

Electrical Formulas

1hp = 746 watts

1 ton (hvac) = 3516 watts

Ohm's Law

E	E = IR	E = P/I	E = \sqrt{PR}
I	I = E/R	I = P/E	I = $\sqrt{P/R}$
P	P = EI	P = I ² R	P = E ² /R
R	R = E/I	R = E ² /P	R = P/I ²

Metric Conversions

Exp.	Prefix	Abbrev.
10 ⁶	meg	M
10 ³	kilo	k
10 ⁻³	milli	m
10 ⁻⁶	micro	μ
10 ⁻⁹	nano	n
10 ⁻¹²	pico	p

Voltage Drop

To determine the required wire size for a given application;

... from Table 8, NEC

$$CM = \frac{2KI d}{VD} \text{ or } \frac{(1.73)KI d}{VD} \text{ for 3phase}$$

#14	.....	.4110 CM
#12	.....	.6530 CM
#10	.....	1.0380 CM
#8	.....	1.6510 CM
#6	.....	2.6240 CM
#4	.....	4.1740 CM
#3	.....	5.2620 CM
#2	.....	6.6360 CM
#1	.....	8.3690 CM
#1/0	.....	10.5600 CM

CM = cmil (Table 8 NEC)

d = one way length in feet

K = 12 for copper, 17 for aluminum

VD = Voltage Drop

The National Electrical Code allows 3% VD on branch circuits, with not more than 5% maximum on the system.

example calculation;

A horse barn is located 300' from the service panel, and there is a 10 amp, 120 volt lighting load in the barn. What size copper conductors are needed to meet NEC requirements for voltage drop?

$$CM = 2 \times 12 \times 10 \times 300 = 72,000 \quad \text{allowable VD} = 3\% \times 120 = 3.6$$

$$72,000 / 3.6 = 20,000 \text{ CM} \dots \#6 \text{ copper conductors}$$

Change the lighting to 240 volt, and the aVD becomes 7.2. (#10s)