**ELECTRICAL DISTRIBUTION**

**INTRODUCTION**

As  a  Construction  Electrician  second  class,  you may have to supervise the installation, maintenance, and repair of overhead primary and secondary power distribution systems. This chapter will provide the necessary  information  to  enable  you  to  calculate electrical loads and perform fundamental tasks in the selection, by size and type, of distribution equipment. When you perform   the   above-mentioned   tasks, remember, your primary goal should be the safety of your troops.

A power distribution system includes all parts of an electrical system between the power source and the customer’s service entrance. The power source may be either  a  local  generating  plant  or  a  high-voltage transmission line feeding a substation that reduces the high voltage to a voltage suitable for local distribution. At most advance bases, the source of power will be generators connected directly to the load.

**DISTRIBUTION  SYSTEMS CONFIGURATION**

 The configurations of four distribution systems are defined  in  the  following  paragraphs.  These  four distribution  systems  —  radial,  loop  (ring),  network, and primary selective — are briefly described. For additional information, review the Electric Power Distribution Systems Operations, NAVFAC MO-201.

**RADIAL  DISTRIBUTION  SYSTEM**

A representative schematic of a radial distribution system is shown in figure 4-1. You should note that the independent feeders branch out to several distribution centers without intermediate connections between feeders.

The most frequently used system is the radial distribution system because it is the simplest and least expensive system to build. Operation and expansion are simple. It is not as reliable as most systems unless quality components are used. The fault or loss of a cable, primary supply, or transformer will result in an outage on all loads served by the feeder. Furthermore, electrical service is interrupted when any piece of service equipment  must  be  de-energized  to  perform routine  maintenance  and  service.

Service on this type of feeder can be improved by installing automatic circuit breakers that will reclose the service at predetermined intervals. If the fault continues after a predetermined number of closures, the breaker will lock out until the fault is cleared and service is restored by hand reset.



Figure 4-1.—Radial distribution system.

**LOOP/RING  DISTRIBUTION  SYSTEM**

The loop, or ring, system of distribution starts at the substation and is connected to or encircles an area serving one or more distribution transformers or load centers. The conductor of the system returns to the same substation.

The loop system (fig. 4-2) is more expensive to build than the radial type, but it is more reliable. It may be justified in an area where continuity of service is of considerable  importance,  for  example,  a  medical center.

In  the  loop  system,  circuit  breakers  sectionalize the loop on both sides of each distribution transformer connected  to  the  loop.  The  two  primary  feeder  breakers and the sectionalizing breakers associated with the loop feeder are ordinarily controlled by pilot wire relaying or directional overcurrent relays. Pilot wire relaying is used when there are too many secondary substations to obtain selective timing with directional over current  relays



Figure 4-2.—Loop, or ring, distribution system.

A  fault  in  the  primary  loop  is  cleared  by  the breakers in the loop nearest the fault, and power is supplied  the  other  way  around  the  loop  without interruption to most of the connected loads. Because the load points can be supplied from two or more directions, it is possible to remove any section of the loop from service for maintenance without causing an outage at other load points. If a fault occurs in a section adjacent to the distribution substation, the entire load may have to be fed from one side of the loop until repairs are made. Sufficient conductor capacity must be  provided  in  the  loop  to  permit  operation  without excessive  voltage  drop  or  overheating  of  the  feeder when either side of the loop is out of service. If a fault occurs in the distribution transformer, it is cleared by the breaker in the primary leads; and the loop remains intact.

**NETWORK  DISTRIBUTION  SYSTEM**

 The network and radial systems differ with respect to the transformer secondaries. In a network system (fig. 4-3) transformer secondaries are paralleled; in a radial system, they are not.

The network is the most flexible type of primary system; it provides the best service reliability to the distribution  transformers  or  load  center,  particularly when  the  system  is  supplied  from  two  or  more distribution substations. Power can flow from any substation to any distribution transformer or load center in the network system. The network system is more flexible with regard to load growth than the radial or loop system and is adaptable to any rate of load growth. Service readily can be extended to additional points of usage with relatively small amounts of new construction. The network system, however, requires large quantities of equipment and extensive relaying; therefore, it is more expensive than the radial system. From the standpoint of economy, the network system is suitable only in heavy-load-density areas where the load   center   units   range   from   1,000   to   4,000 kilovoltamperes  (kVA)



Figure  4-3.—Network  distribution  system