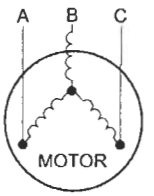
Voltage and Current Unbalance

VOLTAGE UNBALANCE (Maximum 2%)

Voltage unbalance can cause motors to overheat and fail. Below is the recommended method for determining voltage unbalance.

Example: Supply voltage is 240-3-60



AB = 243 volts
BC = 236 volts
AC = 238 volts

$$\text{Average Voltage} = \frac{243 + 236 + 238}{3}$$

$$= \frac{717}{3}$$

$$= 239 \text{ volts}$$

Determine maximum deviation from average voltage:
(AB) 243 – 239 = 4 volts
(BC) 239 – 236 = 3 volts
(AC) 239 – 238 = 1 volt

Maximum deviation is 4 volts.
Determine % voltage unbalance:

$$\% \text{ Voltage unbalance} = 100 \times \frac{4}{239}$$

$$= 1.7\%$$

This amount of phase unbalance is satisfactory as it is below the maximum allowable of 2%.

IMPORTANT: If the supply voltage phase unbalance is more than 2%, contact your local electric utility company or a highly skilled electrician immediately.

CURRENT UNBALANCE (Maximum 10%)

Voltage unbalance will cause a current unbalance, but a current unbalance does not necessarily mean that a voltage unbalance exists. A loose terminal connection or a build-up of dirt or carbon on one set of contacts (using the example of L1 as the problem leg) would cause a higher resistance on that leg (L1) than on L2 and L3. The current follows the path of least resistance, so the current increases in legs L2 and L3. Higher current causes more heat to be generated in the motor windings.

Percent (%) of current unbalance is calculated in the same way as voltage unbalance (see the previous section), with a maximum acceptable current unbalance of 10%.

WHY YOU CANNOT TOLERATE MORE THAN A 2% PHASE UNBALANCE ON 3-PHASE MOTORS:

Winding Temp. Increase = 2 X [(% V Unbal.) Squared]
= 2 X (2 X 2)
= 2 X 4
= 8 % temp. increase in windings

What if we allow a 10% unbalance as suggested by some?

= 2 X [(10 X 10)]
= 2 X 100
= 200% temp. increase in windings