SHEPHERD TRANSFORMERS INDUSTRIES ®

What is Power Factor?

Power Factor is a measure of how efficiently electrical power is consumed. In the ideal world Power Factor would be unity (or 1). Unfortunately in the real world Power Factor is reduced by highly inductive loads to 0.7 or less. Th is induction is caused by equipment such as lightly loaded electric motors, luminaries transformers and fluorescent lighting ballasts and welding sets, etc.

What does it do to electricity bill?

In a 3 phase supply, kW consumed is (VOLTS x AMPS x 1.73 x P ower Factor) / 1000. The Electricity Company supply you VOLTS x AMPS and they have to supply extra to make up for the loss caused by poor Power Factor. When the power factor falls below a set figure, the electricity supply companies charge a premium on the kW being consumed, or, charge for the whole supply as kVA.

What causes Power Factor to change?

Inductive loads cause the AMPS to lag behind the VOLTS. The wave forms of VOLTS and AMPS are then "out of phase" with each other. The more out of phase they b ecome then the lower the Power Factor. Power Factor is usually expressed as Cos Phi. (Ø)
In 3 phase power supplies the "power" can be measured as a triangle. ACTIVE Power is the base line and is the real usable power measured in kW. REACTIVE power is th e vertical or that part of the supply which causes the inductive load. The reactive power in is measured in kVAr (kilo volt-amperes reactive). APPARENT Power is the hypotenuse. This is the resultant of the other two components and is measured in kVA.

Equipment Causing Poor Power Factor:

A great deal of equipment causes poor power factor. One of the worst offenders is lightly loaded induction equipment. Examples of this type of equipment, and their approximate power factors follow:
• 80% power factor or be tter: Air conditioners (correctly sized), pumps, centerless grinders, cold headers, up setters, fans or blowers.
• 60% to 80% power factor: Induction furnaces, standard stamping machines, and weaving machines.
• 60% power factor and below:
Single-stroke presses, automated machine tools, finish grinders, welders. When the above equipment functions within a facility, savings can be achieved by utilizing industrial capacitors.

Why to improve Power factor?

[A] Reduce utility Power Bills

Removing system KVAR improves the Power Factor to
reduce the utility power bill. Most utility bills are influenced by
KVAR usage.

[B] Increase System Capacity

Improving power factor releases system capacity and permits additional load without overloading the system. In a typical system with 0.80 p.f. 800 KW, 1000KVA is available, by correcting the system to unity p.f. the KW = KVA and now corrected system will support 1000KW thus an increase of 200KW of productive power can be drawn on
the same cable network.

[C] Improvement in system-operation characteristics.

A good Power Factor provides a better voltage. Reducing the pressure on electrical distribution network. Reducing cable heating, cable over loading and cable losses. Reducing over loadings of control gears and switch gears etc…

For an industry with dynamically changing loads, Automatic P.F. compensation is affordable and giving best returns on investment, since the required KVAR investment is comparatively smaller than with fixed capacitor needed to meet the entire load.

While the ideal Power Factor (P.F.) is unity or 1, most industrial loads have a PF lower then unity. In case of lighting loads it is much lesser then unity. Moreover this lower P.F. is usually inductive arising out of the windings of the transformers, motors and similar type of loads consume KVARs from the supply line. The principal of P.F. compensation is to supply these KVARs via a capacitor located close to the load, reducing the current drawn from the supply line. The significant effect of improving the power factor of a circuit is to reduce the current flowing through that circuit which in turn results in the following benefits:

Benefits of Power Factor Improvement

Power factor (PF) is the ratio of useful current to total current. It is also the ratio of useful power expressed in kilowatts (KW) to total power expressed in kilowatt-amperes (KVA). Power factor is usually expressed as a decimal or as a percentage.
Example: 60 KWk
PF = 0.60 = 60%
=100 KVA
Kilowatts = 60 KW, KVA = 100 KVA.

HOW TO IMPROVE POWER FACTOR ?

Power factor correction is achieved by installing capacitors. Under fixed load & fixed voltage conditions it is possible to install fixed capacitors in the system. But this will not be an exact compensation for loads which are varying quite frequently. In most of units load varies frequently. Power factor can either be controlled manually or by automatic control system. In manual control the operator has to go on making adjustment all the time which is very tricky and human error can not be ruled out. suppose unit is on no load & all the capacitors remains connected throughout night this may cause 5 to 10% higher electricity bill.

In automatic control, power factor control relay keeps on sensing the power factor all the time and gives suitable signals to contactors connected to the different value capacitors.