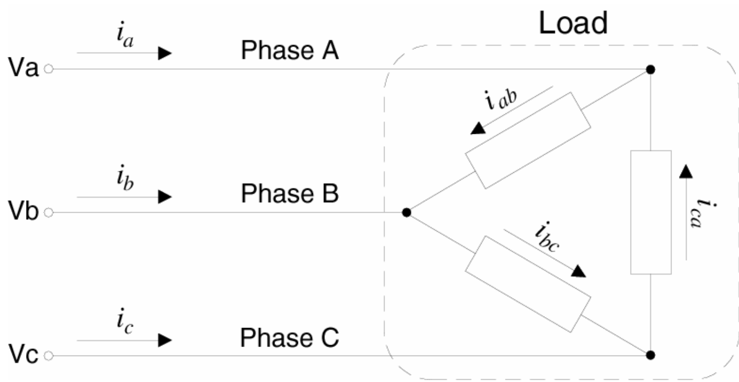
App Note: Estimating Power for Delta Circuits 2/1/1999

This application note describes a technique for estimating the power consumption of a delta circuit. Delta circuits are generally balanced (same current in each phase) and for this analysis we will assume balanced phases. The diagram below shows the three wires that supply power to a delta circuit and the internal currents in the delta load.



To accurately estimate the load, you will need to know the power factor of the load. Purely resistive loads (incandescent lights, electric heaters, etc.) have a power factor of 1.0. Motors and other loads can have lower power factors, typically ranging from 0.5 to 1.0.

Since we are assuming that the delta circuit is balanced, there is no need to measure every phase. Start by measuring Vba, which is the voltage between *Vb* and *Va*. Then measure the current ib. For a load with a power factor of 1.0, the power for the entire load is:

$PTOTAL = 2 \cdot Vba \cdot ib \cdot \cos(30°)$ $\cos(30°) = 0.866$

If the power factor is not 1.0, then the equation becomes:

$PTOTAL = 2 \cdot Vba \cdot ib \cdot \cos(30°) \cdot PF$ where *PF* is the power factor.

Example 1:

You have a resistive electric heater (PF = 1.0) that runs off of a 240 VAC three-phase delta circuit.
ib = 34.64 Amps *Va* = 240 VAC
$PTOTAL = 2 \times 240 \times 34.64 \times 0.866 = 14399$ *Watts*

It is important to note that although *ib* = 34.64 Amps, *iab*, *ibc*, and *ica* each equal 20 Amps, because the currents in the supply wires are 1.732 (the square root of 3) times larger than the phase currents.

Example 2:

You have an electric motor (PF = 0.7) that runs off of a 480 VAC three-phase delta circuit.

ib = 25.0 Amps *Vb* = 480 VAC
$PTOTAL = 2 \times 480 \times 25.0 \times 0.866 \times 0.7 = 14549$ *Watts*

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