



Appendix

I Additional Electrical Data

Table 1: Resistance

Nominal cross-sectional area nom (mm ²)	DC resistance at 20 °C (copper) max (Ω/km)	Max. Active resistance (copper)	
		at 70 °C for PVC (Ω/km)	at 90 °C for XLPE (Ω/km)
1.5	12.1	14.5	15.4
2.5	7.41	8.87	9.45
4	4.61	5.52	5.88
6	3.08	3.69	3.93
10	1.83	2.19	2.33
16	1.15	1.38	1.47
25	0.727	0.872	0.927
35	0.524	0.628	0.669
50	0.387	0.464	0.494
70	0.268	0.322	0.342
95	0.193	0.233	0.247
120	0.153	0.186	0.196
150	0.124	0.152	0.160
185	0.0991	0.122	0.128
240	0.0754	0.0948	0.0988
300	0.0601	0.0774	0.0800
400	0.0470	0.0619	0.0641
500	0.0366	0.0495	0.0514
630	0.0283	0.0405	0.0421
800	0.0221	0.0332	0.0350
1000	0.0176	0.0273	0.0302

Table 2: Reactance

Nominal cross-sectional area	Reactance ¹⁾ (inductive) per conductor at 50 Hz for U ₀ /U 0.6/1 kV			
	PVC insulated		XLPE insulated	
	single core ²⁾ nom. (Ω/km)	multicore nom. (Ω/km)	single core ²⁾ nom. (Ω/km)	multicore nom. (Ω/km)
1.5	----	0.119	----	0.114
2.5	----	0.114	----	0.105
4	----	0.110	----	0.098
6	----	0.103	----	0.094
10	----	0.097	----	0.088
16	0.117	0.091	0.118	0.084
25	0.110	0.088	0.112	0.083
35	0.105	0.085	0.107	0.081
50	0.102	0.085	0.104	0.080
70	0.097	0.081	0.101	0.079
95	0.095	0.081	0.098	0.077
120	0.092	0.079	0.096	0.077
150	0.091	0.079	0.096	0.077
185	0.090	0.079	0.096	0.077
240	0.088	0.079	0.094	0.077
300	0.088	0.079	0.093	0.077
400	0.086	0.079	0.093	0.076
500	0.085	----	0.093	----
630	0.084	----	0.090	----
800	0.083	----	0.092	----

¹⁾ Values for steel wire armoured cables. For unarmoured cables the values can be reduced by approx. 10 %.

²⁾ Cables with aluminium wire armouring and in touching trefoil arrangement.

Table 3: Voltage Drop

Nominal cross-sectional area (mm ²)	DC-System (mV/A/m)	Single-phase AC-System (mV/A/m)	Three-phase AC-System (mV/A/m)
1.5	24.2	27.9	24.1
2.5	14.3	17.1	14.8
4	9.0	10.7	9.3
6	6.0	7.2	6.2
10	3.6	4.3	3.7
16	2.3	2.8	2.4
25	1.5	1.8	1.5
35	1.1	1.3	1.1
50	0.8	0.96	0.85
70	0.6	0.70	0.60
95	0.4	0.55	0.45
120	0.3	0.45	0.35
150	0.25	0.35	0.31
185	0.20	0.30	0.26
240	0.15	0.25	0.22
300	0.12	0.22	0.19
400	0.10	0.19	0.17

The voltage drop in a circuit, of which the cable forms a part, should not exceed 3 - 5% of the nominal voltage; e.g. 20.0 volts (5%) for a three-phase 400 volts supply. The above mentioned voltage drop is tabulated for a current of 1 ampere for a 1 metre run. For any cable length, the values need to be multiplied by the length of the cable (in metres) and by the current (in amperes).

Example:

Formula for the calculated voltage drop in mV/A/m:

$$e_{cal} = \frac{\text{permissible voltage drop (e) x 1000}}{\text{current (I) x length (l)}}$$





Installation length (l): 300 m
 Current (I) to carry: 80 A
 Nominal voltage (U): 400 V (Three-phase AC)
 Permissible voltage drop (e): 20.0 V (5% of 400 V)

$$e_{cal} = \frac{20.0 \text{ V} \times 1000}{80 \text{ A} \times 300 \text{ m}} = 0.83 \text{ mV/A/m}$$

Select a cross-section, such that the voltage drop is equal to or less than 0.83 mV/A/m from table 3. It has to be ensured that the selected cross-section will carry the current (see pages H5 up to H7).

The corresponding cross-section will be 50 mm².

**Table 4: Current Ratings (AC) - U₀ / U 0.6 / 1 kV
Copper conductors laid in air**

Nominal cross-sectional area nom. (mm ²)	 ¹⁾		 ²⁾		 ²⁾			
	PVC (A)	XLPE (A)	PVC (A)	XLPE (A)	PVC (A)	XLPE (A)	PVC (A)	XLPE (A)
1.5	27	33	20	24	21	27		
2.5	35	43	26	32	28	36		
4	47	57	34	42	37	47		
6	59	72	43	53	47	59		
10	81	99	59	73	64	81		
16	107	131	78	97	84	109		
25	144	177	105	132	114	146		
35	176	217	129	162	139	179		
50	214	265	157	197	169	218		
70	270	336	199	250	213	275		
95	334	415	246	308	264	336		
120	389	485	285	359	307	388		
150	446	557	326	412	352	438		
185	516	647	374	475	406	501		
240	618	775	445	564	483	580		
300	711	894	510	649	552	649		
400	843	1061	597	761	646	734		
500	994	1254	663	860	747	827		
630	1180	1486	----	----	858	934		
800	1396	1751	----	----	971	----		
1000	1620	2044	----	----	1078	----		




¹⁾ Current in DC circuits with return conductor far away.

²⁾ For auxiliary and multicore cables with 4-cores fully loaded.

Basic assumption and conditions of installation:

Ambient temperature: 30 °C
 Distance between cables: 2 x overall diameter
 Loading factor: 1.0
 Distance between cables and walls, ground or ceiling: 2 cm
 Distance between systems (one upon another) : 30 cm
 Distance between cables(side by side): 2 x overall diameter
 Distance between cables(one upon another): 2 x overall diameter
 (VDE 0298)

**Table 5: Current Ratings (AC) - U_0 / U 0.6 / 1 kV
Copper conductors laid direct in ground**

Nominal cross-sectional area	 ¹⁾		 ²⁾			
	nom. (mm ²)	PVC (A)	XLPE (A)	PVC (A)	XLPE (A)	PVC (A)
1.5	41	48	27	31	30	33
2.5	55	63	36	40	39	42
4	71	82	46	52	50	54
6	90	102	58	64	62	67
10	124	136	78	86	83	89
16	160	176	101	111	107	115
25	208	229	132	145	138	148
35	250	275	159	174	164	177
50	296	326	188	206	195	209
70	365	400	232	254	238	256
95	438	480	280	305	286	307
120	501	548	318	348	325	349
150	563	616	359	392	365	393
185	639	699	406	444	413	445
240	746	815	473	517	479	516
300	845	924	535	585	539	581
400	975	1065	613	671	614	662
500	1125	1228	684	756	693	749
630	1304	1421	-----	-----	777	843
800	1507	1638	-----	-----	859	935
1000	1715	1870	-----	-----	936	1022




¹⁾ Current in DC circuits with return conductor far away.

²⁾ For auxiliary and multicore cables with 4-cores fully loaded.

Basic assumption and conditions of installation:

Thermal resistivity of soil: 1.0 Km/W
 Standard ground temperature: 20 °C
 Loading factor: 0.7
 Depth of burial: 0.7 – 1.2 m
 No. of cable systems: 1
 (VDE 0298)

**Table 6: Current Ratings (AC) - U_0 / U 0.6 / 1 kV
Copper conductors laid in single way ducts**

Nominal cross-sectional area nom. (mm ²)	 ¹⁾		 ²⁾			
	PVC (A)	XLPE (A)	PVC (A)	XLPE (A)	PVC (A)	XLPE (A)
1.5	35	41	23	26	26	28
2.5	47	54	31	34	33	36
4	60	70	39	44	43	46
6	77	87	49	54	53	57
10	105	116	66	73	71	76
16	136	150	86	94	91	98
25	177	195	112	123	117	126
35	213	234	135	148	139	150
50	252	277	160	175	166	178
70	310	340	197	216	202	218
95	372	408	238	259	243	261
120	426	466	270	296	276	297
150	479	524	305	333	310	334
185	543	594	345	377	351	378
240	634	693	402	439	407	439
300	718	785	455	497	485	494
400	829	905	521	570	522	563
500	956	1044	581	643	589	637
630	1108	1208	-----	-----	660	717
800	1281	1392	-----	-----	730	795
1000	1458	1590	-----	-----	796	869

¹⁾ Current in DC circuits with return conductor far away.

²⁾ For auxiliary and multicore cables with 4-cores fully loaded.

Basic assumption and conditions of installation:

Thermal resistivity of soil: 1.0 Km/W
 Standard ground temperature: 20 °C
 Loading factor: 0.7
 Depth of burial: 0.7 – 1.2 m
 No. of cable systems: 1
 (VDE 0298)

The term "ducts" means fibre, ferrous or earthenware pipes. In case of single core cables for use in AC-systems, ferrous ducts should not be applied.