



## What is Power Factor?

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Power Factor is the ratio of Active Power to Total Power:

$$\frac{\text{Active Power}}{\text{Total Power}} = \text{Power Factor}$$

Active power is what we normally see as the electricity used in our facility. It is measured in kW (Kilowatts). This is normally what the power company charges against.

Total power is what our equipment needs to be sized for in our facility. It is measured in KVA (Kilo-voltamps). The Power Company may charge extra money (penalties) for a large KVA. The large KVA is usually stated in Power Factor.

Total Power is a combination of Active Power and something called Reactive Power.

Reactive Power takes into consideration the energy needed to build all the magnetic fields in a facility. Your facility's equipment must be sized large enough to handle the extra energy needed to produce these magnetic fields. Magnetic fields are produced in ALL current-carrying equipment in a facility. This includes Switchboards, Panelboards, Busway, wiring, all equipment, and especially MOTORS. Motors have thousands of feet of wire, which add greatly to a facility's Reactive Power.

Let me take a minute and talk about these magnetic fields. In an AC (Alternating Current) system, current flow changes direction 60 times every second. This is called 60 Hertz (Hz). Each time the current changes direction, a magnetic field is developed around ALL current-carrying parts of a circuit. This includes all the wire in your facility and all motors. The energy needed to produce this Magnetic Field is real. You don't see it on your energy bill because the power is given back to the circuit in each quarter cycle. The extra current flow is there. Therefore, you and your power company must size equipment large enough to handle the extra energy needed to produce these magnetic fields. This is why many power companies add an extra charge (penalty) to facilities with a large amount of reactive power.

## What is a good Power Factor?

Power Factor is the ratio of Active Power to Total Power. When Reactive Power is large, Total Power increases. With the formula below, we now see that when Total Power increases, the Power Factor decreases.

$$\frac{\text{Active Power}}{\text{Total Power}} = \text{Power Factor}$$



Example:

$$\frac{1000 \text{ kW}}{1100 \text{ kVA}} = .9 \text{ Power Factor}$$

**.9 to 1 is considered a good power factor.**

### What is a bad Power Factor?

If we increase our Total Power.

Example:

$$\frac{1000 \text{ kW}}{1500 \text{ kVA}} = .6 \text{ Power Factor}$$

Anything less than .9 can be considered a bad power factor. Your Power Company may charge you or you may have internal problems in your facility with Power Factors less than .9.

### How do I correct for a bad Power Factor?

The best way solve a low Power Factor problem is to install Power Factor Correction Capacitors. These Power Factor Correction Capacitors capture the energy from the collapsing magnetic field and give the energy back on the next quarter cycle.

### In summary

With these capacitors storing the energy from the magnetic fields the Power Company does not have to supply extra power; therefore, you do not get penalized. With proper placement of these Power Factor Correction capacitors you can control your facility's power needs and reduce the costs of equipment to handle large Reactive Power Loads.