TECHNICAL INFORMATION

Important Points of Checking The Quality and Conformity of The Cable	Cable-Quality Rating
1 Conductor Resistance	% 75
2 Physical Content Control	% 10
Insulation and sheath thicknesses;physical and electrical properties of screen and armour to be checked.	
3 Tensile Strength Values	% 5
4 Elongation Values	% 5
5 Other Specifications	% 5
Routine and type tests of concerned cable standards are applied to check the quality and the conformity of the cable.	
6 Length Control	-
Meter marking on the cable shall be required.	
Total Quality	% 100 Quality

Specified Conductor Diameters

Class 5 (Flexible) Conductor

Nominal Cross-Section	No. and Diameter of Conductor 1	No. and Diameter of Conductor 2	Conductor Weight (min)	Cu Resistance (max)
mm	mm	mm	kg/km	Ω / km
0.75	24 x 0.19	22 x 0.20	6.15	26
1	32 x 0.19	29 x 0.20	8.15	19.5
1.5	30 x 0.24	27 x 0.25	12.10	13.3
2.5	50 x 0.24	45 x 0.25	20.15	7.98
4	54 x 0.29	51 x 0.30	32.50	4.95
6	82 x 0.29	76 x 0.30	48.50	3.30

Note : Above values are supposed to be considered as the minimum rates of copper wires which gained from copper cathode with a 99.9% purity.

Sample 1 : 1.5 mm^2 Class 5 Conductor

Weight and resistance difference between
30 x 0.24 mm and 30 x 0.23 mm
8.9%

Sample 2 : 2.5 mm^2 Class 5 Conductor

Weight and resistance difference between
45 x 0.25 mm and 45 x 0.24 mm
8.6%

Conductor Resistance

Conductor resistance at 20°C

Nominal cross-section	Cu Resistance (Class 1-2)	Cu Flexible Conductor Resistance (Class 5-6)	Al Resistance (Class 2)
mm	W / km	W / km	W / km
0.75	24.50	26	-
1	18.10	19.5	-
1.5	12.10	13.3	-
2.5	7.41	7.98	-
4	4.61	4.95	-
6	3.08	3.30	-
10	1.83	1.91	-
16	1.15	1.21	1.91
25	0.727	0.780	1.20
35	0.524	0.554	0.868
50	0.387	0.386	0.641
70	0.268	0.272	0.443
95	0.193	0.206	0.320
120	0.153	0.161	0.253
150	0.124	0.129	0.206
185	0.0991	0.106	0.164
240	0.0754	0.801	0.125
300	0.0601	-	0.100
400	0.0470	-	0.0778
500	0.0366	-	0.0605

Conversation of conductor resistance values for deviating ambient temperatures at 20°C conducting temperatures

$Rt = R20 . (234.5 + t) / 254.5$ (for Cu)

$Rt = R20 . (228.1 + t) / 248.1$ (for Al)

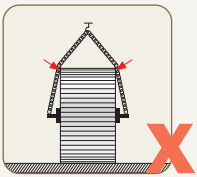
t : Conductor temperature (°C)
Rt : Conductor resistance at t°C (Ω / km)
R20 : Conductor resistance at 20°C (Ω / km)
M=234.5 (Cu) M=228.1 (Al)

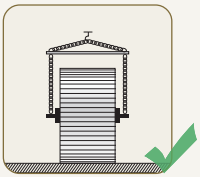
Values of k cofactor used for conductor resistance at 20 °C

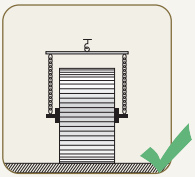
Scaled Temperature	Cofactor	Scaled Temperature	Cofactor	Scaled Temperature	Cofactor	Scaled Temperature	Cofactor
°C	k	°C	k	°C	k	°C	k
1	1.080	11	1.036	21	0.996	31	0.959
2	1.076	12	1.032	22	0.992	32	0.955
3	1.071	13	1.028	23	0.988	33	0.952
4	1.067	14	1.024	24	0.985	34	0.948
5	1.062	15	1.020	25	0.981	35	0.945
6	1.058	16	1.016	26	0.977	36	0.941
7	1.053	17	1.012	27	0.973	37	0.938
8	1.049	18	1.008	28	0.970	38	0.934
9	1.045	19	1.004	29	0.966	39	0.931
10	1.041	20	1.000	30	0.962	40	0.928

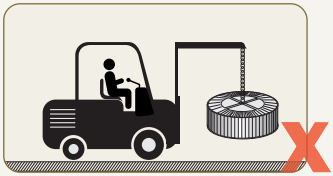
This table is valid for copper conductors.

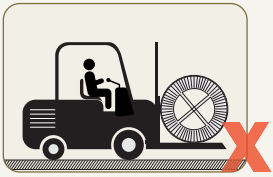
Cable Carrying Methods

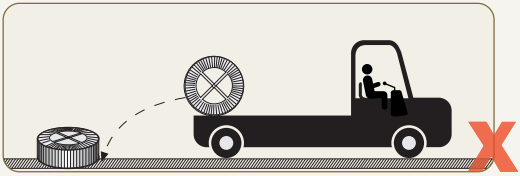


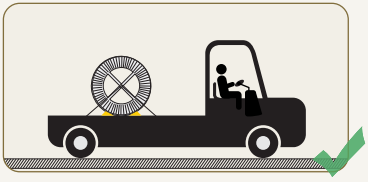




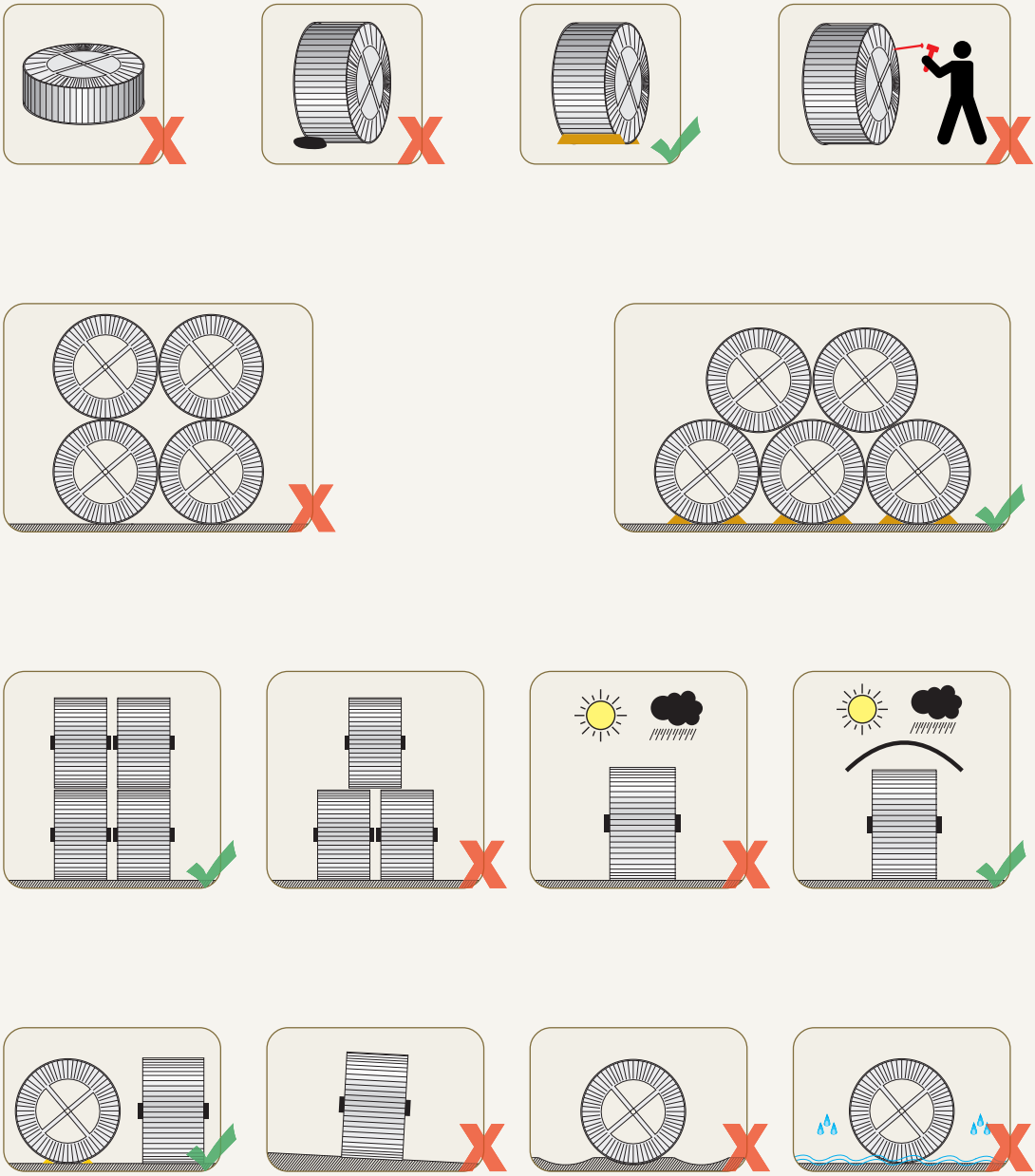




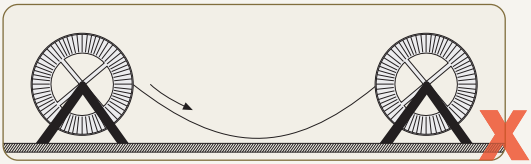




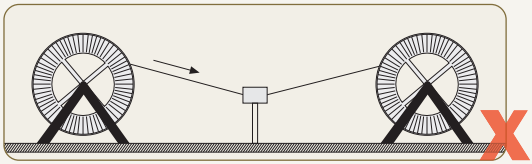
Cable Storage Methods



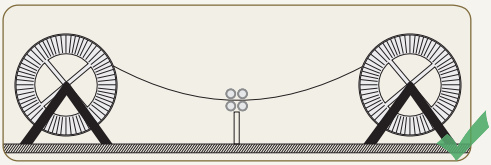
Cable Application Methods



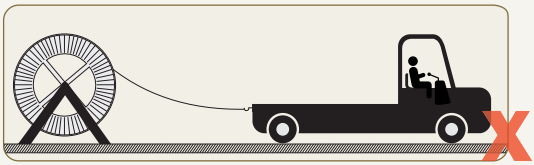
An assistant instrument shall be used during transfer.



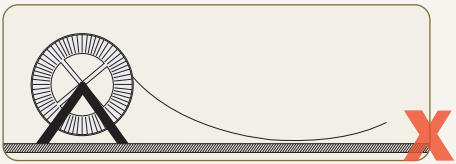
Shall not be transfered tightly.



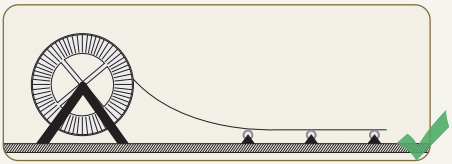
An appropriate machinery shall be used for transfer.



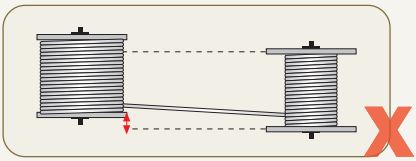
A convenient vehicle shall be used for pulling.



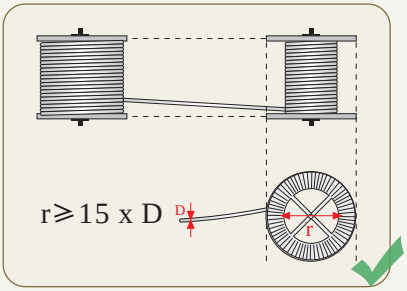
Cable shall not touch to ground.



Spools shall be used to transfer.



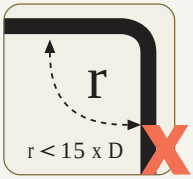
Centres shall be positioned horizontally equal during transfer.



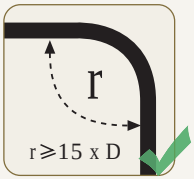
Center diameter of drum shall be arranged to cable size.

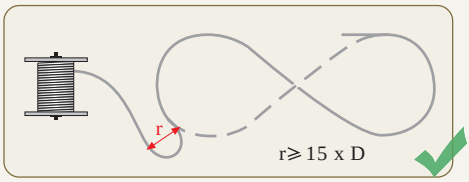
Cable Application Methods

Shall not be uncoiled as above.

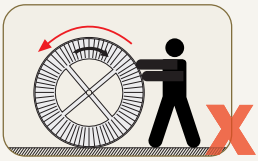


Minimum bending radius is important for uncoiling.

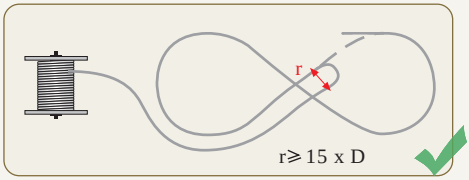




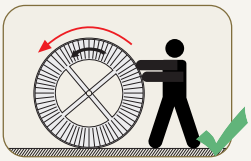
Minimum bending radius is important for uncoiling.



Drum shall not be rolled in the reverse direction.



Minimum bending radius is important for uncoiling.



Drum shall be rolled as above.

Thermal resistivity of earth

Thermal resistivity of earth	Earth conditions	Air conditions
0.7	Very humid	Continuous humid
1	Humid	Regular rainy
2	Dry	Rarely rainy
3	Very dry	Seldom rainy or dry

Correction factors for the various air temperatures

Insulation type	Permissible operating temperature	Permissible operating temperature rise	Correction factors for the air temperature depending on °C								
	°C	K	10	15	20	25	30	35	40	45	50
PVC	70	-	1.22	1.17	1.12	1.07	1.00	0.94	0.87	0.79	0.71
XLPE	90	-	1.15	1.12	1.08	1.04	1.00	0.96	0.91	0.87	0.82

Correction factors for all cables at various ambient temperatures laid in earth

Permissible operating temperature	Permissible operating temperature	Specific thermal resistivity of earth K.m / W															
		0.7					1.0					1.5					2.5
°C	°C	Charging					Charging					Charging					Charging
	5	0.50	0.60	0.70	0.85	1.00	0.50	0.60	0.70	0.85	1.00	0.50	0.60	0.70	0.85	1.00	0.50 - 1.00
70 °C PVC Cables	10	1.29	1.26	1.22	1.15	1.09	1.13	1.11	1.08	1.04	1.00	0.99	0.98	0.97	0.95	0.93	0.86
	15	1.27	1.23	1.19	1.13	1.06	1.11	1.08	1.06	1.01	0.97	0.96	0.95	0.94	0.92	0.89	0.83
	20	1.25	1.21	1.17	1.10	1.03	1.08	1.06	1.03	0.99	0.94	0.93	0.92	0.91	0.88	0.86	0.79
	25	1.23	1.28	1.14	1.08	1.01	1.06	1.03	1.00	0.96	0.91	0.90	0.89	0.87	0.85	0.83	
	30						1.03	1.00	0.97	0.93	0.88	0.87	0.85	0.84	0.82	0.79	0.72
	35								0.94	0.89	0.85	0.84	0.82	0.80	0.78	0.76	
	40													0.77	0.74	0.72	0.63
90 °C XLPE Cables	5	1.24	1.21	1.18	1.13	1.07	1.11	1.09	1.07	1.03	1.03	0.99	0.98	0.97	0.96	0.94	
	10	1.23	1.19	1.16	1.11	1.05	1.09	1.07	1.05	1.01	1.01	0.97	0.96	0.95	0.93	0.91	0.89
	15	1.21	1.17	1.14	1.08	1.03	1.07	1.05	1.02	0.99	0.99	0.95	0.93	0.92	0.91	0.89	0.86
	20	1.19	1.15	1.12	1.06	1.00	1.05	1.02	1.00	0.96	0.96	0.92	0.91	0.90	0.88	0.86	0.84
	25						1.02	1.00	0.98	0.94	0.94	0.90	0.88	0.87	0.85	0.84	0.81
	30								0.95	0.91	0.91	0.87	0.86	0.84	0.83	0.81	0.78
	35													0.95	0.80	0.78	0.75
	40																0.72
																	0.68

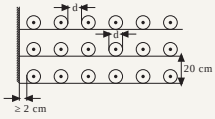
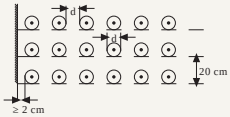
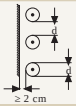
Correction factors for cable systems laid in earth over 7 cm internal distance

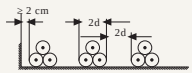
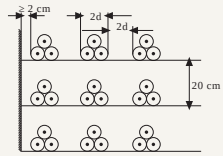
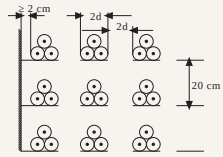
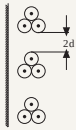
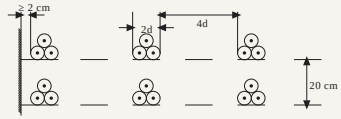
Type	Number of systems	Specific thermal resistivity of earth K.m / W											
		0.7 Charging			1.0 Charging			1.5 Charging			2.5 Charging		
		0.5	0.6	0.7	0.5	0.6	0.7	0.5	0.6	0.7	0.5	0.6	0.7
PVC Cables 0.6 / 1 kV 8.7 / 15 kV	1	0.96	0.97	0.98	1.01	1.01	1.00	1.07	1.10	1.01	1.16	1.10	1.02
	2	0.92	0.89	0.86	0.96	0.94	0.87	1.00	0.97	0.88	1.05	0.97	0.89
	3	0.88	0.84	0.77	0.91	0.85	0.78	0.95	0.87	0.79	0.96	0.87	0.79
	4	0.86	0.80	0.73	0.89	0.81	0.74	0.90	0.82	0.74	0.91	0.82	0.75
	5	0.84	0.76	0.70	0.85	0.77	0.70	0.87	0.79	0.71	0.87	0.79	0.71
	6	0.82	0.74	0.68	0.83	0.75	0.68	0.84	0.76	0.69	0.85	0.76	0.69
	8	0.79	0.71	0.65	0.80	0.72	0.65	0.81	0.73	0.65	0.81	0.73	0.66
	10	0.77	0.69	0.63	0.78	0.70	0.63	0.79	0.71	0.63	0.79	0.71	0.64
XLPE Cables 0.6 / 1 kV 20.3 / 35 kV	1	1.08	1.05	0.99	1.13	1.07	1.00	1.18	1.11	1.01	1.19	1.11	1.03
	2	1.01	0.93	0.86	1.03	0.94	0.87	1.05	0.96	0.88	1.06	1.96	0.88
	3	0.92	0.84	0.77	0.93	0.85	0.77	0.95	0.86	0.78	0.96	0.86	0.79
	4	0.88	0.80	0.73	0.89	0.80	0.73	0.90	0.82	0.74	0.91	0.82	0.74
	5	0.84	0.76	0.69	0.85	0.77	0.70	0.87	0.78	0.70	0.87	0.78	0.71
	6	0.82	0.74	0.67	0.83	0.75	0.68	0.84	0.76	0.68	0.85	0.76	0.69
	8	0.79	0.71	0.64	0.80	0.71	0.65	0.81	0.72	0.65	0.81	0.72	0.65
	10	0.77	0.69	0.62	0.78	0.69	0.63	0.78	0.70	0.60	0.79	0.70	0.63

Correction factors for cable systems laid in earth over 7 cm internal distance

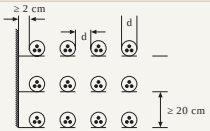
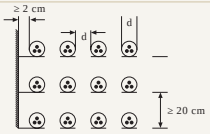
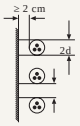
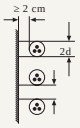
Type	Number of systems	Specific thermal resistivity of earth K.m / W											
		0.7 Charging			1.0 Charging			1.5 Charging			2.5 Charging		
		0.5	0.6	0.7	0.5	0.6	0.7	0.5	0.6	0.7	0.5	0.6	0.7
PVC Cables 0.3 / 1 kV 3.6 / 6 kV	1	0.91	0.92	0.94	0.97	0.87	1.00	1.04	1.03	1.01	1.13	1.07	1.02
	2	0.86	0.87	0.85	0.91	0.90	0.86	0.97	0.93	0.87	1.01	0.94	0.88
	3	0.82	0.80	0.75	0.86	0.82	0.76	0.91	0.84	0.77	0.92	0.84	0.78
	4	0.80	0.76	0.70	0.84	0.77	0.71	0.86	0.78	0.72	0.97	0.79	0.73
	5	0.78	0.72	0.66	0.81	0.73	0.67	0.81	0.74	0.68	0.82	0.75	0.68
	6	0.76	0.69	0.64	0.77	0.70	0.64	0.78	0.71	0.65	0.79	0.72	0.65
	8	0.72	0.65	0.59	0.73	0.66	0.60	0.74	0.67	0.61	0.75	0.67	0.61
	10	0.69	0.62	0.57	0.70	0.63	0.57	0.71	0.64	0.58	0.71	0.64	0.58
XLPE Cables 0.6 / 1 kV 6 / 10 kV	1	1.02	1.03	0.99	1.06	1.05	1.00	1.09	1.06	1.01	1.1	1.07	1.02
	2	0.95	0.89	0.84	0.98	0.91	0.85	0.99	0.92	0.86	1.01	0.94	0.87
	3	0.86	0.80	0.74	0.89	0.81	0.75	0.90	0.83	0.77	0.92	0.84	0.77
	4	0.82	0.75	0.69	0.84	0.76	0.70	0.85	0.78	0.71	0.86	0.78	0.72
	5	0.78	0.71	0.65	0.80	0.72	0.66	0.81	0.73	0.67	0.82	0.74	0.67
	6	0.75	0.68	0.63	0.77	0.69	0.63	0.78	0.70	0.64	0.79	0.71	0.65
	8	0.71	0.64	0.59	0.72	0.65	0.59	0.73	0.66	0.60	0.74	0.66	0.60
	10	0.68	0.61	0.56	0.62	0.62	0.56	0.70	0.63	0.57	0.71	0.63	0.57

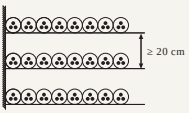
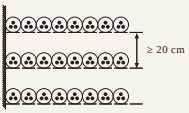
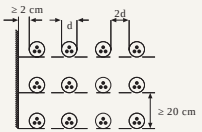
Correction factors for single-core cables in air.

Installation		Distance as cable diameter between two cables and from the wall ≥ 2 cm			
Number of the cable systems		1	2	3	
Laid in earth		0.92	0.89	0.88	
In the cable Channels with poor air circulation	Number of shelves				
	1	0.92	0.89	0.88	
	2	0.87	0.84	0.83	
	3	0.84	0.82	0.81	
	6	0.82	0.80	0.79	
In the cable Channels with good air circulation	Number of shelves				
	1	1.00	0.97	0.96	
	2	0.97	0.94	0.93	
	3	0.96	0.93	0.92	
	6	0.94	0.91	0.90	
Cables vertically arranged on wall on top of the other		0.92	0.89	0.88	

Installation		Distance as cable diameter between two cables and from the wall ≥ 2 cm			
Number of the cable systems		1	2	3	
Laid in earth		0.95	0.90	0.88	
In the cable Channels with poor air circulation	Number of shelves				
	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	
In the cable Channels with good air circulation	Number of shelves				
	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	
Cables vertically arranged on wall on top of the other		0.89	0.86	0.84	
Installation system without reduction factor					

Correction factors for multi core AC cable system and single core DC cable system to be installed in air

Installation		Distance between cables = cable diameter					
Number of the cable systems		1	2	3	6	9	
Laid in earth		0.92	0.89	0.88	0.85	0.94	
In the cable channels with poor air circulation	Number of shelves						
	1	0.92	0.89	0.88	0.85	0.84	
	2	0.87	0.84	0.83	0.81	0.80	
	3	0.84	0.82	0.81	0.79	0.78	
	6	0.82	0.80	0.79	0.77	0.76	
In the cable channels with good air circulation	Number of shelves						
	1	1.00	0.97	0.96	0.93	0.92	
	2	0.97	0.94	0.93	0.90	0.89	
	3	0.96	0.93	0.92	0.89	0.88	
	6	0.94	0.91	0.90	0.87	0.86	
Cables vertically arranged on wall on top of the other		1	2	3	6	9	
Application either shelves or on the wall		1.00	0.93	0.90	0.87	0.86	
Installation systems that need no reduction factor		Randomly selected number cables of cables vertically arrandeg on wall one on top of the other					

Installation		Systems beginning from the wall installed side by side					
Number of the cable systems		1	2	3	6	9	
Laid in earth		0.90	0.84	0.80	0.75	0.73	
In the cable channels with poor air circulation	Number of shelves						
	1	0.95	0.90	0.80	0.75	0.73	
	2	0.95	0.80	0.76	0.71	0.69	
	3	0.95	0.78	0.74	0.70	0.68	
	6	0.95	0.76	0.72	0.68	0.66	
In the cable channels with good air circulation	Number of shelves						
	1	0.95	0.84	0.80	0.75	0.73	
	2	0.95	0.80	0.76	0.71	0.69	
	3	0.95	0.78	0.74	0.70	0.68	
	6	0.95	0.76	0.72	0.68	0.66	
Application either shelves or on the wall		1	2	3	6	9	
		1.00	0.93	0.90	0.87	0.86	
Installation system without reduction factor		Randomly selected number of cables install side by side					

Permissible short-circuit current for PVC insulated cables (Cu)

Cross section	t/sc (short circuit time)														
(mm^2)	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,5	2	3	4	5
1,5	0,53	0,38	0,31	0,27	0,24	0,22	0,20	0,19	0,18	0,17	0,14	0,12	0,10	0,08	0,08
2,5	0,89	0,63	0,51	0,44	0,40	0,36	0,34	0,31	0,30	0,28	0,23	0,20	0,16	0,14	0,13
4	1,42	1,01	0,82	0,71	0,64	0,58	0,54	0,50	0,47	0,45	0,37	0,32	0,26	0,22	0,20
6	2,13	1,51	1,23	1,07	0,95	0,87	0,81	0,75	0,71	0,67	0,55	0,48	0,39	0,34	0,30
10	3,56	2,51	2,05	1,78	1,59	1,45	1,34	1,26	1,19	1,12	0,92	0,80	0,65	0,56	0,50
16	5,69	4,02	3,28	2,84	2,54	2,32	2,15	2,01	1,90	1,80	1,47	1,27	1,04	0,90	0,80
25	8,89	6,29	5,13	4,44	3,98	3,63	3,36	3,14	2,96	2,81	2,30	1,99	1,62	1,41	1,26
35	12,45	8,80	7,19	6,22	5,57	5,08	4,70	4,40	4,15	3,94	3,21	2,78	2,27	1,97	1,76
50	17,78	12,57	10,27	8,89	7,95	7,26	6,72	6,29	5,93	5,62	4,59	3,98	3,25	2,81	2,51
70	24,89	17,60	14,37	12,45	11,13	10,16	9,41	8,80	8,30	7,87	6,43	5,57	4,54	3,94	3,52
95	33,78	23,89	19,50	16,89	15,11	13,79	12,77	11,94	11,26	10,68	8,72	7,55	6,17	5,34	4,78
120	42,67	30,17	24,64	21,34	19,08	17,42	16,13	15,09	14,22	13,49	11,02	9,54	7,79	6,75	6,03
150	53,34	37,72	30,80	26,67	23,85	21,78	20,16	18,86	17,78	16,87	13,77	11,93	9,74	8,43	7,54
185	65,78	46,52	37,98	32,89	29,42	26,86	24,86	23,26	21,93	20,80	16,99	14,71	12,01	10,40	9,30
240	85,34	60,35	49,27	42,67	38,17	34,84	32,26	30,17	28,45	26,99	22,04	19,08	15,58	13,79	12,07
300	106,68	75,43	61,59	53,34	47,71	43,55	40,32	37,72	35,56	33,73	27,54	23,85	19,48	16,87	15,09
400	127,15	89,91	73,41	63,58	56,86	51,91	48,06	44,96	42,38	40,21	32,83	28,43	23,21	20,10	17,98
500	158,94	112,39	91,76	79,47	71,08	64,89	60,07	56,19	52,98	50,26	41,04	35,54	29,02	25,13	22,48

Note : Short-circuit starts at 70°C, final temperature is 160°C. Final temperature for 400 and 500 mm^2 is 140 °C.
Short-circuit current as kA

Permissible short-curcuit current for XLPE insulated cables (Cu)

Cross section	t/sc (short circuit time)														
(mm^2)	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,5	2	3	4	5
1,5	0,68	0,48	0,39	0,34	0,30	0,28	0,26	0,24	0,23	0,21	0,18	0,15	0,12	0,11	0,10
2,5	1,13	0,80	0,65	0,57	0,51	0,46	0,43	0,40	0,38	0,36	0,29	0,25	0,21	0,18	0,16
4	1,81	1,28	1,04	0,90	0,81	0,74	0,68	0,64	0,60	0,57	0,47	0,40	0,33	0,29	0,26
6	2,71	1,92	1,57	1,36	1,21	1,11	1,03	0,96	0,90	0,86	0,70	0,61	0,50	0,43	0,38
10	4,52	3,20	2,61	2,26	2,02	1,85	1,71	1,60	1,51	1,43	1,17	1,01	0,83	0,72	0,64
16	7,24	5,12	4,18	3,62	3,24	2,95	2,73	2,56	2,41	2,29	1,87	1,62	1,32	1,14	1,02
25	11,31	7,99	6,53	5,65	5,06	4,62	4,27	4,00	3,77	3,58	2,92	2,53	2,06	1,79	1,60
35	15,83	11,19	9,14	7,91	7,08	6,46	5,98	5,60	5,28	5,01	4,09	3,54	2,89	2,50	2,24
50	22,61	15,99	13,05	11,31	10,11	9,23	8,55	7,99	7,54	7,15	5,84	5,06	4,13	3,58	3,20
70	31,65	22,38	18,28	15,83	14,16	12,92	11,96	11,19	10,55	10,01	8,17	7,08	5,78	5,01	4,48
95	42,96	30,38	24,80	21,48	19,212	17,54	16,24	15,19	14,32	13,59	11,09	9,61	7,84	6,79	6,08
120	54,26	38,37	31,33	27,13	24,27	22,15	20,51	19,19	18,09	17,16	14,01	12,13	9,91	8,58	7,67
150	67,83	47,96	39,16	33,92	30,33	27,69	25,64	23,98	22,61	21,45	17,51	15,17	12,38	10,73	9,59
185	83,66	59,16	48,30	41,83	37,41	34,15	31,62	29,58	27,89	26,46	21,60	18,71	15,27	13,23	11,83
240	108,53	76,74	62,66	54,26	48,54	44,31	41,02	38,37	36,18	34,32	28,02	24,27	19,81	17,16	15,35
300	135,66	95,93	78,32	67,83	60,67	55,38	51,28	47,96	45,22	42,90	35,03	30,33	24,77	21,45	19,19
400	180,88	127,90	104,43	90,44	80,89	73,84	68,37	63,95	60,29	57,20	46,70	40,45	33,02	28,60	25,58
500	226,10	159,88	130,54	113,05	101,12	92,31	85,46	79,94	75,37	71,50	58,38	56,56	41,28	35,75	31,98
630	284,89	201,45	164,48	142,44	127,41	116,31	107,68	100,72	94,96	90,09	73,56	63,70	52,01	45,05	40,29
800	361,76	255,81	208,87	180,88	161,79	147,69	136,73	127,90	120,59	114,40	93,41	80,89	66,05	57,20	51,16

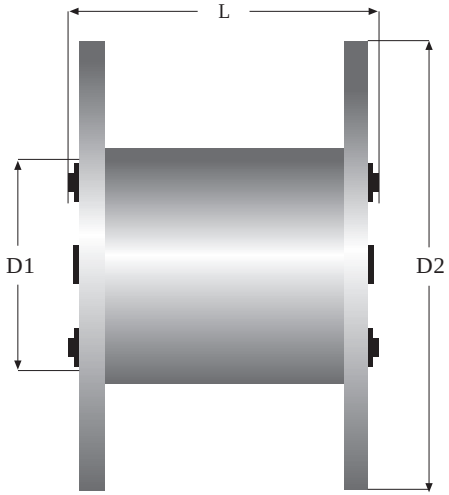
Note : Short-circuit starts at 90°C, final temperature is 250°C.
Short-circuit current as kA

Power and Permissible Distance Table

Cos Ø = 0.9

Power kW	Current Load A	Cross-section (mm^2)															3~380 V
		1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
2.5	4.2	178	291	466	695	1162											
2.5	4.2	103	169	271	404	675	1063										
3	5	150	244	391	584	976	1536										
3	5	87	142	227	339	567	892	1391									
3.5	5.9	127	207	331	495	827	1302										
3.5	5.9	73	120	192	287	480	756	1180									
4	6.7	111	182	292	435	728	1146										
4	6.7	65	106	169	253	423	666	1038									
4.5	7.5	100	163	261	389	650	1024										
4.5	7.5	58	94	51	226	378	595	927	1266								
5	8.4	89	145	233	347	581	914	1425									
5	8.4	51	84	135	202	337	531	825	1130								
6	10.1	74	121	193	289	483	760	1185									
6	10.1	43	70	112	168	280	442	689	940	1247							
7	11.8	63	103	165	247	413	651	1015									
7	11.8	36	60	96	143	240	378	590	805	1067							
8	13.5	55	90	145	216	361	569	887	1210								
8	13.5	32	52	84	225	210	330	515	703	932	1301						
9	15.2	49	80	128	192	321	505	787	1075								
9	15.2	28	46	74	111	186	293	457	625	828	1155						
10	16.8	44	72	116	173	290	457	712	972	1290							
10	16.8	25	42	67	101	180	265	414	565	750	1045						
12	20	37	61	97	146	244	384	598	817	1083							
12	20	21	35	56	84	141	223	347	474	630	878	1166					
14	23	32	53	85	127	212	334	520	710	942	1315						
14	23	18	30	49	73	123	194	302	413	547	765	1014					
16	27		45	72	108	180	284	443	605	802	1120						
16	27		26	42	62	105	165	257	351	466	650	863	1053				
18	30		40	65	97	162	256	399	544	722	1007						
18	30		23	37	56	94	148	231	316	420	585	777	948	1119			
20	33		37	59	88	147	232	362	495	656	916	1216					
20	33		21	34	51	85	135	210	287	381	532	706	862	1017			
22	37			52	78	131	207	323	441	585	817	1085					
22	37			30	45	76	120	288	256	340	475	630	769	907	1072		
25	42			46	69	116	182	285	389	515	720	955	1165				
25	42			27	40	67	106	165	226	300	418	555	677	800	944	1156	
30	50				58	97	153	239	326	432	605	802	979	1155			
30	50				33	56	89	139	189	250	351	466	569	671	793	971	1124
35	59					82	130	202	277	367	512	680	830	980	1157		
35	59					48	75	117	161	213	297	395	482	570	672	823	952
40	67					72	114	178	243	323	450	600	730	862	1018		
40	67					42	66	103	141	187	262	348	425	500	592	725	838
45	76						101	157	215	285	398	528	677	760	898	1100	
45	76						58	91	124	165	230	306	374	442	522	639	740
50	84						91	142	194	258	360	477	582	688	812	995	1150
50	84						53	82	113	150	210	277	338	400	472	578	670
55	93						82	128	175	232	325	431	526	621	734	898	1040
55	93						48	74	102	135	188	250	305	360	426	522	604
60	101							118	161	215	300	397	484	572	675	827	956
60	101							68	94	125	173	230	281	332	392	480	556
70	118							101	130	183	256	340	414	487	578	708	820
70	118							58	80	105	148	197	241	284	336	411	475
75	126							95	129	172	240	318	388	458	541	663	767
75	126							55	75	100	140	185	225	266	314	385	446
80	135								121	160	223	297	362	427	505	620	716
80	135								70	93	130	172	210	248	293	360	416
90	152								107	142	198	264	322	380	450	550	636
90	152								62	82	115	153	187	220	260	319	370
100	169									128	178	237	289	341	403	495	572
100	169									75	102	138	168	198	234	287	332
130	219										138	183	223	263	311	380	441
130	219										80	106	129	153	181	221	256
150	253											158	193	228	269	330	382
150	253											92	112	132	159	192	222
180	303												161	190	225	275	320
180	303												93	110	130	160	185
200	337	Voltage Drop < %5												170	202	248	286
200	337													100	117	144	166
230	388														175	215	250
230	388	Voltage Drop < %3													102	125	145
270	456															183	212
270	456															106	123
300	506																191
300	506																111

Specifications of Delivery Drums



Drum Type	Carrying Capacity	Volume	Dimensions			Weight				
			D2	D1	L	Empty	Closed %50	Total %50	Closed %100	Total %100
cm	kg	m^3	mm	mm	mm	(a) kg	(b) kg	(a+b) kg	(c) kg	(a+c) kg
070	450	0.25	700	350	520	25	6	31	12	37
080	600	0.32	800	400	520	35	8	43	16	51
090	750	0.55	900	450	660	50	10	60	20	70
100	900	0.65	1000	500	680	60	12	72	24	84
110	1100	0.80	1100	500	650	80	15	95	30	110
120	1300	1.20	1200	600	860	90	17	107	34	124
130	1500	1.45	1300	600	860	120	19	139	38	158
140	1700	1.70	1400	700	860	130	21	151	42	172
150	2000	1.90	1500	700	860	160	23	183	46	206
160	2500	2.75	1600	800	1100	230	25	255	50	280
180	3000	3.50	1800	1000	1140	300	35	335	70	370
200	3600	4.30	2000	1200	1140	400	45	445	90	490
210	4000	4.80	2100	1200	1380	450	47	497	94	544
220	4500	6.50	2200	1400	1380	480	50	530	100	580
240	5000	7.50	2400	1500	1380	600	70	670	140	740
260	6500	9.00	2600	1600	1380	700	75	775	150	850
280	8500	13.50	2800	1800	1700	1000	90	1090	180	1180
300	12000	15.50	3000	1800	1700	1300	120	1420	240	1540
320	13500	18.00	3200	1800	1800	1500	150	1650	300	1800

Carrying Capacity of Delivery Drums

Cable dia.	Drum type (D2/cm)																	
mm	70	80	90	100	110	120	130	140	150	160	180	200	220	240	260	280	300	320
10	1140	1520	2220															
11	880	1170	1790	2550														
12	730	1000	1450	2120	2460													
13	620	840	1260	1890	2180	2530												
14	520	690	1070	1530	1770	2060												
15	490	670	950	1350	1560	1830	2520											
16	410	550	800	1175	1360	1630	2230	2570										
17	330	450	690	1030	1200	1400	1960	2270										
18	320	440	660	900	1050	1240	1750	2030	2630									
19	250	350	555	870	1010	1230	1540	1800	2370	2610								
20	250	340	545	745	865	1060	1350	1590	2120	2340								
21	240	320	445	630	735	910	1300	1520	1890	2080								
22	190	260	440	620	720	890	1100	1320	1800	2000								
23	180	250	365	530	620	780	1080	1170	1600	1800	2610							
24	175	245	355	520	610	760	690	1150	1420	1570	2580							
25	170	234	345	510	590	630	910	975	1400	1540	2280							
26	140	180	280	425	500	610	785	950	1245	1370	2060	2670						
27	130	175	270	415	485	600	745	920	1220	1340	2030	2420						
28	120	170	260	340	400	520	930	800	1030	1150	1765	2310						
29		160	205	330	385	500	620	775	1000	1140	1730	2080						
30		150	200	320	375	490	610	750	900	1000	1530	2030						
31			195	310	360	400	510	660	880	970	1490	1800	2550					
32			190	260	300	400	495	640	850	940	1460	1770	2500					
33			185	250	290	390	475	620	725	810	1280	1560	2200					
34			160	250	290	390	470	515	720	800	1290	1570	2190					
35			145	240	280	315	390	510	710	780	1120	1530	1950	2650				
36			140	195	230	300	390	495	685	755	1080	1340	1940	2350				
37			135	185	220	300	375	490	590	660	1050	1300	1900	2300				
38			130	180	220	290	375	400	575	635	1000	1300	1670	2250	2540			
39			130	180	210	290	360	400	570	630	900	1120	1620	2050	2480			
40			120	175	210	240	300	385	560	610	880	1100	1610	2000	2420	2380		
41				170	200	230	280	385	480	530	870	1100	1400	1950	2120	2320		
42				135	160	220	210	375	460	510	850	940	1375	1700	2100	2260		
43				130	155	150	210	280	370	450	800	920	1530	1670	2000	2070	2600	
44					125	150	270	270	290	440	750	900	910	1530	1900	2020	2500	
45					120	200	260	290	430	485	710	900	1180	1490	1800	1900	2400	
46					140	160	260	285	360	390	700	870	1140	1460	1750	1840	2350	
47					140	150	200	280	350	390	600	760	1100	1450	1700	1840	2350	
48					130	150	200	275	340	380	590	750	1100	1400	1700	1800	2300	
49					130	140	195	270	340	375	570	740	1100	1400	1650	1740	2200	
50						140	195	260	330	370	560	730	940	1200	1450	1500	1980	
51						130	195	210	330	370	550	700	930	1200	1400	1460	1920	2590
52						130	185	210	280	290	540	600	910	1150	1400	1460	1920	2600
53							185	200	270	290	460	600	900	1150	1370	1420	1860	2525
54							180	200	265	280	450	575	870	1100	1370	1420	1860	2270
55							180	195	260	280	440	575	750	980	1140	1370	1580	2200
56							175	195	250	275	430	570	740	980	1140	1170	1580	2200
57							130	190	250	275	420	550	730	960	1100	1130	1540	2130
58							130	190	240	270	410	470	720	950	1100	1130	1540	2130
59							130	180	230	260	410	460	700	940	1050	1130	1540	1830
60							120	180	190	220	400	450	690	910	1050	1090	1480	1830
61								170	190	210	340	440	680	780	1050	1090	1290	1770
62								130	185	200	330	440	580	780	870	1050	1240	1770
63								130	180	190	325	440	570	760	860	1050	1240	1770
64								120	175	190	320	430	560	750	850	880	1240	1720
65								120	175	190	310	420	550	740	840	840	1190	1510
66									170	185	310	420	540	710	830	840	1190	1450
67									170	185	300	340	530	710	820	840	1190	1450
68									160	185	300	340	530	600	810	810	975	1450
69									160	180	290	340	510	600	800	810	975	1450
70										180	290	330	510	580	790	810	975	1400
71										180	240	330	420	575	665	810	975	1400
72										180	235	320	420	575	650	770	930	1200
73										140	230	330	420	570	650	770	930	1150
74										140	225	310	410	570	640	770	930	1150
75										120	220	300	410	550	630	590	890	1150
76										120	215	300	390	540	610	590	890	1150
77											210	300	390	530	610	590	890	1120
78											205	240	390	450	610	590	745	1120
80											205	240	380	440	610	590	745	1120
82											200	240	380	430	610	560	700	1120
84											185	230	370	420	575	560	700	900
86											175	230	290	410	460	530	670	900
88											160	220	280	400	430	530	670	865
90											150	220	275	390	430	530	670	865
92											140	210	275	390	430	390	630	825
94												200	270	320	410	390	510	680
96												160	270	320	410	390	510	680
98												140	250	300	410	390	510	680
100													250	300	380	360	480	645

Formulas

• Ohms law:	R = U / I	• DC Power:	P = U . I
• Single - Phased power:	P = U I . Cos Ø	• Three - Phased Power:	P = √3.U. I . Cos Ø
• Energy (heat):	W = I^2 . R . t	• Inductive reactance	X = 2 . (3.14) . f . L
• Resistance of the line: (Feeding and return)	R = (2 . L) / (c . S)	• Efficiency:	h = P output / P input

Voltage drop	If current is known	If power is known
In D.C. systems	Δu = (2 . I . L) / (c . S) (V) %e = (2 . 100 . I . L) / (c . S . U)	Δu = (2 . L . P) / (c . S . U) (V) %e = (2 . 100 . L . P) / (c . S . U^2)
In single-phased A.C. systems	Δu = (2 . I . L . Cos Ø) / (c . S) (V) %e = (2 . 100 . I . L . Cos Ø) / (c . S . U)	Δu = (2 . L . P) / (c. S . U) (V) %e = (2 . 100 . L . P) / (c . S . U^2)
In three-phased A.C. systems	Δu = (√3 . I . L . Cos Ø) / (c . S) (V) %e = (√3 . 100 . I . L . Cos Ø) / (c . S . U)	Δu = (L . P) / (c . S . U) (V) %e = (100 . L . P) / (c . S . U^2)

Description

U : Rated voltage

R : Resistance

t : Time (in seconds)

L : Length of cable (m)

P : Power (in Watts)

c : Conductivity (For copper 58)

u : Voltage drop in V from sending to receiving end of line

%e : Voltage drop in % from sending to receiving end of line

I : Current

h : Efficiency

S : Rated cross-section (mm2)

cos Ø : GPower in factor

W : Energy (heat)

X : Inductive reactance

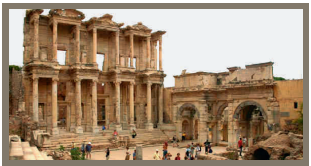
f : Frequency of the line


Pamukkale


Hierapolis


Maidens Tower


Bosphorus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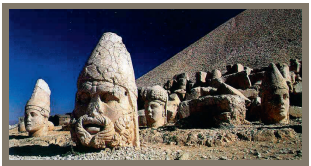
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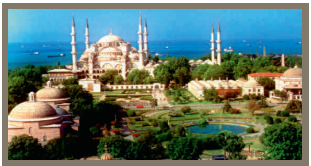
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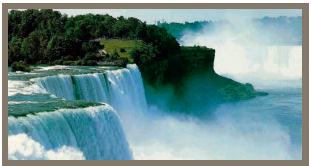
Sümela Monastery


Hagia Sofia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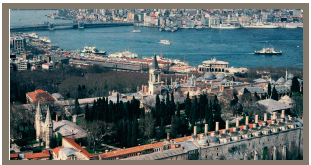
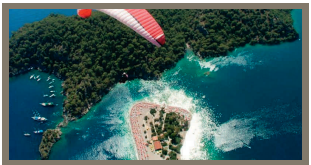
Troia


Yacht Paradise


Fairy Chimneys


Topkapı Palace


Blue Lagoon

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