(E) Bus Arrangement.

(1) AC Phase Arrangement. Alternating-current phase arrangement on 3-phase buses shall be A, B, C from front to back, top to bottom, or left to right, as viewed from the front of the switchboard, switchgear, or panelboard. The B phase shall be that phase having the higher voltage to ground on 3-phase, 4-wire, delta-connected systems. Other busbar arrangements shall be permitted for additions to existing installations and shall be marked.

Exception: Equipment within the same single section or multisection switchboard, switchgear, or panelboard as the meter on 3-phase, 4-wire, delta-connected systems shall be permitted to have the same phase configuration as the metering equipment.

Informational Note: See 110.15 for requirements on marking the busbar or phase conductor having the higher voltage to ground where supplied from a 4-wire, delta-connected system.

The high leg is common on a 240/120-volt, 3-phase, 4-wire center-tap grounded delta system and must be designated as "B phase." Section 110.15 requires the high-leg marking to be the color orange or another effective means of identification, because the B phase voltage can be 208 volts nominal. Exhibit 408.1 is an example of a high-leg, grounded delta system.

The exception to 408.3(E)(1) permits the phase leg having the higher voltage to ground to be located at the right-hand position (C phase), making it unnecessary to transpose the panelboard, switchgear, or switchboard busbar arrangement ahead of and beyond a metering compartment. The exception recognizes the fact that metering compartments have been standardized with the high leg at the right position (C phase) rather than in the center on B phase.

See also

110.15 and **230.56** for further information on identifying conductors with the higher voltage to ground

(2) DC Bus Arrangement. Direct-current ungrounded buses shall be permitted to be in any order. Arrangement of dc buses shall be field marked as to polarity, grounding system, and nominal voltage.

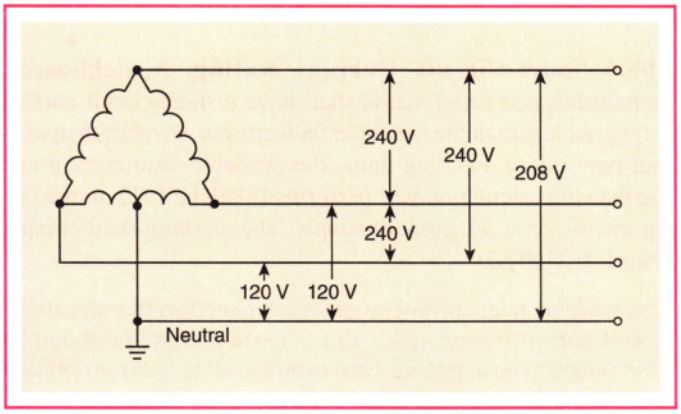

EXHIBIT 408.1 An example of a high-leg, grounded delta system.

(F) Switchboard, Switchgear, or Panelboard Identification. A caution sign(s) or a label(s) provided in accordance with 408.3(F)(1) through (F)(5) shall comply with 110.21(B).

(1) High-Leg Identification. A switchboard, switchgear, or panelboard containing a 4-wire, delta-connected system where the midpoint of one phase winding is grounded shall be legibly and permanently field marked as follows:

CAUTION _____ PHASE HAS _____ VOLTS TO GROUND

The requirement for legible marking of a switchboard, switchgear, or panelboard that contains a 3-phase, 4-wire center-tap grounded delta system resulted from injury and property damage caused by people not recognizing there is a high leg (208 volts to ground) in the switchboard, switchgear, or panelboard. This requirement helps to warn qualified individuals that a high leg exists. It is aimed at eliminating the hazards that come from accidentally connecting 120-volt equipment and devices to the high leg.

(2) Ungrounded AC Systems. A switchboard, switchgear, or panelboard containing an ungrounded ac electrical system as permitted in 250.21 shall be legibly and permanently field marked as follows:

CAUTION UNGROUNDED SYSTEM OPERATING — _____ VOLTS BETWEEN CONDUCTORS

The intent of this requirement is to delineate grounded from ungrounded electrical systems. When a ground fault occurs on a 3-phase ungrounded system, the voltage to ground on the ungrounded system equals the line-to-line voltage. The operational advantage of using an ungrounded system is continuity of operation, which in some processes might create a safer condition than would be achieved by automatic or unplanned opening of the supply circuit. Section 250.21(B) requires ungrounded systems of not less than 120 volts and not more than 1000 volts to be provided with ground detection. Ground detection will warn of the ground fault to permit an orderly shutdown of a process.

(3) High-Impedance Grounded Neutral AC System. A switchboard, switchgear, or panelboard containing a high-impedance grounded neutral ac system in accordance with 250.36 shall be legibly and permanently field marked as follows:

CAUTION: HIGH-IMPEDANCE GROUNDED NEUTRAL AC SYSTEM OPERATING — _____ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — _____ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS

(4) Ungrounded DC Systems. A switchboard, switchgear, or panelboard containing an ungrounded dc electrical system in accordance with 250.169 shall be legibly and permanently field marked as follows:

CAUTION: UNGROUNDED DC SYSTEM OPERATING — _____ VOLTS BETWEEN CONDUCTORS