

LOW VOLTAGE: Current ratings, Correction factors, Voltage drops

FLEXIBLE THERMOPLASTIC CABLE FOR LIGHT DUTY AND ORDINARY		
Cross-section mm ²	Current permissible for ambient temperature of 30°C (A)	
	Single-core	Multi-core
0,5	3	3
0,75	6	6
1	10	10
1,5	16	16
2,5	25	20
4	32	25

Values in this table are extracted from the standard EN 50565 "Guide for the use of low voltage cables" and applicable in most cases. It is recommended to consult the tables of correction coefficients and the voltage drops to assess other environmental conditions.

FLEXIBLE CROSSLINKED CABLE FOR HEAVY SERVICE (TYPE H07RN-F)							
Cross-section mm ²	Current permissible for ambient temperature of 30°C (A)						
	Single-core		Two-core	Three-core		Four-core	Five-core
	Two-phase circuit	Three-phase circuit	Two-phase circuit	Two-phase circuit	Three-phase circuit	Three-phase circuit	Three-phase circuit
4	34	30	34	35	29	30	30
6	43	38	43	44	36	37	38
10	60	53	60	62	51	52	54
16	79	71	79	82	67	69	71
25	104	94	105	109	89	92	94
35	129	117	-	135	110	114	-
50	162	148	-	169	138	143	-
70	202	185	-	211	172	178	-
95	240	222	-	250	204	210	-
120	280	260	-	292	238	246	-
150	321	300	-	335	273	282	-
185	363	341	-	378	309	319	-
240	433	407	-	447	365	377	-
300	497	468	-	509	415	430	-
400	586	553	-	-	-	-	-
500	670	634	-	-	-	-	-
630	784	742	-	-	-	-	-

CORRECTION FACTORS OF TEMPERATURE							
Ambient temperature °C	30	35	40	45	50	55	
Correction factors	1	0,91	0,82	0,71	0,58	0,41	

Values in this table are extracted from the standard EN 50565 "Guide for the use of low voltage cables" and applicable in most cases. The single-phase cables are assembled bundle (2 cables in contact side to side and 3 cables in trefoil). It is recommended to consider the correction coefficients and voltage drops tables to value other environmental conditions.

CABLES TYPE H07RN-F FOR SIGNALLING AND CONTROL		
N° conductors	Current permissible for ambient temperature of 30°C (A)	
	1,5 mm ²	2,5 mm ²
7	11	15
12	9	12
19	8	10
24	7	9
36	5	7

Values in this table are applicable in most cases. It is recommended to consult the tables of correction factors and the voltage drops to assess other environmental conditions.

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CABLES TYPE H01N2-D E H01N2-E FOR ARC WELDING				
For a service to a single cycle for a period of 5 minutes max				
Cross-section mm ²	Current permissible (A) in function of time of application of the charge (Cables in free air: T° 25°C and T° conductor 85°C)			
	100%	85%	60%	35%
10	100	103	108	122
16	135	145	175	230
25	180	195	230	300
35	225	245	290	375
50	285	305	365	480
70	355	385	460	600
95	430	470	560	730
120	500	540	650	850
150	580	630	750	980
185	665	720	860	1120

For a repeated service based on a repetition period of 5 minutes							
Cross-section mm ²	Current permissible (A) a function of time of application of charge (Cables in free air: T° 25°C and T° conductor 85°C)						
	100%	85%	80%	60%	35%	20%	8%
10	100	101	102	106	119	143	206
16	135	138	140	148	173	212	314
25	180	186	189	204	244	305	460
35	225	235	239	260	317	400	608
50	285	299	305	336	415	529	811
70	355	375	383	426	531	682	1053
95	430	456	467	523	658	850	1319
120	500	532	545	613	776	1006	1565
150	580	619	634	716	911	1184	1845
185	665	711	729	826	1054	1374	2145

For a repeated service based on a repetition period of 10 minutes							
Cross-section mm ²	Current permissible (A) a function of time of application of charge (Cables in free air: T° 25°C and T° conductor 85°C)						
	100%	85%	80%	60%	35%	20%	8%
10	100	100	100	101	106	118	158
16	135	136	136	139	150	174	243
25	180	182	183	190	213	254	366
35	225	229	231	243	279	338	497
50	285	293	296	316	371	457	681
70	355	367	373	403	482	602	908
95	430	448	456	498	606	765	1164
120	500	524	534	587	721	917	1404
150	580	610	622	689	853	1090	1676
185	665	702	717	727	995	1277	1971

Cross-section mm ²	Voltage drop (V) in direct current to 100 A on 10 m of cable to the temperature of:		
	20°C	60°C	85°C
10	1,95	2,26	2,45
16	1,24	1,430	1,560
25	0,795	0,920	0,998
35	0,565	0,654	0,709
50	0,393	0,455	0,493
70	0,277	0,321	0,348
95	0,210	0,243	0,264
120	0,164	0,190	0,206
150	0,132	0,153	0,166
185	0,108	0,125	0,136

Values in this table are extracted from the standard EN 50565 "Guide for the use of low voltage cables"

LOW VOLTAGE: Current ratings, Correction factors, Voltage drops

Correction coefficient for ambient temperature other than 30°C		
Ambient temperature (°C)	Correction factor (PVC)	Correction factor (EPR)
10	1,22	1,15
15	1,17	1,12
20	1,12	1,08
25	1,06	1,04
35	0,94	0,96
40	0,87	0,91
45	0,79	0,87
50	0,71	0,82
55	0,61	0,76
60	0,50	0,71

Correction factor for groups of circuits installed on the same layer									
Arrangement (cables in contact)	Number of circuits or of multi-core cables								
	1	2	3	4	5	6	7	8	9
Grouped in bundles	1,00	0,80	0,70	0,65	0,60	0,57	0,54	0,52	0,50
Single layer on wall, floor or not perforated gangway	1,00	0,85	0,79	0,75	0,73	0,72	0,72	0,71	0,70
Ceiling layer	0,95	0,81	0,72	0,68	0,66	0,64	0,63	0,62	0,61
Single layer on perforated gangway, horizontal or vertical (perforated or not)	1,00	0,88	0,82	0,77	0,75	0,73	0,73	0,72	0,72
Single layer on laying cables stairs or stapled to a support	1,00	0,87	0,82	0,80	0,80	0,79	0,79	0,78	0,78

Correction factor for circuits realized with multi-core cables installed in a layer in more supports									
Type of installation		N° gangways	Number of cables						
			1	2	3	4	6	9	
Perforated gangways	in contact	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	2	1,00	0,99	0,96	0,92	0,87	-	
		3	1,00	0,98	0,95	0,91	0,85	-	
Vertical perforated gangways	in contact	2	1,00	0,88	0,81	0,76	0,71	0,70	
		2	1,00	0,91	0,88	0,87	0,85	-	
Laying cables stairs or support element	in contact	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	2	1,00	0,99	0,98	0,97	0,96	-	
		3	1,00	0,98	0,97	0,96	0,93	-	

Correction factor for soil temperatures other than 20°C		
Soil temperature (°C)	Correction factor (PVC)	Correction factor (EPR)
10	1,10	1,07
15	1,06	1,05
25	0,94	0,94
30	0,87	0,88
35	0,80	0,81

LOW VOLTAGE: Current ratings, Correction factor, Voltage drops

CORRECTION FACTOR FOR GROUPS OF MORE CIRCUITS INSTALLED ON THE SAME FLOOR AND LAID IN PIPES AND DIRECT BURIED WITH A SINGLE CABLE FOR PIPE					
Cables	Circuits	Distance between circuits (m)			
		in contact	0,25	0,50	1,0
	n° cables 2	0,85	0,90	0,95	0,95
	n° cables 3	0,75	0,85	0,90	0,95
	n° cables 4	0,70	0,80	0,85	0,90
	n° cables 5	0,65	0,80	0,85	0,90
	n° cables 6	0,60	0,80	0,80	0,90
	n° circuits 2	0,80	0,90	0,90	0,95
	n° circuits 3	0,70	0,80	0,85	0,90
	n° circuits 4	0,65	0,75	0,80	0,90
	n° circuits 5	0,60	0,70	0,80	0,90
	n° circuits 6	0,60	0,70	0,80	0,90

CORRECTION FACTOR FOR DIFFERENT VALUES OF DEPTH OF LAYING					
Laying depth (m)	0,5	0,8	1,0	1,2	1,5
Correction coefficient	1,02	1,00	0,98	0,96	0,94

CORRECTION FACTOR FOR DIFFERENT VALUES OF GROUND THERMAL RESISTIVITY (K·m/W)						
SINGLE-CORE CABLES	Resistivity of the ground	1,0	1,2	1,5	2,0	2,5
	Correction factor	1,08	1,05	1,00	0,90	0,82
MULTICORE CABLES	Resistivity of the ground	1,0	1,2	1,5	2,0	2,5
	Correction factor	1,06	1,04	1,00	0,91	0,84

PVC INSULATED CABLES												
COEFFICIENTS "K" FOR THE CALCULATION OF VOLTAGE DROPS IN ALTERNATE CURRENT												
Cross-section mm ²	SINGLE-CORE CABLES						TWO-CORE CABLES			THREE-CORE CABLES		
	Single-phase ☉☉			Three-phase ☉☉☉			Single-phase			Three-phase		
	cosφ 0,8	cosφ 0,9	cosφ 1	cosφ 0,8	cosφ 0,9	cosφ 1	cosφ 0,8	cosφ 0,9	cosφ 1	cosφ 0,8	cosφ 0,9	cosφ 1
	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am
1,5	25,63	28,77	31,83	22,17	24,89	27,53	25,59	28,73	31,83	22,13	24,86	27,53
2,5	15,43	17,30	19,10	13,35	14,97	16,52	15,39	17,27	19,10	13,31	14,94	16,52
4	9,63	10,77	11,84	8,33	9,32	10,25	9,59	10,74	11,84	8,30	9,29	10,25
6	6,46	7,21	7,90	5,59	6,24	6,83	6,43	7,19	7,90	5,56	6,22	6,83
10	3,79	4,21	4,57	3,28	3,64	3,95	3,76	4,19	4,57	3,25	3,62	3,95
16	2,44	2,69	2,90	2,11	2,33	2,50	2,41	2,68	2,90	2,09	2,31	2,50
25	1,61	1,76	1,87	1,39	1,53	1,61	1,59	1,75	1,87	1,37	1,51	1,61
35	1,17	1,27	1,33	1,01	1,10	1,15	1,15	1,26	1,33	1,00	1,09	1,15
50	0,85	0,91	0,92	0,73	0,79	0,80	0,83	0,90	0,92	0,72	0,78	0,80
70	0,62	0,66	0,65	0,54	0,57	0,56	0,61	0,65	0,65	0,53	0,56	0,56
95	0,50	0,52	0,50	0,43	0,45	0,43				0,42	0,44	0,43
120	0,41	0,42	0,39	0,35	0,36	0,34						
150	0,35	0,35	0,31	0,30	0,30	0,27						
185	0,30	0,30	0,26	0,26	0,26	0,22						
240	0,25	0,25	0,20	0,22	0,21	0,17						

$$\Delta V = \frac{K \cdot I \cdot L \text{ (meters)}}{1000} \quad \text{(voltage drop in V)}$$

K = values of table - I = current in A - L = line length in meters

LOW VOLTAGE: Current ratings, Correction factor, Voltage drops

RUBBER INSULATED CABLES												
COEFFICIENTS "K" FOR THE CALCULATION OF VOLTAGE DROPS IN ALTERNATE CURRENT												
Cross-section mm ²	SINGLE-CORE CABLES						TWO-CORE CABLES			THREE-CORE CABLES		
	Single-phase ⊙⊙			Three-phase ⊙⊙⊙			Single-phase			Three-phase		
	cosφ 0,8	cosφ 0,9	cosφ 1	cosφ 0,8	cosφ 0,9	cosφ 1	cosφ 0,8	cosφ 0,9	cosφ 1	cosφ 0,8	cosφ 0,9	cosφ 1
	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am	mV/Am
1,5	27,31	30,65	33,92	23,62	26,51	29,34	27,25	30,61	33,92	23,57	26,48	29,34
2,5	16,44	18,43	20,35	14,22	15,94	17,60	16,39	18,40	20,35	14,18	15,91	17,60
4	10,24	11,47	12,62	8,86	9,92	10,92	10,20	11,44	12,62	8,83	9,89	10,92
6	6,87	7,67	8,42	5,94	6,64	7,28	6,83	7,65	8,42	5,91	6,61	7,28
10	4,02	4,48	4,87	3,48	3,87	4,21	3,99	4,45	4,87	3,45	3,85	4,21
16	2,59	2,86	3,09	2,24	2,48	2,67	2,56	2,84	3,09	2,21	2,46	2,67
25	1,70	1,87	1,99	1,47	1,62	1,72	1,68	1,85	1,99	1,45	1,60	1,72
35	1,24	1,35	1,41	1,07	1,17	1,22	1,22	1,33	1,41	1,05	1,15	1,22
50	0,89	0,96	0,99	0,77	0,83	0,85	0,87	0,95	0,99	0,76	0,82	0,85
70	0,66	0,70	0,70	0,57	0,61	0,60	0,64	0,69	0,70	0,55	0,59	0,60
95	0,52	0,55	0,53	0,45	0,47	0,46	0,51	0,54	0,53	0,44	0,46	0,46
120	0,43	0,44	0,41	0,37	0,38	0,36	0,41	0,43	0,41	0,36	0,37	0,36
150	0,36	0,37	0,33	0,31	0,32	0,29	0,35	0,36	0,33	0,30	0,31	0,29
185	0,32	0,32	0,27	0,27	0,27	0,24				0,26	0,27	0,24
240	0,26	0,26	0,21	0,23	0,22	0,18				0,22	0,22	0,18
300	0,23	0,22	0,17	0,20	0,19	0,15				0,19	0,18	0,15
400	0,20	0,19	0,13	0,17	0,16	0,12				0,16	0,16	0,12
500	0,17	0,16	0,11	0,15	0,14	0,091						
630	0,16	0,14	0,09	0,14	0,12	0,075						

N.B. The coefficients were calculated for rubber cables related to CEI 20-13 standard

$$\Delta V = \frac{K \cdot I \cdot L \text{ (meters)}}{1000} \quad \text{(voltage drop in V)}$$

K = values of table - I = current in A - L = line length in meters

MEDIUM VOLTAGE: Correction factors

CONDITIONS CURRENT CARRYING CAPACITY				
Load factor (%)	Ambient temperature (°C)	Soil temperature (°C)	Resistivity of the ground (°C cm/W)	Laying depth (cm)
100	30	20	100	80

CORRECTION FACTOR FOR LAYING IN AIR AT TEMPERATURE DIFFERENT THAN 30°C										
Ambient temperature (°C)	20	25	30	35	40	45	50	55	60	65
Correction factors	1,09	1,05	1,00	0,95	0,90	0,85	0,79	0,74	0,67	0,60

CORRECTION FACTOR FOR LAYING IN SOIL AT TEMPERATURE DIFFERENT THAN 20°C							
Soil temperature (°C)	15	20	25	30	35	40	45
Correction factors	1,05	1,00	0,96	0,92	0,88	0,84	0,80

CORRECTION FACTOR FOR LAYING IN SOIL WITH RESISTIVITY DIFFERENT THAN 100°C cm/W					
Type of soil	Dry slag carryover	Dry sand	Compacted soil normal humidity	Moist soil	Wet land and sand
Thermal resistivity	500	300	100	80	70
Correction factors	0,56	0,67	1,00	1,11	1,16

CORRECTION FACTOR FOR LAYING IN SOIL DIFFERENT THAN 80 cm DEPTH						
Laying depth (cm)	80	100	125	150	175	200
Correction factors	1,00	0,98	0,96	0,95	0,94	0,92

MEDIUM VOLTAGE: Determination of the section and the choice of the type of cable

The wire size is determined based on the following conditions:

- Maximum permissible current carrying capacity (data sheets of individual cables)
- Maximum acceptable voltage drop (1)
- Maximum permissible temperature of short-circuit (2)

(1) Calculation of the voltage drop

$$\Delta V = KL \sqrt{R \cos \varphi + X \sin \varphi}$$

where:

- ΔV = voltage drop expressed in Volts
- $K = 2$ for single phase line
 $= \sqrt{3}$ for three-phase line
- L = line length (km)
- I = phase current (A)
- R = phase resistance at rating temperature (Ω/km)
- X = phase reactance (Ω/km)
- $\cos \varphi$ = power factor
- $\sin \varphi = \sqrt{1 - \cos^2 \varphi}$

(2) Calculation of the maximum current of short-circuit

$$I_{cc} = K S / \sqrt{t}$$

where:

- I_{cc} = short-circuit current (A)
- t = duration of short circuit (seconds)
- S = conductor cross-section
- $K = 115$ for copper conductor and short-circuit temperature of 160°C
- $= 143$ for copper conductor and short-circuit temperature of 250°C
- $= 152$ for copper conductor and short circuit temperature of 300°C
- $= 100$ in the case of joints with welding
- $= 92$ for aluminum conductor and short-circuit temperature of 250°C

CHOICE OF CABLES FOR SYSTEMS WITH THREE PHASE VOLTAGE MAX UP TO 52 kV				
Rated voltage U KV	Max. Voltage Um kV	Category	Maximum duration of single continuous working with one grounded phase	Cable insulation rating Uo kV
3	3,6	A	up to 1 hour	1,8
		B	up to 8 hours	1,8
		C	over 8 hours	3,6
6	7,2	A	up to 1 hour	3,6
		B	up to 8 hours	3,6
		C	over 8 hours	6
10	12	A	up to 1 hour	6
		B	up to 8 hours	6
		C	over 8 hours	8,7
15	17,5	A	up to 1 hour	8,7
		B	up to 8 hours	8,7
		C	over 8 hours	12
20	24	A	up to 1 hour	12
		B	up to 8 hours	12
		C	over 8 hours	18
30	36	A	up to 1 hour	18
		B	up to 8 hours	18
		C	over 8 hours	26
45	52	A	up to 1 hour	26
		B	up to 8 hours	26
		C	over 8 hours	36

Category A includes those systems in which they can be operated with a phase to earth for a period not exceeding one hour

Category B: includes those systems in which it can be operated with a phase to earth for a period not exceeding 8 consecutive hours and a total duration not exceeding 125 hours per year

Category C: includes all those systems that are not the categories A and B