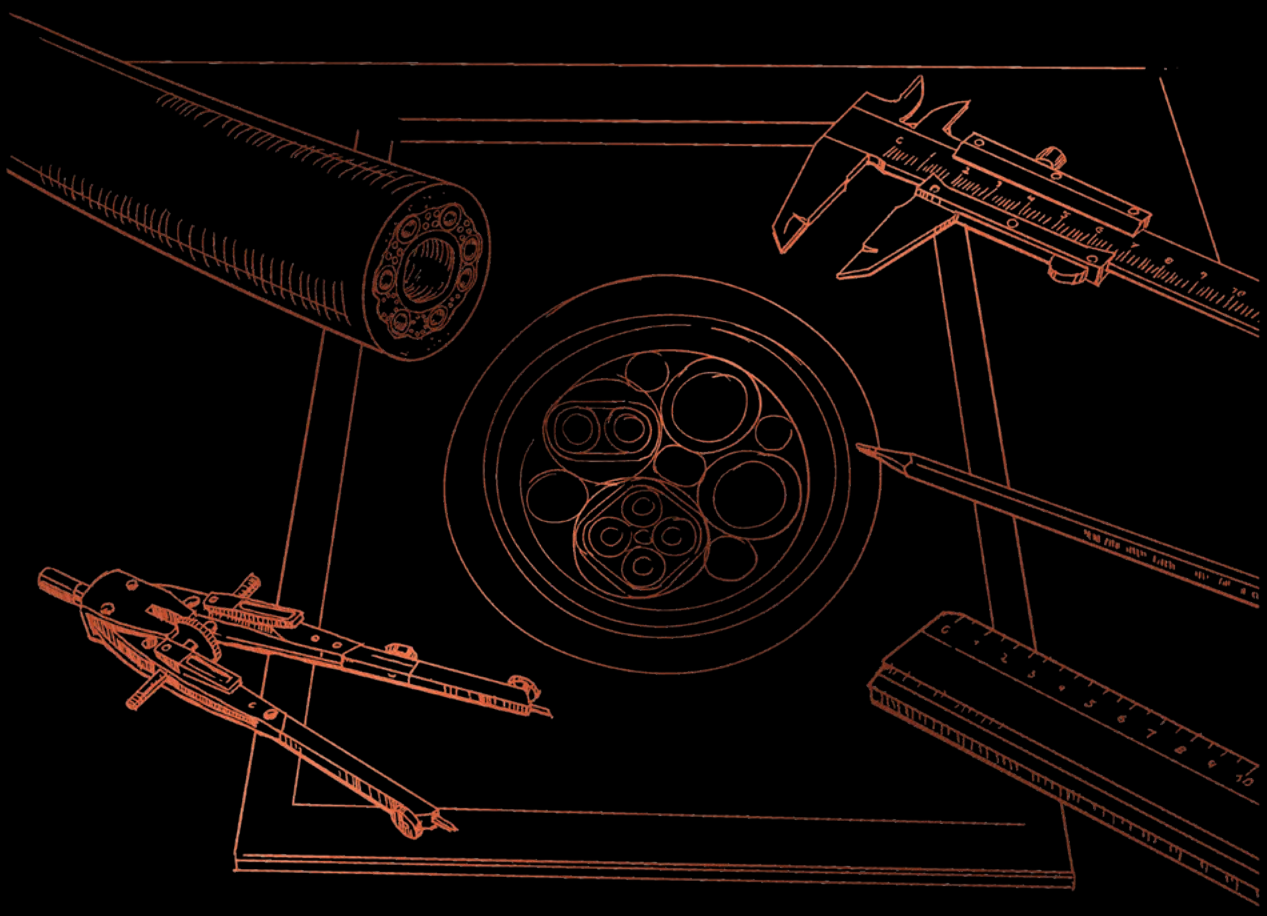
HELU

Summary

TECHNICAL APPENDIX

Ed. 1 // EN



Always stay electrified.

Contents

CONDUCTOR RESISTANCE

(DIN VDE 0295, IEC 60228)

Nominal cross section mm²	Bare Cu conductor (Ohm/km)		Tinned Cu conductor (Ohm/km)		Aluminium conductor (Ohm/km)
	Class 1 and 2	Class 5 and 6	Class 1 and 2	Class 5 and 6	Class 1 and 2
0.5	36.0	39.0	36.7	40.1	-
0.75	24.5	26.0	24.8	26.7	-
1.0	18.1	19.5	18.2	20.0	-
1.5	12.1	13.3	12.2	13.7	-
2.5	7.41	7.98	7.56	8.21	-
4.0	4.61	4.95	4.70	5.09	-
6.0	3.08	3.30	3.11	3.39	-
10.0	1.83	1.91	1.84	1.95	3.08

Class 1 = Solid conductors for single and multi-core cables
Class 2 = Stranded conductors for single and multi-core cables
Class 5 = Finely stranded, Cu conductors for single and multi-core cables
Class 6 = Very finely stranded, Cu conductors for single and multi-core cables

CONDUCTOR STRUCTURE

(DIN VDE 0295, IEC 60228)

The number of wires in columns 2-7 may vary. Acc. to DIN VDE 0295, the maximum Ø of single wires and the maximum conductor resistance at 20˚C are decisive for the structure of the conductor.

Conductor cross section mm²	Stranded conductors	Multi-stranded conductors	Flexible conductors	Very flexible conductors			
	Class 2 DIN VDE 0295		Class 5 DIN VDE 0295	Class 6 DIN VDE 0295			
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
	Number of wires[3] x Single wire Ø mm	Number of wires[1] x Single wire Ø mm	Wire count[1] x single wire[2] ø mm	Wire count[1] x single wire[2] ø mm	Number of wires[1] x Single wire Ø mm	Wire count[1] x Single wire Ø mm	Wire count[1] x Single wire Ø mm
0.5	7 x 0.30	7 x 0.30	~16 x 0.2	~28 x 0.15	~64 x 0.1	~131 x 0.07	~256 x 0.05
0.75	7 x 0.37	7 x 0.37	~24 x 0.2	~42 x 0.15	~96 x 0.1	~195 x 0.07	~384 x 0.05
1	7 x 0.43	7 x 0.43	~32 x 0.2	~56 x 0.15	~128 x 0.1	~260 x 0.07	~512 x 0.05
1.5	7 x 0.52	7 x 0.52	~30 x 0.2	~84 x 0.15	~192 x 0.1	~392 x 0.07	~768 x 0.05
2.5	7 x 0.67	~19 x 0.41	~50 x 0.2	~140 x 0.15	~320 x 0.1	~651 x 0.07	~1280 x 0.05
4	7 x 0.85	~19 x 0.52	~56 x 0.2	~224 x 0.15	~512 x 0.1	~1040 x 0.07	-
6	7 x 1.05	~19 x 0.64	~84 x 0.2	~192 x 0.2	~768 x 0.1	~1560 x 0.07	-
10	7 x 1.35	~49 x 0.51	~80 x 0.2	~320 x 0.2	~1280 x 0.1	~2600 x 0.07	-

[1] Data on wire count may vary.

[2] Acc. to DIN VDE 0295, the diameters of the single wires of each conductor may not exceed the given max. value. The single wires of a conductor must be of the same nominal diameter.

[3] The min. single wire count for uncompressed conductors. The single wires of a conductor must have the same nominal diameter.

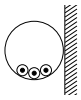
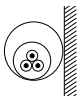
[2] **Ref:** maximum permissible diameter of single wires

Nominal value mm	Max. value mm
0.2	0.21
0.25	0.26
0.3	0.31
0.4	0.41
0.5	0.51
0.6	0.61

CURRENT CARRYING CAPACITY FOR INSTALLATION TYPES A1, A2, B1, AND B2

CABLES AND WIRES FOR PERMANENT INSTALLATION IN BUILDINGS

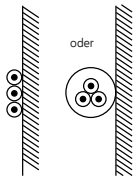
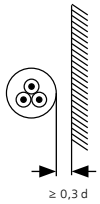
Conductor operating temperature 70˚C, environmental temperature 30˚C

Model abbreviations	**H07V-U, -R, -K**		**NYM, NHXMH, NYY, NYCY**		**H07V-U, -R, -K**		**NYM, NHXMH, NYY, NYCY**	
Installation: - in insulated walls - in electrical installation tubing	Single cores in electrical installation tubing in an insulated wall		Multi-core cable or multi-core, sheathed cable in an electrical installation tube in an insulated wall		Single cores in electrical installation tubing on a wall		Multi-core cable or multi-core, sheathed cable in an electrical installation tube on a wall	
								
	Installation in insulated walls				**Installation in electrical installation tubing**			
Installation type	**A1**		**A2**		**B1**		**B2**	
Number of loaded cores	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**
Nominal cross section, mm²	**Current carrying capacity in ampere (A)**							
1.5	15.5	13.5	15.5	13.0	17.5	15.5	16.5	15.0
2.5	19.5	18.0	18.5	17.5	24.0	21.0	23.0	20.0
4	26.0	24.0	25.0	23.0	32.0	28.0	30.0	27.0
6	34.0	31.0	32.0	29.0	41.0	36.0	38.0	34.0
10	46.0	42.0	43.0	39.0	57.0	50.0	52.0	46.0

CURRENT CARRYING CAPACITY FOR INSTALLATION TYPES C AND E

CABLES AND WIRES FOR PERMANENT INSTALLATION IN BUILDINGS

Conductor operating temperature 70˚C, environmental temperature 30˚C

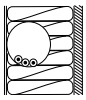
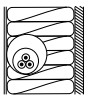
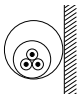
Model abbreviations	**NYM, NHXHM, NYY, NYCY** [1]			
Installation: - direct - in the open	Single or multi-core cables or single or multi-core sheathed cables on a wall		Multi-core cables or multi-core sheathed cables with spacing of at least 0.3 x diameter d from the wall	
				
	Direct installation		**Installation in the open**	
Installation type	**C**		**E**	
Number of loaded cores	**2**	**3**	**2**	**3**
Nominal cross section, mm²	**Current carrying capacity in ampere (A)**			
1.5	19.5	17.5	22.0	18.5
2.5	27.0	24.0	30.0	25.0
4	36.0	32.0	40.0	34.0
6	46.0	41.0	51.0	43.0
10	63.0	57.0	70.0	60.0

[1] For cables with concentric conductors, the load capacity is only valid for multi-core designs

CURRENT CARRYING CAPACITY FOR INSTALLATION TYPES A1, A2, B1, AND B2

CABLES AND WIRES FOR PERMANENT INSTALLATION IN BUILDINGS

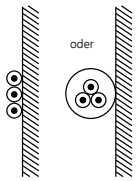
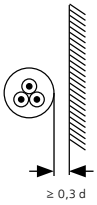
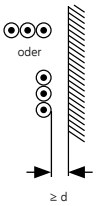
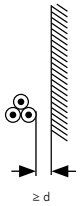
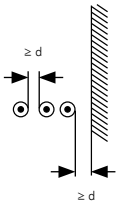
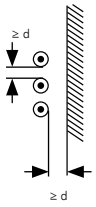
Conductor operating temperature 90˚C, environmental temperature 30˚C

Model abbreviations	**H07V2-K H07Z-U, -R. -K**		**N2XY, N2X2Y N2XH, N2XCH (N)HXH-FE180 (N)HXCH-FE180**		**H07V2-K H07Z-U, -R. -K**		**N2XY, N2X2Y N2XH, N2XCH (N)HXH-FE180 (N)HXCH-FE180**	
Installation: - in insulated walls - in electrical installation tubing	Single cores in electrical installation tubing in an insulated wall		Multi-core cable or multi-core, sheathed cable in an electrical installation tube in an insulated wall		Single cores in electrical installation tubing on a wall		Multi-core cable or multi-core, sheathed cable in an electrical installation tube on a wall	
								
	Installation in insulated walls				**Installation in electrical installation tubing**			
Installation type	**A1**		**A2**		**B1**		**B2**	
Number of loaded cores	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**
Nominal cross section, mm²	**Current carrying capacity in ampere (A)**							
1.5	19.0	17.0	18.5	16.5	23.0	20.0	22.0	19.5
2.5	26.0	23.0	25.0	22.0	31.0	28.0	30.0	26.0
4	35.0	31.0	33.0	30.0	42.0	37.0	40.0	35.0
6	45.0	40.0	42.0	38.0	54.0	48.0	51.0	44.0
10	61.0	54.0	57.0	51.0	75.0	66.0	69.0	60.0

CURRENT CARRYING CAPACITY FOR INSTALLATION TYPES C, E, F, AND G

CABLES AND WIRES FOR PERMANENT INSTALLATION IN BUILDINGS

Conductor operating temperature 90˚C, environmental temperature 30˚C

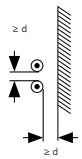
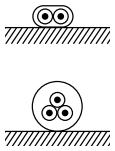
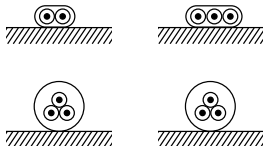
Model abbreviations	**N2XY, N2X2Y N2XH, N2XCH[1)] (N)HXH-FE180 (N)HXCH-FE180[1)]**				**N2XY, N2X2Y N2XH NHXHX-FE180**			
Installation: - direct - in the open	Single or multi-core cable on a wall		Multi-core cable with spacing of at least 0.3 x diameter d from the wall		Single-core cable with spacing of at least 1 x diameter d from the wall			
					with contact		with spacing d	
								
	Direct installation		**Installation in the open**					
Installation type	**C**		**E**		**F**		**G**	
Number of loaded cores	**2**	**3**	**2**	**3**	**2**	**3**		
Nominal cross section, mm²	**Current carrying capacity in ampere (A)**							
1.5	24.0	22.0	26.0	23.0	-	-	-	-
2.5	33.0	30.0	36.0	32.0	-	-	-	-
4	45.0	40.0	49.0	42.0	-	-	-	-
6	58.0	52.0	63.0	54.0	-	-	-	-
10	80.0	71.0	86.0	75.0	-	-	-	-

[1)] For cables with concentric conductors, the load capacity is only valid for multi-core designs

CURRENT CARRYING CAPACITY FOR CONDUCTORS AND SINGLE CORES

UP TO 1000 V AND HEAT-RESISTANT CABLES

Environmental temperature 30˚C

Model abbreviations	**H05V-U, -K H07V-U, -R, -K H07RN-F H05V2-K H07V2-K H05Z-K H07Z-K H05G-U, H05G-K H07G-U, -R, -K H05S-U, H05S-K H05SJ-K, A05SJ-U, -K KOMPO-SPEED 600 KOMPOSPEED 600-C MULTISPEED 600-PUR SINGLE 600 SINGLE 600-C**	**H05RR-F H05RN-F H07RN-F H05BQ-F H03VV-F H03VVH2-F H05VV-F H05VVH2-F H03VVH8-F H03VVH2H8-F H05VVH8-F H05VVH2H8-F [1]**	**JZ-500, JZ-600, JZ-602, JZ-750 SY-JZ, JZ-HF, F-CY-JZ MULTIFLEX 512 PUR PUR YELLOW HELUTHERM 120 PVC-FLAT NEO-FLAT TOPSERV, TOPFLEX MEGAFLEX 500 NSHTÖU H07RN-F YELLOWFLEX H05VVH6-F H07VVH6-F H05VV5-F, H05VVC4V5-K 05VV5-F, 05VVC4V5-K H05BQ-F, H07BQ-F UNIPUR, UNIPUR-CP**
Installation: - in the open - on oder against surfaces	in the open	on der against surfaces	
			

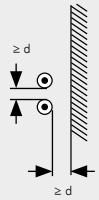
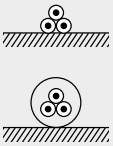
Number of loaded cores	**1**	**2**	**3**	**2 or 3**
Nominal cross section, mm²	**Current carrying capacity in ampere (A)**			
0.5	-	3.0	3.0	9.0
0.75	15.0	6.0	6.0	12.0
1	19.0	10.0	10.0	15.0
1.5	24.0	16.0	16.0	18.0
2.5	32.0	25.0	20.0	26.0
4	42.0	32.0	25.0	34.0
6	54.0	40.0	-	44.0

[1] The load capacities are valid for use in household and handheld appliances

CURRENT CARRYING CAPACITY FOR CABLES FROM 0.6/1 kV

SPECIALTY RUBBER-INSULATED SINGLE CORES, MULTI-CORE RUBBER-SHEATHED CABLES, AND CABLE HARNESSES

Conductor operating temperature 90˚C (80˚C); environmental temperature 30˚C

Model abbreviations	**NSGAÖU NSGAFÖU NSHXAÖ NSHXAFÖ**	**NSGAÖU NSGAFÖU NSGAFCMÖU NSHXAÖ NSHXAFÖ**	**NSSHÖU NT...**	**NT...**
Nominal voltage	**0.6/1 kV and 1.8/3 kV**	**3.6/6 kV**	**up to 6/10 kV**	**above 6/10 kV**
Allowable operating temperature at the conductor	**90˚C**		**-**	
Recommended operating temperature	**-**		**80˚C**	
Installation	**in the open**  		**on or against surfaces** 	
Number of loaded cores	**1**	**1**	**3**	**3**
Nominal cross section, mm²	**Current carrying capacity in ampere (A)**			
4	55	56	41	-
6	70	71	53	-
10	98	99	74	-
16	132	133	99	105

CURRENT CARRYING CAPACITY (GENERAL)

FOR FLEXIBLE CABLES NOT INCLUDED IN THE PREVIOUS TABLES

Environmental temperature 30˚C

Nominal cross section, mm²	Group 1	Group 2	Group 3
	Cu conductor	Cu conductor	Cu conductor
	A	A	A
0,5	9	9	12
0,75	12	12	15
1,0	15	15	19
1,5	18	18	24
2,5	26	26	32
4	34	34	42
6	44	44	54
10	61	61	73

Group 1 Individual or multiple single-core cables installed in piping, e.g., PVC single-core cables H03V../H05V../H07V..

Group 2 Multi-core cables, e.g., sheathed cables, flexible cables, conduit wires in the open or ventilated channels

Group 3 Single-core cables installed in the open where the conductors are laid with spacing of at least the diameter of the cable, as well as single corewiring in control and distribution systems and busbar distributors.

CURRENT CARRYING CAPACITY FOR HELUTHERM® 145

OPERATING TEMPERATURE AT THE CONDUCTOR 120°C

For continuous operation at environmental temperatures of 30°C. Conversion factors for differing operational conditions see tables below. Sufficiently large or ventilated rooms in which the environmental temperature is not noticebly affected by heat given off by cables. Protection against direct heat radiation from the sun, etc.

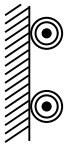
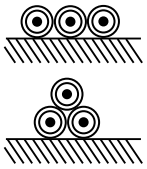
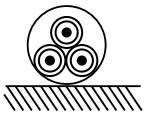
Installation				
	in the open	**on surfaces without mutual contact**	**on surfaces with mutual contact**	**in tubing, channeling, housing**
Conversion factors for bundling	**-**	**acc. to table 1**	**acc. to table 2***	**acc. to table 3**
Nominal cross section, mm²	**Current carrying capacity in ampere (A) up to 30˚C environmental temperature**			
0.25	13	12	9	7
0.33	17	15	11	9
0.50	19	18	12	10
0.75	24	23	17	13
1.0	31	30	20	17
1.5	39	36	25	20
2.5	51	48	33	26
4	68	65	45	36
6	88	84	58	46
10	121	116	80	64
16	160	152	106	85
25	211	200	140	111
35	261	248	172	138
50	320	304	211	169
70	411	391	272	217
95	502	476	331	265
120	587	558	387	310
150	680	646	449	359
185	781	743	516	413
240	931	884	614	492

***Table 2 also applies to HELUTHERM 145 MULTI / HELUTHERM 145 MULTI-C**

Conversion factors for bundling

Number of alternating and direct current circuits of single-core cables		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**12**
Table 1	Factor	1.00	0.94	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Table 2	Factor	1.00	0.85	0.79	0.75	0.73	0.72	0.72	0.71	0.70	0.70	0.70
Table 3	Factor	1.00	0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.48	0.45

Conversion factors for differing environmental temperatures

Temperature in ˚C	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**145**
Factor	1.05	1.00	0.94	0.88	0.82	0.75	0.67	0.58	0.53	0.47	0.41	0.33	0.24	0.17	0.01

CURRENT CARRYING CAPACITY FOR SILICONE-INSULATED CABLES

The values in the following table are approximate. For each individual case, these are to be selected corresponding to their use.

Heat resistance at ambient temperatures up to 150˚C

	Group 1	Group 2	Group 3
Nominal cross section, mm²	**Load capacity A**		
0.25	2.8	-	5
0.5	6	7	10
0.75	9	12	15
1	12	15	19
1.5	16	18	24
2.5	21	26	32
4	28	34	42
6	36	44	54
10	49	61	73
16	65	82	98
25	85	108	129
35	105	135	158
50	140	168	198
70	175	207	245
95	210	250	292
120	250	292	344
150	-	335	391
185	-	382	448
240	-	453	528
300	-	523	608

Group 1: One or more single-core cables installed in piping
Group 2: Multi-core, sheathed cables, flexible cables in open or ventilated channels
Group 3: Single-core cables installed in the open where the cables are installed with a separation of at least the diameter of the cable itself

Load capacity at ambient temperatures up to 150˚C
The following conversion values apply:

Temperature ˚C	Current carrying capacity values in %
up to 150	100
above 150 up to 155	91
above 155 up to 160	82
above 160 up to 165	71
above 165 up to 170	58
above 170 up to 175	41

CURRENT CARRYING CAPACITY FOR NYY, NAYY, NYCY, NYCWY, NAYCWY 0.6/1 kV

Current carrying capacity in ampere (A), installation underground (20˚C) acc. to DIN VDE 0276 part 603, cyclic load degree 0.7[2)]

Nominal cross section, mm²	Copper conductor					Aluminium conductor				
	NYY			NYCY	NYCWY	NAYY			NAYCY	NAYCWY
			 [1)]					 [1)]		
16	107	102	160	108	102	-	-	-	-	-
25	138	133	208	139	133	106	102	160	108	103
35	164	159	250	166	160	127	123	193	129	123
50	195	188	296	196	190	151	144	230	153	145

Current carrying capacity in ampere (A), installation in the open (30˚C)

Nominal cross section, mm²	Copper conductor					Aluminium conductor				
	NYY			NYCY	NYCWY	NAYY			NAYCY	NAYCWY
			 [1)]					 [1)]		
16	84	79	107	89	80	-	-	-	-	-
25	114	106	144	119	108	87	82	110	91	83
35	139	129	176	146	132	107	100	135	112	101
50	169	157	214	177	160	131	119	166	137	121

[1)] Rated current in direct current systems with a distant return conductor

[2)] Definition of the degree of loading see DIN VDE 0276-603, table 16

Conversion factors for multi-core cables (from 5 cores)

The conversion factors are to be used when installing underground or in the open using values in the above tables.

Number of loaded cores n	Installation underground f	Installation in the open f
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

Note: applies to conductor cross sections from 1.5 to 10 mm

CURRENT CARRYING CAPACITY FOR N2XY, NA2XY, NA2XCY, 0:6/1 kV

Current carrying capacity in ampere (A), installation underground (20˚C) acc. to DIN VDE 0276 part 603, cyclic load degree 0.7[2)]

Nominal cross section, mm²	Copper conductor						Aluminium conductor	
	N2XY			N2XCY			NA2XY	
			 [1)]					 [1)]
16	115	112	176	117	113	-	-	-
25	148	145	229	150	146	114	112	177
35	177	174	275	179	176	136	135	212
50	209	206	326	211	208	162	158	252

Current carrying capacity in ampere (A), installation in the open (30˚C)

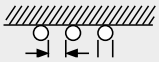
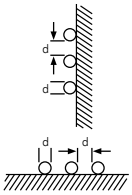
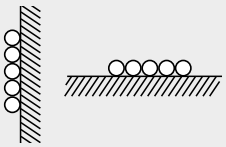
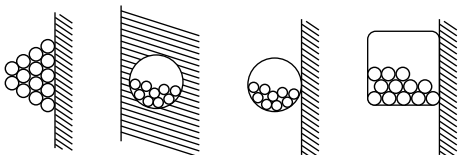
Nominal cross section, mm²	Copper conductor						Aluminium conductor	
	N2XY			N2XCY			NA2XY	
			 [1)]					 [1)]
16	102	98	131	109	100	-	-	-
25	138	133	177	146	136	106	102	136
35	170	162	217	179	165	130	126	166
50	207	197	265	218	201	161	149	205

[1)] Rated current in direct current systems with a distant return conductor

[2)] Definition of the degree of loading see DIN VDE 0276-603, table 16

CURRENT CARRYING CAPACITY – CONVERSION FACTORS

FOR BUNDLING ON A WALL, ON THE FLOOR, IN INSTALLATION PIPING OR CHANNELS, AND UNDER THE CEILING

Number of multi-core cables or AC or DC circuits made of single-core cables	1	2	3	5	7	9
Installation conditions	**Conversion factors**					
Single layer under the ceiling, with contact 	0.95	0.81	0.72	0.66	0.63	0.61
Single layer under the ceiling, with space equal the outer diameter d 	0.95	0.85	0.85	0.85	0.85	0.85
Single layer on the wall or on the floor, with space equal to the outer diameter d 	1.00	0.94	0.90	0.90	0.90	0.90
Single layer on the wall or on the floor, with contact 	1.00	0.85	0.79	0.73	0.72	0.70
Bundled directly on the wall, on the floor, in electircal installation tubing or channels, or on or in the wall 	1.00	0.80	0.70	0.60	0.54	0.50

Notes:
- These factors are to be applied when determining the current carrying capacity of identical or identically loaded cables when bundled in the same installation conditions. The conductor cross sections may not differ by more than one size.
- If the thin, horizontal separation between neighbouring cables is more than double its outer diameter, no reduction factor needs to be applied.
- The same reduction factors are to be used with groups of two or three single-core cables or multi-core cables.

If a system consists of both two-core and three-core cables, the total number of cables will be assumed equal to the number of circuits. The applicable factor is to be used either on the table for two loaded conductors of two-core cables or on the table for three loaded conductors of three-core cables.
If a group consists of n loaded, single-core cables or wires, it may be considered as n/2 circuits, each with two loaded conductors or as n/3 circuits, each with three loaded conductors.

CURRENT CARRYING CAPACITY – CONVERSION FACTORS

FOR DIFFERING ENVIRONMENTAL TEMPERATURES

Conversion factors for different environmental remperatures

Allowable operating temperature	60˚C	70˚C	80˚C	85˚C	90˚C
Environmental temperature ˚C					
30	1,00	1,00	1,00	1,00	1,00
40	0,82	0,87	0,89	0,90	0,91
55	0,41	0,61	0,71	-	0,76
60	-	0,50	0,63	-	0,71
70	-	-	0,45	-	0,58
80	-	-	-	-	0,41

Conversion factors for heat-resistant cables

Allowable operating temperature	80˚C	90˚C	110˚C	135˚C	180˚C
Environmental temperature ˚C					
up to 50	1,00	1,00	1,00	1,00	1,00
55	0,91	0,94	1,00	1,00	1,00
70	0,58	0,71	1,00	1,00	1,00
80	-	0,50	1,00	1,00	1,00
105	-	-	0,41	0,87	1,00
130	-	-	-	0,35	1,00
175	-	-	-	-	0,41

Conversion factors for multi-core cables with nominal conductor cross sections up to 10 mm²

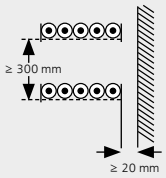
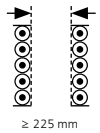
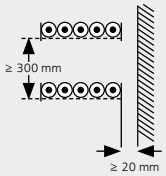
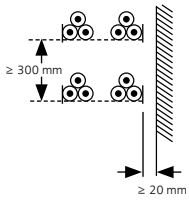
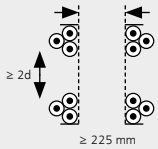
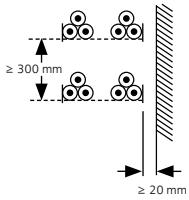
Number of loaded cores	Conversion factors
5	0,75
7	0,65
10	0,55
14	0,50
19	0,45

Umrechnungsfaktoren für aufgewickelte Leitungen

Number of layers on the drum	1	2	3	4	5
Conversion factors	0.80	0.61	0.49	0.42	0.38
Note: For spiral winding, use the conversion factor 0.80					

CURRENT CARRYING CAPACITY – CONVERSION FACTORS

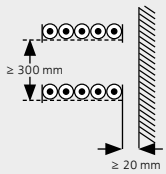
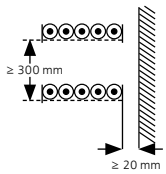
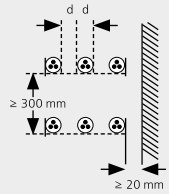
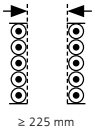
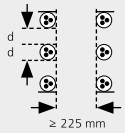
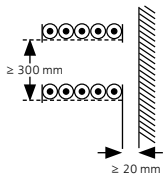
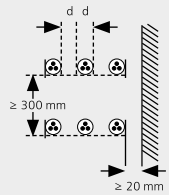
FOR BULDING OF SINGLE-CORE CABLES OR WIRES IN CABLE TROUGHS AND CABLE LADDERS

Number of three-pole circuits consisting of single-core cables or wires		To be used as a multiplier for the rated value of	Number of toughs or ladders	1	2	3
Installation type				**Conversion factors**		
Perforated cable troughs	**With contact** 	**Three cables or wires evenly arranged horizontally**	1	0.98	0.91	0.87
Perforated cable troughs	**With contact** 	**Three cables or Cables evenly arranged vertically**	1	0.96	0.86	-
Cable ladders	**With contact** 	**Three cables or wires evenly arranged horizontally**	1	1.00	0.97	0.96
Perforated cable troughs		**Three cables or wires in a horizontal triangular arrangement**	1	1.00	0.98	0.96
Perforated cable troughs		**Three cables or Cables evenly arranged triangular arrangement**	1	1.00	0.91	0.89
Cable ladders		**Three cables or wires in a horizontal triangular arrangement**	1	1.00	1.00	1.00

Note:
The conversion factors are only valid for groups of cables and wires installed in single layers. They do not apply if the cables or wires are installed in contact with one another or if the indicated separations between the cable troughs or cable ladders are not maintained. In such cases, the conversion factors must be reduced.
For circuits connected in parallel, every bundle of three cables in the parallel circuit should be viewed as a circuit.

CURRENT CARRYING CAPACITY – CONVERSION FACTORS

FOR BUNDLING OF MULTI-CORE CABLES IN TROUGHS AND LADDERS

Number of multi-core cables			1	2	3	4	5	6
Installation type		**Number of toughs or ladders**	**Conversion factors**					
Unperforated cable troughs	**With contact** 	1	0.97	0.84	0.78	0.75	0.71	0.68
Perforated cable troughs	**With contact** 	1	1.00	0.88	0.82	0.79	0.76	0.73
Perforated cable troughs	**With spacing** 	1	1.00	1.00	0.98	0.95	0.91	-
Perforated cable troughs	**With contact** 	1	1.00	0.88	0.82	0.78	0.73	0.72
Perforated cable troughs	**With spacing** 	1	1.00	0.91	0.89	0.88	0.87	-
Cable ladders	**With contact** 	1	1.00	0.87	0.82	0.80	0.79	0.78
Cable ladders	**With spacing** 	1	1.00	1.00	1.00	1.00	1.00	-

Note:
The conversion factors are only valid for groups of cables and wires installed in single layers. They do not apply if the cables or wires are installed in contact with one another or if the indicated separations between the cable troughs or cable ladders are not maintained. In such cases, the conversion factors must be reduced.

CURRENT CARRYING CAPACITY FOR XLPE-INSULATED MEDIUM-VOLTAGE CABLES, SINGLE CORE 6/10 kV, 12/20 kV, 18/30 kV
N2XSY, NA2XSY, N2XS2Y, NA2XS2Y, N2XS(F)2Y, NA2XS(F)2Y, N2XS(FL)2Y, NA2XS(FL)2Y

Current carrying capacity in ampere (A), installation underground (20˚C)

Conductor type	Copper conductor						Aluminium conductor					
Arrangements												
U_0/U	6/10 kV		12/20 kV		18/30 kV		6/10 kV		12/20 kV		18/30 kV	
Nominal cross section, mm²	Rated current in ampere (A)											
25	157	179	-	-	-	-	-	-	-	-	-	-
35	187	212	189	213	-	-	145	165	-	-	-	-
50	220	249	222	250	225	251	171	194	172	195	174	195
70	268	302	271	303	274	304	208	236	210	237	213	238

Current carrying capacity in ampere (A), installation in the open (30˚C)

Conductor type	Copper conductor						Aluminium conductor					
Arrangements												
U_0/U	6/10 kV		12/20 kV		18/30 kV		6/10 kV		12/20 kV		18/30 kV	
Nominal cross section, mm²	Rated current in ampere (A)											
25	163	194	-	-	-	-	-	-	-	-	-	-
35	197	235	200	235	-	-	153	182	-	-	-	-
50	236	282	239	282	241	282	183	219	185	219	187	219
70	294	350	297	351	299	350	228	273	231	273	232	273

ELECTRICAL CHARACTERISTICS OF XLPE-INSULATED MEDIUM-VOLTAGE CABLES, 6–30 kV

Conductor resistance at 20˚C

	Maximum values	
Cross section mm²	**Cu conductor Ohm/km**	**Al conductor Ohm/km**
25	0,727	1,2
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
500	0,0366	0,0605

Conversion factors for conductor temperatures

Temperature ˚C	**60**	**65**	**70**	**80**	**90**
Cu conductor	1.157	1.177	1.196	1.236	1.275
Al conductor	1.161	1.181	1.202	1.242	1.282

Conversion factors for conductor temperatures

$$R\delta = R_{20} \cdot \frac{234{,}5 + \delta}{254{,}5}$$ for Cu conductor

$$R\delta = R_{20} \cdot \frac{228 + \delta}{248}$$ for Al conductor

Conductor temperature in ˚C $= \delta$
Conductor temperature at δ ˚C in ohms/km $= R\delta$
Conductor temperature at 20 ˚C in ohms/km $= R_{20}$

ELECTRICAL CHARACTERISTICS OF XLPE-INSULATED MEDIUM-VOLTAGE CABLES, 6 - 30 kV

Resistance at 50 Hz (AC resistance)

Copper conductor						
Nominal voltage	**6 / 10 kV**		**12 / 20 kV**		**18 / 30 kV**	
Cross-section mm²						
	approx. Ohm / km					
35	0,671	0,673	0,671	0,672	-	-
50	0,497	0,498	0,496	0,498	0,496	0,497
70	0,345	0,346	0,345	0,346	0,344	0,346
95	0,249	0,251	0,249	0,250	0,249	0,250
120	0,198	0,200	0,198	0,200	0,198	0,199
150	0,163	0,165	0,163	0,165	0,162	0,164
185	0,132	0,134	0,131	0,133	0,131	0,133
240	0,102	0,104	0,101	0,103	0,101	0,103
300	0,082	0,085	0,082	0,084	0,082	0,084
400	0,068	0,071	0,067	0,070	0,067	0,069
500	0,055	0,058	0,055	0,058	0,054	0,057

Aluminium conductor						
Nominal voltage	**6 / 10 kV**		**12 / 20 kV**		**18 / 30 kV**	
Cross-section mm²						
	approx. Ohm / km					
35	1,12	1,12	1,12	1,12	-	-
50	0,825	0,826	0,825	0,826	0,824	0,826
70	0,571	0,572	0,571	0,572	0,571	0,572
95	0,413	0,415	0,413	0,414	0,413	0,414
120	0,327	0,329	0,327	0,329	0,327	0,328
150	0,269	0,271	0,268	0,270	0,268	0,270
185	0,215	0,217	0,215	0,217	0,214	0,216
240	0,165	0,167	0,165	0,167	0,164	0,166
300	0,133	0,135	0,133	0,135	0,133	0,135
400	0,106	0,109	0,106	0,109	0,106	0,108
500	0,085	0,088	0,084	0,087	0,084	0,087

Inductive resistance at 50 Hz

Nominal voltage	**6 / 10 kV**		**12 / 20 kV**		**18 / 30 kV**	
Cross-section mm²						
	in Ohm / km					
35	0,144	0,158	0,153	0,168	-	-
50	0,136	0,150	0,145	0,159	0,154	0,169
70	0,129	0,143	0,138	0,152	0,147	0,161
95	0,123	0,137	0,131	0,145	0,139	0,154
120	0,118	0,132	0,126	0,140	0,134	0,148
150	0,114	0,128	0,121	0,135	0,129	0,143
185	0,110	0,124	0,117	0,131	0,125	0,139
240	0,105	0,120	0,112	0,126	0,120	0,134
300	0,102	0,116	0,108	0,123	0,115	0,130
400	0,097	0,111	0,103	0,117	0,110	0,124
500	0,094	0,108	0,100	0,114	0,106	0,120

ELECTRICAL CHARACTERISTICS OF XLPE-INSULATED MEDIUM-VOLTAGE CABLES, 6 - 30 kV

Mutual capacitance

Nominal voltage	6 / 10 kV	12 / 20 kV	18 / 30 kV
Cross-section mm²	μF / km		
35	0.22	0.16	-
50	0.25	0.18	0.14
70	0.28	0.20	0.15
95	0.31	0.22	0.17
120	0.34	0.23	0.18
150	0.37	0.25	0.19
185	0.40	0.27	0.20
240	0.44	0.30	0.22
300	0.48	0.32	0.24
400	0.55	0.36	0.27
500	0.60	0.40	0.29

Inductance

Nominal voltage	6 / 10 kV		12 / 20 kV		18 / 30 kV	
Cross-section mm²						
	mH / km					
35	0.45	0.76	0.48	0.76	-	-
50	0.42	0.73	0.45	0.74	0.48	0.75
70	0.39	0.70	0.43	0.70	0.45	0.71
95	0.38	0.67	0.41	0.68	0.43	0.68
120	0.36	0.65	0.39	0.65	0.42	0.66
150	0.35	0.63	0.38	0.63	0.41	0.64
185	0.34	0.61	0.36	0.62	0.39	0.63
240	0.32	0.59	0.35	0.59	0.37	0.60
300	0.31	0.57	0.33	0.58	0.36	0.59
400	0.30	0.55	0.33	0.55	0.34	0.56
500	0.29	0.53	0.31	0.53	0.33	0.54

ELECTRICAL CHARACTERISTICS OF XLPE-INSULATED MEDIUM-VOLTAGE CABLES, 6 - 30 kV

Short-circuit current capacity
Conductor temperature: 90˚C
Short-circuit temperature: 250 ˚C

Cables with copper conductors

Conductor cross-section mm²	Short-circuit time in s (seconds)														
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.5	2.0	3.0	4.0	5.0
	permissible thermal short-circuit current in kA														
25	11.3	8.0	6.5	5.7	5.1	4.6	4.3	4.0	3.8	3.6	2.9	2.5	2.1	1.8	1.6
35	15.8	11.2	9.1	7.9	7.1	6.5	6.0	5.6	5.3	5.0	4.1	3.5	2.9	2.5	2.2
50	22.6	16.0	13.1	11.3	10.1	9.2	8.5	8.0	7.5	7.2	5.8	5.1	4.1	3.6	3.2
70	31.7	22.4	18.3	15.8	14.2	12.9	12.0	11.2	10.6	10.0	8.2	7.1	5.8	5.0	4.5
95	43.0	30.4	24.8	21.5	19.2	17.5	16.2	15.2	14.3	13.6	11.1	9.6	7.8	6.8	6.1
120	54.3	38.4	31.3	27.1	24.3	22.2	20.5	19.2	18.1	17.2	14.0	12.1	9.9	8.6	7.7
150	67.8	48.0	39.2	33.9	30.3	27.7	25.6	24.0	22.6	21.5	17.5	15.2	12.4	10.7	9.6
185	83.7	59.2	48.3	41.8	37.4	34.2	31.6	29.6	27.9	26.5	21.6	18.7	15.3	13.2	11.8
240	108.5	76.7	62.7	54.3	48.5	44.3	41.0	38.4	36.2	34.3	28.0	24.3	19.8	17.2	15.3
300	135.7	95.9	78.3	67.8	60.7	55.4	51.3	48.0	45.2	42.9	35.0	30.3	24.8	21.5	19.2
400	180.9	127.9	104.4	90.4	80.9	73.8	68.4	64.0	60.3	57.2	46.7	40.4	33.0	28.6	25.6
500	226.1	159.9	130.5	113.1	101.1	92.3	85.5	79.9	75.4	71.5	58.4	50.6	41.3	35.8	32.0

Cables with aluminium conductors

Conductor cross-section mm²	Short-circuit time in s (seconds)														
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.5	2.0	3.0	4.0	5.0
	permissible thermal short-circuit current in kA														
25	7.4	5.3	4.3	3.7	3.3	3.0	2.8	2.6	2.5	2.4	1.9	1.7	1.4	1.2	1.1
35	10.4	7.4	6.0	5.2	4.7	4.2	3.9	3.7	3.5	3.3	2.7	2.3	1.9	1.6	1.5
50	14.9	10.5	8.6	7.4	6.6	6.1	5.6	5.3	5.0	4.7	3.8	3.3	2.7	2.4	2.1
70	20.8	14.7	12.0	10.4	9.3	8.5	7.9	7.4	6.9	6.6	5.4	4.7	3.8	3.3	2.9
95	28.2	20.0	16.3	14.1	12.6	11.5	10.7	10.0	9.4	8.9	7.3	6.3	5.2	4.5	4.0
120	35.7	25.2	20.6	17.8	16.0	14.6	13.5	12.6	11.9	11.3	9.2	8.0	6.5	5.6	5.0
150	44.6	31.5	25.7	22.3	19.9	18.2	16.9	15.8	14.9	14.1	11.5	10.0	8.1	7.1	6.3
185	55.0	38.9	31.7	27.5	24.6	22.5	20.8	19.4	18.3	17.4	14.2	12.3	10.0	8.7	7.8
240	71.3	50.4	41.2	35.7	31.9	29.1	27.0	25.2	23.8	22.6	18.4	16.0	13.0	11.3	10.1
300	89.2	63.1	51.5	44.6	39.9	36.4	33.7	31.5	29.7	28.2	23.0	19.9	16.3	14.1	12.6
400	118.9	84.1	68.6	59.5	53.2	48.5	44.9	42.0	39.6	37.6	30.7	26.6	21.7	18.8	16.8
500	148.6	105.1	85.8	74.3	66.5	60.7	56.2	52.5	49.5	47.0	38.4	33.2	27.1	23.5	21.0

ELECTRICAL CHARACTERISTICS OF XLPE-INSULATED MEDIUM-VOLTAGE CABLES, 6 - 30 kV

Earthing current

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

Short-circuit current capacity of copper screens, short-circuit temperature: 350˚C

Short-circuit time in seconds s	Short-circuit current load in kA		
	at 16 mm²	25 mm²	35 mm²
	kA	kA	kA
0,1	9,7	15,1	21,2
0,2	6,9	10,7	15,1
0,3	5,7	8,9	12,5
0,4	5,0	7,7	10,9
0,5	4,5	7,0	9,8
0,6	4,2	6,4	9,0
0,7	3,9	6,0	8,4
0,8	3,5	5,6	7,9
0,9	3,4	5,3	7,5
1,0	3,3	5,1	7,2
1,5	2,7	4,2	5,9
2,0	2,3	3,6	5,1
3,0	1,9	2,9	4,2
4,0	1,7	2,6	3,6
5,0	1,5	2,3	3,2

Classification of screen cross-sections

Conductor cross-section mm²	Screen cross-section mm²
35 bis 120	16
150 bis 300	25
400 bis 500	35

CORE LABELLING ACC. TO DIN VDE 0293-308

Number of cores	with green/yellow protective conductor(-J)	without green/yellow protective conductor(-O)
2	-	blue/brown
3	green-yellow/blue/brown	brown/black/grey
3[1)]	-	blue/brown/black
4	green-yellow/brown/black/grey	blue/brown/black/grey
4[1)]	green-yellow/blue/brown/black	-
5	green-yellow/blue/brown/black/grey	blue/brown/black/grey/black
6 and more	green-yellow/the remaining black with printed numbers	black with printed numbers

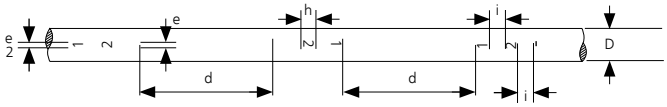
[1)] Only for certain applications

Core identification with printed numbers (printed longitudinally)

Label height and separation

Core nominal Ø mm	e[2)] mm	h mm	i mm	d mm
D < 2.4	> 0.6	> 2.3	approx. 2	< 50
2.4 < D (5.0	> 1.2	> 3.2	approx. 3	< 50
5.0 < D	> 1.6	> 4.6	approx. 4	< 50

[2)] For digit 1, the minimum value for the width is half the measure listed in this column.



e: Width of label
h: Height of ID code
i: Separation between two consecutive digits and between digits and dashes
d: Separation between two consecutive labels

""Excerpts from the DIN VDE 0293 standard are reproduced for the registered limited edition with permission ref. 102.025 from the German Institute for Standardization (DIN) and the Institute of Electrical and Electronics Engineers (VDE). Any further reproduction or printing of these materials is subject to a specific permit. Maßgebend für das Anwenden der Normen sind deren Fassungen mit dem neuesten Ausgabedatum, die bei der VDE VERLAG GMBH, Bismarckstr. 33, 10625 Berlin, www.vde-verlag.de, erhältlich sind."

CORE IDENTIFICATION ACC. TO DIN 47100

WITH COLOUR REPETITION FROM 45th CORE

Electronic control cables and computer cables: core stranding
The first colour is the base colour of the core. For multi-colour cores, colouring is a combination of a base colour and a ring colour. The second or third colours are added as ring colour coding. Ring widths 2-3 mm. Slight blurriness of identification colours on the edges and a small offset of the two half-rings is permissible. Counted from the outside in through all layers consecutively and concordantly.

No. Base/ring colours	No. Base/ring colours	No. Base/ring colours	No. Base/ring colours
1 white	17 white-grey	33 green-red	45 white
2 brown	18 grey-brown	34 yellow-red	46 brown
3 green	19 white-pink	35 green-black	47 green
4 yellow	20 pink-brown	36 yellow-black	48 yellow
5 grey	21 white-blue	37 grey-blue	49 grey
6 pink	22 brown-blue	38 pink-blue	50 pink
7 blue	23 white-red	39 grey-red	51 blue
8 red	24 brown-red	40 pink-red	52 red
9 black	25 white-black	41 grey-black	53 black
10 violet	26 brown-black	42 pink-black	54 violet
11 grey-pink	27 grey-green	43 blue-black	55 grey-pink
12 red-blue	28 yellow-grey	44 red-black	56 red-blue
13 white-green	29 pink-green	–	57 white-green
14 brown-green	30 yellow-pink	–	58 brown-green
15 white-yellow	31 green-blue	–	59 white-yellow
16 yellow-brown	32 yellow-blue	–	60 yellow-brown
–	–	–	61 white-grey

CORE IDENTIFICATION IN ALIGNMENT WITH DIN 47100*

Without colour repetition

No. Base/ring colours	No. Base/ring colours	No. Base/ring colours	No. Base/ring colours
1 white	17 white-grey	33 green-red	45 white-brown-black
2 brown	18 grey-brown	34 yellow-red	46 yellow-green-black
3 green	19 white-pink	35 green-black	47 grey-pink-black
4 yellow	20 pink-brown	36 yellow-black	48 red-blue-black
5 grey	21 white-blue	37 grey-blue	49 white-green-black
6 pink	22 brown-blue	38 pink-blue	50 brown-green-black
7 blue	23 white-red	39 grey-red	51 white-yellow-black
8 red	24 brown-red	40 pink-red	52 yellow-brown-black
9 black	25 white-black	41 grey-black	53 white-grey-black
10 violet	26 brown-black	42 pink-black	54 grey-brown-black
11 grey-pink	27 grey-green	43 blue-black	55 white-pink-black
12 red-blue	28 yellow-grey	44 red-black	56 pink-brown-black
13 white-green	29 pink-green	–	57 white-blue-black
14 brown-green	30 yellow-pink	–	58 brown-blue-black
15 white-yellow	31 green-blue	–	59 white-red-black
16 yellow-brown	32 yellow-blue	–	60 brown-red-black
–	–	–	61 black-white

*deviation to DIN, without colour repetition, from core no. 45 and above

CORE IDENTIFICATION ACC. TO DIN 47100

WITH COLOUR REPETITION

Electronic Control Cables and Computer Cables: Paired Stranding
The first colour is the base colour of the core. For multi-colour paired cores, colouring is a combination of a base colour and a ring colour. The second colour is used as a ring colour coding. Ring widths 2-3 mm. Slight blurriness of identification colours on the edges and a small offset of the two half-rings is permissible. Counted from the outside in through all layers consecutively and concordantly.

Paired stranding Pair no.			Core	Colour
1	23	45	a	white
			b	brown
2	24	46	a	green
			b	yellow
3	25	47	a	grey
			b	pink
4	26	48	a	blue
			b	red
5	27	49	a	black
			b	violet
6	28	50	a	grey-pink
			b	red-blue
7	29	51	a	white-green
			b	brown-green
8	30	52	a	white-yellow
			b	yellow-brown
9	31	53	a	white-grey
			b	grey-brown
10	32	54	a	white-pink
			b	pink-brown
11	33	55	a	white-blue
			b	brown-blue

Paired stranding Pair no.			Core	Colour
12	34	56	a	white-red
			b	brown-red
13	35	57	a	white-black
			b	brown-black
14	36	58	a	grey-green
			b	yellow-grey
15	37	59	a	pink-green
			b	yellow-pink
16	38	60	a	green-blue
			b	yellow-blue
17	39	61	a	green-red
			b	yellow-red
18	40	62	a	green-black
			b	yellow-black
19	41	63	a	grey-blue
			b	pink-blue
20	42	64	a	grey-red
			b	pink-red
21	43	65	a	grey-black
			b	pink-black
22	44	66	a	blue-black
			b	red-black

Colour code acc. to DIN 47002
for YV panel hookup wire
(if two colours, base colour is underlined)

wh	white	bn	brown
gn	green	ye	yellow
gy	grey	pk	pink
bu	blue	rd	red
bk	black	vt	violet
whbn	whitebrown	whgn	whitegreen
whye	whiteyellow	whbl	whiteblue
whrd	whitered	whbk	whiteblack
bngn	browngreen	bnye	brownyellow
bnbu	brownblue	bnbk	brownblack
gngye	greenyellow	gnrd	greenred
gnbk	greenblack	yebu	yellowblue
yerd	yellowred	yebk	yellowblack
gyrd	greyred	gybk	greyblack
pkbk	pinkblack	pkvt	pinkviolet
burd	bluered	rdbk	redblack
vtrd	violetred		

Colour code for YR bell sheathed cable

2 x 0.8: bk, bu
3 x 0.8: bk, bu, bn
4 x 0.8: bk, bu, bn, ye
5 x 0.8: bk, bu, bn, ye, gn
6 x 0.8: bk, bu, bn, ye, gn, vt
8 x 0.8: bk, bu, bn, ye, gn, vt, wh, og
10 x 0.8: bk, bu, bn, ye, gn, vt, wh, og, tr, gy
12 x 0.8: bk, bu, bn, ye, gn, vt, wh, og, tr, gy, rd, lbu
14 x 0.8: bk, bu, bn, ye, gn, vt, wh, og, tr, gy, rd, lbu, cog, lgn
16 x 0.8: bk, bu, bn, ye, gn, vt, wh, og, tr, gy, rd, lbu, cog, lgn, lrd, lye

CORE IDENTIFICATION ACC. TO INTERNATIONAL COLOUR CODE

Electronic control cables UL version: Stranded cores
The first colour is the base colour of the core. For multi-colour cores, colouring is a combination of a base colour and a ring colour. The second colour is used as a ring colour coding. Ring widths 2-3 mm. Slight blurriness of identification colours on the edges and a small offset of the two half-rings is permissible. Counted from the inside out through all layers consecutively and concordantly.

No. Base/ring colours	No. Base/ring colours	No. Base/ring colours	No. Base/ring colours
1 black	16 white-green	31 green-red	46 grey-brown
2 brown	17 white-blue	32 green-orange	47 grey-red
3 red	18 white-violet	33 green-blue	48 grey-orange
4 orange	19 white-grey	34 green-violet	49 grey-yellow
5 yellow	20 brown-black	35 green-grey	50 grey-green
6 green	21 brown-red	36 green-white	51 grey-blue
7 blue	22 brown-orange	37 yellow-black	52 grey-violet
8 violet	23 brown-yellow	38 yellow-brown	53 grey-white
9 grey	24 brown-green	39 yellow-red	54 orange-black
10 white	25 brown-blue	40 yellow-orange	55 orange-brown
11 white-black	26 brown-violet	41 yellow-blue	56 orange-red
12 white-brown	27 brown-grey	42 yellow-violet	57 orange-yellow
13 white-red	28 brown-white	43 yellow-grey	58 orange-green
14 white-orange	29 green-black	44 yellow-white	59 orange-blue
15 white-yellow	30 green-brown	45 grey-black	60 orange-violet

CORE PAIR IDENTIFICATION ACC. TO INTERNATIONAL COLOUR CODE

Electronic control cables UL version: Stranded pairs
The first colour is the base colour of the core. For multi-colour paired cores, colouring is a combination of a base colour and a ring colour. The second colour is used as a ring colour coding. Ring widths 2-3 mm. Slight blurriness of identification colours on the edges and a small offset of the two half-rings is permissible. Counted from the inside out through all layers consecutively and concordantly.

Paired stranding Pair no.	Core	Colour
1	a	black
	b	brown
2	a	black
	b	red
3	a	black
	b	orange
4	a	black
	b	yellow
5	a	black
	b	green
6	a	black
	b	blue
7	a	black
	b	violet
8	a	black
	b	grey

Paired stranding Pair no.	Core	Colour
9	a	black
	b	white
10	a	brown
	b	red
11	a	brown
	b	orange
12	a	brown
	b	yellow
13	a	brown
	b	green
14	a	brown
	b	blue
15	a	brown
	b	violet
16	a	brown
	b	brown

Paired stranding Pair no.	Core	Colour
17	a	brown
	b	white
18	a	red
	b	orange
19	a	red
	b	yellow
20	a	red
	b	green
21	a	red
	b	blue
22	a	red
	b	violet
23	a	red
	b	grey
24	a	red
	b	white

CORE IDENTIFICATION TRAYCONTROL 300 / TRAYCONTROL 300-C

acc. to company specifications

TRAYCONTROL 300 / TRAYCONTROL 300-C (AWG 28-22)

No.	Base/ring colours	No.	Base/ring colours	No.	No. Base/ring colours
1	black	18	white/violet	35	white/red/orange
2	brown	19	white/grey	36	white/red/yellow
3	red	20	white/black/brown	37	white/red/green
4	orange	21	white/black/red	38	white/red/blue
5	yellow	22	white/black/orange	39	white/red/violet
6	green	23	white/black/yellow	40	white/red/grey
7	blue	24	white/black/green	41	white/orange/yellow
8	violet	25	white/black/blue	42	white/orange/green
9	grey	26	white/black/violet	43	white/orange/blue
10	white	27	white/black/grey	44	white/orange/violet
11	white/black	28	white/brown/red	45	white/orange/grey
12	white/brown	29	white/brown/orange	46	white/yellow/green
13	white/red	30	white/brown/yellow	47	white/yellow/blue
14	white/orange	31	white/brown/green	48	white/yellow/violet
15	white/yellow	32	white/brown/blue	49	white/yellow/grey
16	white/green	33	white/brown/violet	50	white/green/blue
17	white/blue	34	white/brown/grey		

TRAYCONTROL 300 / TRAYCONTROL 300-C (AWG 20-16)

No.	Base/ring colours	No.	Base/ring colours	No.	No. Base/ring colours
1	black	18	white/green	35	white/red/red
2	red	19	white/yellow	36	white/red/green
3	white	20	white/blue	37	white/red/blue
4	green	21	white/brown	38	white/red/brown
5	orange	22	white/orange	39	white/red/violet
6	blue	23	white/grey	40	white/green/black
7	brown	24	white/violet	41	white/green/red
8	yellow	25	white/black/red	42	white/green/green
9	violet	26	white/black/green	43	white/green/blue
10	grey	27	white/black/yellow	44	white/green/brown
11	pink	28	white/black/blue	45	white/green/violet
12	light brown	29	white/black/brown	46	white/blue/black
13	red/green	30	white/black/orange	47	white/blue/red
14	red/yellow	31	white/black/grey	48	white/blue/green
15	red/black	32	white/black/violet	49	white/blue/blue
16	white/black	33	white/black/black	50	white/blue/brown
17	white/red	34	white/red/black		

CORE IDENTIFICATION TRAYCONTROL 300 TP / TRAYCONTROL 300-C TP

acc. to company specifications

TRAYCONTROL 300 TP / TRAYCONTROL 300 TP-C (AWG 20-18)

Paired stranding Pair no.	Core	Colour
1	a	black
	b	red
2	a	black
	b	white
3	a	black
	b	green
4	a	black
	b	blue
5	a	black
	b	brown
6	a	black
	b	yellow
7	a	black
	b	orange
8	a	red
	b	green
9	a	red
	b	white

Paired stranding Pair no.	Core	Colour
10	a	red
	b	blue
11	a	red
	b	yellow
12	a	red
	b	brown
13	a	red
	b	orange
14	a	green
	b	blue
15	a	green
	b	white
16	a	green
	b	brown
17	a	green
	b	orange
18	a	green
	b	yellow

Paired stranding Pair no.	Core	Colour
19	a	white
	b	blue
20	a	white
	b	brown
21	a	white
	b	orange
22	a	white
	b	yellow
23	a	blue
	b	brown
24	a	blue
	b	orange
25	a	blue
	b	yellow

TRAYCONTROL 300 TP / TRAYCONTROL 300 TP-C (AWG 26-22)

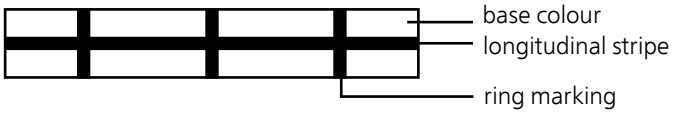
Paired stranding Pair no.	Core	Colour
1	a	white
	b	black
2	a	white
	b	brown
3	a	white
	b	red
4	a	white
	b	orange
5	a	white
	b	yellow
6	a	white
	b	green
7	a	white
	b	blue
8	a	white
	b	violet
9	a	white
	b	grey

Paired stranding Pair no.	Core	Colour
10	a	black
	b	brown
11	a	black
	b	red
12	a	black
	b	orange
13	a	black
	b	yellow
14	a	black
	b	green
15	a	black
	b	blue
16	a	black
	b	violet
17	a	black
	b	grey
18	a	brown
	b	red

Paired stranding Pair no.	Core	Colour
19	a	brown
	b	orange
20	a	brown
	b	yellow
21	a	brown
	b	green
22	a	brown
	b	blue
23	a	brown
	b	violet
24	a	brown
	b	grey
25	a	red
	b	orange

CORE IDENTIFICATION SINGLE-CORE AUTOMOTIVE CABLES

Single colour:
black, white, blue, orange, brown, green, violet, red, pink, yellow, grey



Two colour: Preferred colours

Base colour	Identification colour Length-wise striping	Base colour	Identification colour Length-wise striping
white	grey	red	white
white	red	red	yellow
white	brown	red	grey
white	blue	red	green
white	black	red	blue
-	-	red	black
yellow	grey	-	-
yellow	red	brown	white
yellow	brown	brown	yellow
yellow	blue	brown	green
yellow	black	brown	black
grey	green	blue	white
grey	red	blue	yellow
grey	brown	blue	green
-	-	blue	red
green	white	-	-
green	grey	black	white
green	brown	black	yellow
green	blue	black	green
green	black	black	red

further colour combinations

Base colour	Identification colour Length-wise striping	Base colour	Identification colour Length-wise striping
white	yellow	brown	grey
white	green	brown	violet
white	violet	brown	blue
yellow	white	blue	grey
yellow	green	blue	violet
yellow	violet	blue	brown
grey	white	black	brown
grey	yellow	black	violet
grey	violet	black	brown
green	yellow	orange	white
green	red	orange	yellow
green	violet	orange	grey
-	-	orange	green
red	brown	orange	violet
-	-	orange	blue
violet	white	orange	black
violet	yellow	-	-
violet	grey	-	-
violet	green	-	-
violet	brown	-	-
violet	blue	-	-
violet	black	-	-

Three colour: Preferred colours

Base colour	1st Identification colour Length-wise striping	2st Identification colour Length-wise striping
grey	green	yellow
grey	red	yellow
grey	brown	yellow
red	white	yellow
red	yellow	yellow
red	grey	yellow
red	green	yellow
red	blue	yellow
red	black	yellow
brown	white	yellow
brown	yellow	yellow
brown	green	yellow
brown	black	yellow
blue	white	yellow
blue	yellow	yellow
blue	green	yellow
blue	red	yellow
black	white	yellow
black	yellow	yellow
black	green	yellow
black	red	yellow

Minimum amounts for single-colour and two-colour combinations per cross-section and colour combination:
for 0.5 to 2.5 mm² = 3 km
for 4.0 to 25.0 mm² = 1 km. Remaining cross-sections avail. on request.

We manufacture three-colour combinations on demand.
Minimum quantities per cross-section and colour combination:
for 0.5 to 2.5 mm² = 5 km
for 4.0 to 25.0 mm² = 3 km. Remaining cross-sections avail. on request.

further colour combinations

Base colour	1st Identification colour Length-wise striping	2nd Identification colour Length-wise striping
grey	white	yellow
grey	yellow	yellow
grey	violet	yellow
red	brown	yellow
violet	white	yellow
violet	yellow	yellow
violet	grey	yellow
violet	green	yellow
violet	brown	yellow
violet	blue	yellow
violet	black	yellow
brown	grey	yellow
brown	violet	yellow
brown	blue	yellow
blue	grey	yellow
blue	violet	yellow
blue	brown	yellow
black	grey	yellow
black	violet	yellow
black	brown	yellow
orange	white	yellow
orange	yellow	
orange	grey	
orange	green	
orange	violet	
orange	blue	
orange	black	

CORE IDENTIFICATION HELUKABEL®-JB

Colour-coded control cables JB and SY-JB with green-yellow protice conductors

This colour combination for cables up to 102 cores consists of 11 base colours. From core no. 12, the identification also uses one or two coloured rings or stripes. The ring width is approx. 2 mm.

3 to 5-core cables
Identification acc. to VDE 0293-308 for flexible cables
3 cores = green-yellow/brown/blue
4 cores = green-yellow/brown/black/grey
5 cores = green-yellow/blue/brown/black/grey

6 and more cores
Identification acc. to table below. The first colour is the base colour, the second and third are ring or stripe colours. Counted from the inside out through all layers consecutively and concordantly. The green-yellow protective conductor is the last core of the outer layer.

No. Base/ring colours	No. Base/ring colours	No. Base/ring colours
0 green-yellow	36 transparent-blue	69 transparent-white-black
1 white	37 beige-blue	70 beige-white-black
2 black	38 grey-brown	71 brown-white-blue
3 blue	39 red-brown	72 grey-white-blue
4 brown	40 violet-brown	73 red-white-blue
5 grey	41 pink-brown	74 violet-white-blue
6 red	42 orange-brown	75 pink-white-blue
7 violet	43 transparent-brown	76 orange-white-blue
8 pink	44 beige-brown	77 transparent-white-blue
9 orange	45 red-grey	78 beige-white-blue
10 transparent	46 violet-grey	79 grey-white-brown
11 beige	47 pink-grey	80 red-white-brown
12 black-white	48 orange-grey	81 violet-white-brown
13 blue-white	49 transparent-grey	82 pink-white-brown
14 brown-white	50 beige-grey	83 orange-white-brown
15 grey-white	51 orange-red	84 transparent-white-brown
16 red-white	52 transparent-red	85 beige-white-brown
17 violet-white	53 beige-red	86 red-white-grey
18 pink-white	54 pink-violet	87 violet-white-grey
19 orange-white	55 orange-violet	88 pink-white-grey
20 transparent-white	56 transparent-violet	89 orange-white-grey
21 beige-white	57 beige-violet	90 transparent-white-grey
22 blue-black	58 transparent-pink	91 beige-white-grey
23 brown-black	59 beige-pink	92 blue-white-red
24 grey-black	60 transparent-orange	93 brown-white-red
25 red-black	61 beige-orange	94 violet-white-red
26 violet-black	62 blue-white-black	95 pink-white-red
27 pink-black	63 brown-white-black	96 orange-white-red
28 orange-black	64 grey-white-black	97 brown-white-violet
29 transparent-black	65 red-white-black	98 orange-white-violet
30 beige-black	66 violet-white-black	99 brown-black-blue
31 brown-blue	67 pink-white-black	100 grey-black-blue
32 grey-blue	68 orange-white-black	101 red-black-blue
33 red-blue		
34 pink-blue		
35 orange-blue		

CORE IDENTIFICATION HELUKABEL®-OB

Colour coded control cables -OB and SY-OB without green-yellow protective conductor

This colour combination for cables up to 101 cores consists of 11 base colours. From core no. 12, the identification also uses one or two coloured rings or vertical stripes. The ring width is approx. 2 mm.

2 to 5-core cables
Identification acc. to DIN VDE 0293-308 for flexible cables
2 cores = blue/brown
3 cores = brown/black/grey
4 cores = blue/brown/black/grey
5 cores = blue/brown/black/grey/black

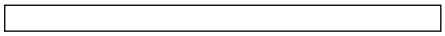
6 and more cores
Identification acc. to table below. The first colour is the base colour, the second and third are ring or stripe colours. Counted from the inside out through all layers consecutively and concordantly.

No. Base/ring colours	No. Base/ring colours	No. Base/ring colours
1 white	36 transparent-blue	69 transparent-white-black
2 black	37 beige-blue	70 beige-white-black
3 blue	38 grey-brown	71 brown-white-blue
4 brown	39 red-brown	72 grey-white-blue
5 grey	40 violet-brown	73 red-white-blue
6 red	41 pink-brown	74 violet-white-blue
7 violet	42 orange-brown	75 pink-white-blue
8 pink	43 transparent-brown	76 orange-white-blue
9 orange	44 beige-brown	77 transparent-white-blue
10 transparent	45 red-grey	78 beige-white-blue
11 beige	46 violet-grey	79 grey-white-brown
12 black-white	47 pink-grey	80 red-white-brown
13 blue-white	48 orange-grey	81 violet-white-brown
14 brown-white	49 transparent-grey	82 pink-white-brown
15 grey-white	50 beige-grey	83 orange-white-brown
16 red-white	51 orange-red	84 transparent-white-brown
17 violet-white	52 transparent-red	85 beige-white-brown
18 pink-white	53 beige-red	86 red-white-grey
19 orange-white	54 pink-violet	87 violet-white-grey
20 transparent-white	55 orange-violet	88 pink-white-grey
21 beige-white	56 transparent-violet	89 orange-white-grey
22 blue-black	57 beige-violet	90 transparent-white-grey
23 brown-black	58 transparent-pink	91 beige-white-grey
24 grey-black	59 beige-pink	92 blue-white-red
25 red-black	60 transparent-orange	93 brown-white-red
26 violet-black	61 beige-orange	94 violet-white-red
27 pink-black	62 blue-white-black	95 pink-white-red
28 orange-black	63 brown-white-black	96 orange-white-red
29 transparent-black	64 grey-white-black	97 brown-white-violet
30 beige-black	65 red-white-black	98 orange-white-violet
31 brown-blue	66 violet-white-black	99 brown-black-blue
32 grey-blue	67 pink-white-black	100 grey-black-blue
33 red-blue	68 orange-white-black	101 red-black-blue
34 pink-blue		
35 orange-blue		
35 orange-blue		

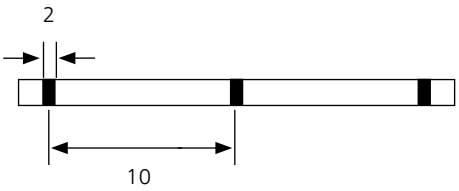
CORE IDENTIFICATION SWITCHBOARD CABLES

S-YY Lg

Dimensions in mm



single coloured,
no ring marking



with ring marking,
ring width with ring
distance

The cores are coded in colour groups so that every 4, 5, 6, 10 different core colours repeat consecutively according to the following scheme:

Number of cores in a colour group	Core colour sequence
4	blue, red, grey, green
5	blue, red, grey, green, brown
6	blue, red, grey, green, brown, black
10	blue, red, grey, green, brown, black, yellow, white, pink, violet

Example
S-YY 30 (5 x6) x1x 0.6 Lg
= 5x the colour group with 6 differently coloured cores.

In a cable, only colour groups of the same type may be used.

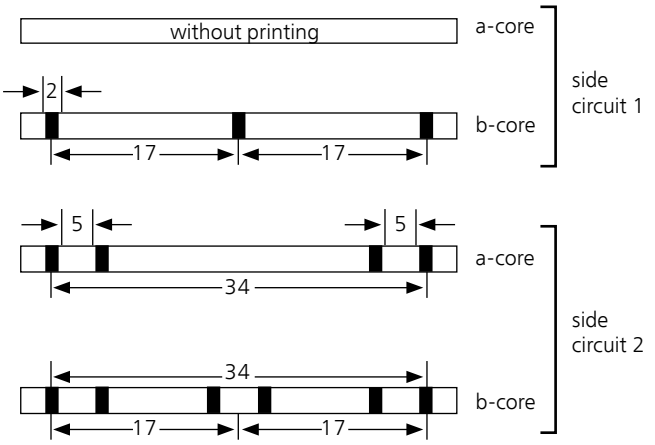
In every layer, the blue core is the first complete colour group and has red rings. Remaining cores of the preceding colour group are before this labelled core.

Counting method: From the outside in
The cores of the switchboard cable are stranded in concentric layers. Beginning in the outer layer, the stranded elements are counted consecutively through all layers. The count is performed in all layers concordantly.

CORE IDENTIFICATION INSTALLATION CABLES

J-YY...Bd, J-HH...Bd, J-Y(St)Y...Bd, J-H(St)H...Bd und J-2Y(St)Y...Bd

The identification of the single-cores in a quad is done using black rings:



the cores of five star quads of a reference bundle are coloured using the following base colours:

Quad 1: Base colour of all cores red
Quad 2: Base colour of all cores green
Quad 3: Base colour of all cores grey
Quad 4: Base colour of all cores yellow
Quad 5: Base colour of all cores white

The bundle for calculation is labelled with red wrapping in every layer. The other bundles have a white or natural-coloured wrap. The quads of a reference bundle are counted in the order of their base colour.
The reference and primary bundles of cables with more than five star quads are counted beginning with the calculation bundle of the 1st inner layer and progressing concordantly through all layers outward.

J-Y(St)Y...Lg

2-pair installation cable cores are stranded into star quads.

Main bundle 1 a core red, b core black
Main bundle 2 a core white, b core yellow

3 and more paired installation cables

a core for 1st pair of every layer red (counting pair), every other pair is white,

b core blue, yellow, green, brown, black repeated consecutively

Counting method: Start in outer layer, count inward through all layers concordantly and consecutively

JE-Y(St)Y...Bd, JE-LiYCY...Bd, JE-H(St) und JE-HCH...Bd

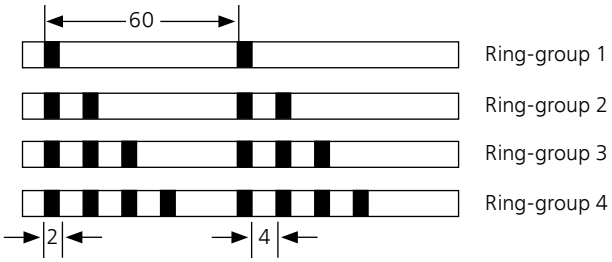
Pair identification
The insulating sheaths of cores are identified through the different base colours that repeat in the same order in every bundle.

Base colours of pairs

Pair	1	2	3	4
a core	blue	grey	green	white
b core	red	yellow	brown	black

For 2-pair cables: cores stranded in star quad:
Main bundle 1: a core blue b core red
Main bundle 2: a core grey b core yellow
Every bundle is assigned to a ring group. All cores of a bundle are labelled in groups by the colour of the rings and the order of the coloured rings.
Bundle counting method: Begin in the inner layer, count going out through all layers consecutively and concordantly.

Ring identification and ring groups



Bundle identification and ring groups

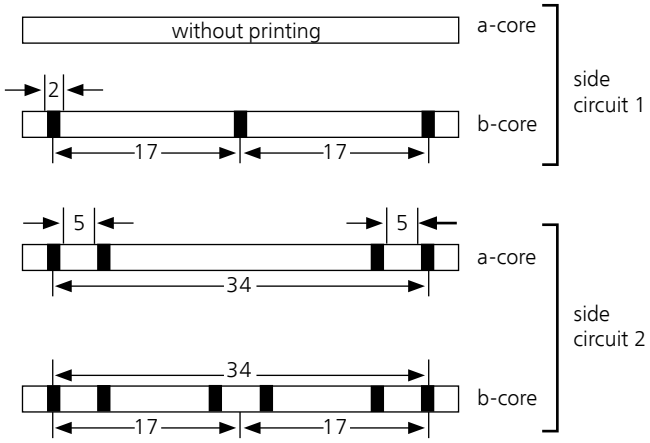
Bundle no.	Ring colour	Ring group	Wrapping colour
1	pink	I	-
2		II	
3		III	
4		IIII	
5	orange	I	-
6		II	
7		III	
8		IIII	
9	violet	I	-
10		II	
11		III	
12		IIII	
13	pink	I	blue
14		II	
15		III	
16		IIII	
17	orange	I	red
18		II	
19		III	
20		IIII	

For cables with more than 12 bundles, additional bundles also receive a coloured, plastic wrapping to identify rings.

CORE LABELLING OUTDOOR COMMUNICATION CABLES

A-2Y(L)2Y...Bd and A-2YF(L)2Y...Bd

The labelling of the single-cores of a quad is done using black rings:

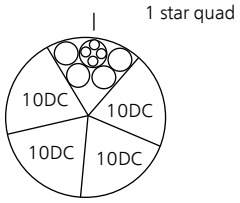


The cores of the five star quads of a reference bundle are coloured with the following base colours:

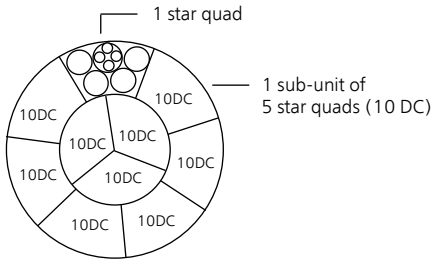
Quad 1: Base colour of all cores red
Quad 2: Base colour of all cores green
Quad 3: Base colour of all cores grey
Quad 4: Base colour of all cores yellow
Quad 5: Base colour of all cores white

The bundle for calculation is labelled with a red plastic spiral wrap in all orientations. The other bundles have a white or natural-coloured wrap. The quads of a reference bundle are counted in order of their base colour.

Construction of a primary bundle (HB):
5 reference bundles = 50 dual-cores (DC)



Construction of a primary bundle (HB):
10 reference bundles = 100 dual-cores (DC)



The reference and primary bundles of cables with more than five star quads are counted beginning with the calculation bundle of the 1st inner layer and progressing concordantly through all layers outward.

COLOR SYMBOLS ACCORDING TO VDE AND IEC

In the future, internationally consistent colour abbreviations acc. to IEC 60757 (identical to CENELEC harmonisation document HD 457) will be used. The following table shows a comparison of German and IEC colour abbreviations:

Colour	German abbreviation		Abbreviation acc. to IEC 60757
	new	old	
Black	SW	bw	BK
Brown	BR	br	BN
Red	RT	rt	RD
Orange	OR	or	OG
Yellow	GE	ge	YE
Green	GN	gn	GN
Blue	BL	bl	BU
Violet	VL	vi	VT
Grey	GR	gr	GY
White	WS	ws	WH
Pink	RS	rs	PK
Turquoise	TK	tk	TQ

IEC = International Electrotechnical Commission

Contact

Our technical expert is happy to assist you and answer any questions you may have:

Christian Dettmer
Head of Technical Department
PH: +49 7150 9209 712
M: +49 160 3541567
Christian.Dettmer@helukabel.de

Always stay electrified.

HELU KABEL GmbH | Schloßhaldenstraße 10 | 71282 Hemmingen | Tel. 07150 9209 0 | info@helukabel.de | helu.com