



US Army Corps
of Engineers
Afghanistan Engineer District

AED Design Requirements: Breaker and Conductor Sizing

Various Locations,
Afghanistan

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Overcurrent protection for conductors and equipment is provided to open the circuit if the current reaches a value that will cause an excessive or dangerous temperature in the **conductors or conductor insulation**. It is very important that the ampacity of the breaker properly protect the conductors. This document does not include instruction for motor protection (See National Electrical Code (NEC) Article 430 for motor protection).

- Breakers are normally sized based on the maximum load that will pass through them on a continuous or non continuous operation (NEC Article 210.20(A)).
 1. Non continuous operation: The load is not operating over 3 hours continuous. The breaker size would be based on maximum load. Example: 100 amp maximum load x 100% = 100 amp breaker size.
 2. Continuous operation: Defined by the NEC is the maximum load on for 3 hours are more. The breaker would be sized for the maximum load plus 25 percent. Example: 100 amp load x 125% = 125 amp breaker size.
 3. Continuous and non continuous mixed loads: The breaker would be sized for not less than 100 % of the non continuous load plus 125 % of the continuous load.
- Conductors shall be sized based on Table 1 below, and NEC 240.4. The table was created based on a worst case capacity from NEC Table 310.16 and IEC 60364 Table A.52-4. Table 1 ampacity values are valid for 3 current carrying-conductors or less in a conduit or raceway, at an ambient temperature of 30°C. If actual conditions differ from these values, Table 2 (correction for number of conductors) and Table 3 (correction for ambient temperature) shall be used to adjust the capacity for conductors shown in Table 1.

ALLOWABLE CAPACITIES OF CONDUCTORS RATED 0 THRU 2000 VOLTS					
Not more than 3 Current-Carrying Conductors in Raceway/Cable/Earth (86°F)			Effective (Z) @ .85 PF Uncoated Copper (ohm/km)		
<u>Size</u>		Ampacity	<u>Conduit Type</u>		
AWG (Cu)	mm ²		PVC	Aluminum	Steel
12	4	20	5.60	5.60	5.60
10	6	30	3.600	3.6	3.6
8	10	40	2.260	2.26	2.3
6	16	55	1.440	1.48	1.48
4	25	70	0.950	0.95	0.98
3	35	85	0.750	0.79	0.79
2	35	89	0.620	0.62	0.66
1	50	108	0.520	0.52	0.52
1/0	70	136	0.430	0.43	0.43
2/0	70	136	0.360	0.36	0.36
3/0	95	164	0.289	0.302	0.308
4/0	120	188	0.243	0.256	0.262
250	150	216	0.217	0.230	0.24
300	150	216	0.194	0.207	0.213
350	185	245	0.174	0.190	0.197
400	240	286	0.161	0.174	0.184
500	300	328	0.141	0.157	0.164
600	300	328	0.131	0.144	0.154

*Based on NEC Table 310.16

** Based on IEC 60364-5-52 Table A 52-4

Table 1

ADJUSTMENT FACTOR FOR MORE THAN 3 CURRENT CARRYING CONDUCTORS	
Number of Conductors	Percentage of Adjustment
4-6	80
7-9	70
10-20	50
21-30	45
31-40	40
41 and above	35

Table 2

CORRECTION FACTORS		
Ambient Temp		X
°C	°F	
21-25	70-77	1.05
26-30	78-86	1.00
31-35	87-95	0.94
36-40	96-104	0.88
41-45	105-113	0.82
46-50	114-122	0.75
51-55	123-131	0.67

Table 3