

Three-Phase Supply

Both single-phase supply and three-phase supply are alternating current (a.c.) supply. Electrically and mathematically, a three-phase supply is the addition of three single-phase supplies, and the three a.c. cyclical patterns are one after the other symmetrically and repeatedly by cycles.

In Hong Kong, any recent and new buildings with more than four floors have been equipped with a three-phase four-wire rising-main which provides a feasibility to use three-phase supply in any premises. Comparing single-phase and three-phase supplies, the latter has quite a number of merits.

Since the three-phase supply is an integration of three single-phase supplies, hence it delivers more power to drive larger loads. Each single-phase supply has a return conductor. A three-phase supply combines the three return conductors as one common conductor called neutral. When loads in the three-phases are the same, then the neutral can be saved. In three-phase, the current is relatively small in the neutral, and the phases do not receive peak currents simultaneously, hence voltage drops are reduced in three-phase supplies.

The integration of three single-phase supply permits a compact flexibility in equipment design to save space and material. However the redistribution of heat stress and voltage stress must be fully coped with. In a single-phase supply, the magnitude of power is pulsating in sine-wave manner. But the three-phase supply gives a constant power. The single-phase supply produces a stationary magnetic field, and hence starting of motors requires additional facilities. The three-phase supply produces a rotating magnetic field by the vector sum of currents. The rotating field can effect self-starting in motors. In a single-phase supply, its voltage between the two conductors is fixed. But in a three-phase four-wire supply, we may have two voltage levels: the supply between two phase conductors, or between a phase conductor and the neutral conductor.

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 Geoffery L Chan at glchan@hec.com.hk