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)

\[ \text{BTUs per hour} = \left(\frac{1}{\text{EFF}} - 1\right) \times \text{Wdc} \times 3.42 \]

4. CALCULATING CHARGER INPUT CURRENT DRAIN

**SINGLE-PHASE CHARGERS**

\[ I_{IN} = \frac{E_{OUT} \times I_{OUT}}{E_{IN} \times \text{EFF} \times \text{P.F.}} \]

**THREE-PHASE CHARGERS**

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

**TABLE OF CONVENTIONS**

- \( A \) = DC output rating of charger in amperes
- \( C \) = 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 \( \times \) load)
- \( H \) = Number of hour recharge time
- \( L \) = Load on system in amperes
- \( \text{Wdc} \) = Output volts \( \times \) output amperes
- \( I_{IN} \) = Input current (amperes ac)
- \( E_{OUT} \) = Output voltage (volts dc)
- \( I_{OUT} \) = Output current (amperes dc)
- \( E_{IN} \) = Input voltage (volts ac)
- \( \text{EFF} \) = Efficiency (e.g. 88% = 0.88)
- \( \text{P.F.} \) = Power Factor (e.g. 92% = 0.92)
- \( \sqrt{3} = 1.7321 \)

POWER CABLELING FORMULAS

**WIRE GAUGE TABLE**

<table>
<thead>
<tr>
<th>SIZE</th>
<th>AWG</th>
<th>AREA CIRC.</th>
<th>SIZE</th>
<th>AWG MCM</th>
<th>AREA CIRC.</th>
<th>SIZE</th>
<th>AWG MCM</th>
<th>AREA CIRC.</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>MILS</td>
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<td>380</td>
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<td>650</td>
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<tr>
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<tr>
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<td></td>
<td>600,000</td>
<td></td>
<td></td>
<td>2,000,000</td>
</tr>
</tbody>
</table>

**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
- \( \text{MAX. AMP} \) = Maximum allowable amperes for given voltage drop
- \( \text{AVD} \) = Allowable voltage drop
- \( K \) = 11.1 constant factor for commercial (TW type) copper wire (KS5482-01)
  
  = 17.4 for aluminum (KS20189)