Increasing Utilization Efficiency and Cost Savings with Power Factor Correction on Low Voltage Networks

**Background**

Most loads on modern electrical networks tend to be inductive in nature, a motor for example. Any inductive load has two components – one real (measured in Watts or KW) and the other reactive (calculated as VAR or KVAR). Real power does work by way of turning the motor while reactive power maintains the electromagnetic field required to do the work. The vector sum of these two components gives total or apparent power (represented as VA or KVA). Since reactive power cannot do work by itself, it is often seen as power lost. By definition, a pure inductance (denoted as L) has a lagging power factor since the current lags voltage by 90° while a pure capacitance (denoted as C) has a leading power factor since the current leads voltage by 90°.

**What does power factor mean?**

Power factor, also referred to as cosΦ is defined as the ratio of real power (KW) to apparent power (KVA). Unity power factor means cos Φ = 1, which in real terms simply means that KW = KVA, which therefore implies that KVAR = 0. So when cosΦ → 1, it reflects a very efficient usage of power consumed. When cosΦ = 0.85 or lower, it is considered low power factor, which means there is scope for power factor improvement (PFI) by way of reactive power compensation using capacitors.

**Equation**

\[
\cos \Phi = \frac{KW}{KVA}
\]
What makes ABB capacitors special?
Dry type = lowest possibility of burn outs = maximum safety
Internally protected = each element carries fuse protection
Metallized film = best dielectric properties in dry type design
Self-healing = failures are contained and localized instantly
Modular design = longer operating life of capacitor
Rugged design = safe and reliable operation at all times
100% ABB design & build = best quality control
Global presence = local support anywhere in the world.

What is “good” power factor and why is it important?
Typically \(\cos \Phi\) of 0.90 or higher, is considered to be good power factor. Key benefits of higher power factor are:
- Frees up real power that can supply additional loads
- Helps reduce heat losses in transformers and equipment
- Helps stabilize voltage levels on the network
- Operating life of equipment is greatly increased
- Reduced utility billing means cost savings to the consumer

How does improved power factor benefit a consumer?
Utilities normally penalize consumers on high KVAR values. By installing capacitors on a plant or facility, reactive power is now generated internally by the consumer. The key benefits are:
- Reduced utility billing and no penalties to end-user/consumer
- Cumulative savings across the operating life of PFI equipment
- Measurable payback on PFI equipment investment
- Improved utilization efficiency

Payback time varies inversely with power factor improvement and can go from 6 to 24 months. Also, the increase in utilization efficiency opens up real power (KW) on a given network, which can help defer capital expenditure in some cases, where new loads may need to be added on an existing system.

What PFI solutions can ABB offer?
We have a wide range of standard and custom design capacitor units for small KVAR values, typically from 2 to 100KVAR. In addition, we provide stepwise KVAR compensation with capacitor banks, plain and detuned, standard and custom, all the way up to 1200KVAR, from 208V to 600V. Our SCR-driven Dynacomp series provides instantaneous, precise and stepless compensation. All our power factor solutions are cUL approved and are all assembled locally, in ABB Canada.

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