

# Chapter 03

## Electrical Supply System

### Topic:

Requirements of a distribution system

# Requirements of a distribution system

1. Voltage regulation
2. Dependability
3. Balanced voltage
4. Efficiency
5. Frequency
6. Sinusoidal waveform
7. Freedom from inductive interference

# Voltage regulation

**(i) Voltage regulation.** A voltage variation has a large effect upon the operation of both power machinery and lights. A motor is designed to have its best characteristics at the rated voltage and consequently a voltage that is too high or too low will result in a decrease in efficiency. If the fluctuations in the voltage are sudden, these may cause the tripping of circuit breakers and consequent interruptions to service. Usually the voltage at the generator terminals, where this is done, in some cases the voltage variations at the load may be made sufficiently small by keeping the resistance and reactance of the lines and feeders low.

# Dependability

**(ii) Dependability.** One important requirement of electric supply is to furnish uninterrupted service. The losses which an industrial consumer sustains due to the failure of electric power supply are usually vastly greater than the actual value of the power that he would use during this period. It is on account of the expense of idle workmen and machines and other overhead charges. Interruptions to service cause irritation and are sometimes positively dangerous to life and property. For example, failure of power in hospitals, in crowded theatres and stores may lead to very grave consequences. Therefore, it is the duty of electric supply company to keep the power system going and to furnish uninterrupted service.

# Balanced voltage

**(iii) Balanced voltage.** It is very important that the polyphase voltage should be balanced. If an unbalanced polyphase voltage is supplied to a consumer operating synchronous or induction motors, it will result in a decrease in the efficiency of his machinery and also a decrease in its maximum power output. Motors called upon to deliver full load when their terminal voltages are unbalanced are liable to considerable damage due to overheating. One method of maintaining balance of voltage is by having balanced loads connected to the circuit.

# Efficiency

**(iv) Efficiency.** The efficiency of a transmission system is not of much importance in itself. The important economic feature of the design being the layout of the system as a whole so as to perform the requisite function of generating and delivering power with a minimum overall annual cost. The annual cost can be minimised to a considerable extent by taking care of power factor of the system. It is because losses in the lines and machinery are largely determined by power factor. Therefore, it is important that consumers having loads of low power factor should be penalised by being charged at a higher rate per kWh than those who take power at high power factors. Loads of low power factor also require greater generator capacity than those of high power factor (for the same amount of power) and produce larger voltage drops in the lines and transformers.



**(v) Frequency.** The frequency of the supply system must be maintained constant. It is because a change in frequency would change the motor speed, thus interfering with the manufacturing operations.

**(vi) Sinusoidal waveform.** The alternating voltage supplied to the consumers should have a sine waveform. It is because any harmonics which might be present would have detrimental effect upon the efficiency and maximum power output of the connected machinery. Harmonics may be avoided by using generators of good design and by avoidance of high flux densities in transformers.

**(vii) Freedom from inductive interference.** Power lines running parallel to telephone lines produce electrostatic and electromagnetic field disturbances. These fields tend to cause objectionable noises and hums in the apparatus connected to communication circuits. Inductive interference with telephone lines may be avoided by limiting as much as possible the amount of zero-sequence and harmonic current and by the proper transposition of both power lines and telephone lines.

• **Thankyou**