

Three-Phase AC Delta System

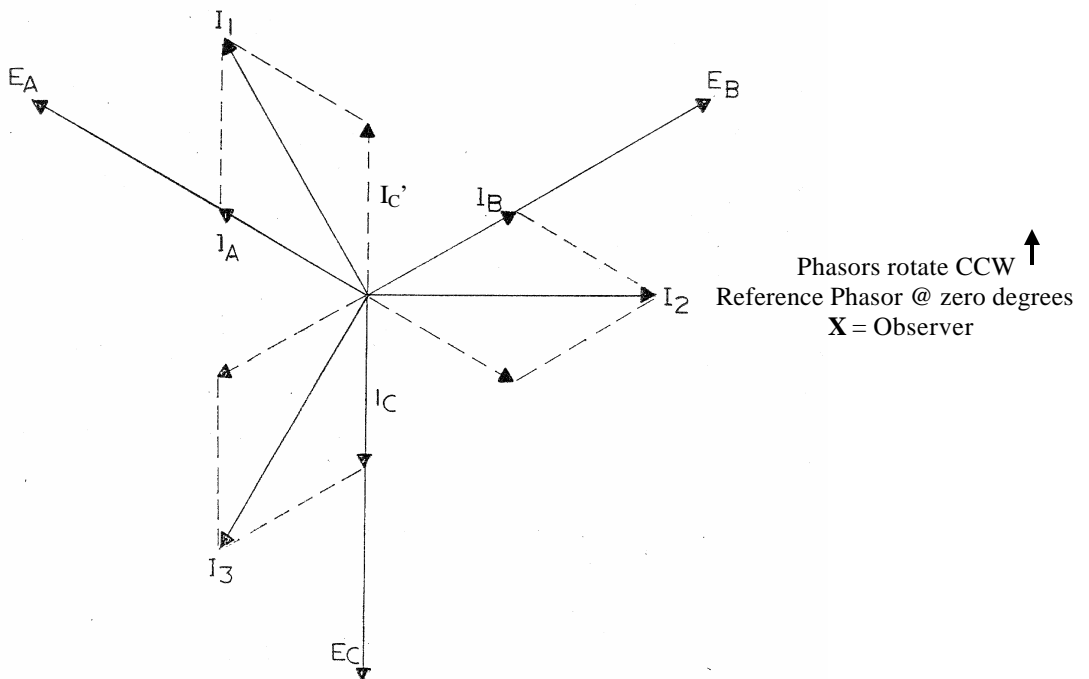
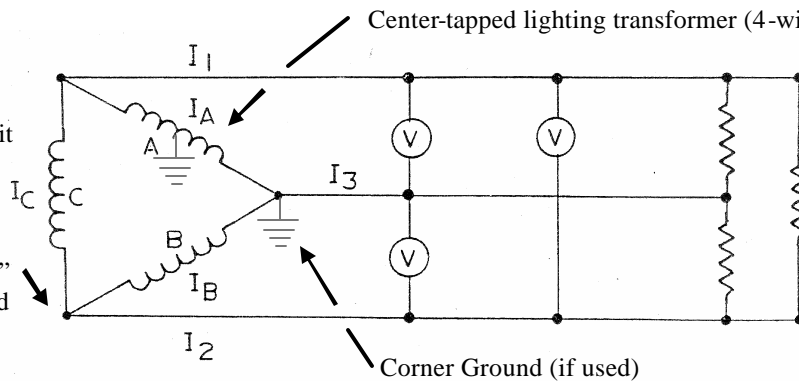
The Delta is a 3-wire system which is primarily used to provide power for three-phase motor loads. The system is normally ungrounded and has only one three-phase voltage available. The lack of a system ground makes it difficult to protect for ground faults. Often, a ground detection scheme, employing ground lamps, is used to provide an indication or alarm in the event of a system ground. The Delta System is sometimes corner grounded to protect for ground faults on the other two phases.

In a delta system the line voltage is equal to the phase voltage i.e. (Line Voltage $E_{Line 1-3} = E_{A Phase}$) and the line current is the vector sum of two individual phase currents i.e. (Line Current $I_1 = I_A + I_C'$). For balanced loads: Line Current $I_L = I_A \times 1.732$.

On 240 volt Delta Systems, where single-phase lighting is desired, a 4-wire system can be configured by grounding the center-tap of one 240 volt transformer to provide 120 volts single-phase for lighting. The corner of the delta which is opposite the lighting circuit ground is referred to as the "high leg" or "wild leg" and cannot be used for lighting as the voltage to ground is 1.732 times the voltage of the single-phase center-tapped transformer. When this 4-wire scheme is utilized, the lighting transformer will usually have a larger kVA rating because it must carry both the single-phase lighting load and the three-phase motor or other loads.

Note: Only one intentional system ground point can be utilized, otherwise a short circuit would exist.

"wild leg" or "high leg" (opposite center-tapped ground)



2002 NEC Code Reference: Article 110.15 High-Leg Marking. On a 4-wire, delta-connected system where the midpoint of one phase winding is grounded to supply lighting and similar loads, the conductor or busbar having the higher phase voltage to ground shall be durably and permanently marked by an outer finish that is orange in color or by other effective means. Such identification shall be placed at each point on the system where a connection is made if the grounded conductor is also present. See also **ARTICLE 408. 3 (E) Phase Arrangement.**

Three-Phase AC Wye System

The Wye (also known as Star - especially in the motor rewind industry) is a 4-wire system which provides two different supply voltages. The center-point of the Wye is the system neutral and is usually solidly grounded. Where it is desirable to limit the phase-to-ground fault magnitude the center-point of the Wye may be connected to ground through a neutral grounding resistor or a current limiting reactor. Because the system is tied to ground it is easy to provide system ground fault protection. Three-phase loads can be connected phase-to-phase and single-phase loads can be connected from any phase to the system neutral. On a wye system, the phase unbalance current is carried by the system neutral.

On a Wye system the line current is equal to the phase current i.e. ($I_{Line 1} = I_{Phase A}$) and the line-to-line voltage is equal to the vector sum of two individual phase voltages i.e. ($E_{Line 1-2} = E_{Phase A} + E_{Phase B'}$). In a Wye system the phase-to-phase voltage is 1.732 x the phase-to-ground voltage. Some typical Wye system voltages are: 120/208Y, 277/480Y, 2400/4160Y, 4160/7200Y, 7200/12470Y, 7620/13200Y, and 19920/34500Y.

