GREEN CUBES
THE POWER TO PERFORM

Charger & Power Cable Sizing Formulas

Charger Sizing Formulas

1. Calculating Charger Requirements

$$A = \frac{1.1C}{H} + L$$

2. Calculating Hours to Recharge

$$H = \frac{1.1C}{A - L}$$

3. Calculating Charger Losses (BTUs)

$$\text{BTUs PER HOUR} = \left(\frac{1}{EFF} - 1\right) \times Wdc \times 3.42$$

4. Calculating Charger Input Current Drain

Single-Phase Chargers

$$I_{IN} = \frac{E_{OUT} \times I_{OUT}}{E_{IN} \times EFF \times P.F.}$$

Three-Phase Chargers

$$I_{IN} = \frac{E_{OUT} \times I_{OUT}}{E_{IN} \times EFF \times P.F. \times \sqrt{3}}$$

Table of Conventions

A =	DC output rating of charger in amperes
1.1 =	Efficiency factor to return 100% ampere-hours removed from a lead-acid battery. Use 1.4 for NiCad batteries.
C =	Calculated number of ampere-hours discharged from battery. (time in hours x load)
H =	Number of hours recharge time
L =	Load on system in amperes
Wdc =	Output volts x output amperes
I_{IN} =	Input current (amperes ac)
E_{OUT} =	Output voltage (vo ts dc)
I_{OUT} =	Output current (amperes dc)
E_{IN} =	Input voltage (vo ts ac)
EFF =	Efficiency (e.g. 88% = 0.88)
P.F. =	Power Factor (E.G. 92% = 0.92)
√3 =	1.7321

Power Cable Formulas

Wire Gauge Table

SIZE AWG	AREA CIRC. MILS	SIZE AWG MCM*	AREA CIRC. MILS	SIZE AWG MCM*	AREA CIRC. MILS
18	1,620	1	83,690	600	600,000
16	2,580	0	105,600	700	700,000
14	4,110	00	131,100	750	750,000
12	6,530	000	167,800	800	800,000
10	10,380	0000	211,600	900	900,000
8	16,510	250	250,000	1,000	1,000,000
6	26,240	300	300,000	1,250	1,250,000
4	41,740	350	350,000	1,500	1,500,000
3	52,620	400	400,000	1,750	1,750,000
2	66,360	500	500,000	2,000	2,000,000

Source: Handbook 100 National Bureau of Standards.
Note: All wire size #6 and larger is stranded.
* All sizes larger than #0000 are expressed in MCM.

1. Calculating Wire Size Requirements

$$CMA = \frac{A \times LF \times K}{AVD}$$

2. Calculating Current Carrying Capacity of Wire

$$\text{MAX. AMP} = \frac{CMA \times AVD}{LF \times K}$$

Table of Conventions

CMA =	Cross section of wire In circular MIL area
A =	U timate drain in amperes
LF =	Conductor loop feet
MAX. AMP =	Maximum allowable amperes for given vo tage drop
AVD =	Allowable voltage drop Allowable voltage drop
K =	11.1 constant factor for commercial (TW type) copper wire (KS5482-01) 17.4 for aluminum (KS20189)

ABOUT GREEN CUBES TECHNOLOGY

Green Cubes Technology harnesses over 30 years of industry experience to ensure we design, develop and deliver solutions for the most challenging energy needs. We offer battery technology innovation, application design and performance management to drive productivity, scalability and sustainability.

Green Cubes provides complete power systems to the stationary power industry. With the addition of the Guardian and Aspiro Product lines offered under the UNIPOWER brand, these industry proven DC plant systems serve critical applications all around the world. Green Cubes offers complete power solutions including energy storage, power conversion, and seamless integration.

For more information, email **contact@greencubes.com** or visit **greencubes.com**

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