GOOD PRACTICES IN SME

Compensating reactive power

Designed by freepik

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How is reactive power compensated?

Simply speaking, compensating reactive power consist of using equipment and appliances, which prevent its generation. An unfavourable power factor, resulting from the share of inductive power received, can be limited (compensated) by connecting storage devices (or consuming devices if storage dominates the network). There are two methods of altering the power factor: natural and artificial. Natural methods consist of choosing the right equipment and their proper use. They are based primarily on:

- choosing motors with the right power rating,
- replacing motors running under capacity with lower power motors,
- avoiding idling in motors and transformers,
- turning off technological appliances (e.g. turning off transformer welders during breaks in welding),
- adequate engine maintenance,
- installing synchronous motors instead of induction motors,
- appropriate power consumption, and planning transformer workloads to reflect demand.

Artificial methods include installing additional equipment in electrical systems, whose function would be compensating reactive power drawn by the power consuming appliances. The characteristics of the appliance are the determining factor for the compensating equipment, so that for inductive appliances the compensating component would be capacitors or synchronous compensators, and chokes for storage appliances.
Depending on the scope of the compensation measures and its realization there are three main types of compensating reactive power:

- individual compensation– consists of connecting the compensation equipment directly to the appliance's terminals,
- group compensation – consists of installing compensation equipment in the building's electrical switchboards,
- central compensation – consists of installing compensation equipment directly on the buses of the supplying station (usually the transformer station).

Source: cited from: Katarzyna Strzałka-Gołuszka, Marcin Gołuszka, Jan Strzałka „Aspekty techniczne i ekonomiczne kompensacji mocy biernej w obiektach użyteczności publicznej",2019

Why compensate reactive power?

The work of appliances at a power factor cosφ lower than unity causes an increased power consumption with regard to the same workload at active power and a unity power factor. A low power factor has a range of disadvantageous effects, such as:

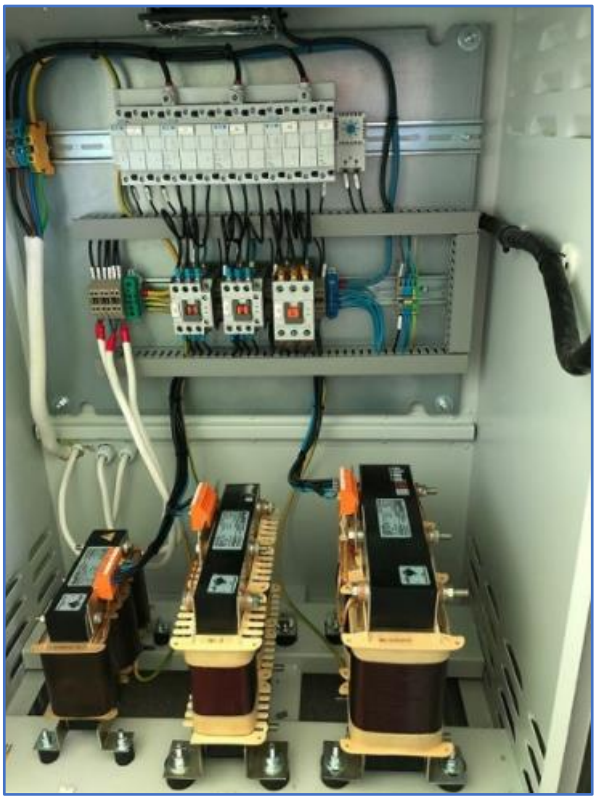
- necessity of installing generating and converting equipment with a higher power rating,
- necessity of using appliances with higher current ratings and higher short-circuit currents,
- necessity of using higher diameter cables and wires,
- decreased capacity of supply networks,
- increased active energy loss in transformers, networks and receiving installations,
- increased voltage drops in transformers and supply lines.

For this reason the regulations limit, independently from voltage, the amount of reactive power consumed, and power consumption above the allowed limit can lead to financial penalties leveraged by the operators of the distribution network.
The advantages of utilizing appropriate reactive power compensation circuits are:

- decreased, and potentially the elimination of, costs of consuming reactive power, and power returned into the network,
- minimalization of active power transmission losses connected to reactive power transmission,
- increased capacity of the transmission system,
- increased reliability of the suppling circuit,
- decreased voltage drops.

Source: cited from: Innogy Polska S.A. „Kompensacja mocy biernej sposobem na zmniejszenie rachunków za prąd w firmie",2019; Katarzyna Strzałka-Gołuszka, Marcin Gołuszka, Jan Strzałka „Aspekty techniczne i ekonomiczne kompensacji mocy biernej w obiektach użyteczności publicznej",2019

Pic. 1 BMS: capacitor battery for compensating inductive reactive power



Pic. 2 BMS: choke battery for compensating storage reactive power