Electrical Blog No. 16 – Power Factor

To understand the electrical power factor, it is essential to know their definition. ***Real power*** (P, measured in Watt) is the actual power consumed by an equipment to perform mechanical work or produce physical effect such as heat, light, etc. ***Reactive power*** (Q, measured in VAR) represents the power being cyclically stored and released in the magnetic field of an inductor or the electric field of a capacitor with no net power consumed. ***Apparent power*** (S, units in VA) is the vector summation of these two: the real and the reactive powers. **Power factor** (PF) is the ratio of real power to apparent power. Hence, PF is an indication of the "efficiency" of the power utilization of an electrical load. Using bicycle race as an example, real power is the power for actual mileage traveled where as reactive power is the power for the cyclist to lean left or right (similar to inductive or capacitive compensation) so that the forwarding power can be maximized.

PF could be theoretically as low as 'Zero', indicating no power is actually consumed despite there is current flow, or as high as 'One' (Unity PF), representing full utilization of the power. To deliver the same real power, a higher current will be required in case of a lower power factor situation. Such increase in current flowing through cables and equipment will result in more energy losses and hence the cost incurred demanding a higher system capacity. The numerical value of PF could be 'negative' denoting a capacitive load, or 'positive' reflecting inductive load. Generally, electrical loads are inductive in nature such as transformers, induction motors and fluorescent lighting. Capacitor banks are often installed to compensate such inductive reactive power for improving the load power factor. Maintaining a good power factor (above 0.85) is essential to reduce the apparent power for both energy and cost savings.

The Electrical Blog is contributed by the Electrical Division. If you would like to know more about this topic, please contact the Division Hon Secretary, Ir Simon Chung at simon.chung@arup.com