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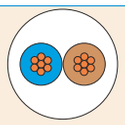
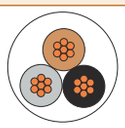
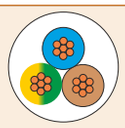
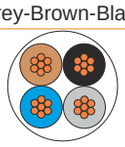
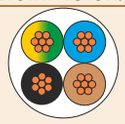
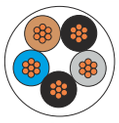
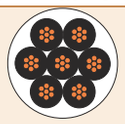
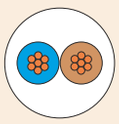
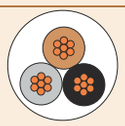
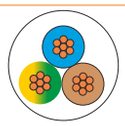
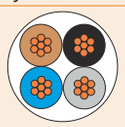
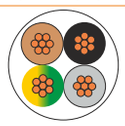
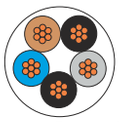
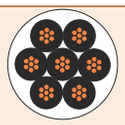
Reliable Technology

Insulation colors used in low voltage cables are as follows.

Cable Type	No. of cores	O Type (without yellow/green ground wire)	J Type (with yellow/green ground wire)
BUILDING WIRES AND CABLES			
NVV (NYM) H03VV-F H05VV-F H07VVH6-F NHXMH 052XZ1-F	2	 Blue-Brown	
	3	 Grey-Brown-Black	 Blue-Brown-Yellow/Green
	4	 Blue-Brown-Black-Grey	 Blue-Brown-Black-Yellow/Green
	5	 Blue-Brown-Black-Grey-Black	 Blue-Brown-Black-Gray-Yellow/Green
	>5	 All black numbered with white colours	 Yellow/Green and all remaining black numbered
0,6/1 kV LOW VOLTAGE CABLES			
YVV (NYY) YVCV (NYCY) YVZ2V (NYRY) YVZ3V (NYFGY) YXV (2XY) N2XH N2XH FE 180 YAVV (NAYY)	2	 Blue-Brown	
	3	 Grey-Brown-Black	 Blue-Brown-Yellow/Green
	4	 Blue-Brown-Black-Grey	 Brown-Black-Grey-Yellow/Green
	5	 Blue-Brown-Black-Grey-Black	 Blue-Brown-Black-Grey-Yellow/Green
	>5	 All black numbered with white colours	 Yellow/Green and all remaining black numbered

Cable to the current loading conditions:

Heat arising from a cable under load should be spread to the environment by every point on the surface of cable. Current load of the cable should be restricted according to this condition.
Current carrying capacities of cables given on the tables are prepared to meet the following installation conditions:

A) In air (It is assumed that the cables are protected from sun light):

Environmental Temperature	: 30°C
Loading factor	: 1,0

It is also assumed that the heat arising from cable is not preveted to spread, environmental temperature is not heating source. If the cables are installed minimum 2 m distance from the nearest floor, ceiling or wall, these conditions are met. Distance between the cables installed side by side should be at least 2 times the diameter of the cable. Distance between the cables installed one on the top of the other should be at least 2 times the diameter of the cable. This distance is about 20 cm for cable installing systems. Because of the heat spreading effect, suitable distances should be arrnged between the cables and also ducts are properly ventilated.

B) In duct

Environmental Temperature	: 30°C
Loading factor	: 1,0

C) In Ground

Environmental Temperature	: 20°C
Loading factor	: 1,0
Thermal resistivity of soil	: 0,7 K.m/W (very moist soil)
	: 1,0 K.m/W (moist soil)
	: 1,5 K.m/W (dry soil)
	: 2,5 K.m/W (very dry soil)
Installation depth	: 70 cm
No. Of cable system	: 1

For the given current values it is assument that cables are directly installed to the underground which is lay downed by sand and bonded by bricks. In this case cable canal consists of limited numbers of cable ducts each of them not longer than 6 m. Also it assume that the cable joints are protected from direct sun light.
Current loading capacities of the cables can also vary according to spesific heat resistance of the insulation material. This value

For PVC insulated cables	: 6,0 K.m/W
For XLPE insulated cables	: 3,5 K.m/W

If cable installation conditions are diffirent then above conditions,current carrying capacities can be calculated by multiplying the currents given on the related tables.
Current carring capacities of the cables for Standard installation conditions are given on Tables 1-4, and for other operating conditions on Table 5-14

TABLE 1

Current carrying capacities for 0,6/1 kV PVC and XLPE insulated cables with copper conductor (A)

A) In ground : 20°C, 70 cm depth of lay, soil-thermal resistivity 1 K.m/W, load factor 0,7

B) In air : 30°C, load factor 1,0

Method of laying : Flat formation, gap between cables; in air= 1 x Cable outer diameter, in ground=7cm)

: Trefoil formation

1 (Number of system)

Insulation material Permissible conductor temp.	PVC 70°C								XLPE 90°C					
Number of cores	1				2		3-4		1				3-4	
Nominal cross-section area														
mm²	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1,5	-	25	-	20	32	20	26	18.5	39	32	32	25	30	24
2,5	-	34	-	27	42	27	34	25	51	42	43	34	40	32
4	-	45	-	37	54	37	44	34	66	56	55	44	52	42
6	-	57	-	48	68	48	56	43	82	71	68	57	64	53
10	-	78	-	66	90	66	75	6	109	96	90	77	86	73
16	127	103	107	89	116	89	98	80	139	128	115	102	111	96
25	163	137	137	118	150	118	128	106	179	173	149	139	143	130
35	195	169	165	145	181	145	157	131	213	212	178	170	173	160
50	230	206	195	176	215	176	185	159	251	258	211	208	205	195
70	282	261	239	224	264	224	228	202	307	328	259	265	252	247
95	336	321	287	271	317	271	275	244	366	404	310	326	303	305
120	382	374	326	314	360	314	313	282	416	471	352	381	346	355
150	428	428	366	361	406	361	353	324	460	541	396	438	390	407
185	483	494	414	412	458	412	399	371	526	626	449	507	441	469
240	561	590	481	484	537	484	464	436	610	749	521	606	511	551
300	632	678	542	549	-	-	524	481	689	864	587	697	580	638
400	730	817	624	657	-	-	600	560	788	1018	669	816	663	746
500	823	940	698	749	-	-	-	-	889	1173	748	933	-	-

TABLE 2

Current carrying capacities for 0,6/1kV PVC and XLPE insulated cables with aluminium conductor (A)

A) In ground : 20°C, 70 cm depth of lay, soil-thermal resistivity 1 K.m/W, load factor 0,7

B) In air : 30°C, load factor 1,0

Method of laying : Flat formation, gap between cables; in air= 1 x Cable outer diameter, in ground=7cm

: Trefoil formation

1 (Number of system)

Insulation material Permissible conductor temp.	PVC 70°C								XLPE 90°C					
Number of cores	1				2		3-4		1				3-4	
Nominal cross-section area														
mm²	A	B	A	B	A	B	A	B	A	B	A	B	A	B
25	-	-	-	-		93	99	83	-	-	-	-	111	100
35	151	131	127	113	-	113	118	102	164	163	137	131	132	122
50	179	160	151	138	-	138	142	124	195	200	163	161	157	147
70	218	202	186	174	-	174	176	158	238	254	201	205	195	189
95	261	249	223	210	-	210	211	190	284	313	240	253	233	232
120	297	291	254	244	-	244	242	221	323	366	274	296	266	270
150	332	333	285	281	-	281	270	252	361	420	308	341	299	308
185	376	384	323	320	-	320	308	289	408	486	350	395	340	357
240	437	460	378	378	-	378	363	339	476	585	408	475	401	435
300	494	530	427	433	-	-	412	377	537	675	462	548	455	501
400	572	642	496	523	-	-	475	444	616	798	531	647	526	592
500	649	744	562	603	-	-	-	-	699	926	601	749	-	-

TABLE 3

Current carrying capacities for medium voltage, XLPE insulated cables with copper conductor (A)

A) In ground : 20°C, 70 cm depth of lay, soil-thermal resistivity 1 K.m/W, load factor 0,7

B) In air : 30°C, load factor 1,0

Method of laying : Flat formation, gap between cables; in air= 1 x Cable outer diameter, in ground=7cm

: Trefoil laying 1 (Number of system)

Insulation material Permissible conductor temp.	XLPE 90°C																							
Rated voltage	3,5/6 kV						6/10 kV - 8,7/15 kV						12/20 kV						18/30 kV - 20,8/36 kV					
Number of cores	1				3		1				3		1				3		1				3	
Nominal cross-section area mm²	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
25	185	180	154	167	149	141	191	157	162	148	143	-	-	-	-	-	-	-	-	-	-	-	-	-
35	201	238	191	199	176	171	231	187	195	178	173	213	233	189	189	199	178	173	214	233	192	202	181	176
50	241	285	227	241	208	196	277	220	234	210	206	250	279	223	223	238	210	206	251	279	226	241	214	210
70	301	356	277	301	255	249	345	269	292	256	257	304	347	273	273	296	256	257	306	348	276	299	261	262
95	364	435	331	365	307	307	418	321	354	307	313	361	420	325	325	358	307	313	363	421	329	362	313	319
120	424	496	379	419	353	353	481	364	407	349	360	407	483	368	368	412	349	360	410	483	373	416	356	364
150	479	554	422	479	396	406	537	405	460	392	410	445	540	410	410	466	392	410	449	540	415	469	400	418
185	549	637	476	543	447	464	612	457	527	443	469	498	614	463	463	532	443	469	503	615	468	536	441	478
240	640	746	550	640	523	548	716	528	621	513	553	569	718	534	534	627	513	553	576	718	541	630	510	562
300	724	846	619	731	581	632	811	593	709	576	635	633	813	601	601	715	576	635	641	812	608	717	-	-
400	795	941	698	840	653	726	901	665	815	650	731	686	904	674	674	819	650	731	697	904	684	823	-	-
500	883	1051	773	949	-	-	1006	739	921	-	-	756	1011	750	750	927	-	-	768	1011	762	929	-	-

TABLE 4

Current carrying capacities for medium voltage XLPE insulated cables with aluminium conductor (A)

A) In ground : 20°C, 70 cm depth of lay, soil-thermal resistivity 1 K.m/W, load factor 0,7

B) In air : 30°C, load factor 1,0

Method of laying : Flat formation, gap between cables; in air= 1 x Cable outer diameter, in ground=7cm

: Trefoil laying 1 (Number of system)

Insulation material Permissible conductor temp.	XLPE 90°C																							
Rated voltage	3,5/6 kV						6/10 kV - 8,7/15 kV						12/20 kV						18/30 kV - 20,8/36 kV					
Number of cores	1				3		1				3		1				3		1				3	
Nominal cross-section area mm²	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
35	-	-	-	-	-	-	164	178	144	151	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	186	233	178	188	160	150	194	215	171	181	162	160	195	217	173	184	168	171	196	217	175	187	166	164
70	234	280	217	235	199	191	236	269	209	226	199	199	237	270	211	229	207	211	238	270	214	232	204	204
95	287	344	259	286	238	236	281	327	249	275	238	242	282	328	252	278	247	255	284	328	256	281	244	248
120	338	392	298	329	275	273	318	283	317	271	280	320	378	287	320	378	282	297	322	378	290	323	278	284
150	388	441	333	376	307	313	350	424	316	359	304	318	353	425	320	363	316	334	355	425	324	365	312	326
185	449	510	377	428	349	360	393	485	358	412	345	365	396	485	362	415	359	384	400	485	366	418	343	374
240	530	587	438	508	410	426	453	573	416	489	401	431	457	573	421	493	420	454	461	572	426	494	398	440
300	605	682	495	586	460	528	507	652	469	559	453	494	511	652	474	563	476	513	516	649	479	564	476	513
400	678	781	562	676	520	564	559	741	532	651	517	569	566	740	538	652	552	593	572	737	545	654	542	583
500	762	883	633	772	-	-	622	838	599	744	-	-	630	838	606	746	-	-	638	835	614	747	-	-

TABLE 5
Rating factors for all cables laid underground

Permissible Operation Temperature	Soil Temperature (°C)	Thermal Resistivity of Earth K.m/W															
		0,7 K.m/W					1,0 K.m/W					1,5 K.m/W					2,5 K.m/W
		Load Factor					Load Factor					Load Factor					Load Factor
		0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	05-1,00
XLPE Cables 90 °C	5	1,24	1,21	1,18	1,13	1,07	1,11	1,09	1,07	1,03	1,00	0,99	0,98	0,97	0,96	0,94	0,89
	10	1,23	1,19	1,16	1,11	1,05	1,09	1,07	1,05	1,01	0,98	0,97	0,96	0,95	0,93	0,91	0,86
	15	1,21	1,17	1,14	1,08	1,03	1,07	1,05	1,02	0,99	0,95	0,95	0,93	0,92	0,91	0,89	0,84
	20	1,19	1,15	1,12	1,06	1,00	1,05	1,02	1,00	0,96	0,93	0,92	0,91	0,90	0,88	0,86	0,81
	25	-	-	-	-	-	1,02	1,00	0,98	0,94	0,90	0,90	0,88	0,87	0,85	0,84	0,78
	30	-	-	-	-	-	-	-	0,95	0,91	0,88	0,87	0,86	0,84	0,83	0,81	0,75
	35	-	-	-	-	-	-	-	-	-	-	-	-	0,82	0,80	0,78	0,72
	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,68
PVC Cables 70 °C	5	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
	10	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
	15	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
	20	1,23	1,18	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	0,76
	25	-	-	-	-	-	1,03	1,00	0,97	0,93	0,88	0,87	0,85	0,84	0,82	0,79	0,72
	30	-	-	-	-	-	-	-	0,94	0,89	0,85	0,84	0,82	0,80	0,78	0,76	0,68
	35	-	-	-	-	-	-	-	-	-	-	-	-	0,77	0,74	0,72	0,63
	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,59

TABLE 6
Rating factors for three-phase, 7 cm spacing between the systems in trefoil formation, single core cables laid underground flat

	Number of Systems	Thermal Resistivity of Moist Soil (K.m/W)																			
		0,7 K.m/W					1,0 K.m/W					1,5 K.m/W					2,5 K.m/W				
		Load Factor					Load Factor					Load Factor					Load Factor				
		0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00
XLPE Insulated Cables 0,6/1kV-36 kV	1	1,09	1,04	0,99	0,93	0,87	1,11	1,05	1,00	0,93	0,87	1,13	1,07	1,01	0,94	0,87	1,17	1,09	1,03	0,94	0,87
	2	0,97	0,90	0,84	0,77	0,71	0,98	0,91	0,85	0,77	0,71	1,00	0,92	0,86	0,77	0,71	1,02	0,94	0,87	0,78	0,71
	3	0,88	0,80	0,74	0,67	0,61	0,89	0,82	0,75	0,67	0,61	0,90	0,82	0,76	0,68	0,61	0,92	0,83	0,76	0,68	0,61
	4	0,83	0,75	0,69	0,62	0,56	0,84	0,76	0,70	0,62	0,56	0,85	0,77	0,70	0,62	0,56	0,82	0,78	0,71	0,63	0,56
	5	0,79	0,71	0,65	0,58	0,52	0,80	0,72	0,66	0,58	0,52	0,80	0,73	0,66	0,58	0,52	0,81	0,73	0,67	0,59	0,52
	6	0,76	0,68	0,62	0,55	0,50	0,77	0,69	0,63	0,55	0,50	0,77	0,70	0,63	0,56	0,50	0,78	0,70	0,64	0,56	0,50
	8	0,72	0,64	0,58	0,51	0,46	0,72	0,65	0,59	0,52	0,46	0,73	0,65	0,59	0,52	0,46	0,74	0,66	0,59	0,52	0,46
	10	0,69	0,61	0,56	0,49	0,44	0,69	0,62	0,56	0,49	0,44	0,70	0,62	0,56	0,49	0,44	0,70	0,63	0,57	0,49	0,44
PVC Insulated Cables 0,6/1kV - 3,6/6 kV	1	1,01	1,02	0,99	0,93	0,87	1,04	1,05	1,00	0,93	0,87	1,07	1,06	1,01	0,94	0,87	1,11	1,08	1,01	0,94	0,87
	2	0,94	0,89	0,84	0,77	0,71	0,97	0,91	0,85	0,77	0,71	0,99	0,92	0,86	0,77	0,71	1,01	0,93	0,87	0,78	0,71
	3	0,86	0,79	0,74	0,67	0,61	0,89	0,81	0,75	0,67	0,61	0,90	0,83	0,76	0,68	0,61	0,91	0,83	0,77	0,68	0,61
	4	0,82	0,75	0,69	0,62	0,56	0,84	0,76	0,70	0,62	0,56	0,85	0,77	0,71	0,62	0,56	0,86	0,78	0,71	0,63	0,56
	5	0,78	0,71	0,65	0,58	0,52	0,80	0,72	0,66	0,58	0,52	0,80	0,73	0,66	0,58	0,52	0,81	0,73	0,67	0,59	0,52
	6	0,75	0,68	0,62	0,55	0,50	0,77	0,69	0,63	0,55	0,50	0,77	0,70	0,64	0,56	0,50	0,78	0,70	0,64	0,56	0,50
	8	0,71	0,64	0,58	0,51	0,46	0,72	0,65	0,59	0,52	0,46	0,73	0,65	0,59	0,52	0,46	0,73	0,66	0,60	0,52	0,46
	10	0,68	0,61	0,55	0,49	0,44	0,69	0,62	0,56	0,49	0,44	0,69	0,62	0,56	0,49	0,44	0,70	0,63	0,57	0,49	0,44

PREPARED BY STANDARDS : TS HD 603 S1 - TS HD 604 S1

TABLE 7
Rating factors for three-phase, 25 cm spacing between the systems in trefoil formation, single core cables laid underground flat

	Number of Systems	Thermal Resistivity of Moist Soil (K.m/W)																			
		0,7 K.m/W					1,0 K.m/W					1,5 K.m/W					2,5 K.m/W				
		Load Factor					Load Factor					Load Factor					Load Factor				
		0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00
XLPE Insulated Cables 0,6/1kV-36 kV	1	1,09	1,04	0,99	0,93	0,87	1,11	1,05	1,00	0,93	0,87	1,13	1,07	1,01	0,94	0,87	1,17	1,09	1,03	0,94	0,87
	2	1,01	0,94	0,89	0,82	0,75	1,02	0,95	0,89	0,82	0,75	1,04	0,97	0,90	0,82	0,75	1,06	0,98	0,91	0,83	0,75
	3	0,94	0,87	0,81	0,74	0,67	0,95	0,88	0,82	0,74	0,67	0,97	0,89	0,82	0,74	0,67	0,99	0,90	0,83	0,74	0,67
	4	0,91	0,84	0,78	0,70	0,64	0,92	0,84	0,78	0,70	0,64	0,93	0,85	0,79	0,70	0,64	0,95	0,86	0,79	0,71	0,64
	5	0,88	0,80	0,74	0,67	0,60	0,89	0,81	0,75	0,67	0,60	0,90	0,82	0,75	0,67	0,60	0,91	0,83	0,76	0,67	0,60
	6	0,86	0,79	0,72	0,65	0,59	0,87	0,79	0,73	0,65	0,59	0,88	0,80	0,73	0,65	0,59	0,89	0,81	0,74	0,65	0,59
	8	0,83	0,76	0,70	0,62	0,56	0,84	0,76	0,70	0,62	0,56	0,85	0,77	0,70	0,62	0,56	0,86	0,78	0,71	0,62	0,56
	10	0,81	0,74	0,68	0,60	0,54	0,82	0,74	0,68	0,60	0,54	0,83	0,75	0,68	0,61	0,54	0,84	0,76	0,69	0,61	0,54
PVC Insulated Cables 0,6/1kV - 3,6/6 kV	1	1,01	1,02	0,99	0,93	0,87	1,04	1,05	1,00	0,93	0,87	1,07	1,06	1,01	0,94	0,87	1,11	1,08	1,01	0,94	0,87
	2	0,97	0,95	0,89	0,82	0,75	1,00	0,96	0,90	0,82	0,75	1,03	0,97	0,91	0,82	0,75	1,06	0,98	0,92	0,83	0,75
	3	0,94	0,88	0,82	0,74	0,67	0,97	0,88	0,82	0,74	0,67	0,97	0,89	0,83	0,74	0,67	0,98	0,90	0,84	0,74	0,67
	4	0,91	0,84	0,78	0,70	0,64	0,92	0,85	0,79	0,70	0,64	0,93	0,86	0,79	0,70	0,64	0,95	0,87	0,80	0,71	0,64
	5	0,88	0,81	0,75	0,67	0,60	0,89	0,82	0,76	0,67	0,60	0,90	0,82	0,76	0,67	0,60	0,91	0,83	0,77	0,67	0,60
	6	0,86	0,79	0,73	0,65	0,59	0,87	0,80	0,74	0,65	0,59	0,88	0,81	0,74	0,65	0,59	0,89	0,81	0,75	0,65	0,59
	8	0,83	0,76	0,70	0,62	0,56	0,84	0,77	0,71	0,62	0,56	0,85	0,78	0,71	0,62	0,56	0,86	0,78	0,72	0,62	0,56
	10	0,82	0,75	0,69	0,60	0,54	0,82	0,75	0,69	0,60	0,54	0,83	0,76	0,69	0,61	0,84	0,84	0,76	0,70	0,61	0,54

TABLE 8
Rating factors for three-phase, 25 cm spacing between the systems in flat formation, single core cables laid underground flat

	Number of Systems	Thermal Resistivity of Moist Soil (K.m/W)																			
		0,7 K.m/W					1,0 K.m/W					1,5 K.m/W					2,5 K.m/W				
		Load Factor					Load Factor					Load Factor					Load Factor				
		0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00
XLPE Insulated Cables 0,6/1kV-36 kV	1	1,08	1,05	0,99	0,91	0,85	1,13	1,07	1,00	0,92	0,85	1,18	1,09	1,01	0,92	0,85	1,19	1,11	1,03	0,93	0,85
	2	1,01	0,93	0,86	0,77	0,71	1,03	0,94	0,87	0,78	0,71	1,05	0,95	0,88	0,78	0,71	1,06	0,96	0,88	0,79	0,71
	3	0,92	0,84	0,77	0,69	0,62	0,93	0,85	0,77	0,69	0,62	0,95	0,86	0,78	0,69	0,62	0,96	0,86	0,79	0,69	0,62
	4	0,88	0,80	0,73	0,65	0,58	0,89	0,80	0,73	0,65	0,58	0,90	0,81	0,74	0,65	0,58	0,91	0,82	0,74	0,65	0,58
	5	0,84	0,76	0,69	0,61	0,55	0,85	0,77	0,70	0,61	0,55	0,87	0,78	0,70	0,62	0,55	0,87	0,78	0,71	0,62	0,55
	6	0,82	0,74	0,67	0,59	0,53	0,83	0,75	0,68	0,60	0,53	0,84	0,75	0,68	0,60	0,53	0,85	0,76	0,69	0,60	0,53
	8	0,79	0,71	0,64	0,57	0,51	0,80	0,71	0,65	0,57	0,51	0,81	0,72	0,65	0,57	0,51	0,81	0,72	0,65	0,57	0,51
	10	0,77	0,69	0,62	0,55	0,49	0,78	0,69	0,63	0,55	0,49	0,78	0,70	0,63	0,55	0,49	0,79	0,70	0,63	0,55	0,49
PVC Insulated Cables 0,6/1kV - 3,6/6 kV	1	0,96	0,97	0,98	0,91	0,85	1,01	1,01	1,00	0,92	0,85	1,07	1,05	1,01	0,92	0,85	1,16	1,10	1,02	0,93	0,85
	2	0,92	0,89	0,86	0,77	0,71	0,96	0,94	0,87	0,78	0,71	1,00	0,95	0,88	0,78	0,71	1,05	0,97	0,89	0,79	0,71
	3	0,88	0,84	0,77	0,69	0,62	0,91	0,85	0,78	0,69	0,62	0,95	0,86	0,79	0,69	0,62	0,96	0,87	0,79	0,69	0,62
	4	0,86	0,80	0,73	0,65	0,58	0,89	0,81	0,74	0,65	0,58	0,90	0,82	0,74	0,65	0,58	0,91	0,82	0,75	0,65	0,58
	5	0,84	0,76	0,70	0,61	0,55	0,85	0,77	0,70	0,61	0,55	0,87	0,78	0,71	0,62	0,55	0,87	0,79	0,71	0,62	0,55
	6	0,82	0,74	0,68	0,59	0,53	0,83	0,75	0,68	0,60	0,53	0,84	0,76	0,69	0,60	0,53	0,85	0,76	0,69	0,60	0,53
	8	0,79	0,71	0,65	0,57	0,51	0,80	0,72	0,65	0,57	0,51	0,81	0,72	0,65	0,57	0,51	0,81	0,73	0,66	0,57	0,51
	10	0,77	0,69	0,63	0,55	0,49	0,78	0,70	0,63	0,55	0,49	0,79	0,70	0,63	0,55	0,49	0,79	0,71	0,64	0,55	0,49

PREPARED BY STANDARDS : TS HD 603 S1 - TS HD 604 S1

TABLE 9

Rating factors for three-phase, 7 cm spacing between the systems in flat formation, single or multi core cables laid underground side by side

	Number of Systems	Thermal Resistivity of Moist Soil (K.m/W)																			
		0,7 K.m/W					1,0 K.m/W					1,5 K.m/W					2,5 K.m/W				
		Load Factor					Load Factor					Load Factor					Load Factor				
		0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00	0,5	0,6	0,7	0,85	1,00
XLPE Insulated Cables 0,6/1kV-36 kV	1	1,02	1,03	0,99	0,94	0,89	1,06	1,05	1,00	0,94	0,89	1,09	1,06	1,01	0,94	0,89	1,11	1,07	1,02	0,95	0,89
	2	0,95	0,89	0,84	0,77	0,72	0,98	0,91	0,85	0,78	0,72	0,99	0,92	0,86	0,78	0,72	1,01	0,94	0,87	0,79	0,72
	3	0,86	0,80	0,74	0,68	0,62	0,89	0,81	0,75	0,68	0,62	0,90	0,83	0,77	0,68	0,62	0,92	0,84	0,77	0,69	0,62
	4	0,82	0,75	0,69	0,63	0,57	0,84	0,76	0,70	0,63	0,57	0,85	0,78	0,71	0,63	0,57	0,86	0,78	0,72	0,64	0,57
	5	0,78	0,71	0,65	0,59	0,53	0,80	0,72	0,66	0,59	0,53	0,81	0,73	0,67	0,59	0,53	0,82	0,74	0,67	0,60	0,53
	6	0,75	0,68	0,63	0,56	0,51	0,77	0,69	0,63	0,56	0,51	0,78	0,70	0,64	0,57	0,51	0,79	0,71	0,65	0,57	0,51
	8	0,71	0,64	0,59	0,52	0,47	0,72	0,65	0,59	0,52	0,47	0,73	0,66	0,60	0,52	0,47	0,74	0,66	0,60	0,53	0,47
	10	0,68	0,61	0,56	0,49	0,44	0,69	0,62	0,56	0,50	0,44	0,70	0,63	0,57	0,50	0,44	0,71	0,63	0,57	0,50	0,44
PVC Insulated Cables 0,6/1kV - 3,6/6 kV	1	0,91	0,92	0,94	0,94	0,89	0,97	0,97	1,00	0,94	0,89	1,04	1,03	1,01	0,94	0,89	1,13	1,07	1,02	0,95	0,89
	2	0,86	0,87	0,85	0,77	0,72	0,91	0,90	0,86	0,78	0,72	0,97	0,93	0,87	0,78	0,72	1,01	0,94	0,88	0,79	0,72
	3	0,82	0,80	0,75	0,68	0,62	0,86	0,82	0,76	0,68	0,62	0,91	0,84	0,77	0,68	0,62	0,92	0,84	0,78	0,69	0,62
	4	0,80	0,76	0,70	0,63	0,57	0,84	0,77	0,71	0,63	0,57	0,86	0,78	0,72	0,63	0,57	0,87	0,79	0,73	0,64	0,57
	5	0,78	0,72	0,66	0,59	0,53	0,81	0,73	0,67	0,59	0,53	0,81	0,74	0,68	0,59	0,53	0,82	0,75	0,68	0,60	0,53
	6	0,76	0,69	0,64	0,56	0,51	0,77	0,70	0,64	0,56	0,51	0,78	0,71	0,65	0,57	0,51	0,79	0,72	0,65	0,57	0,51
	8	0,72	0,65	0,59	0,52	0,47	0,73	0,66	0,60	0,52	0,47	0,74	0,67	0,61	0,52	0,47	0,75	0,67	0,61	0,53	0,47
	10	0,69	0,62	0,57	0,49	0,44	0,70	0,63	0,57	0,50	0,44	0,71	0,64	0,58	0,50	0,44	0,71	0,64	0,58	0,50	0,44

TABLE 10

Rating factor for differing air temperatures

HD 603 (1kV) - Rating factors for differing AIR temperatures

HD 603 (1kV)

Temperature (°C)	10	15	20	25	30	35	40	45	50
Factor	1,22	1,17	1,12	1,03	1,0	0,93	0,87	0,79	0,71

HD 603 (1kV) - Rating factors for differing SOIL temperatures

HD 603 (1kV)

Temperature (°C)	5	10	15	20	25	30	35	40	45
Factor	1,14	1,09	1,05	1,0	0,95	0,90	0,84	0,77	0,71

HD 620 (MV cables) - Rating factors for differing AIR temperatures

HD 620

Temperature (°C)	10	15	20	25	30	35	40	45	50
Factor (Type 10B-A / 10B-B 8,7/15 kV - up to 20,8/36 kV)	1,15	1,12	1,08	1,04	1,0	0,96	0,91	0,87	0,82
Factor (Type 10B-C 20,8/36 kV)	1,17	1,13	1,09	1,04	1,0	0,95	0,90	0,84	0,79

HD 620 (MV cables) - Rating factors for differing SOIL temperatures

HD 620

Temperature (°C)	5	10	15	20	25	30	35	40	45
Factor (up to 8,7/15 kV - 20,8/36 kV)	1,10	1,07	1,04	1,0	0,96	0,92	0,89	0,85	0,79

IEC 60502-2 (MV cables) - Rating factors for differing AIR temperatures

IEC 60502-2

Temperature (°C)	20	25	30	35	40	45	50	55	60
Factor (max. conductor temp.: 90°C)	1,08	1,04	1,0	0,96	0,91	0,87	0,82	0,76	0,71

IEC 60502-2 (MV cables) - Rating factors for differing SOIL temperatures

IEC 60502-2

Temperature (°C)	10	15	20	25	30	35	40	45	50
Factor (max. conductor temp.: 90°C)	1,07	1,04	1,0	0,96	0,93	0,89	0,85	0,80	0,76

PREPARED BY STANDARDS : TS HD 603 S1 - TS HD 604 S1

TABLE 11
Effective Resistance

Nominal Cross Sections of Conductor mm²	Resistance	
	Cu Ω/km	Al Ω/km
1,5	12,10	-
2,5	7,41	-
4	4,61	-
6	3,08	-
10	1,83	-
16	1,15	1,91
25	0,727	1,20
35	0,524	0,868
50	0,387	0,641
70	0,268	0,443
95	0,193	0,320
120	0,153	0,253
150	0,124	0,206
185	0,0991	0,164
240	0,0754	0,125
300	0,0601	0,100
400	0,0470	0,0778

Conversion of conductor resistance values for deviating

$$R_{20} = R_d \frac{254,5}{234,5 + d} \text{ (Cu)}$$

$$R_{20} = R_d \frac{248}{228 + d} \text{ (Al)}$$

R20 : Conductor resistance at 20°C) (Ω/km)
Rd : Conductor resistance at d°C) (Ω/km)
d : Conductor temperature (°C)

TABLE 12
Correction laying depth factors

Depth cm	U= 1000 V	
	S ≤50 mm²	70-240 mm²
50	1,02	1,04
60	1,01	1,02
70	1,00	1,00
80	0,99	0,98
100	0,97	0,96
120	0,95	0,94
150	0,93	0,92

TS HD 603 S1 - TS HD 604 S1 PREPARED BY STANDARDS

TABLE 13
Reduction factors for different ground termal resistivity

Nominal area mm²	Termal resistivity K x cm / W								
	50	70	80	100	120	150	200	250	300
1,5	1,14	1,08	1,05	1	0,96	0,90	0,83	0,77	0,72
2,5	1,15	1,08	1,05	1	0,96	0,90	0,82	0,76	0,71
4	1,16	1,08	1,05	1	0,95	0,89	0,82	0,76	0,71
6	1,16	1,09	1,06	1	0,95	0,89	0,81	0,75	0,70
10	1,17	1,09	1,07	1	0,95	0,89	0,80	0,75	0,70
16	1,18	1,10	1,08	1	0,95	0,89	0,80	0,74	0,69
25	1,20	1,10	1,08	1	0,94	0,89	0,79	0,72	0,67
50	1,24	1,13	1,08	1	0,94	0,89	0,77	0,70	0,65
95	1,24	1,13	1,08	1	0,94	0,86	0,77	0,70	0,64
150	1,25	1,13	1,08	1	0,94	0,86	0,76	0,69	0,64
240	1,25	1,13	1,08	1	0,93	0,86	0,76	0,69	0,64

PREPARED BY STANDARDS : TS HD 603 S1 - TS HD 604 S1

TABLE 14
MV Cables correction factors
Reduction factors thermal resistivity on the ground for single core cables

		Cross sectional area mm²	Termal resistivity K.m/W								
			0,50	0,70	0,80	1,00	1,20	1,50	2,00	2,50	3,00
Type 10B-A Type 10B-B	from 8,7/15kV to 20,8/36kV	25	1,37	1,19	1,12	1,00	0,91	0,80	0,67	0,58	0,52
		50	1,39	1,20	1,12	1,00	0,91	0,80	0,67	0,58	0,52
		95	1,42	1,21	1,13	1,00	0,91	0,79	0,67	0,58	0,52
		150	1,45	1,22	1,13	1,00	0,90	0,78	0,66	0,57	0,51
		240	1,47	1,23	1,14	1,00	0,90	0,78	0,65	0,57	0,51
		400	1,49	1,23	1,14	1,00	0,90	0,78	0,65	0,56	0,50
		630	1,51	1,24	1,14	1,00	0,89	0,77	0,65	0,56	0,50
		1000	1,53	1,25	1,15	1,00	0,89	0,77	0,64	0,55	0,49
Type 10B-C Type 10 B-D	20,8/36kV	240	1,29	1,15	1,09	1,00	0,93	0,85	0,75	0,68	0,62
		400	1,30	1,15	1,09	1,00	0,93	0,84	0,74	0,67	0,62
		630	1,30	1,15	1,09	1,00	0,92	0,84	0,74	0,66	0,61
		1000	1,32	1,16	1,10	1,00	0,92	0,83	0,73	0,66	0,61

TABLE 15
Laying depth reducing factors

Depth cm	U ≤15 kV S≤300 mm²	U ≤15 kV S≤300 mm²	U > 15 kV S≤300 mm²	U > 15 kV S≤300 mm²
50	1,03	1,05	-	-
60	1,02	1,03	-	-
70	1,00	1,00	-	-
80	0,99	0,98	1,02	1,03
100	0,97	0,95	1,00	1,00
120	0,95	0,93	0,99	0,98
150	0,93	0,91	0,97	0,95
200	-	-	0,94	0,92
250	-	-	0,92	0,90
S = Cross-sectional area of the conductor				

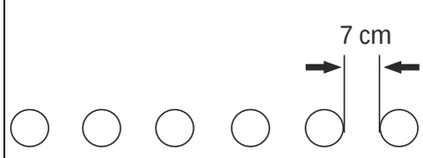
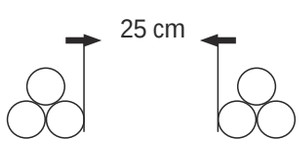
Number of systems	Cross sectional area mm²	2	3	4	5	6	8	10
	25	0,86	0,78	0,73	0,70	0,67	0,64	0,62
	50	0,85	0,77	0,72	0,69	0,67	0,64	0,62
	95	0,85	0,77	0,72	0,69	0,67	0,63	0,62
	150	0,84	0,76	0,72	0,68	0,66	0,63	0,62
	240	0,84	0,76	0,71	0,68	0,66	0,63	0,61
	400	0,84	0,75	0,71	0,67	0,65	0,62	0,60
	630	0,83	0,75	0,70	0,65	0,65	0,62	0,60
	1000	0,82	0,74	0,69	0,64	0,64	0,61	0,59
	25	0,89	0,81	0,77	0,73	0,72	0,69	0,67
	50	0,89	0,80	0,76	0,73	0,71	0,68	0,66
	95	0,89	0,80	0,76	0,73	0,71	0,68	0,66
	150	0,88	0,80	0,76	0,72	0,70	0,67	0,65
	240	0,88	0,79	0,75	0,72	0,70	0,67	0,65
	400	0,87	0,78	0,74	0,71	0,69	0,66	0,64
	630	0,87	0,77	0,73	0,70	0,68	0,65	0,63
	1000	0,86	0,76	0,72	0,69	0,67	0,64	0,62

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TABLE 16
Reduction factors for the other cable systems in the air

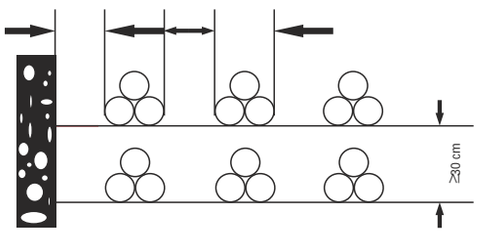
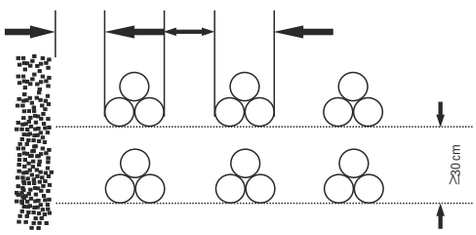
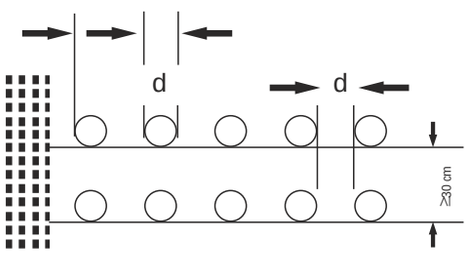
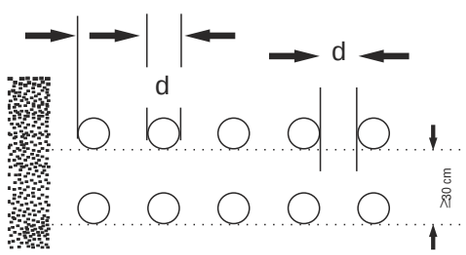
	Number of racks	Number of systems		
		1	2	3
A. On non-aerated cable racks ≥2 cm 2d 2d  	1 2 3 6	0,95 0,90 0,88 0,86	0,90 0,85 0,83 0,81	0,88 0,83 0,81 0,79
B. On aerated cable racks ≥2 cm 2d 2d  	1 2 3 6	1,00 1,00 1,00 1,00	0,98 0,95 0,94 0,93	0,96 0,93 0,92 0,90
A. On non-aerated cable racks ≥2 cm  	1 2 3 6	0,92 0,87 0,84 0,82	0,89 0,84 0,82 0,80	0,88 0,83 0,81 0,79
B. On aerated cable racks ≥2 cm  	1 2 3 6	1,00 1,00 1,00 1,00	0,97 0,94 0,93 0,91	0,96 0,93 0,92 0,90

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TABLE 17
Connection factors for multicore cables laid in ground or in air with crosssection from 1,5 mm² to 10 mm²

Number of Cores under load	In ground	In the air
5	0,70	0,75
7	0,60	0,65
10	0,50	0,55
14	0,45	0,50
19	0,40	0,45
24	0,35	0,40
40	0,30	0,35
61	0,25	0,30

TABLE 18
Permissible operating temperature short-circuit temperature and short circuit currents
for cables with copper and aluminium conductor

Nominal short circuit current desinty for 1sec (A/mm²)											
Cable type	Max. operating temperature °C	Max. short circuit temperature °C	Initial temperature °C								
			90	80	70	65	60	50	40	30	20
Copper conductor XLPE insulation	90	250	143	149	154	157	159	165	170	176	181
Al. conductor XLPE insulation	90	250	94	98	102	104	105	109	113	116	120
Copper conductor PVC insulation											
≤ 300 mm²	70	160	---	---	115	119	122	129	136	143	150
> 300 mm²	70	140	---	---	103	107	111	118	126	133	140
Al. conductor PVC insulation											
≤ 300 mm²	70	160	---	---	76	78	81	85	90	95	99
> 300 mm²	70	140	---	---	68	71	73	78	83	88	93

Short circuit current for various exposure time , I_{th}

$$I_{th} \quad \frac{I_{thN}}{\sqrt{T_k}}$$

I_{thN} = Short circuit current for 1sec

T_k = Exposure time, sec

I_{thN} = Conductive section (mm²) x short circuit current density (A/mm²) x 10^{-3} kA

TABLE 19
Inductive reactance of PVC insulated cables at 50 Hz.

Nominal cross-section of Conductor mm²	Nominal voltage					
	0,6/1 kV		3,6/6 kV		6/10 kV	
	Multi Core (1) ohm/km	1 Core (2) ohm/km	3 Core (1) ohm/km	1 Core (2) ohm/km	3 Core (1) ohm/km	1 Core (2) ohm/km
25	0,082	0,103	0,107	0,137	0,122	0,127
35	0,079	0,098	0,101	0,131	0,116	0,119
50	0,078	0,095	0,097	0,127	0,114	0,113
70	0,075	0,090	0,092	0,117	0,107	0,107
95	0,075	0,088	0,088	0,112	0,103	0,104
120	0,073	0,085	0,085	0,107	0,099	0,100
150	0,073	0,084	0,083	0,105	0,096	0,097
185	0,072	0,084	0,081	0,102	0,093	0,094
240	0,072	0,082	0,078	0,097	0,089	0,093
300	-	0,081	0,077	0,095	0,087	0,091
400	-	0,079	-	0,092	-	0,088
500	-	0,079	-	0,089	-	0,085

1- 10% more is taken for armored cables.
2- Trefoil formation.

TABLE 20
Inductive reactance of XLPE insulated cables at 50 Hz.

Nominal cross-section of Conductor mm²	Nominal voltage									
	0,6/1 kV		6/10 kV		8,7/15 kV		12/20 kV		20,3/35 kV	
	1 Core (2) W/km	Multi Core (1) W/km	1 Core (2) W/km	Multi Core (1) W/km	1 Core (2) W/km	Multi Core (1) W/km	1 Core (2) W/km	Multi Core (1) W/km	1 Core (2) W/km	Multi Core (1) W/km
35	-	0,075	0,133	-	0,139	-	0,144	-	-	-
50	0,088	0,072	0,127	0,110	0,132	0,117	0,137	0,123	0,146	0,135
70	0,085	0,072	0,119	0,103	0,124	0,110	0,129	0,115	0,135	0,127
95	0,082	0,069	0,114	0,099	0,118	0,105	0,123	0,110	0,131	0,121
120	0,082	0,069	0,109	0,095	0,114	0,101	0,118	0,106	0,125	0,116
150	0,082	0,069	0,106	0,092	0,11	0,098	0,114	0,102	0,121	0,113
186	0,082	0,069	0,102	0,090	0,106	0,095	0,110	0,099	0,117	0,109
210	0,079	0,069	0,098	0,087	0,102	0,091	0,105	0,095	0,112	0,104
300	-	-	0,095	0,084	0,099	0,089	0,102	0,092	0,108	0,101
400	-	-	0,091	-	0,095	-	0,098	-	0,103	-
500	-	-	0,099	-	0,092	-	0,094	-	0,100	-
Longitudinally water-proof construction										
35	-	-	0,147	-	-	-	0,157	-	-	-
50	-	-	0,140	-	-	-	0,150	-	0,159	-
70	-	-	0,133	-	-	-	0,142	-	0,150	-
95	-	-	0,127	-	-	-	0,135	-	0,143	-
120	-	-	0,123	-	-	-	0,131	-	0,139	-
150	-	-	0,120	-	-	-	0,127	-	0,135	-
186	-	-	0,114	-	-	-	0,122	-	0,129	-
210	-	-	0,110	-	-	-	0,117	-	0,124	-
300	-	-	0,106	-	-	-	0,113	-	0,119	-
400	-	-	0,102	-	-	-	0,109	-	0,115	-
500	-	-	0,100	-	-	-	0,106	-	0,112	-

1- 10% more is taken for armored cables.
2- Trefoil formation.

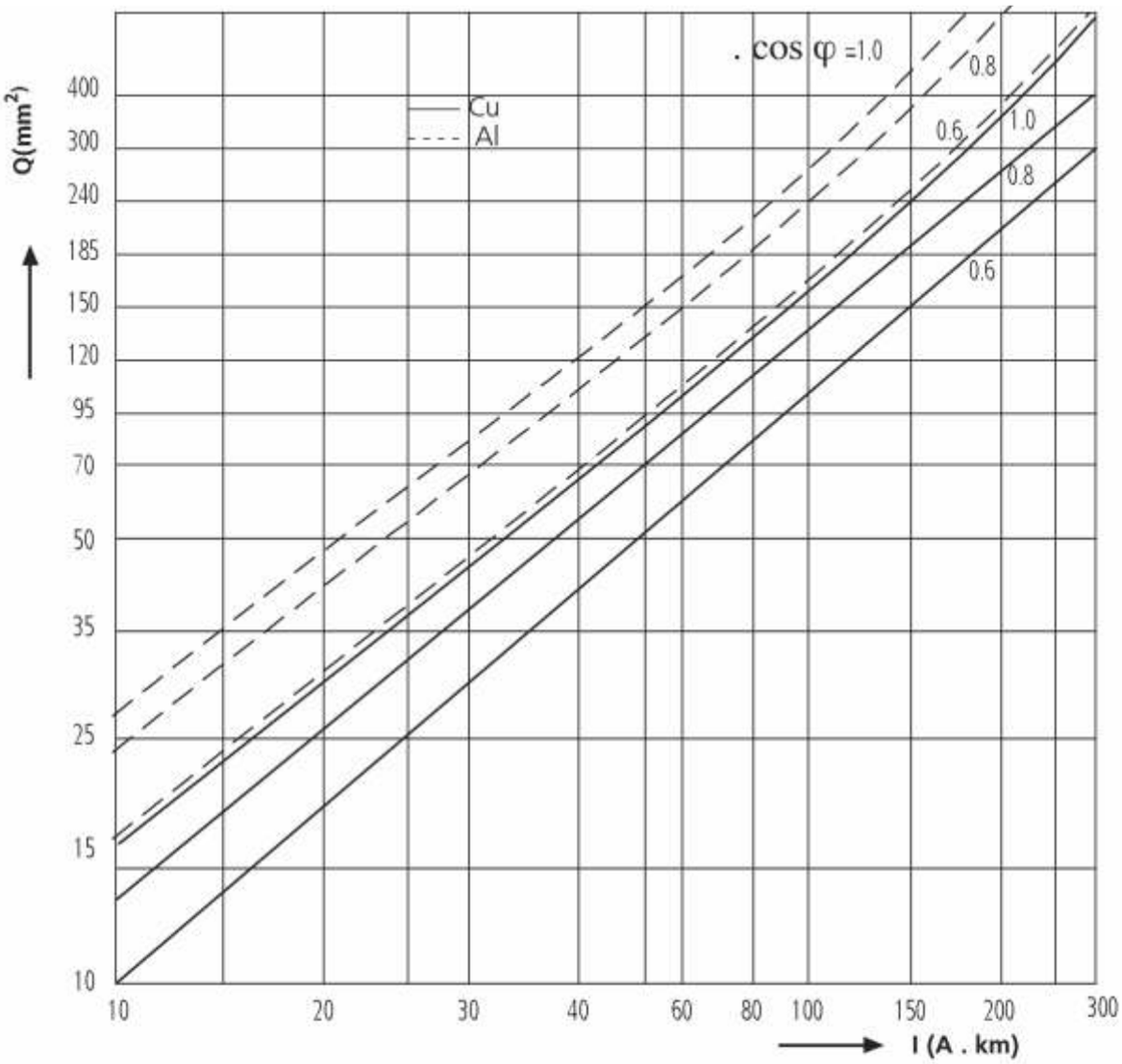
TABLE 21
Earth fault currents - PVC insulated cables

Nominal cross-section	Nominal Voltage	Nominal Voltage
mm²	3,6/6 kV (A/km)	6/10 kV (A/km)
25	0,60	1,9
35	0,60	2,1
50	0,70	2,3
70	0,70	2,6
95	0,80	2,9
120	0,90	3,2
150	0,90	3,4
185	1,00	3,8
210	1,00	4,5
300	1,20	5,0

TABLE 22
Earth fault currents - XLPE insulated cables

Nominal cross-section	Nominal Voltage	Nominal Voltage	Nominal Voltage	Nominal Voltage
mm²	6/10 kV (A/km)	8.7/15 kV (A/km)	12/20 kV (A/km)	18/30 kV (A/km)
35	1,2	1,4	1,8	-
50	1,3	1,6	1,9	2,2
70	1,5	1,8	2,1	2,4
95	1,7	1,9	2,3	2,7
120	1,8	2,1	2,5	2,9
150	2,0	2,3	2,7	3,1
185	2,1	2,5	2,9	3,3
240	2,4	2,8	3,2	3,6
300	2,6	3,0	3,5	3,9
400	3,0	3,4	4,0	4,4
500	3,0	3,7	4,4	4,8

TABLE 23
Voltage drop at low voltage cables



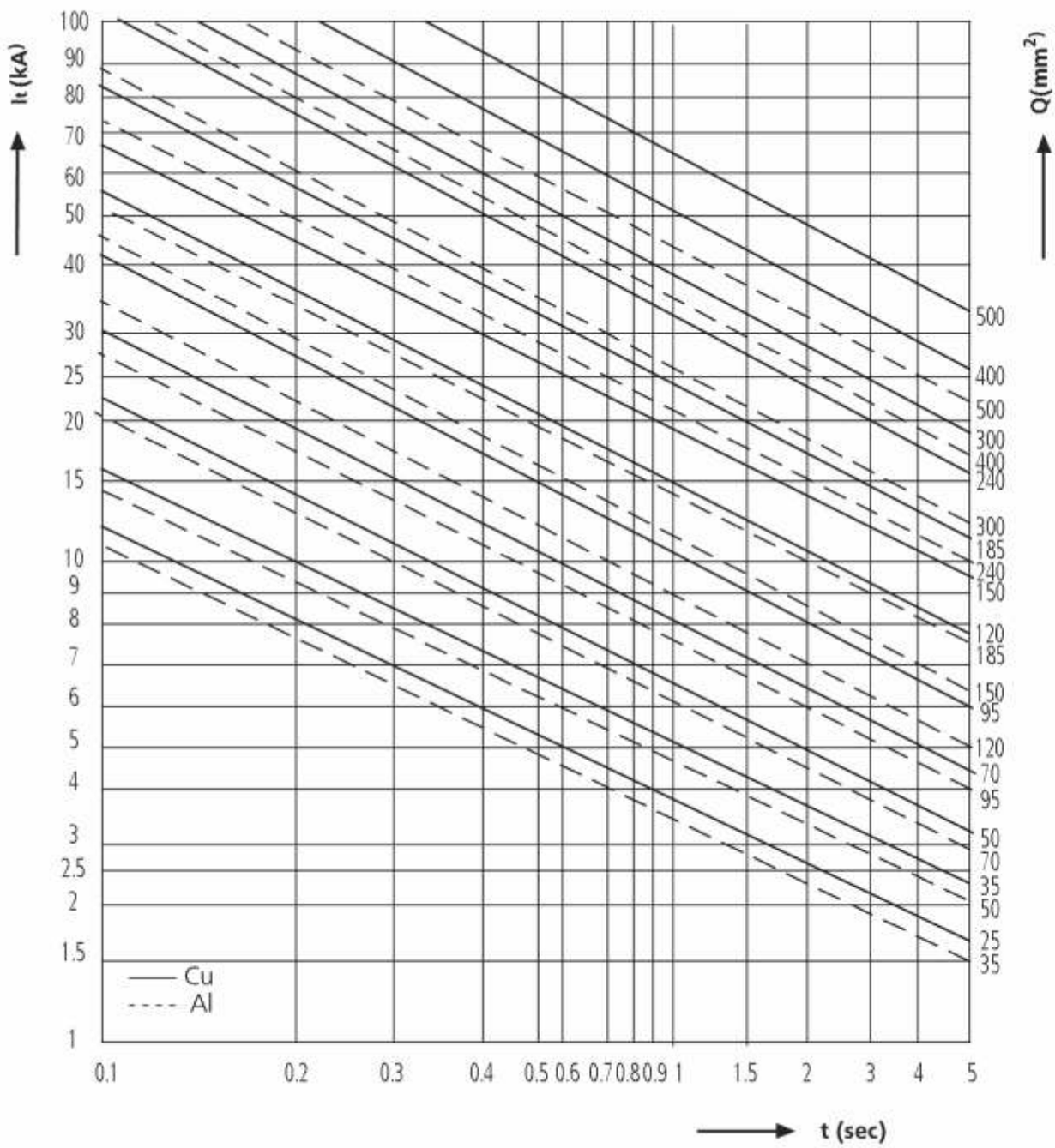
Voltage drop : %5
Service voltage : 220/380V
Conductor tempature : 70 °C

In many cases, especially for large cross section, the inductive voltage drop must be taken into consideration.
General formula for theree phase systems:

$$e = \frac{100 \,.\, \sqrt{3} \,.\, I \,.\, l}{U} (R \,.\, \cos\varphi + X \,.\, \sin\varphi)$$

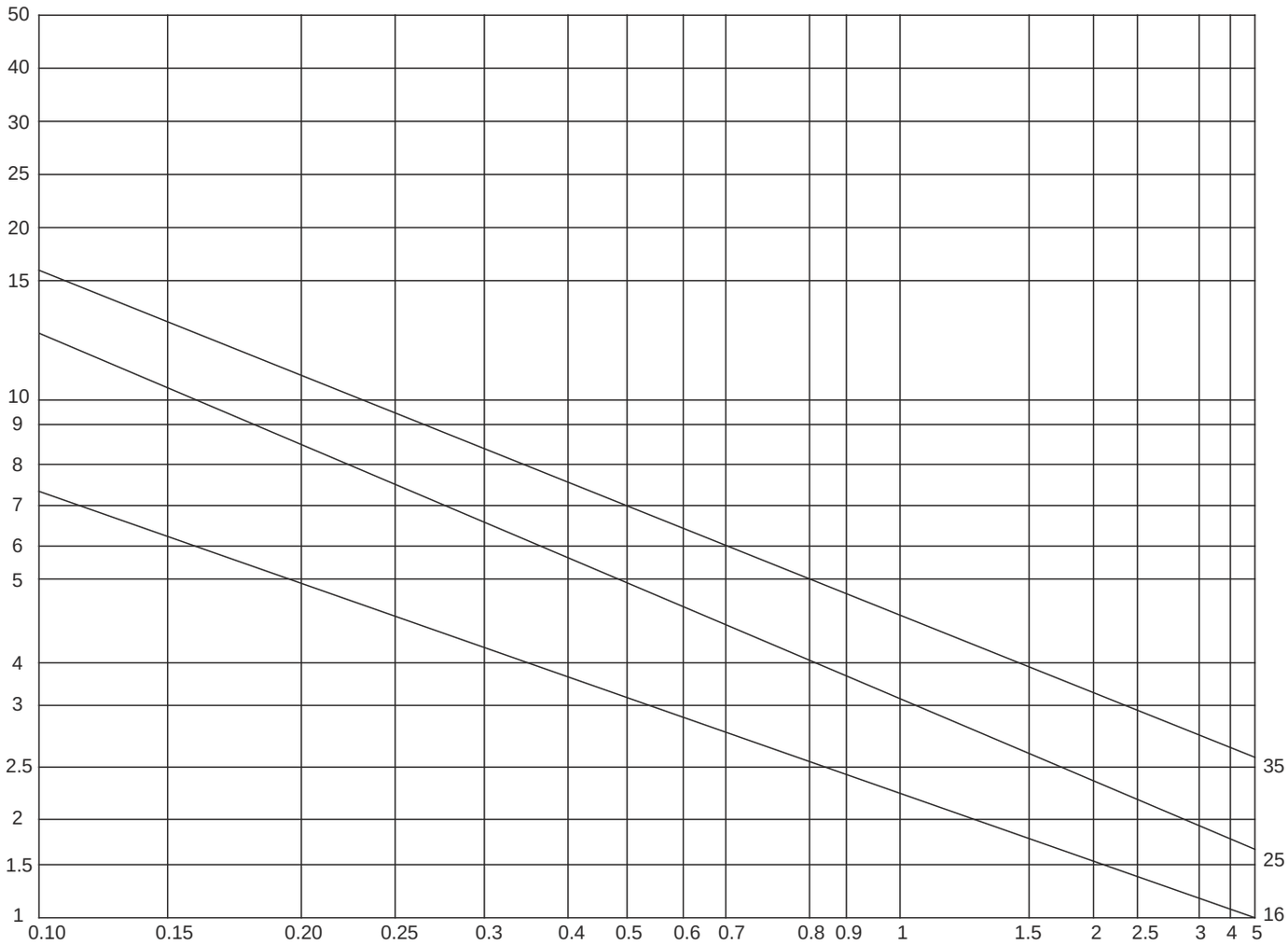
U= Phase to phase voltage (V) l = Length cable (km)
e= Voltage drop (%) R= Resistance (ohm/km)
I= Current loading (A) X= Inductance (ohm/km)

TABLE 24
Permissible short-circuit current for XLPE insulated cables for 1-30 kV



(Short circuit initial temperature 90 °C, final temperature 250 °C).

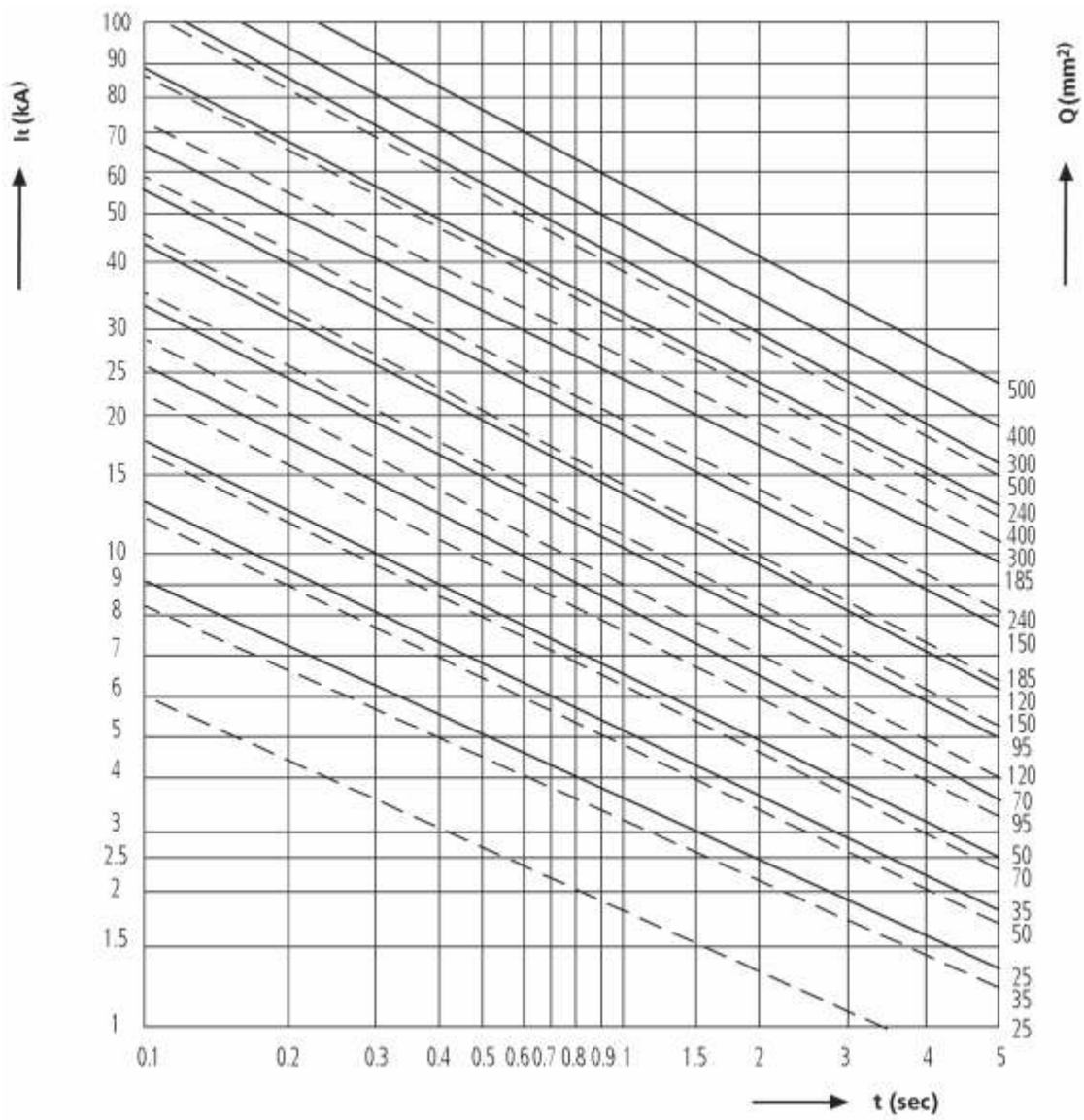
TABLE 25
Permissible short-circuit current for variouscross - sections of screens



Standard cross-sections of screens

Cross-sections of conductor (mm^2)	Cross-sections of screen (mm^2)
35 - 120	16
150 - 300	25
400 - 500	35

TABLE 26
Permissible short-circuit current for PVC insulated cables for 1-10kV



For single core systems laying arrangement, cores shall be in the form of;

L1 L2 L3 L3 L2 L1 L1 L2 L3 L3 L2 L1

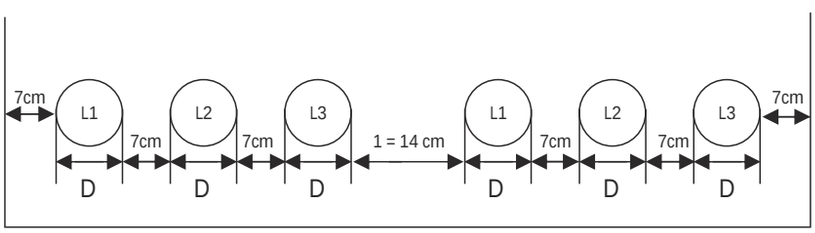
For the systems which have more than one layer, provided that, it shall be minimum 20 cm gap between systems.

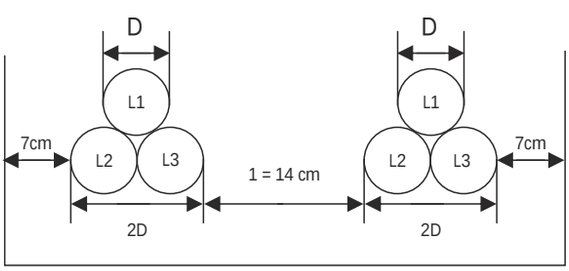
1 st. layer	2nd. layer
L1 L2 L3	L3 L2 L1
L1 L2 L3	L3 L2 L1
L1 L2 L3	L3 L2 L1

Same phases shall not install near side by side for all these systems. For example; L1 L1 L1, L2 L2 L2, L3 L3 L3 is a wrong formation for laying.
The minimum gap between two cables shall be as same diameter with cables and also length of cable shall be approximately equal for each of them.

Number of Cores	Bending Radius		
	Unarmoured LV Cables	Unarmoured MV Cables	Armoured Cables
Single Core	12 x D	14 x D	15 x D
Multi Core	10 x D	12 x D	12 x D

Example for single core system





FORMULAS - CONVERSION FACTORS

Ohms Law	$U = I \times R$	
Energy	$W = I^2 \times R \times t$	
Resistance of a Line (Feed and Return)	$R = \frac{2 \times l}{\gamma \times S}$	
Power	$P = U \times I$	
Single-Phase Power	$P = U \times I \times \cos f$	
Three-Phase Power	$P = 1{,}73 \times U \times I \times \cos f$	
Efficiency	$h = \frac{P_{output}}{P_{input}}$	

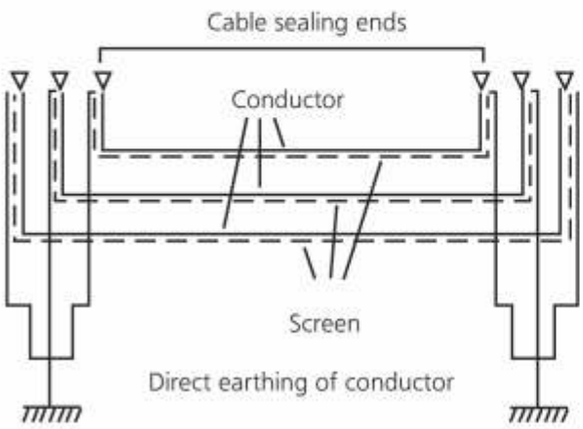
U	Rated voltage (V)
I	Current (A)
R	Resistance (ohm)
W	Energy (Joule)
t	Time (seconds)
l	Length of cable (m)
u	Voltage drop (V) from sending to receiving end of line
γ	Conductivity (for copper 58 MS/m at 20°C)
S	Rated cross-section (mm²)
cos f	Power factor
P	Power (W)
h	Efficiency

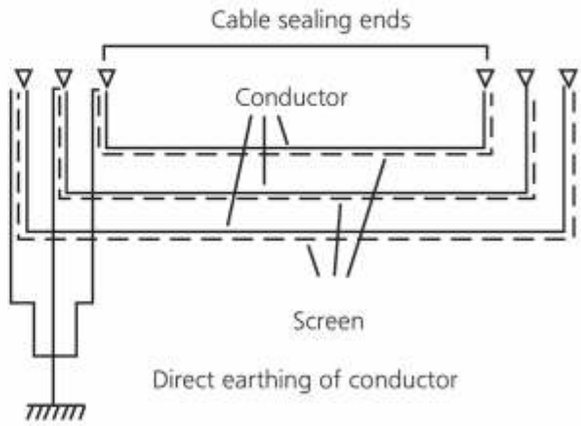
	In single-phase AC and DC systems	In three-phase AC and DC systems
If current is known	$u = \frac{2 \times l \times I}{\gamma \times S}$ (V)	$u = \frac{1{,}73 \times l \times I \times \cos f}{\gamma \times S}$ (V)
If power is known	$u = \frac{2 \times l \times P}{\gamma \times S \times U}$ (V)	$u = \frac{l \times P}{\gamma \times S \times U}$ (V)
If current is known	$S = \frac{2 \times l \times I}{\gamma \times u}$ (mm²)	$S = \frac{1{,}73 \times l \times I \times \cos f}{\gamma \times u}$ (mm²)
If power is known	$S = \frac{2 \times I \times P}{\gamma \times u \times U^2}$ (mm²)	$S = \frac{l \times P}{\gamma \times u \times U^2}$ (mm²)

Lenght	meters (m)	inches (in)	feet (ft)	yard (yd)	miles (mil)
1m	1,0	39,37	3,28	1,0936	$0{,}621371 \times 10^3$
1 in	0,0254	1,0	0,0833	0,0277	$0{,}0158 \times 10^3$
1 ft	0,3048	12,00	1,0	0,333	$0{,}189 \times 10^3$
1 yd	0,9144	36,00	3,0	1,0	$0{,}568 \times 10^3$
1 mile	1609,344	63360,0	5280,0	1760,0	$1{,}0 \times 10^3$

Area	m²	in²	ft²
1 m²	1,0	1550,0	10,7639
1 in²	$0{,}64516 \times 10^3$	1,0	$6{,}944 \times 10^3$
1 ft²	0,0929	144,0	1,0

EARTING METHODS FOR CABLE SCREENS



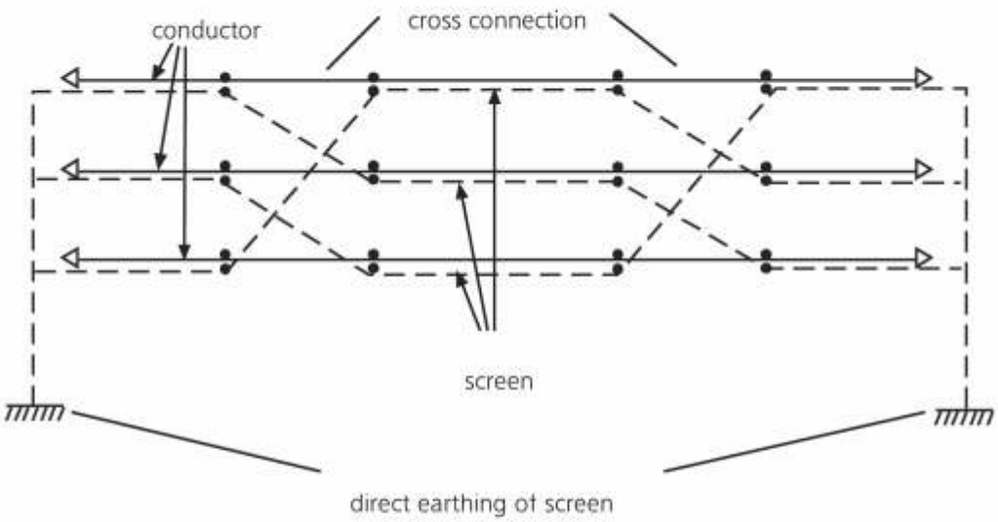


1) Earthing at two ends

Cable screens are connected together and earthed at both ends of cable route. On this method, current inducted at cable screen cause additional losses and reduce the current carrying capacity. Losses at cables: installed as triangle bunch are lower than cables installed side by side.

2) Earthing at one end

Cable screens are connected together and earthed at one end of cable route. Voltage between the cable screen and earth is proportional with the cable length and current rate in conductor. This method is only applied for short distances.



3) Cross connection

It is used at long distances (1km or over). The line is splitted in 3 equal electrical parts. Screens of adjacent cables are cross connected at joint boxer are earthed via voltage limiter. Additionally the screens are connected and directly earthed at two ends. In this method, current carrying capacity is as big as screening at one and.

Permitted minimum bending radius during the cabling

Multi-core cables
0,6/1 kV : 12 D
0,6/1 kV : 15 D

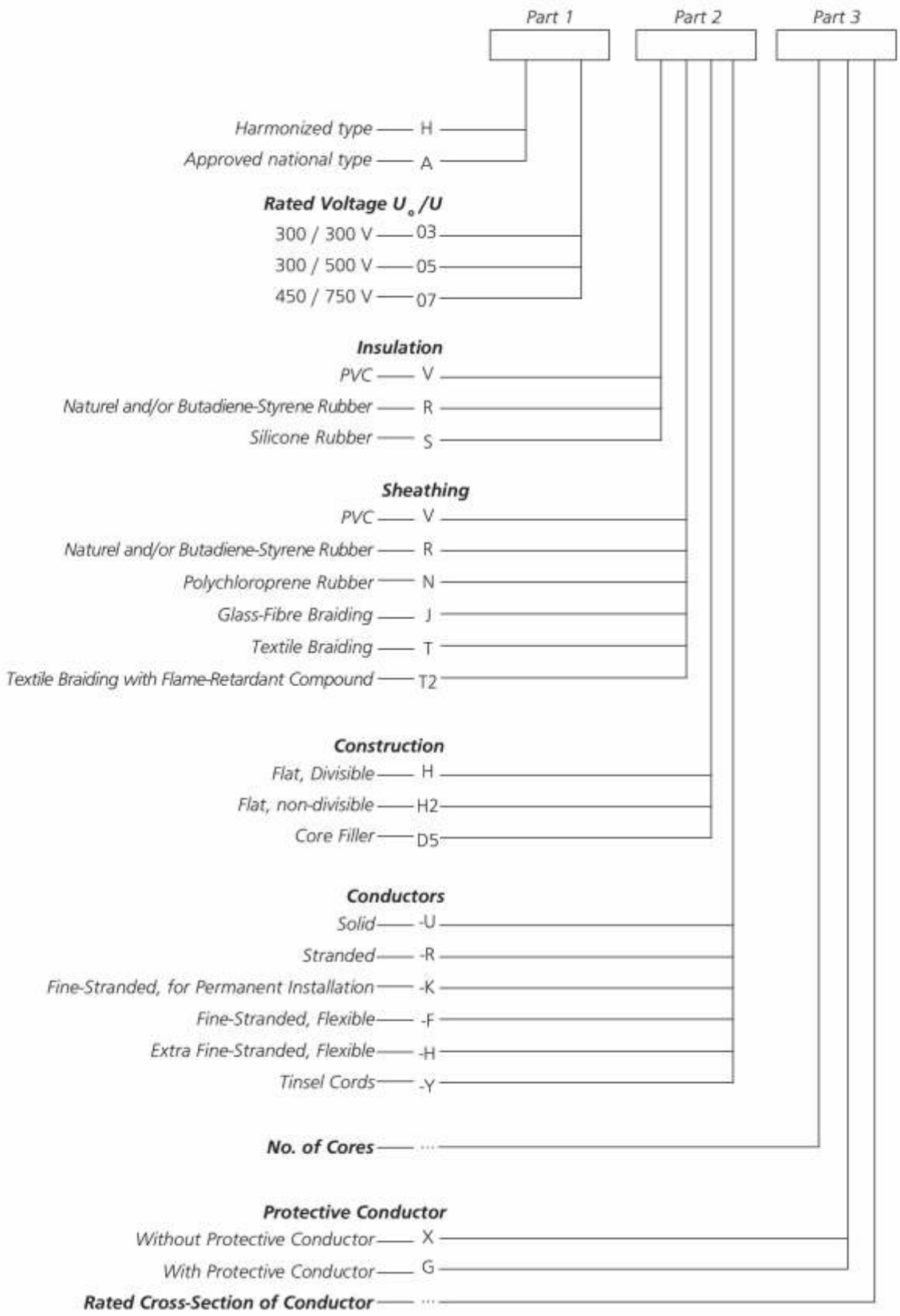
All single mode cables
D : Cable diameter

Minimum ambient temperature during the cabling
: +3°C PVC cables
: -5°C XLPE cables

Permitted maximum tensile strenght during the cabling

Unarmoured cables with copper conductor : a x 50 N/mm² (5 kg/mm²)
Unarmoured cables with aluminium conductor : a x 30 N/mm² (3 kg/mm²)
All cables with steel wire armoured : d² X 9 N/mm² (0,9 kg/mm²)
All cables with steel belt armoured : d² X 3 N/mm² (0,3 kg/mm²)

A : Total conductive section of all cores
D : Cable Diameter (mm)


Part 1
Part 2
Part 3
Harmonized type H
Approved national type A
Rated Voltage U_o/U
300 / 300 V 03
300 / 500 V 05
450 / 750 V 07
Insulation
PVC V
Naturel and/or Butadiene-Styrene Rubber R
Silicone Rubber S
Sheathing
PVC V
Naturel and/or Butadiene-Styrene Rubber R
Polychloroprene Rubber N
Glass-Fibre Braiding J
Textile Braiding T
Textile Braiding with Flame-Retardant Compound T2
Construction
Flat, Divisible H
Flat, non-divisible H2
Core Filler D5
Conductors
Solid -U
Stranded -R
Fine-Stranded, for Permanent Installation -K
Fine-Stranded, Flexible -F
Extra Fine-Stranded, Flexible -H
Tinsel Cords -Y
No. of Cores ...
Protective Conductor
Without Protective Conductor X
With Protective Conductor G
Rated Cross-Section of Conductor ...

(TS HD 361.S3)

Symbols	Materials
	Insulating and Unmetalic Sheath Materials
E	Polyethylene
N	Polychloroprene
V	PVC
X	Cross-linked polyethylene
Z1	Thermoplastic material has a suitable low level corrosive gas emission with polyethlene basis for low smoke emission
	Metalic Covers
AT	Aluminium screen
A8	Aluminium screen over each core
C4	Copper wire braiding over cores
C7	Copper screen from the ribbon or tape or copper wire
C8	over each core as C7
	Armouring
Z2	Galvanized or plain round steel wire armour
Z3	Galvanized or plain flat steel wire armour
Z4	Galvanized or plain steel tape armour
Y2	Round aluminium wire armour
Y3	Flat aluminium wire armour
	Special Construction
	Circular constructed cable
H	Sheathed or unsheathed separable flat constructed cable
H2	Unseparable flat constructed cables and cordon
H4	Multicore flat cable with non insulated one conductor
H5	Stranded cable with two or more cores together
H6	Flat cable with two or more
	Conductor Material
	Copper
-A	Aluminium
	Conductor Shape
-F	Twisted cable or twisted conductor of cordon
-H	Twisted cable or high level twisted conductor of cordon
-K	One cable conductor for fixed installation
-R	Rigid, round conductor, braided
-S	Rigid, with sector shaped conductor, braided
-U	Rigid, round conductor, solid
-W	Rigid, with sector shaped conductor, solid
-Y	Conductor with the shape of the bride wire

Example : YVV-U

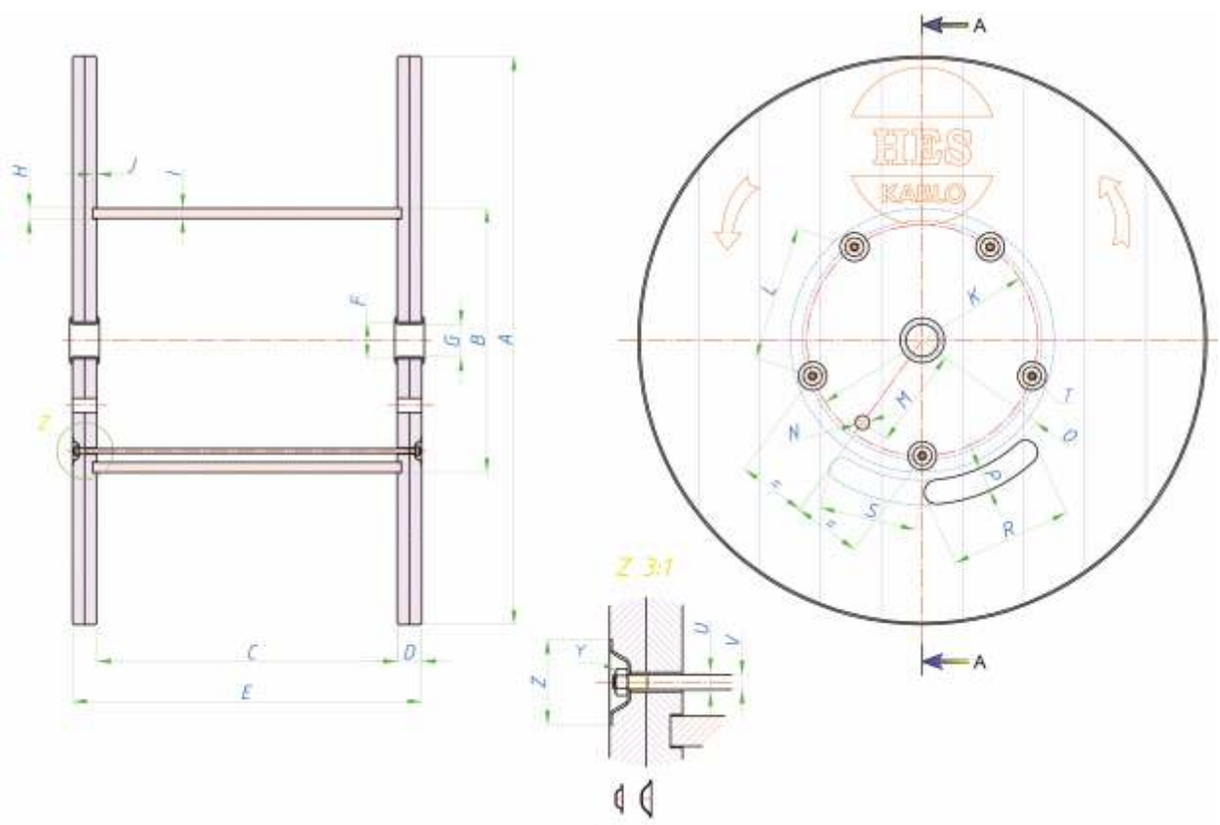
Example : YVZ2V-R

Example : YAXC8VZ3V-R

VDE 0271	Explanation
A	*Aluminium conductor*
Y	*Polyvinylichloride insulation or sheath*
2Y	*Polyethylene*
2X	*Cross-linked polythylene*
H	*Sheath or tape conductive layer*
S	*Copper shield*
SE	*Metallic screen (copper) over each core*
C	*Concentric copper conductor*
F	*Galvanized flat steel wire armour*
R	*Galvanized round steel wire armour*
G	*Steel tape (for F and R)*
s	*Sector-shaped conductor*
v	*Compacted conductor*
rm	*Stranded conductors*
k	*Resistant againts corrosion*
W	*Resistant againts heat and corrosion*
u	*Flame retardant*

VDE 0250	Explanation
Y	*Thermoplastic insulation material (PVC)*
S	*Metallic screen*
G	*Rubber insulation*
2G	*Thermo resistant*
W	*Resistant against air conditions*
u	*Flame retardant*
AF	*Stranded cable*
B	*Metal Sheath (lead)*
T	*Pilot core (textile, steel or similar)*
ö	*Oil resistant*
J	*Green / Yellow conductor for earth*

Flange Diameter	Hub	The Width Of The Reel	The Reel Outer Width	Belly Hole Diameter	Approximate Weight Reel
mm	mm	mm	mm	mm	Kg
700	350	280	360	80	40
800	350	460	540	80	60
900	400	460	540	80	80
1000	500	620	720	80	115
1100	600	620	720	80	140
1200	600	620	720	80	160
1300	650	670	770	80	190
1400	650	670	770	80	245
1500	750	670	770	80	275
1500	750	920	1020	80	350
1600	800	960	1080	108	370
1700	800	960	1080	108	500
1800	1000	960	1100	108	520
1900	1000	960	1100	108	550
2000	1000	960	1100	108	580
2100	1100	1150	1290	108	770
2200	1200	1250	1410	108	840
2300	1300	1400	1560	108	870
2400	1400	1550	1730	135	930
2500	1500	1650	1830	135	1000



Drums

Cable Diameter (mm)	700	800	900	1000	1100	1200	1300	1400	1500 A:680	1500 A:900	1600	1700	1800	1900	2000	2100	2200	2400
4	3580																	
5	2310	5204																
6	1518	3583	5123															
7	1122	2574	3718	5808														
8	866	1935	2911	4537	5142	6751												
9	665	1539	2292	3526	3996	5193	7078											
10	554	1301	1879	2923	3312	4384	5791	7009										
11	412	928	1424	2244	2543	3326	4633	5502	6039									
12	342	788	1164	2803	2043	2885	3910	4690	5148									
13	277	660	1001	1551	1758	2393	3248	4020	4412									
14	264	603	850	1348	1528	2116	2758	3402	3733	4978								
15	208	509	735	1160	1314	1855	2396	3044	3341	4455								
16	196	422	629	985	1117	1612	2108	2570	2821	3762	4752							
17	158	407	607	933	1058	1425	1804	2319	2546	3309	4224							
18	148	330	511	801	908	1250	1630	2026	2224	3005	3598	4372						
19	139	317	490	754	855	1086	1434	1804	1980	2659	3205	3928	3665	4466				
20	115	304	423	658	745	1052	1394	1643	1803	2386	3077	3583	3515	4069				
21	86	198	343	547	620	820	1112	1443	1584	2079	2546	3005	2904	3408	4431			
22	79	189	286	462	524	792	1045	1256	1379	1838	2270	2703	2587	3062	4030			
23	79	189	286	429	486	662	919	1121	1230	1655	2010	2577	2288	2916	3649	4525		
24		179	272	412	467	636	889	1082	1188	1570	1961	2357	2231	2666	3286	4017	4723	
25		136	221	339	385	543	772	957	1050	1400	1720	2090	1953	2360	3017	3701	7274	
26		128	208	325	369	520	717	901	1011	1322	1629	1980	1901	2297	2866	3540	4103	
27				311	353	498	689	805	884	1167	1452	1787	1645	2014	2616	3168	3686	4926
28				311	353	436	613	773	849	1131	1410	1736	1597	1955	2475	3092	3526	4747
29				247	280	416	588	741	813	1096	1369	1556	1549	1750	2244	2745	3216	4263
30				236	267	396	564	638	700	955	1207	1508	1364	1695	2178	2675	3067	4180
31				236	267	396	472	609	668	923	1131	1296	1320	1504	1961	2419	2778	3726
32				224	254	322	450	609	668	891	1131	1296	1276	1454	1900	2288	2709	3571
33				212	240	305	450	515	566	764	984	1253	1109	1403	1697	2051	2372	3224
34					240	305	429	515	566	735	950	1100	1069	1230	1640	1991	2308	3153
35					182	288	429	490	537	707	916	1061	1030	1185	1584	1931	2244	3009
36					182	288	349	464	509	707	784	1021	915	1185	1400	1715	1998	2693
37					171	226	331	406	445	594	754	982	880	1139	1400	1715	1939	2627
38					171	226	331	383	421	569	754	884	845	984	1348	1659	1881	2562
39					160	212	313	383	421	569	724	849	845	984	1178	1458	1710	2269
40							313	383	421	544	724	849	810	943	1178	1408	1656	2209
41							260	361	396	520	607	813	678	902	1131	1408	1603	2150
42							245	361	396	520	581	691	678	802	1084	1358	1549	2090
43							245	290	318	424	581	691	647	766	976	1177	1394	1827
44									318	424	554	660	647	766	933	1177	1346	1827
45									318	424	554	660	616	729	933	1131	1298	1773
46									297	403	453	629	528	729	891	1131	1298	1720
47									297	403	453	550	528	638	792	965	1111	1481
48									297	382	453	550	502	606	754	925	1111	1481
49									276	382	430	522	502	606	754	925	1068	1433
50											430	522	475	574	754	925	1068	1433
51											407	495	475	574	717	885	1026	1385
52											407	495	475	574	717	885	1026	1337
53											407	424	449	465	594	739	860	1170
54													374	465	594	739	860	1129
55													374	465	594	704	823	1129
56													352	437	561	704	823	1087
57													352	437	561	704	785	1087
58													352	437	561	669	785	1045
59													330	410	528	669	785	1045
60													330	410	528	669	748	1045
61													264	342	453	543	641	860
62													264	342	453	543	641	860
63													246	319	424	543	609	824
64													246	319	424	513	609	824
65													246	319	424	513	609	824
66													246	319	424	513	577	788
67																427	481	657
68																402	481	657
69																402	481	627
70																402	454	627
71																402	454	627
72																377	454	597
73																377	454	597
74																	427	597
75																	427	597
76																	427	567
77																	427	567
78																	427	567
79																	401	537
80																		537

Cable Diameter * 15
Cable Diameter * 18
Cable Diameter * 22