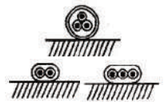
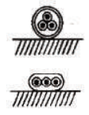
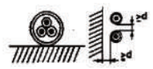
DIN VDE 0298

Table 12-1: current rating

For cables with a nominal voltage of up to 1000 V and for heat-resistant cables at an ambient temperature of +30 °C.
You can find general regulations and recommended values in DIN VDE 0298 part 2 and part 4.
The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 11 and 15, and based on DIN VDE 0891, 1990-05, part 1.
For copyright reasons, only excerpts from DIN VDE 0298 part 4 can be mapped at this point.

Cable category						
	A Single-core cables •Rubber insulation •PVC insulation •TPE insulation •Heat-resistant	B Multi-core cables for domestic/handheld equipment •Rubber insulation •PVC insulation •TPE insulation		C Multi-core cables excl. domestic/handheld equipment •Rubber insulation •PVC insulation •TPE insulation •Heat-resistant	D Multi-core rubber-sheathed cables min. 0.6/1 kV Single-core Special rubber core cables 0.6/1 or 1.8/3 kV	
Installation type						
Number of cores under load	1[3]	2	3	2 or 3	3	1[3]
Nominal cross-section in mm²	Current rating in A	Current rating in A		Current rating in A		
0.08[1]	3	-	-	2	-	-
0.14[1]	4.5	-	-	3	-	-
0.25[1]	7	-	-	4.5	-	-
0.34[1]	8	-	-	5	-	-
0.5	12[2]	3	3	9[2]	-	-
0.75	15	6	6	12	-	-
1.0	19	10	10	15	-	-
1.5	24	16	16	18	23	30
2.5	32	25	20	26	30	41
4	42	32	25	34	41	55

1) Current rating values for small conductor cross-sections taken from VDE 0891-1 (0.08 mm2– 0.34 mm2
2) Extended range for 0.5 mm2 in line with VDE 0298-4, 2003-08, table 11
3) When bundling single-core, touching or bundled cables, when installed on surfaces, in the open air or on cable conduits, please observe DIN VDE 0298-4, 2013-06, table 10

IMPORTANT:
The information portrayed in this table differs from that in DIN VDE 0298-4, 2013-06.
As such, in the event of any uncertainty the current version of DIN VDE 0298-4 always applies.
Please observe all applicable conversion factors going beyond table 12-1 for:
- differing ambient temperature: table 12-2
- several-core cables up to10mm2 with more than 3 cores under load: table 12-3
- heat-resistant cables for ambient temperatures exceeding 50°C: table 12-4
- for wound cables: table 12-5
- bundling of single-core or multi-core cables in pipes, ducts, walls or flooring: table 12-6
- bundling of multi-core cables on troughs or conduits: table 12-7
- bundling of single-core cables on troughs or conduits: table 12-8

Please also observe all applicable current ratings going beyond table 12-1 for:
- Flexible cables with cross-linked Elastomer insulation for industrial applications: table 12-9
- Welding cable H01N2-D: table 12-10
- Operating current and power loss of copper conductors: table 12-11
- Current rating for cables in the USA: see NEC excerpt in table 13
- Cables for fixed installation in buildings: see DIN VDE 0298 part 4, 2013-06, table 3 and 4
- ESUY earthing cable: see DIN VDE 0105-1
- Cables in machinery: see DIN EN 60204-1/VDE 0113-1

Note for Low-voltage electrical installations – Protection for safety – Protection against overcurrent:
According to HD 60364-4-43: 2010 and DIN VDE 0100-430 (VDE 0100-430):
2010-10 (IEC 60364-4-43: 2008, modified + Corrigendum Oct. 2008)
According to the above-mentioned standard, the requirements for the protection of live conductors from the effects of overcurrents must be observed. This standard describes how live conductors are protected by one or more devices for the automatic disconnection of the supply in the event of overload and short-circuit.

Table 12-2: conversion factors

For ambient temperatures other than +30 °C. The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 17.
For copyright reasons, only excerpts from DIN VDE 0298 part 4 can be mapped at this point.

Permissible/recommended operating temperature at the conductor (Details of the maximum value in°C can be found in the feld "Technical data, temperature range for fxed or fexible installation" on the relevant product page in the catalogue)					
	60 °C	70 °C	80 °C	85 °C	90 °C
Ambient temperature in°C	Conversion factors to be applied to the current rating values in T12-1				
30	1.00	1.00	1.00	1.00	1.00
40	0.82	0.87	0.89	0.90	0.91
50	0.58	0.71	0.77	-	0.82
60	-	0.50	0.63	-	0.71
70	-	-	0.45	-	0.58
80	-	-	-	-	0.41

Table 12-3: conversion factors

For several-core cables with conductor cross-sections up to 10 mm2. The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 26.
For copyright reasons, only excerpts from DIN VDE 0298 part 4 can be mapped at this point.

Number of cores under load	Conversion factor for installation in the open air	Conversion factor for installation underground
5	0.75	0.70
7	0.65	0.60
10	0.55	0.50
14	0.50	0.45
24	0.40	0.35

Table 12-4: conversion factors for heat-resistant cables

The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 18.
For copyright reasons, only excerpts from DIN VDE 0298 part 4 can be mapped at this point.

Permissible/recommended operating temperature at the conductor (Details of the maximum value in°C can be found in the feld "Technical data, temperature range for fxed or fexible installation" on the relevant product page in the catalogue)				
	90 °C	110 °C	135 °C	180 °C
Ambient temperature in°C	Conversion factors to be applied to the current rating values for heat-resistant cables in T 12-1, column A, C or D.			
up to 50	1.00	1.00	1.00	1.00
75	0.61	1.00	1.00	1.00
85	0.35	0.91	1.00	1.00
105	-	0.41	0.87	1.00
130	-	-	0.35	1.00
175	-	-	-	0.41

Table 12-5: conversion factors for wound cables

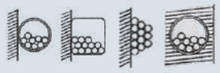
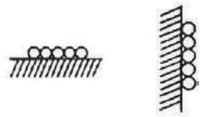
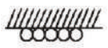
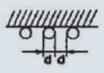
The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 27.

Number of layers on the coil, drum, reel	1	2	3	4	5
Conversion factor	0.80	0.61	0.49	0.42	0.38

A conversion factor of 0.8 applies to spiral winding (in one layer).

Table 12-6: conversion factors

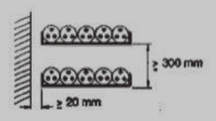
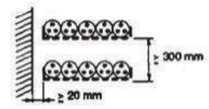
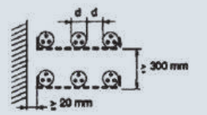
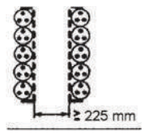
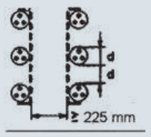
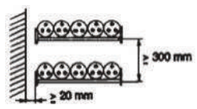
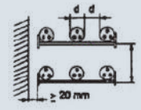
For bundling on walls, in pipes and ducts, on flooring and under ceilings. The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 21.
For copyright reasons, only excerpts from DIN VDE 0298 part 4 can be mapped at this point.

Confguration for installation	Number of multi-core cables or number of AC or three-phase circuits formed by single-core cables (2 or 3 live conductors)					
	1	2	3	4	6	10
	Conversion factors to be applied to the current rating values in table 12-					
Bundled directly on the wall, on the foor, in pipes or ducts for electrical installations. 	1.00	0.80	0.70	0.65	0.57	0.48
In a single layer on the wall or foor, touching. 	1.00	0.85	0.79	0.75	0.72	0.70
In a single layer on the wall or foor, with a gap equal to outer diameter d. 	1.00	0.94	0.90	0.90	0.90	0.90
In a single layer under the ceiling, touching. 	0.91	0.81	0.72	0.68	0.64	0.61
In a single layer under the ceiling, with a gap equal to outer diameter d. 	0.95	0.85	0.85	0.85	0.85	0.85

○ = Symbol for single-core or multi-core cable
IMPORTANT: The conversion factors must be applied in order to determine the current rating for cables of the same type and under the same load, when bundled in the same installation type. In the process, the nominal conductor cross-sections must not vary by more than one cross-section classifi cation.

Table 12-7: conversion factors

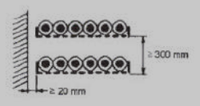
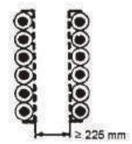
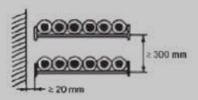
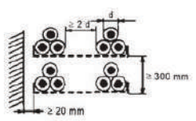
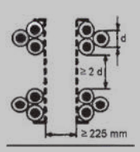
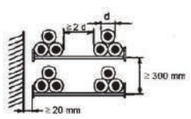
For bundling multi-core cables on troughs and conduits. The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 22.
For copyright reasons, only excerpts from DIN VDE 0298 part 4 can be mapped at this point.

Confguration for installation			Number of troughs or conduits	Number of multi-core cables					
				1	2	3	4	6	9
				Conversion factors					
Non-perforated cable troughs	touching		1	0.97	0.84	0.78	0.75	0.71	0.68
	touching		1	1.00	0.88	0.82	0.79	0.76	0.73
	with gap		1	1.00	1.00	0.98	0.95	0.91	-
Perforated cable troughs	touching		1	1.00	0.88	0.82	0.78	0.73	0.72
	with gap		1	1.00	0.91	0.98	0.88	0.87	-
Cable conduits	touching		1	1.00	0.87	0.82	0.80	0.79	0.78
	with gap		1	1.00	1.00	1.00	1.00	1.00	-

IMPORTANT: The factors stated in this table apply only to groups of single-core cables installed in a single layer in confi gurations as specifi ed above. However, they do not apply if the cables are touching and installed over one another, or if the actual gap dimensions between the cable troughs or cable conduits fall short of the specifi ed gaps. If this is the case, reduce the conversion factors (e.g. as per table 12-6). If circuits are connected in parallel, each three-conductor bundle of the parallel connection is to be considered as one circuit.

Table 12-8: conversion factors

For bundling single-core cables on troughs and conduits. The values given in the table below are reference values and in a simplified form took out of the DIN VDE 0298 part 4, 2013-06, table 23.
For copyright reasons, only excerpts from DIN VDE 0298 part 4 can be mapped at this point.

Confguration for installation			Number of troughs or conduits	Number of 3-pin circuits formed by single-core cables			To be used as the multiplier for the measurement value of:
				1	2	3	
				Conversion factors			
Perforated cable troughs	touching		1	0.97	0.84	0.78	Three cables arranged horizontally and level
	touching		1	1.00	0.88	0.82	Three cables arranged vertically and level
Cable conduits	touching		1	1.00	1.00	0.98	Three cables arranged horizontally and level
Perforated cable troughs	touching		1	1.00	0.88	0.82	Three cables arranged in a horizontal, triangular confguration
Perforated cable troughs	touching		1	1.00	0.91	0.98	Three cables arranged in a vertical, triangular confguration
Cable conduits	touching		1	1.00	0.87	0.82	Three cables arranged in a vertical, triangular confguration

IMPORTANT: The factors stated in this table apply only to groups of single-core cables installed in a single layer in confi gurations as specifi ed above. However, they do not apply if the cables are touching and installed over one another, or if the actual gap dimensions between the cable troughs or cable conduits fall short of the specifi ed gaps. If this is the case, reduce the conversion factors (e.g. as per table 12-6). If circuits are connected in parallel, each three-conductor bundle of the parallel connection is to be considered as one circuit.

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Table 52-D2-Correctlon lactors lor ambient ground temperatures other than 20 °C to be applied to the current-carrying capacities for cables in ducts in the ground

Ground lemperalure °C	Insulation	
	PVC	XLPE and EPR
10	1.10	1.07
15	1.05	1.04
25	0.95	0.96
30	0.89	0.93
35	0.84	0.89
40	0.77	0.85
45	0.71	0,80
50	0.63	0.76
55	0.55	0.71
60	0.45	0.65
65	-	0,60
70	-	0.53
75	-	0,46
80	-	0.38

Table 52-D3-Correction factors for cables in buried ducts for soil thermal resistivities other than 2,5 K·m/W to be applied to the current-carrying capacities for relerence method D

Thermal resistivity,K·m/W	1	1,5	2	2,5	3
Correclion faclor	1,18	1,1	1.05	1	0.96

NOTE 1-The corroction factors given have been avoragod ovor the range of conduclor sizes and types of installation included in tables 52-C1 to 52-C4.The overall accuracy of correction lactors is within ±5%
NOTE 2-The correction faclors are applicable to cables drawn into buried ducls:for cables laid direct in the ground the correction laclors for thermal resistivities less than 2.5 K·m/W will be higher.Whore more precise values are required they may be calculated by methods given in IEC 60287
NOTE 3-The correction factors are applicable to ducts buried at depths of up to 0.8 m.

Table 52-E1-Reduction factors for groups of more than one circuit or of more than one multi-core cable to be used with current-carrying capacities of tables 52-C1 to 52-C12

Item	Arrangemen (cables touching)	Number of circuits or multi-core cables												To be used with current-carrying capacities reference
		1	2	3	4	5	6	7	8	9	12	16	20	
1	Bunched in air. on a surface, embedded or enclosed	1,00	0.80	0,70	0,65	0,60	0,57	0,54	0,52	0,50	0,45	0,41	0,38	52-C1 to 52-C12 methods A to F
2	Single layer on wall,fioor or unperforated tray	1,00	0,85	0,79	0,75	0,73	0,72	0,72	0,71	0,70	No further reduction factor for more than nine circuits or multi-core cables			52-C1 to 52·C6 method C
3	Single layer on wall,fioor or unperforated tray	0.95	0,81	0,72	0,68	0,66	0,64	0,63	0,62	0,61				
4	Single layer on a perforated hornizontal or vertical tray	1,00	0,88	0,82	0,77	0,75	0,73	0,73	0,72	0,72				52-C7 to 52-C12 methods E and F
5	Single layer on ladder support or cleats etc	1,00	0,87	0,82	0,80	0,80	0,79	0,79	0,78	0,78				

NOTE 1-These factors are applicable to uniform groups of cables,equally loaded.
NOTE 2-Where horizontal clearances between adjacent cables exceeds twice their overall diameter,no reduction factor need be appliod.
NOTE 3-The same factors are applied to
-groups of two or three single core cables
-multi-core cables.
NOTE 4-It a system consists of both two-and three-core cables,the total number of cables is taken as the number of circuits,and the corresponding factor is applied to the tables for two loaded conductors for the two-core cables,and to the tables for three loaded conductors for the three-core cables.
NOTE 5-If a group consists of n single-core cables it may either be considered as n/2 circuits of two loaded conductors or n/3 circuits of three loaded conductors.
NOTE 6-The values given have been averaged over the range of conductor sizes and types of installation included in tables 52-C1 to 52-C12 the overall accuracy of tabulated values is within±5 %.
NOTE 7-For some installations and for other methods not provided for in the above table it may be appropriate to use lactors calculated for specific cases,see for example tables 52·E4 to 52-E5

Table 52-E2-Reduction factors for more than one circuit,cables laid directly in the ground

(Installation method D in tables 52-C1 to 52-C4.Single-core or multi-core cables)

Number of circuits	Cable to cable clearance (a)*				
	Nil (cables touching)	One cable diameter	0,125 m	0,25 m	0,5 m
2	0,75	0,80	0,85	0,90	0,90
3	0,65	0,70	0,75	0,80	0,85
4	0,60	0,60	0,70	0,75	0,80
5	0,55	0,55	0,65	0,70	0,80
6	0,50	0,55	0,60	0,70	0,80

* Multi-core cables

* Single-core cables

NOTE-Values given apply to an installation depth of 0,7 m and a soil thermal resistivity of 2.5 K·m/W.They are average values for the range of cable sizes and types quoted for tables 52-C1 to 52-C4.The process of averaging,together with rounding off,can result in some cases in errors up to ±10 %.(Where more precise values are required they may be calculated by methods given in IEC 60287.)

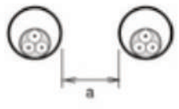
Table 52-E3-Reduction factors for more than one circuit, cables laid in ducts in the ground

(Installation method D in tables 52-C1 to 52-C4)

A. Multi-core cables in single-way ducts

Number of cables	Duct to duct clearance (a)*			
	Nil (ducts touching)	0,25 m	0,5 m	1,0 m
2	0,85	0,90	0,95	0,95
3	0,75	0,85	0,90	0,95
4	0,70	0,80	0,85	0,90
5	0,65	0,80	0,85	0,90
6	0.60	0,80	0,80	0,90

* Multi-core cables



NOTE -Values given apply to an installation depth of 0,7 m and a soil thermal resistivity of 2.5 K·m/W. They are average values for the range of cable sizes and types quoted for tables 52-C1 to 52-C4.The process of averaging,together with rounding off,can result in some cases in errors up to ±10 %.(Where more precise values are required they may be calculated by methods given in IEC 60287.)

B. Single-core cables in single-way ducts

Number of single-core circuits of two or three cables	Duct to duct clearance (a)*			
	Nl (ducts touching)	0,25 m	0,5 m	1,0 m
2	0,80	0,90	0,90	0,95
3	0,70	0,80	0,85	0,90
4	0,65	0,75	0,80	0,90
5	0.60	0,70	0,80	0,90
6	0,60	0,70	0,80	0,90

* Single-core cables

NOTE-Values given apply to an installation depth of 0,7 m and a soil thermal resistivity of 2,5 K·m/W They are average values for the range of cable sizes and types quoted for tables 52-C1 to 52-C4.The process of averaging,together with rounding off,can result in some cases in errors up to ±10 %.(Where more precise values are required they may be calculated by methods given in IEC 60287.)

Table 52-E4-Reduction factors for group of more than one multi-core cable (note 1) to be applied to reference ratings for multi-core cables in free air

(Method of installation E in tables 52-C7 to 52-C12)

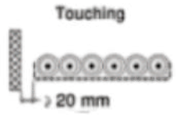
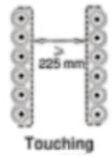
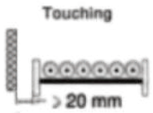
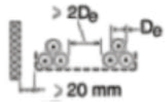
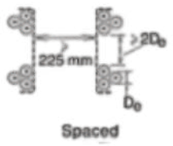
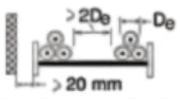
Method of installation in table 52-B2			Number of trays	Number of cables					
				1	2	3	4	6	9
Perforated trays (note 2)	13	Touching, > 20 mm	1	1,00	0,88	0,82	0,79	0,76	0,73
			2	1,00	0,87	0,80	0,77	0,73	0,68
			3	1,00	0,86	0,79	0,76	0,71	0,66
		Spaced, D_e, > 20 mm	1	1,00	1,00	0,98	0,95	0,91	-
			2	1,00	0,99	0,96	0,92	0,87	-
			3	1,00	0,98	0,95	0,91	0,85	-
Vertical perforated trays (note 3)	13	225 mm, Touching	1	1,00	0,88	0,82	0,78	0,73	0,72
			2	1,00	0,88	0,81	0,76	0,71	0,70
		225 mm, D_e, Spaced	1	1,00	0,91	0,82	0,88	0,87	-
			2	1,00	0,91	0,81	0,87	0,85	-
Ladder supports, cleats,etc. (note 2)	14 15 16	Touching, > 20 mm	1	1,00	0,87	0,82	0,80	0,79	0,78
			2	1,00	0,86	0,80	0,78	0,76	0,73
			3	1,00	0,85	0,79	0,76	0,73	0,70
		Spaced, D_e, > 20 mm	1	1,00	1,00	1,00	1,00	1,00	-
			2	1,00	0,99	0,98	0,97	0,96	-
			3	1,00	0,98	0,97	0,96	0,93	-

Factors apply to single layer groups of cables as shown above and do not apply when cables are installed in more than one layer touching each other.Values for such installations may be significantly lower and shall be determined by an appropriate method.

NOTE 1-Values given are averages for the cable types and range of conductor sizes considered in tables 52-C7 to 52-C12.The spread of values is generally less than ±5 %.
NOTE 2-Values are given for a vertical spacing between trays of 300 mm and at least 20 mm between trays and wall.For closer spacing the factors should be reduced.
NOTE 3-Values are given for horizontal spacing between trays of 225 mm with trays mounted back to back.For closer spacing the factors should be reduced.

Table 52-E5-Reduction factors for groups of more than one circuit of single-core cables (note 1)
to be applied to reference rating for one circuit of single-core cables in free air

(Method of installation F in tables 52-C7 to 52-C12)

Method of installation in table 52-B2			Number of trays	Number of three-phase circuits (note 2)			Use as a multiplier to rating for
				1	2	3	
Perforated trays (note 3)	13		1 2 3	0,98 0,96 0,95	0,91 0,87 0,85	0,87 0,81 0,78	Three cables in horizontal formation
Vertically perforated trays (note 4)	13		1 2	0,96 0,95	0,86 0,84	- -	Three cables in vertical formation
Ladder supports, cleats ete. (note 3)	14 15 16		1 2 3	1,00 0,98 0,97	0,97 0,93 0,90	0,96 0,89 0,86	Three cables in horizontal formation
Perforated trays (Note 3)	13		1 2 3	1,00 0,97 0,96	0,98 0,93 0,92	0,96 0,89 0,86	Three cables in trefoil formation
Vertical perforated trays (note 4)	13		1 2	1,00 1,00	0,91 0,90	0,89 0,86	
Ladder supports, cleats ete. (note 3)	14 15 16		1 2 3	1,00 0,97 0,96	1,00 0,95 0,94	1,00 0,93 0,90	

Factors are given for single layers of cables(or trefoil groups)as shown in the table and do not apply when cables are installed in more than one layer touching each other.Values for such installations may be significantly lower and shall be determined by an appropriate method.

NOTE 1-Values given are averages for the cable types and range of conductor sizes considered in table 52-C7 to 52-C12.The spread of values is generally less than ±5 %.
NOTE 2-For circuits having more than one cable in parallel per phase,each three-phase set of conductors should be considered as a circuit for the purpose of this table.
NOTE 3-Values are given for a vertical spacing between trays ol 300 mm.For closer spacing the factors should be reduced
NOTE 4-Values are given for a horizontal spacing between trays of 225 mm with trays mounted back to back and at least 20 mm between the tray and any wall,For closer spacing the factors should be reduced.

Annex A
(informative)
Example of one method of simplification of the tables of section 523

This annex is intended to illustrate one possible method by which the tables 52-C1 to 52-C4, 52-C9 to 52-C12 and 52-E1 to 52-E5 can be simplified for adoption in national rules.
The use of other suitable methods is not excluded (see note 1 of 523.1.4).

Table A.52-1 -Current-carrying capacity in amperes

Referenoe methods in table 52-B1	Number of loaded conductors and type of insulatlon											
A1		Three PVC	Two PVC		Thtee XLPE	Two XLPE						
A2	Three PVC	Two PVC		Thtee XLPE	Two XLPE							
B1				Three PVC	Two PVC		Thtee XLPE		Two XLPE			
B2			Three PVC	Two PVC		Thtee XLPE	Two XLPE					
C					Three PVC		Two PVC	Thtee XLPE		Two XLPE		
E						Three PVC		Two PVC	Thtee XLPE		Two XLPE	
F							Three PVC		Two PVC	Thtee XLPE		Two XLPE
1	2	3	4	5	6	7	8	9	10	11	12	13
SIze mm² Coppor	13	13,5	14,5	15,5	17	18.5	19.5	22	23	24	26	-
2.5	17,5	18	19,5	21	23	25	27	30	31	33	36	-
4	23	24	26	28	31	34	36	40	42	45	49	-
6	29	31	34	36	40	43	46	51	54	58	63	-
10	39	42	46	50	54	60	63	70	75	80	86	-
16	52	56	61	68	73	80	85	04	100	107	115	-
25	68	73	80	89	95	101	110	119	127	135	149	161
35	-	-	-	110	117	126	137	147	158	169	185	200
50	-	-	-	134	141	153	167	179	192	207	225	242
70	-	-	-	171	179	196	213	229	246	268	289	310
95	-	-	-	207	216	238	258	278	298	328	352	377
120	-	-	-	239	249	276	299	322	346	382	410	437
150	-	-	-	-	285	318	344	371	395	441	473	504
185	-	-	-	-	324	362	392	424	450	506	542	575
240	-	-	-	-	380	424	461	500	538	599	641	679
Aluminium												
2.5	13,5	14	15	16,5	18.5	19.5	21	21	24	26	28	-
4	17.5	18,5	20	22	25	26	28	28	32	35	38	-
6	23	24	26	28	32	33	36	36	42	45	49	-
10	31	32	36	39	44	46	49	49	58	62	67	-
16	41	43	48	53	58	61	66	66	77	84	91	-
25	53	57	63	70	73	78	83	83	97	101	108	121
35	-	-	-	86	90	96	103	103	120	126	135	150
50	-	-	-	104	110	117	125	125	146	154	164	184
70	-	-	-	133	140	150	160	160	187	198	211	237
95	-	-	-	161	170	183	195	195	227	241	257	289
120	-	-	-	186	197	212	226	226	263	280	300	337
150	-	-	-	-	226	245	261	261	304	324	346	389
185	-	-	-	-	256	280	298	298	347	371	397	447
240	-	-	-	-	300	330	352	352	409	439	470	530

It is necessary io consult tables 52-C1 to 52-C121o determine the range of conductor sizes for which the above current-carrying capacities are applicable for each installalion method.

Table A.52-2 -Current-carrying capacities in amperes

Installation method	Size mm²	Number of loaded conductors and type of insulation			
		Two PVC	Three PVC	Two XLPE	Three XLPE
D	Coppe 1.5 2.5 4 6 10 16 25 35 50 70 95 120 150 185 240 300	 22 29 38 47 63 81 104 125 148 183 216 246 278 312 361 408	 18 24 31 39 52 67 86 103 122 151 179 203 230 258 297 336	 26 34 44 56 73 95 121 146 173 213 252 287 324 363 419 474	 22 29 37 46 61 79 101 122 144 178 211 240 271 304 351 396
D	Aluminium 2,5 4 6 10 16 25 35 50 70 95 120 150 185 240 300	 22 29 36 48 62 80 96 113 140 166 189 213 240 277 313	 18.5 24 30 40 52 66 80 94 117 138 157 178 200 230 260	 26 34 42 56 73 93 112 132 163 193 220 249 279 322 364	 22 29 36 47 61 78 94 112 138 164 186 210 236 272 308

Table A.52-3-Reduction factors for groups of several circuits or of several multi-core cables (to be used with current-carrying capacities of table A.52-1)

Item	Arrangement	Number of circuits or multi-core cables								
		1	2	3	4	6	9	12	16	20
1	Embedded or enclosed	1,00	0,80	0,70	0,70	0,55	0,50	0.45	0,40	0,40
2	Single layer on walls, floors or on unperforated trays	1,00	0,85	0,80	0,75	0,70	0,70	-	-	-
3	Single layer fixed directly under a ceiling	0,95	0,80	0,70	0,70	0,65	0,60	-	-	-
4	Single layer on perforated horizontal trays or on vertical trays	1,00	0,90	0,80	0,75	0,75	0,70	-	-	-
5	Single layer on cable ladder supports or cleats etc	1,00	0,85	0,80	0,80	0,80	0,80	-	-	-

Annex B
(informative)

Formula to express current-carrying capacities

The values given in tables 52-C1 to 52-C12 lie on smooth curves relating current-carrying capacity to the cross-sectional area of the conductor.

These curves can be derived using the following formula:

$$I = A \times S^m - B \times S^n$$

where
I is the current-carrying capacity,in amperes (A);
S is the nominal cross-sectional area of conductor,in square millimetres (mm^2)*;
A and B are coefficients;
m and n are exponents according to cable type and method of installation.

Values of the coefficients and exponents are given in table B.52-1.Current-carrying capacities should be rounded to the nearest 0,5 A for values not exceeding 20 A and to the nearest ampere for values greater than 20 A.

The number of significant figures obtained is not to betaken as an indication of the accuracy of the current-carrying capacity.

For practically all cases only the first term is needed.The second term is needed in only eight cases where large single-core cables are used.

It is not advisable to use these coefficients and exponents for conductor sizes outside the appropriate range used in tables 52-C1 to 52-C12.

*In the case of the 50 mm2 nominal size.for cables with extruded insulation,the value of 47,5 mm2 should be used.For all other sizes and for all sizes of mineral insulated cables,the nominal value is sutticiently precise.

Table B.52-1 -Table of coefficients and exponents

Current-carrying capacity table	Column	Copper conductor		Aluminium conductor	
		A	m	A	m
52-C1	2 3≤120mm² 3>120mm² 4 5 6≤16mm² 6>16mm² 7	11,2 10,8 10,19 13,5 13,1 15,0 15,0 17,6	0,6118 0,6015 0,6118 0,625 0,600 0,625 0,625 0,551	8,61 8,361 7,84 10,51 10,24 11,6 10,55 13,5	0,616 0,6025 0,616 0,6254 0,5994 0,625 0,640 0,551
52-C2	2 3≤120mm² 3>120mm² 4 5 6≤16mm² 6>16mm² 7	14,9 14,46 13,56 17,76 17,25 18,77 17,0 20,8	0,611 0,598 0,611 0,6250 0,600 0,628 0,650 0,548	11,6 11,26 10,56 13,95 13,5 14,8 12,6 15,8	0,615 0,602 0,615 0,627 0,603 0,625 0,648 0,550
52-C3	2 3≤120mm² 3>120mm² 4 5 6≤16mm² 6>16mm² 7	10,4 10,1 9,462 11,84 11,65 13,5 12,4 14,6	0,605 0,592 0,605 0,628 0,6005 0,625 0,635 0,550	7,94 7,712 7,225 9,265 9,03 10,5 9,536 11,3	0,612 0,5984 0,612 0,627 0,601 0,625 0,6324 0,550
52-C4	2 3≤120mm² 3>120mm² 4 5 6≤16mm² 6>16mm² 7	13,34 12,95 12,14 15,62 15,17 17,0 15,4 17,3	0,611 0,598 0,61 0,6252 0,60 0,623 0,635 0,549	10,9 10,58 9,92 12,3 11,95 13,5 11,5 13,3	0,605 0,592 0,605 0,630 0,605 0,625 0,639 0,551

Table B.52-1 (continued)

Current-carrying capacity table	Column	Coefficients and exponents			
		A	m	B	n
52-C5	500 V 2 3 4	18,5 14,9 16,8	0,56 0,612 0,59	- - -	- - -
	750 V 2 3 4	18,5 14,9 16,8	0,596 0,5995 0,59	- - -	- - -
52-C6	500V2 3 4	18,5 14,9 16,8	0,60 0,60 0,58	- - -	- - -
	750 V 2 3 4	24,0 20,3 23,88	0,60 0,60 0,5794	- - -	- - -
52-C7	500 V 2 3 4 5 6	19,5 16,5 18,0 20,2 23,0	0,58 0,58 0,59 0,58 0,58	- - - - -	- - - - -
	750 V 2 3 4 5≤120mm² 5>120mm² 6≤120mm² 6>120mm²	20,6 17,4 20,15 22,0 22,0 25,17 25,17	0,60 0,60 0,5845 0,58 0,58 0,5785 0,5785	- - - - 1×10^{-11} - $1,9\times10^{-11}$	- - - - 5,25 - 5,15
52-C8	500 V 2 3 4 5 6	24,2 20,5 23,0 26,1 29,0	0,58 0,58 0,57 0,549 0,57	- - - - -	- - - - -
	750 V 2 3 4 5≤120mm² 5>120mm² 6≤120mm² 6>120mm²	26,04 21,8 25,0 27,55 27,55 31,58 31,58	0,5997 0,60 0,585 0,5792 0,5792 0,5791 0,5791	- - - - $1,3\times10^{-10}$ - $1,8\times10^{-7}$	- - - - 4,8 - 3,55

Table B.52-1 (concluded)

Current-carrying capacity table	Column	Coefficients and exponents			
		A	m	B	n
52-C9	2≤16mm²	16.8	0,62	-	-
	2>16mm²	14.9	0,646	-	-
	3≤16mm²	14,3	0.62	-	-
	3>16mm²	12.9	0.64	-	-
	4	17,1	0,632	-	-
	5≤300mm²	13.28	0,6564	6×10^{-5}	2,14
	5>300mm²	13,28	0,6564	-	-
	6≤300mm²	13,75	0.6581	$1,2\times10^{-4}$	2,01
	6>300mm²	13.75	0,6581	-	-
	7	18,75	0,637	-	-
	8	15,8	0,654	-	-
52-C10	2≤16mm²	12,8	0,627	-	-
	2>16mm²	11,4	0,64	-	-
	3≤16mm²	11,0	0.62	-	-
	3>16mm²	9,9	0,64	-	-
	4	12,0	0.653	-	-
	5	9.9	0,663	-	-
	6	10,2	0,666	-	-
	7	13.9	0.647	-	-
	8	11,5	0,668	-	-
52-C11	2≤16mm²	20,5	0,623	-	-
	2>16mm²	18,6	0,646	-	-
	3≤16mm²	17,8	0,623	-	-
	3>16mm²	16,4	0,637	-	-
	4	20,8	0,636	-	-
	5≤300mm²	16,0	0,6633	-	-
	5>300mm²	16,0	0,6633	6×10^{-4}	1,793
	6≤300mm²	16,57	0,665	-	-
	6>300mm²	16,57	0,665	3×10^{-4}	1,876
	7	22.9	0,644	-	-
	8	19,1	0,662	-	-
52-C12	2≤16mm²	16,0	0,625	-	-
	2>16mm²	13,4	0.649	-	-
	3≤16mm²	13,7	0,623	-	-
	3>16mm²	12.6	0,635	-	-
	4	14,7	0,654	-	-
	5	11.9	0,671	-	-
	6	12,3	0.673	-	-
	7	16,5	0,659	-	-
	8	13.8	0.676	-	-

Annex C
(informative)
Effect of harmonic currents on balanced three-phase systems

C.1 Reduction factors for harmonic currents in four-core and five-core cables with four cores carrying current

Subclause 523.5.3 states that where the neutral conductor carries current without a corresponding reduction in load of the phase conductors the current flowing in the neutral conductor shall be taken into account in ascertaining the current-carrying capacity of the circuit

This subclause is intended to cover the situation where there is current flowing in the neutral of a balanced three-phase system.Such neutral currents are due to the line currents having a harmonic content which does not cancel in the neutral.The most significant harmonic which does not cancel in the neutral is usually the third harmonic.The magnitude of the neutral current due to the third harmonic may exceed the magnitude of the power frequency phase current.The neutral current will then have a significant effect on the current-carrying capacity of the cables in the circuit.

The reduction factors given in this annex apply to balanced three-phase circuits;it is recognized that the situation is more onerous if only two of the three phases are loaded.In this situation the neutral conductor will carry the harmonic currents in addition to the unbalanced current.Such a situation can lead to overloading of the neutral conductor.

Equipment likely to cause significant harmonic currents are,for example,fluorescent lighting banks and d.c.power supplies such as those found in computers.Further information on harmonic disturbances can be found in IEC 61000.

The reduction factors given in table C.52-1 only apply to cables where the neutral conductor is within a four-or five-core cable and is of the same material and cross-sectional area as thephase conductors.These reduction factors have been calculated based on third harmoniccurrents.If significant,more than 10 %,higher harmonics,9th,12th,etc.are expected thenlower reduction factors are applicable.Where there is an unbalance between phases of morethan 50 %then lower reduction factors may be applicable.

The tabulated reduction factors,when applied to the current-carrying capacity of a cable with three loaded conductors,will give the current-carrying capacity of a cable with four loaded conductors where the current in the fourth conductor is due to harmonics.The reduction factors also take the heating effect of the harmonic current in the phase conductors into

Where the neutral current is expected to be higher than the phase current then the cable size should be selected on the basis of the neutral current.

Where the cable size selection is based on a neutral current which is not significantly higher than the phase current it is necessary to reduce the tabulated current-carrying capacity for three loaded conductors.

If the neutral current is more than 135 %of the phase current and the cable size is selected on the basis of the neutral current then the three phase conductors will not be fully loaded.Thereduction in heat generated by the phase conductors offsets the heat generated by the neutralconductor to the extent that it is not necessary to apply any reduction factor to the current-carrying capacity for three loaded conductors.

Table C.52-1 - Reduction factors for harmonic currents in 4-and 5-core cables

Third harmonic content of phase current %	Reduction factor	
	Size selection is based on phase current	Size selection is based on neutral current
0-15	1,0	-
15-33	0,86	-
33-45	-	1,0
>45	-	0,86

C.2 Examples of the application of reduction factors for harmonic currents

Consider a three-phase circuit with a design load of 39A to be installed using four-core PVC insulated cable clipped to a wall,installation method C.

From table 52-C3 a 6 mm²cable with copper conductors has a current-carrying capacity of 41 A and hence is suitable if harmonics are not present in the circuit.

If 20 %third harmonic is present then a reduction factor of 0.86 is applied and the design load becomes:

$$\frac{39}{0,86} = 45\ A$$

For this load a 10 mm2 cable is suitable.

If 40 %third harmonic is present the cable size selection is based on the neutral current which is:

$$39 \times 0,4 \times 3 = 46,8\ A$$

and a reduction factor of 0,86 is applied,leading to a design load of:

$$\frac{46,8}{0,86} = 54,4\ A$$

For this load,a 10 mm²cable is suitable.

If 50 %third harmonic is present the cable size is again selected on the basis of the neutral current,which is:

$$39 \times 0,5 \times 3 = 58,5\ A$$

In this case the rating factor is 1 and a 16 mm²cable is suitable.

All the above cable selections are based on the current-carrying capacity of the cable only; voltage drop and other aspects of design have not been considered.

Bibliography

IEC 60502(all parts),Power cables with extruded insulation and their accessories for rated voltages from 1 kV(Um=1,2 kV)up to 30 kV(Um=36 V)

IEC 60702(all parts),Mineral insulated cables with a rated voltage not exceeding 750 V

IEC 61000(all parts),Electromagnetic compatibility (EMC)