3.4	85.3	11018
1x 800 RM/95	17.5	3.5	88.1	12706
1x1000 RM/95	17.5	3.7	90.9	14568
1x1200* RMS/95	17.5	3.6	97.7	17222
1x1600* RMS/95	17.5	4.0	105.2	21732

1-Stranded Circular Conductor 2-Semi-conductive Conductor Screen 3-XLPE Insulation 4-Semi-conductive Insulation Screen 5-Semi-conductive Tape

6-Copper Wire Screen 7-PVC Overall Sheath

\*Segmental conductor

Maximum conductor temperature: 90°C

Also available with aluminium conductor and PE sheath.

## Electrical Data

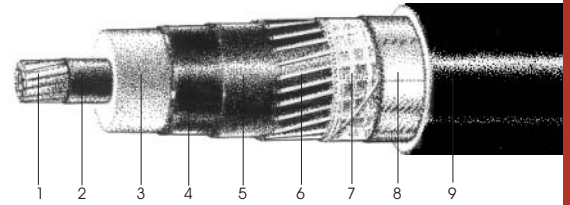
Number of cores	AC resistance (Ohm/km)		REACTANCE (Ohm/km)		CAPACITANCE (micro F/km)
	Trefoil	Flat	Trefoil	Flat	
1 x 185 RM / 95	0.1271	0.1270	0.156	0.212	0.11
1 x 240 RM / 95	0.0972	0.0970	0.148	0.204	0.12
1 x 300 RM / 95	0.078	0.0777	0.144	0.199	0.13
1 x 400 RM / 95	0.0618	0.0614	0.135	0.190	0.15
1 x 500 RM / 95	0.0491	0.0485	0.129	0.183	0.16
1 x 630 RM / 95	0.0392	0.0384	0.125	0.177	0.17
1 x 800 RM / 95	0.0321	0.0311	0.121	0.172	0.19
1 x 1000 RM / 95	0.0272	0.0260	0.116	0.166	0.20
1 x 1200 RMS / 95	0.0247	0.0233	0.112	0.159	0.23
1 x 1600 RMS / 95	0.0207	0.0192	0.113	0.158	0.25

**AC ABHAR CABLE**



**Cu/SC/XLPE/SC/SCT/CWS/WBT/AIC/PE****IEC 60840**

Wire screened, water blocked, single core high voltage power cable with copper conductor and XLPE insulation.

**76/132 (145) kV**

Number of Cores & Cross Section mm <sup>2</sup>	Insulation Thickness mm	Sheath Thickness mm	Cable Diameter Approx. mm	Total Weight Approx. kg/km
1x 185 RM/95	18.0	3.0	702.6	5602
1x 240 RM/95	18.0	3.1	75.3	6308
1x 300 RM/95	18.0	3.2	77.4	7007
1x 400 RM/95	18.0	3.3	80.9	8004
1x 500 RM/95	18.0	3.4	84.5	9252
1x 630 RM/95	18.0	3.5	87.7	10768
1x 800 RM/95	17.5	3.6	90.4	12432
1x 1000 RM/95	17.5	3.7	92.1	14046
1x 1200* RMS/95	17.5	3.6	98.9	16672
1x 1600* RMS/95	17.5	4.0	106.4	21071

1-Stranded Circular Conductor 2-Semi-conductive Conductor Screen 3-XLPE Insulation 4-Semi-conductive Insulation Screen 5-Semi-conductive Tape

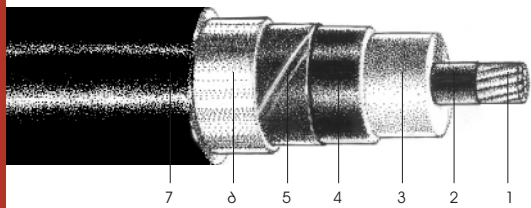
6-Copper Wire Screen 7-Water-blocking Tape 8-Aluminium Copolymer Layer 9-PE Overall sheath  
\*Segmental conductor

Maximum conductor temperature: 90°C  
Also available with aluminium conductor.

**Electrical Data**

Number of cores	AC resistance (Ohm/km)		REACTANCE (Ohm/km)		CAPACITANCE (micro F/km)
	Trefoil	Flat	Trefoil	Flat	
1 x 185 RM / 95	0.1271	0.1270	0.157	0.213	0.11
1 x 240 RM / 95	0.0972	0.0970	0.150	0.205	0.12
1 x 300 RM / 95	0.078	0.0777	0.145	0.200	0.13
1 x 400 RM / 95	0.0618	0.0614	0.136	0.190	0.15
1 x 500 RM / 95	0.0491	0.0485	0.131	0.183	0.16
1 x 630 RM / 95	0.0392	0.0384	0.127	0.178	0.17
1 x 800 RM / 95	0.0321	0.0311	0.0122	0.173	0.19
1 x 1000 RM / 95	0.0272	0.260	0.117	0.167	0.20
1 x 1200 RMS / 95	0.0246	0.0233	0.113	0.160	0.23
1 x 1600 RMS / 95	0.0206	0.0192	0.114	0.159	0.25

**AC ABHAR CABLE**



**IEC 60840** *Cu/SC/XLPE/SC/SCWBT/Lsh/PVC*

Lead sheathed, single core high voltage power cable with copper conductor and XLPE insulation.

**76/132 (145) kV**

Number of Cores & Cross Section mm <sup>2</sup>	Insulation Thickness mm	Lead Thickness mm	Sheath Thickness mm	Cable Diameter Approx. mm	Total Weight Approx. kg/km
1x 185 RM	18.0	2.5	3.2	79.8	12673
1x 240 RM	18.0	2.6	3.3	82.7	13908
1x 300 RM	18.0	2.7	3.4	85.5	15222
1x 400 RM	18.0	2.8	3.5	89.2	16878
1x 500 RM	18.0	2.8	3.6	92.8	18530
1x 630 RM	18.0	3.1	4.0	92.9	18099
1x 800 RM	17.5	3.1	4.1	96.6	20283
1x 1000 RM	17.5	3.3	4.3	103.4	23239
1x 1200* RMS	17.5	3.4	4.4	105.2	26111
1x 1400* RMS	17.5	3.5	4.5	109.2	28982
1x 1600* RMS	17.5	3.6	4.6	112.0	31627

1-Stranded Circular Conductor 2-Semi-conductive Conductor Screen 3-XLPE Insulation 4-Semi-conductive Insulation Screen 5-Semi-conductive Water-blocking Tape  
 6-Lead Sheath 7-PVC Overall Sheath  
 \*Segmental conductor

Maximum conductor temperature: 90°C  
 Also available with aluminium conductor and PE sheath.

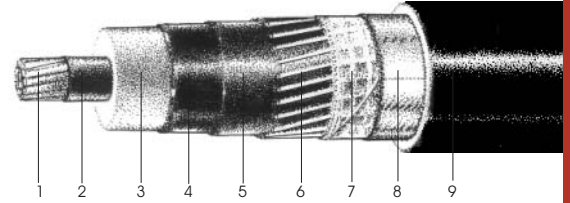
**Electrical Data**

Number of cores	AC resistance (Ohm/km)		REACTANCE (Ohm/km)		CAPACITANCE (micro F/km)
	Trefoil	Flat	Trefoil	Flat	
1 x 185 RM	0.1271	0.1270	0.158	0.213	0.11
1 x 240 RM	0.0972	0.0970	0.151	0.205	0.12
1 x 300 RM	0.0780	0.0777	0.146	0.200	0.13
1 x 400 RM	0.0617	0.0614	0.137	0.191	0.15
1 x 500 RM	0.0491	0.0485	0.131	0.184	0.16
1 x 630 RM	0.0392	0.0384	0.128	0.179	0.17
1 x 800 RM	0.0320	0.0311	0.123	0.174	0.19
1 x 1000 RM	0.0271	0.026	0.119	0.167	0.20
1 x 1200 RMS	0.0245	0.0233	0.115	0.161	0.23
1 x 1600 RMS	0.0205	0.0192	0.115	0.160	0.25



**Cu/SC/XLPE/SC/SCWBT/CWS/WBT/AIPE/HDPE IEC 62067**

Wire screened, water blocked, single core extra high voltage power cable with copper conductor and XLPE insulation.



**133/230(245) kV**

Number of Cores & Cross Section mm <sup>2</sup>	Insulation Thickness mm	Sheath Thickness mm	Cable Diameter Approx. mm	Total Weight Approx. kg/km
1x 630 RM/95	25	4.0	107.7	12,733
1x 800 RM/95	25	4.1	111.5	14,603
1x 1000 RM/95	23	4.2	112.4	16,452
1x 1200* RMS/95	23	4.4	122.3	19,884
1x 1600* RMS/95	23	4.6	127.8	24,117

1-Stranded circular Conductor 2-Semi-conductive Conductor Screen 3-XLPE Insulation 4-Semi-conductive Insulation Screen 5-Semi-conductive water blocking tape 6-Copper wire Screen 7-Water-blocking tape 8-Aluminium Copolymer Layer 9-HDPE overall sheath  
\*Segmental conductor

Maximum conductor temperature: 90°C  
Also available with aluminium conductor.

**Electrical Data**

Number of cores	AC resistance (Ohm/km)		REACTANCE (Ohm/km)		CAPACITANCE (micro F/km)
	Trefoil	Flat	Trefoil	Flat	
1 x 630 RM / 95	0.0389	0.0384	0.140	0.186	0.14
1 x 800 RM / 95	0.0317	0.0311	0.136	0.181	0.15
1 x 1000 RM / 95	0.0268	0.0259	0.128	0.173	0.17
1 x 1200 RMS / 95	0.0242	0.0232	0.123	0.166	0.19
1 x 1600 RMS / 95	0.0201	0.0191	0.123	0.165	0.21



# TECHNICAL DATA



## IEC & AWC Abbreviations

<b>Cu</b>	Copper
<b>Al</b>	Aluminium
<b>AA</b>	Aluminium Alloy
<b>TiCu</b>	Tinned Copper
<b>SiCu</b>	Silver Coated copper
<b>RM</b>	Stranded Circular
<b>SM</b>	Shaped Stranded
<b>SE</b>	Shaped Solid
<b>RE</b>	Solid Circular
<b>RF</b>	Flexible Circular
<b>RMS</b>	Stranded Segmental (Milliken)
<b>CTS</b>	Copper Tape Screen
<b>CWS</b>	Copper Wire Screen
<b>CuB</b>	Copper Wire Braided Screen
<b>ICTS</b>	Individual Copper Tape Screen
<b>ICWS</b>	Individual Copper Wire Screen
<b>ISCR</b>	Individual Screen Formed by Polyester + Tinned Drain Wire + Aluminium Backed Polyester + Polyester
<b>ISCRC</b>	Individual Screen Formed by Polyester + Tinned Drain Wire + Copper Backed Polyester + Polyester
<b>OSCR</b>	Overall Screen Formed by Polyester + Tinned Drain Wire + Aluminium Backed Polyester
<b>OSCRC</b>	Overall Screen Formed by Polyester + Tinned Drain Wire + Copper Backed Polyester
<b>TCB</b>	Tinned Copper Wire Braided Screen
<b>CW</b>	Communication Wire
<b>ATA</b>	Double Aluminium Tape Armour
<b>STA</b>	Double Galv. Steel Tape Armour
<b>AWA</b>	Aluminium Wire Armour
<b>AWAT</b>	Aluminium Wire Armour + Counter Herlix
<b>SWA</b>	Galv. Steel Wire Armour
<b>SWAT</b>	Galv. Steel Wire Armour + Counter Helix
<b>SSWA</b>	Stainless Steel Wire Armour
<b>DAWA</b>	Double Aluminum Wire Armour
<b>DSWA</b>	Double Galv. Steel Wire Armour
<b>TCWA</b>	Tinned Copper Wire Armour
<b>AWB</b>	Aluminium Wire Braided
<b>SWB</b>	Galv. Steel Wire Braided
<b>BWB</b>	Bronze Wire Braided
<b>SSWB</b>	Stainless Steel Wire Braided
<b>LSh</b>	Lead Sheath
<b>AlPE</b>	Aluminium Copolymer Coated

<b>Bd</b>	Bedding
<b>BT</b>	Brass tape
<b>BHT</b>	Bituminized Hessian Tape
<b>BPT</b>	Bitumen Coated Paper Tape
<b>BdT</b>	Bedding Tape (PVC or PE)
<b>BrT</b>	Bronze Tape
<b>MGT</b>	Mica Glass Tape
<b>PPT</b>	Polypropylene Tape
<b>SCT</b>	Semi Conductive Tape
<b>WBT</b>	Water Blocking Tape
<b>Pet</b>	Polyester Tape (Mylar)
<b>SCWBT</b>	Semi-Conductive Water Blocking Tape
<b>PPY</b>	Polypropylene Yarn
<b>WBY</b>	Water Blocking Yarn
<b>SCYF</b>	Semi-conductive Yarn Filler
<b>GC</b>	Graphite Coating
<b>GFB</b>	Glass Fiber Braided
<b>FPE</b>	Foamed Polyethylene (Cellular)
<b>TPU</b>	Thermoplastic Polyurethane
<b>SC</b>	Ext. Polymer Semi Conductive
<b>TPE</b>	Thermoplastic Elastomer
<b>PVC</b>	Polyvinylchloride
<b>XLPE</b>	Cross Linked Polyethylene
<b>SIR</b>	Silicone Rubber
<b>PE</b>	Polyethylene
<b>EVA</b>	Ethylene Vinyl Acetate
<b>XEVA</b>	Cross Linked EVA
<b>HDPE</b>	High Density Polyethylene
<b>HEPR</b>	Hard Grade Ethylene Propylene Rubber
<b>LDPE</b>	Low Density Polyethylene
<b>MDPE</b>	Medium Density Polyethylene
<b>LSFOH</b>	Low Smoke Flame Retardant Zero Halogen
<b>EPR</b>	Ethylene Propylene Rubber
<b>PVCE</b>	High Temperature PVC (90°C)
<b>PVCH</b>	High temperature Sheathing Compound equal to IEC ST2 ,VDE YM5 (90°C)
<b>APVC</b>	Anti Termite PVC
<b>APVCE</b>	Anti Termite High Temperature PVC (90°C)
<b>APVCH</b>	Anti Termite & High Temperature Sheathing Compound equal to IEC ST2 ,VDE YM5 (90°C)
<b>XPVC</b>	Cross Linked PVC
<b>OPVC</b>	Oil, Acid & Hydrocarbon Resistance Sheathing Compound
<b>OPVCH</b>	Oil Resistant & High Temperature Sheathing Compound equal to IEC ST2 ,VDE YM5 (90°C)

## VDE Abbreviations

<b>N</b>	DIN VDE standard type
<b>(N)</b>	With reference to DIN VDE standard
<b>A</b>	Aluminium conductor
<b>-</b>	Copper
<b>Y</b>	PVC
<b>2X</b>	Cross-linked PE(VPE)
<b>C</b>	Concentric Cu conductor,in longitudinal twist
<b>CW</b>	Concentric Cu conductor,corrugated
<b>CE</b>	Concentric Cu conductor for individual core
<b>S</b>	Cu shielding
<b>SE</b>	Cu screening per individual core in multi-core cables
<b>H</b>	Conductive layer
<b>(F)</b>	Longitudinally watertight shielding
<b>B</b>	Steel strip reinforcement
<b>F</b>	Flat wire,zinc-plated
<b>G</b>	Counterhelix consisting of zinc-plated steel strip
<b>R</b>	Round-section wire,zinc-plated
<b>A</b>	Protective cover consisting of fiber materials
<b>K</b>	Lead sheath
<b>KL</b>	Aluminium sheath
<b>Y</b>	PVC
<b>2Y</b>	PE
<b>I</b>	With protective conductor
<b>O</b>	Without protective conductor
<b>r...</b>	Round-section conductor
<b>s...</b>	Sector-section conductor
<b>o...</b>	Oval conductor
<b>e...</b>	Single wire conductor
<b>m...</b>	Multi-wire conductor
<b>h...</b>	Hollow conductor
<b>N</b>	Compacted conductor

## FORMULAS

### 1- DC Resistance

$$R_{dc_{\theta}} = R_{dc_{20}} [1 + \alpha(\theta - 20)] \quad (\Omega / km)$$

$R_{dc_{20}}$  : Resistance at 20°C according to IEC 60228 ( $\Omega / km$ )

$\alpha$  : Temperature coefficient of resistance per degree at 20°C  
(Copper =  $3.93 \times 10^{-3}$ , Aluminium =  $4.04 \times 10^{-3}$ )

$\theta$  : Temperature (°C)

### 2- AC Resistance

$$R_{AC_{\theta}} = R_{dc_{\theta}} (1 + Y_p + Y_s)(1 + \lambda_1 + \lambda_2) \quad (\Omega / km)$$

$Y_p$  : Proximity effect

$Y_s$  : Skin effect

$\lambda_1$  : Sheath loss

$\lambda_2$  : Armour loss

### 3- Inductance

$$L = K + 0.2Ln(2S/d) \quad (mH/km)$$

$K$  : Constant relating to conductor structure

$S$  : Axial cable spacing ( $S = 1.26 \times$  phase spacing for flat and single core cables) (mm)

$d$  : Conductor diameter (mm)

$K$	Strands
0	1
0.078	3
0.0642	7
0.0554	19
0.0528	37
0.0514	61 & over

### 4- Capacitance

$$C = \frac{\epsilon_r}{18Ln(D/d)} \quad (\mu F / km)$$

$\epsilon_r$  : Dielectric constant (XLPE=2.3)

$D$  : Insulated diameter (mm)

$d$  : Conductor diameter (mm)





## FORMULAS

### 5- Reactance

$$X = \omega L 10^{-3} \quad (\Omega / km)$$

$$\omega = 2\pi f$$

$L$  : Inductance (mH/km)

### 6- Impedance

$$Z = \sqrt{R_{ac}^2 + X^2} \quad (\Omega / km)$$

$R_{ac}$  : AC resistance ( $\Omega / km$ )

$X$  : Reactance ( $\Omega / km$ )

### 7- Short-circuit current

$$I_{sc} = \frac{\varepsilon K S}{\sqrt{t}} \sqrt{\ln\left(\frac{\beta + \theta_F}{\beta + \theta_I}\right)} \quad (A)$$

$\varepsilon$  : Will be calculated acc. to IEC 60949

$S$  : Cross sectional area (mm<sup>2</sup>)

$t$  : Duration of short-circuit (Max. 5 sec.)

$\theta_F$  : Max. temperature at the short circuit condition (°C) (250 FOR XLPE)

$\theta_I$  : Max. temperature at the normal operating (°C) (90 FOR XLPE)

	Copper	Aluminium	Lead	Steel
$K$	226	148	41	78
$\beta$	234.5	228	230	202

## FORMULAS

### 8- Electrical field strength

$$E_{\max} = \frac{U_0}{d \ln(D/d)} \quad (kV/mm) \quad \text{On Conductor}$$

$$E_{\min} = \frac{U_0}{D \ln(D/d)} \quad (kV/mm) \quad \text{On Insulation}$$

$U_0$  : Voltage (kV)  
 $D$  : Insulated diameter (mm)  
 $d$  : Conductor diameter (mm)

### 9- Charging Current

$$I = C\omega U_0 10^{-3} \quad (A/km)$$

$\omega = 2\pi f$   
 $C$  : Capacitance ( $\mu F/km$ )  
 $U_0$  : Voltage (kV)

### 10- Dielectric loss

$$P = C\omega U_0^2 \tan \delta \quad (\text{watt}/km)$$

$\omega = 2\pi f$   
 $C$  : Capacitance ( $\mu F/km$ )  
 $U_0$  : Voltage (KV)  
 $\tan \delta = 0.001$

## FORMULAS

### 11- Sheath Loss

$$P_e = \frac{3I^2\omega^2(dm/2S)^2 10^{-8}}{R_s} \quad (\text{watt/km}) \quad \text{Eddy current losses}$$

$$P_c = \frac{I^2 X_m^2 R_s}{R_s^2 + X_m^2} \quad (\text{watt/km}) \quad \text{Circulating current losses}$$

$$X_m = \omega 0.2Ln(2S/d_m) 10^{-3}$$

$$\omega = 2\pi f$$

$$R_s : \text{Sheath resistance} \quad (\Omega/\text{km})$$

$$S : \text{Axial spacing} \quad (\text{mm})$$

$$I : \text{Current} \quad (A)$$

$$d_m : \text{Mean sheath diameter} \quad (\text{mm})$$

### 12- Insulation Resistance

$$R = \frac{\rho Ln(D/d) 10^{-9}}{2\pi} \quad (M\Omega.km)$$

$$\rho : \text{Volume resistivity at } 20^\circ\text{C (XLPE=10}^{14}\text{)} \quad (\Omega.m)$$

$$D : \text{Insulated diameter (mm)}$$

$$d : \text{Conductor diameter (mm)}$$

### 13- Maximum Pulling Tension

**Unarmoured :**

$$T = K S \quad (\text{N}) \quad \begin{array}{l} K = 50 \text{ for copper} \\ K = 30 \text{ for aluminium} \end{array}$$

**Armoured :**

$$T = K' D^2 \quad (\text{N}) \quad \begin{array}{l} K' = 9 \text{ for wire armour} \\ K' = 3 \text{ for tape armour, lead sheath} \end{array}$$

$$S : \text{Conductor cross section} \quad (\text{mm}^2)$$

$$D : \text{Cable diameter} \quad (\text{mm})$$



## Conductors DC Resistance:

1	2	3	4	5	6	7	8	9	10
Nominal cross-sectional area mm <sup>2</sup>	Minimum number of wires in the conductor						Maximum resistance of conductor at 20°C		
	Circular		Circular compacted		Shaped		Annealed copper conductor		Aluminium or aluminium alloy conductor <sup>c</sup> ohm/km
	Cu	Al	Cu	Al	Cu	Al	Plain wires ohm/km	Metal-coated wires ohm/km	
0.5	7	-	-	-	-	-	36.5	36.7	-
0.75	7	-	-	-	-	-	24.5	24.8	-
1	7	-	-	-	-	-	18.1	18.2	-
1.5	7	-	6	-	-	-	12.1	12.2	-
2.5	7	-	6	-	-	-	7.41	7.56	-
4	7	-	6	-	-	-	4.61	4.70	-
6	7	-	6	-	-	-	3.08	3.11	-
10	7	7	6	6	-	-	1.83	1.84	3.08
16	7	7	6	6	-	-	1.15	1.16	1.91
25	7	7	6	6	6	6	0.727	0.734	1.20
35	7	7	6	6	6	6	0.524	0.529	0.868
50	19	19	6	6	6	6	0.387	0.391	0.641
70	19	19	12	12	12	12	0.268	0.27	0.443
95	19	19	15	15	15	15	0.193	0.195	0.32
120	37	37	18	15	18	15	0.153	0.154	0.253
150	37	37	18	15	18	15	0.124	0.126	0.206
185	37	37	30	30	30	30	0.0991	0.1	0.164
240	37	37	34	30	34	30	0.0754	0.0762	0.125
300	61	61	34	30	34	30	0.0601	0.0607	0.100
400	61	61	53	53	53	53	0.047	0.0475	0.0778
500	61	61	53	53	53	53	0.0366	0.0369	0.0605
630	91	91	53	53	53	53	0.0283	0.0286	0.0469
800	91	91	53	53	-	-	0.0221	0.0224	0.0367
1 000	91	91	53	53	-	-	0.0176	0.0177	0.0291
1 200				b			0.0151	0.0151	0.0247
1 400 <sup>a</sup>				b			0.0129	0.0129	0.0212
1 600				b			0.0113	0.0113	0.0186
1 800 <sup>a</sup>				b			0.0101	0.0101	0.0165
2 000				b			0.0090	0.0090	0.0149
2 500				b			0.0072	0.0072	0.0127

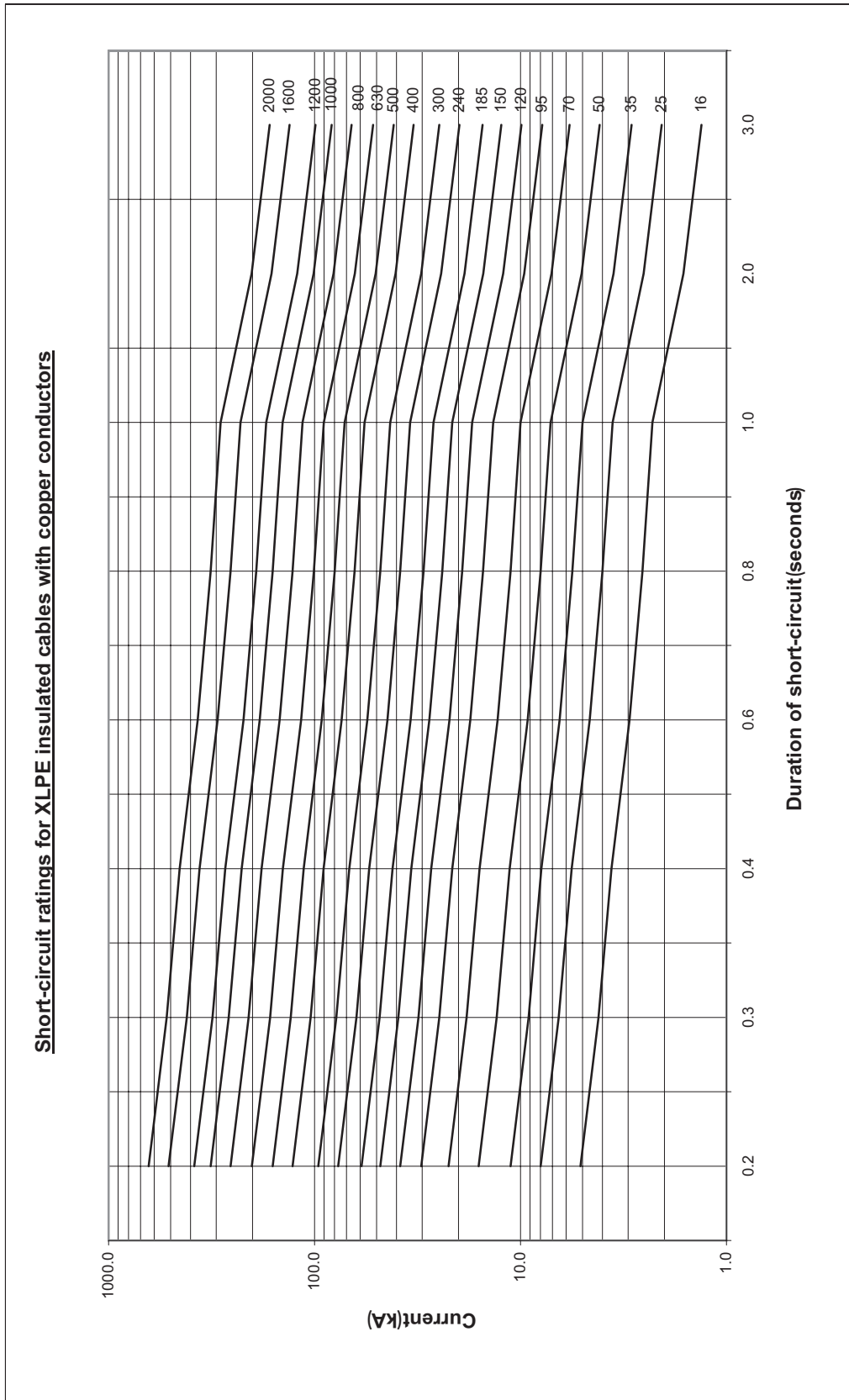
<sup>a</sup> These sizes are non-preferred. Other non-preferred sizes are recognized for some specialized applications but are not within the scope of this standard .

<sup>b</sup> The minimum number of wires for these sizes is not specified. These sizes may be constructed from 4.5 or 6 equal segments (Milliken).

<sup>c</sup> For stranded aluminium alloy conductors having the same nominal cross-sectional area as an aluminium conductor the resistance value should be agreed between the manufacture and the purchaser.



# Short-circuit ratings for XLPE insulated cables with copper conductors



# Short-circuit ratings for XLPE insulated cables with aluminium conductors

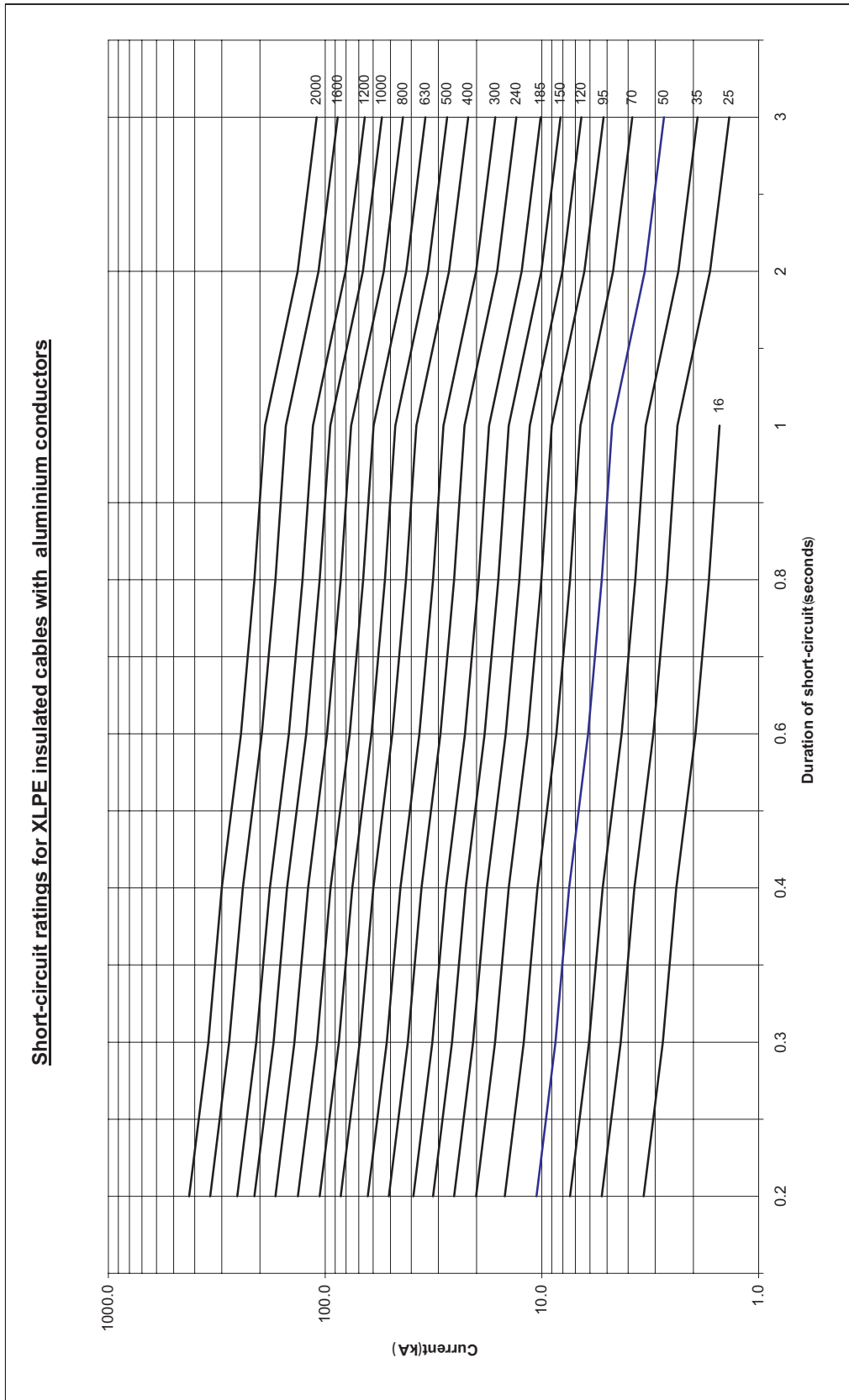


Table 1 - Current ratings for copper conductor cables (A)

Cross section conductor mm <sup>2</sup>	Cables in Ground				Cables in Air			
	Flat formation		Trefoil formation		Flat formation		Trefoil formation	
	Cross bonded	Both ends	Cross bonded	Both ends	Cross bonded	Both ends	Cross bonded	Both ends
95	340	330	320	325	400	390	350	350
120	390	375	365	365	465	445	400	400
150	435	410	410	410	530	495	455	455
185	495	455	465	460	610	560	520	520
240	570	515	535	535	720	645	615	610
300	625	540	600	580	785	690	700	685
400	715	590	680	650	915	775	810	785
500	815	645	770	725	1060	860	930	890
630	925	700	865	805	1230	950	1070	1010
800	1035	745	960	880	1410	1040	1210	1130
1000	1140	790	1050	945	1590	1115	1345	1240
1200*	1295	840	1215	1015	1850	1235	1590	1390
1400	1390	870	1300	1065	2010	1295	1720	1480
1600	1475	900	1375	1110	2185	1350	1850	1570
2000	1610	930	1490	1165	2435	1425	2040	1685

\* Segmental conductor for 1200 mm<sup>2</sup> or more

Table 2 - Current Ratings for aluminium conductor cables (A)

Cross section conductor mm <sup>2</sup>	Cables in Ground				Cables in Air			
	Flat formation		Trefoil formation		Flat formation		Trefoil formation	
	Cross bonded	Both ends	Cross bonded	Both ends	Cross bonded	Both ends	Cross bonded	Both ends
95	265	260	250	250	310	305	270	270
120	300	295	285	285	360	350	310	310
150	340	325	320	320	410	395	335	355
185	385	365	360	360	470	450	405	405
240	445	420	420	420	560	520	480	480
300	490	445	465	460	610	565	550	540
400	560	495	535	525	715	640	635	625
500	640	550	610	590	835	725	740	720
630	735	605	595	665	975	820	855	830
800	830	660	785	740	1130	910	985	940
1000	935	710	875	815	1295	990	1115	1055
1200*	1005	750	940	865	1415	1070	1215	1140
1400	1075	780	1000	910	1520	1125	1305	1220
1600	1130	805	1050	950	1635	1175	1385	1285
2000	1230	845	1135	1010	1820	1250	1525	1395

\* Segmental conductor for 1200 mm<sup>2</sup> or more



Table 3 - Correction factor for ground temperature

Conductor	Ground Temperature, °C							
	10	15	20	25	30	35	40	45
90	1.07	1.04	1	0.96	0.93	0.89	0.84	0.8

Table 4 - Correction factor for ambient air temperature

Air temperature, °C	10	15	20	25	30	35	40	45	50
Rating factor	1.24	1.19	1.15	1.1	1.05	1.0	0.95	0.89	0.83

Table 5 - Correction factor for ground thermal resistivity

Thermal resistivity, Km/W	0.7	1.0	1.2	1.5	2.0	2.5	3.0
Correction factor	1.14	1.00	0.93	0.84	0.74	0.67	0.61

Table 6 - Correction factor for phase spacing

one group in flat formation with cross-bonded or single-bonded screen

Spacing s, mm	$D_e$	$D_e+70$	200	250	300	350	400
Correction factor	0.93	1	1.03	1.05	1.07	1.08	1.10

$D_e$  = Cable dia.

S = Space between center to center of conductor

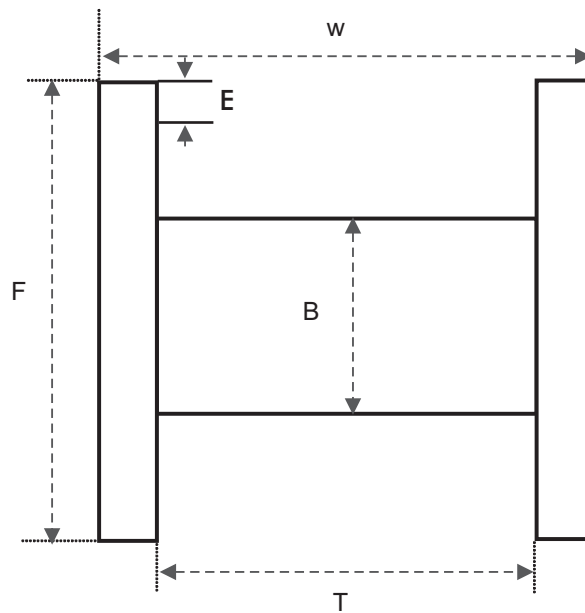
Table 7 - Correction factor for Laying depth

Laying depth, m	
0.50	1.1
0.70	1.05
0.90	1.01
1.00	1.00
1.20	0.98
1.50	0.95





Drum size	Flange Dia. F	Barrel Dia. B	Traverse T	Width overall W	Drum weight Kg
6	600	300	400	430	20
8	800	350	520	600	30
10	1000	450	620	700	50
12	1200	600	720	820	70
14	1400	700	790	920	125
16	1600	900	900	1028	175
18	1800	1100	1120	1248	290
20	2000	1200	1120	1248	330
22	2200	1400	1120	1248	450
24	2400	1600	1370	1570	595
26	2600	1600	1700	1900	645
30	3000	2000	1900	2100	770



$$L_T = \frac{\pi NP (B + PD)}{1000}$$

$$P = \frac{F - B - 2E}{2D}$$

$$N = 0.95 \frac{T}{D}$$

$L_T$  = Length of Cable (m)

F = Flange Dia. (mm)

B = Barrel Dia. (mm)

D = Cable Dia. (mm)

T = Traverse (mm)

E = Empty Space (mm)

