13.1 FEATURES OF A POLY-PHASE SUPPLY

As its name implies, a poly-phase power supply or multi-phase supply provides the user with several power supply 'phases'. The way in which these 'phases' are generated is described in sections 13.2 and 13.3, and we concentrate here on the advantages of the use of a poly-phase supply which are:

1. For a given amount of power transmitted to the user, the volume of conductor material needed in the supply cable is less than in a single-phase system to supply the same amount of power. A poly-phase transmission system is therefore more economical than a single-phase supply system.
2. Poly-phase motors and other electrical equipment are generally smaller and simpler than single-phase motors and equipment. For industry, poly-phase equipment is cheaper and easier to maintain.

A poly-phase supply system may have two, three, four, six, twelve or even twenty-four phases, with the three-phase system being the most popular. The National Grid distribution network is a three-phase system. An introduction to electrical power distribution systems was given in Chapter 8, where it was shown that power is distributed to industry using a three-phase system, a single-phase system being used for domestic power distribution.

13.2 A SIMPLE TWO-PHASE GENERATOR

Consider the simple single-phase generator or alternator in Figure 13.1(a). If line N1 is earthed, the waveform of the alternating voltage on line L is shown dotted in Figure 13.1(c).
Suppose now that we disconnect the earth from line N1 and move it to the centre-point of the alternator winding (shown as N2 in diagram (b)). In effect, the two ‘ends’ of the winding are ‘live’ with respect to point N2, but they each have one-half the r.m.s. voltage on them when compared with the single-phase case (Figure 13.1(a)). Moreover, when line L1 is positive with respect to point N2, then L2 is negative with respect to it. The corresponding waveform diagrams for the voltages on lines L1 and L2 are shown in Figure 13.1(c).

Clearly, by earthing the centre point of the alternator winding, we have produced two sets of ‘phase’ voltages which can be used independently and have (in this case) a phase angle difference of 180° between them. This type of power supply is used in many bi-phase rectifier circuits (see Chapter 16).

13.3 A THREE-PHASE GENERATOR

A three-phase supply can be thought of as being generated by three windings on the rotor of an alternator connected as shown in Figure