VOLTAGE DROP FORMULAS

The NEC® recommends a maximum 3% voltage drop for either the branch circuit or the feeder.

Single-Phase:

$$VD = \frac{2 \times R \times I \times L}{CM}$$

Three-Phase:

$$VD = \frac{1.732 \times R \times I \times L}{CM}$$

VD = Volts (voltage drop of the circuit)

R = 12.9 Ohms/Copper or 21.2 Ohms/Aluminum (resistance constants for a conductor that is 1 circular mil in diameter and 1 foot long at an operating temperature of 75° C.)

I = Amps (load at 100 percent)

L = Feet (length of circuit from load to power supply)

CM = Circular-Mils (conductor wire size)

2 = Single-Phase Constant

1.732 = Three-Phase Constant

CONDUCTOR LENGTH/VOLTAGE DROP

Voltage drop can be reduced by limiting the length of the conductors.

Single-Phase:

$$L = \frac{CM \times VD}{2 \times R \times I}$$

Three-Phase:

$$L = \frac{CM \times VD}{1.732 \times R \times I}$$

CONDUCTOR SIZE/VOLTAGE DROP

Increase the size of the conductor to decrease the voltage drop of circuit (reduce its resistance).

Single-Phase:

$$CM = \frac{2 \times R \times I \times L}{VD}$$

Three-Phase:

$$CM = \frac{1.732 \times R \times I \times L}{VD}$$