



Current Carrying Capacity of RADOX Solar cables

Content:

1. Scope	2
2. Definitions	2
3. General remarks	2
4. Current rating under service conditions	3
4.1 Standard conditions for current rating	3
4.2 Reduction factors for increased ambient temperature	3
4.3 Reduction factors for different conductor temperatur	4
4.4 Life time expectation	4
5. Tables	5/6

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RADOX Solar Cables

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1. Scope :

The following tables referring to RADOX cores give an easy and fast support for the layout of apparatus and components.

The following remarks are based on today's state of the art and practical experience as described in the standards IEC 60216, IEC 60287 and IEC 60364. The application of products will frequently vary from the theoretical values of constant ambient temperature, constant current carrying, homogeneous laying and others. That means, in practice the theoretical current carrying will differ from the real values both in a positive as in a negative way.

For a safe layout of apparatus and components it is recommended to carry out a test with the installed wire under service conditions.

2. Definitions :

Current load	: current passed through the cable during operation
Continuous operation	: an operation with constant current whose duration is at least long enough to allow the system to reach thermal equilibrium, but may then go on indefinitely
Current rating	: maximum permissible current under determined operation conditions
Permissible operating temperature	: maximum permissible conductor temperature during continuous operation

3. General remarks :

3.1 The current carrying capacity of cables depends on:

- ▶ Conductor material (copper, copper alloy, aluminium, steel)
- ▶ Surface treatment of the conductor (plain, tinned, silver plated, nickel plated)
- ▶ Conductor cross section
- ▶ Thermal capacity of the insulation material
- ▶ Ambient temperature (air/ground temperature)
- ▶ Installation mode (free in the air, in cable ducts, in earth)
- ▶ Accumulation (single core, several cores spaced, bundles)
- ▶ Other ambient effects (sun-radiation, UV)

3.2 The conductor cross-section has to be selected in such a way that the actual current load does not exceed the current rating, i.e. the conductor temperature does not exceed the permissible operating temperature. The determining factor is the appropriate, most unfavourable operating condition, encountered during operation over the whole length of the cable.



RADOX Solar Cables

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4. Current rating under service conditions :

$$I = I_N \cdot f_1 \cdot f_2 \cdot f_3$$

- I [A] : Current rating for continuous operation under service conditions
- I_N [A] : Current rating for continuous operation under standard conditions
- f_1 : Reduction factor for increased ambient temperature (see # 4.2)
- f_2 : Reduction factor for deviated conductor temperature (see # 4.3)
- f_3 : Reduktion factor for bundeled cables (see tables on pages 3 and 4)

4.1 Standard conditions for current rating

4.1.1 The tabled values for the current rating were calculated according to IEC 287 for the following standard conditions:

- continuous operation
- single circuit for 3-phase current, single conductor for 1-phase current
- 30°C ambient temperature and sufficiently large and ventilated spaces, whose ambient temperature is not appreciably increased by the heat coming from the cables.
- 120°C conductor temperature
- frequency up to 200 Hz

4.1.2 Installation in air, unrestricted heat dissipation, means that the following installation conditions are observed :

- distance of the cables from the wall, from the floor, from the ceiling > cable diameter
- distance between two adjacent power circuits > 2 x cable diameter
- vertical distance between power circuits laid one upon another for individual cables > 2 x cable diameter and for layers of cables > 200 mm
- perforated tray with a perforation > 30 % of the total surface

4.1.3 Open trays are continuous supports with vertical sides, but without cover. A possible perforation accounts for < 30% of the total surface.

4.1.4 Closed ducts are entirely closed. Pipes belong to this category also.
The max. filling degree is 70%.

4.2 Reduction factors for increased ambient temperature :

Ambient temperature [°C]	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115
Reduction factor f_1	1	0.97	0.94	0.91	0.88	0.85	0.82	0.78	0.75	0.71	0.67	0.62	0.58	0.53	0.47	0.41	0.33	0.22



RADOX Solar Cables

Current Carrying Capacity of Radox Solar Cables

4.3 Reduction factors for different conductor temperature :

Conductor temperature [°C]	120	110	100	90	80	70
Reduction factor f ₂	1	0.96	0.91	0.85	0.79	0.72

Maximum permitted typical conductor temperature for various insulation Materials according to IEC 60216 (20'000 h / 50 % elongation at break):

PVC, CR	70°C
PE-X, EPR	90°C
RADOX [®] 125	120°C

4.4 Life time expectation

If crosslinked wires are used at higher temperatures than indicated by the temperature index of IEC 60216, the life time is reduced accordingly. Analogical, the life time will increase at lower temperatures. RADOX[®] 125 for example has a life span of 20'000 h at a conductor temperature of +120°C, which is approx. 2,5 years. If it is used at another temperature, life time expectations are as follows:

Example RADOX Solar Cables:

160°C	1'250 h
150°C	2'500 h
140°C	5'000 h
130°C	10'000 h
120°C	20'000 h
110°C	40'000 h
100°C	80'000 h
90°C	160'000 h
80°C	320'000 h



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Continuous current rating

Conductor temperature 120 °C

Ambient temperature 30 °C

Installation method	2. on floor or wall				3. fixed on a ceiling or under floor									4. in conduit in a void or in a pipe														
	1	2	3	4	1	2	3	4	5	6	7	8	≥ 9	1	2	3	4	5	6	7	8	9	10	12	14	16	20	
Number of simultaneous loaded conductors per installation																												
Reduction faktor f ₃	0.85	0.79	0.75		0.95	0.81	0.72	0.68	0.66	0.64	0.63	0.62	0.61	0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.48	0.45	0.43	0.41	0.38		
Conductor size mm ²	35	48	64	84	118	158	212	262	330	420	499	580	670	30	41	55	72	96	128	172	212	262	330	420	499	580	670	
	27	36	48	63	89	119	159	207	248	315	375	435	523	28	38	51	67	94	125	168	207	248	315	375	435	523		
	34	46	61	80	113	151	202	249	314	399	475	551	637	29	39	52	69	96	128	172	212	262	330	420	499	580	670	
	26	35	47	61	85	114	153	199	238	286	360	418	483	26	32	40	53	72	96	128	166	208	265	315	372	443	523	
	24	33	44	58	81	108	145	189	225	278	340	395	456	24	30	38	50	68	92	120	158	202	257	310	366	443	523	
	23	31	41	54	76	102	136	181	218	272	330	383	443	23	29	36	47	65	88	116	154	199	254	310	366	443	523	
	22	30	40	53	74	100	132	179	218	272	330	383	443	22	28	35	45	62	84	111	148	194	249	305	360	443	523	
	22	30	40	53	74	100	132	179	218	272	330	383	443	22	28	35	45	62	84	111	148	194	249	305	360	443	523	
	21	28	37	49	66	92	120	160	202	257	310	366	426	21	27	34	43	58	78	104	138	182	227	282	337	402	485	
	19	26	34	45	60	80	106	142	182	237	290	346	406	19	25	32	40	53	71	94	124	162	207	262	317	382	465	
	18	24	32	42	56	74	98	130	166	211	264	320	380	18	24	30	38	50	67	89	118	154	199	254	309	374	457	
	17	23	31	41	54	72	96	128	166	211	264	320	380	17	23	29	36	48	64	86	114	148	193	248	303	368	451	
	16	22	30	40	53	70	94	126	164	209	262	318	378	16	22	28	35	46	62	83	110	142	187	242	297	362	445	
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