Solid Grounding

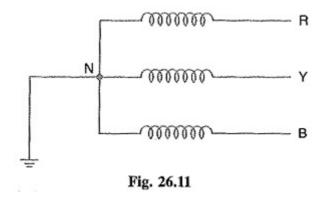
► NEUTRAL GROUNDING, POWER SYSTEM

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Solid Grounding or Effective Grounding:

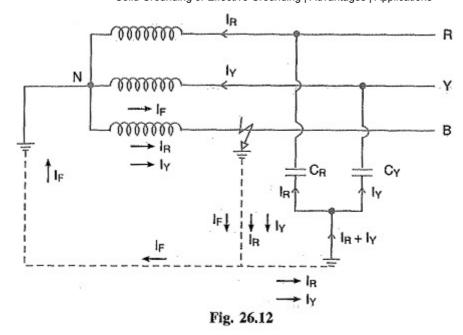
When the neutral point of a 3-phase system (e.g. 3-phase generator, 3-phase transformer etc.) is directly connected to earth (i.e. soil) through a wire of negligible resistance and reactance, it is called <u>Solid Grounding</u> or Effective Grounding.

Fig. 26.11 shows the <u>solid grounding</u> of the neutral point. Since the neutral point is directly connected to earth through a wire, the neutral point is held at earth potential under all conditions. Therefore, under fault conditions, the voltage of any conductor to earth will not exceed the normal phase voltage of the system.



The solid grounding of neutral point has the following advantages:

- 1. The neutral is effectively held at earth potential.
- 2.. When earth fault occurs on any phase, the resultant capacitive current I_C is in phase opposition to the fault current I_F . The two currents completely cancel each other. Therefore, no arcing ground or over-voltage conditions can occur. Consider a line to ground fault in line B as shown in Fig. 26.12. The capacitive currents flowing in the healthy phases R and Y are I_R and I_y respectively. The resultant capacitive current I_C is the phasor sum of I_R and I_y . In addition to these capacitive currents, the power source also supplies the fault current I_F . This fault current will go from fault point to earth, then to neutral point N and back to the fault point through the faulty phase. The path of I_C is capacitive and that of I_F is inductive. The two currents are in phase opposition and completely cancel each other. Therefore, no arcing ground phenomenon or over-voltage conditions can occur.



- 3. When there is an earth fault on any phase of the system, the phase to earth voltage of the faulty phase becomes zero. However, the phase to earth voltages of the remaining two healthy phases remain at normal phase voltage because the potential of the neutral is fixed at earth potential. This permits to insulate the equipment for phase voltage. Therefore, there is a saving in the cost of equipment.
- 4. It becomes easier to protect the system from earth faults which frequently occur on the When there is an earth fault on any phase of the system, a large fault current flows between the fault point and the grounded neutral. This permits the easy operation of earth-fault relay.

The following are the disadvantages of solid grounding:

- 1. Since most of the faults on an overhead system are phase to earth faults, the system has to bear a large number of severe shocks. This causes the system to become unstable.
- 2. The <u>solid grounding</u> results in heavy earth fault currents. Since the fault has to be cleared by the <u>circuit breakers</u>, the heavy earth fault currents may cause the burning of circuit breaker contacts.
- 3. The increased earth fault current results in greater interference in the neighbouring communication lines.

Applications:

<u>Solid grounding</u> is usually employed where the circuit impedance is sufficiently high so as to keep the earth <u>fault</u> current within safe limits. This system of grounding is used for voltages upto 33 kV with total power capacity not exceeding 5000 kVA.

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