Preview 04

Power Factor Improvement

A Report By

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Q: 1

What is the significance of power factor?

The power factor is the cosine of the phase difference between voltage and current. It is also the cosine of the angle of the load impedance. the power factor may be seen as that factor by which the apparent power must be multiplied to obtain the real or average power. The value of pf ranges between zero and unity.

For a purely resistive load, the voltage and current are in phase, so the power factor = 1.

For a purely reactive load (inductive and capacitive), the voltage and current are 90 degree out of phase. The angle between the voltage and current can be either +90 degree or -90 degree. So, the Power Factor= 0; as no current will flow through the circuit.

Power factor is said to be leading or lagging. Leading power factor means that current leads voltage, which implies a capacitive load. Lagging power factor means that current lags voltage, implying an inductive load.

Power factor affects the electric bills consumers pay the electric utility companies. Loads with low power factors are costly to serve because they require large currents. The ideal situation would be to draw minimum current from a supply. A load with low power factor draws more current as additional current flows back and forth between the load and the source which rises additional power losses.

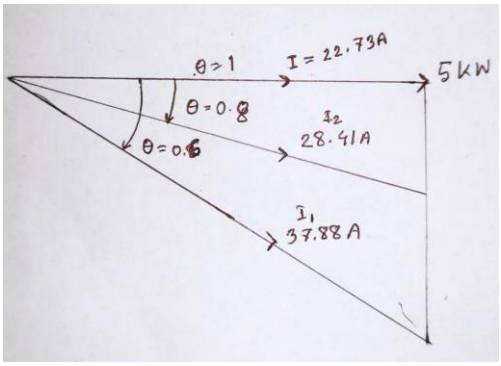
For this reason, power companies often encourage their customers to have power factors closer to unity as possible and penalize some customers who do not improve their load power factors.

What is the improvement principle of power factor? (analyze this problem from physical and mathematical perspective).

If a 5kw induction motor runs at 220V ac.

At 0.6 power factor, the current draw would be

I_1= P/ (V * Cos θ) = 5kw/ (220 * 0.6) = 37.88A



But it we improve the power factor to 0.8,

The current draw would be

I_2= P/ (V * Cos θ) = 5kw/ (220 * 0.8) = 28.41A

And if we improve the power factor to unity,

The current draw would be,

I= P/ (V * Cos θ) = 5kw/ (220 * 1) = 22.73A

From above calculation it is quite obvious that improving power factor to unity reduces current flow for the same amount of power thus reduces additional power losses.

Since most loads are inductive, one or more capacitors are connected in parallel to improve the power factor.

Q2

Design a circuit to measure power and power factor. You can use necessary elements and instruments in Multisim.