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 (volts dc)
- I_{OUT} = Output current (amperes dc)
- E_{IN} = Input vollage (volts ac)
- EFF = Efficiency (e.g. 88% = 0.88)
- P.F. = Power Factor (E.G. 92% = 0.92)
- $\sqrt{3}$ = 1.7321

POWER CABLING 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 = Ultimate drain in amperes
- LF = Conductor loop feet
- MAX. AMP = Maximum allowable amperes for given voltage drop
- AVD = Allowable voltage drop
- K = 11.1 constant factor for commercial (TW type) copper wire (KS5482-01)
- = 17.4 for aluminum (KS20189)

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