

and maintenance (those tasks involving operations that can be accomplished by employees and where extensive disassembly of equipment is not required). Routine servicing and maintenance shall be able to be performed without exposing the worker to a risk of electric shock or personal injury.

**Informational Note:** An example of such routine maintenance is cleaning or replacing an air filter.

## ARTICLE

## 647

## Sensitive Electronic Equipment

**647.1 Scope.** This article covers the installation and wiring of separately derived systems operating at 120 volts line-to-line and 60 volts to ground for sensitive electronic equipment.

This type of supply system is employed as a means to reduce objectionable noise and its adverse effect on the performance of electronic audio and video equipment. Article 647 permits the use of this type of supply system for all commercial and industrial applications where sensitive audio/video or similar electronic equipment is used. Such systems can be used only in areas that are under the close supervision of qualified individuals.

**647.3 General.** Use of a separately derived 120-volt single-phase 3-wire system with 60 volts on each of two ungrounded conductors to an equipment grounding conductor shall be permitted for the purpose of reducing objectionable noise in sensitive electronic equipment locations, provided the following conditions apply:

- (1) The system is installed only in commercial or industrial occupancies.
- (2) The system's use is restricted to areas under close supervision by qualified personnel.
- (3) All of the requirements in 647.4 through 647.8 are met.

#### 647.4 Wiring Methods.

**(A) Panelboards and Overcurrent Protection.** Use of standard single-phase panelboards and distribution equipment with a higher voltage rating shall be permitted. The system shall be clearly marked on the face of the panel or on the inside of the panel doors. Common trip two-pole circuit breakers or a combination two-pole fused disconnecting means that are identified for use at the system voltage shall be provided for both ungrounded conductors in all feeders and branch circuits. Branch circuits and feeders shall be provided with a means to simultaneously disconnect all ungrounded conductors.

Circuit breakers and fuses are acceptable means of providing overcurrent protection for technical power circuits. Additionally, all technical power feeder and branch circuits are required to be provided with a disconnecting means that simultaneously opens all ungrounded conductors of the circuit.

**(B) Junction Boxes.** All junction box covers shall be clearly marked to indicate the distribution panel and the system voltage.

**(C) Conductor Identification.** All feeders and branch-circuit conductors installed under this section shall be identified as to system at all splices and terminations by color, marking, tagging, or equally effective means. The means of identification shall be posted at each branch-circuit panelboard and at the disconnecting means for the building.

**(D) Voltage Drop.** The voltage drop on any branch circuit shall not exceed 1.5 percent. The combined voltage drop of feeder and branch-circuit conductors shall not exceed 2.5 percent.

Unlike electrical distribution systems that supply lighting and appliance branch circuits, the supply systems covered by Article 647 are subject to mandatory voltage-drop requirements. The voltage-drop requirements are needed to ensure the operation of overcurrent devices in order to protect conductors and equipment supplied by these systems. Because the use of standard overcurrent devices and distribution equipment with higher voltage ratings is permitted, the impedance in circuits supplied by these systems under fault conditions is a primary concern.

**(1) Fixed Equipment.** The voltage drop on branch circuits supplying equipment connected using wiring methods in Chapter 3 shall not exceed 1.5 percent. The combined voltage drop of feeder and branch-circuit conductors shall not exceed 2.5 percent.

**(2) Cord-Connected Equipment.** The voltage drop on branch circuits supplying receptacles shall not exceed 1 percent. For the purposes of making this calculation, the load connected to the receptacle outlet shall be considered to be 50 percent of the branch-circuit rating. The combined voltage drop of feeder and branch-circuit conductors shall not exceed 2.0 percent.

**Informational Note:** The purpose of this provision is to limit voltage drop to 1.5 percent where portable cords may be used as a means of connecting equipment.

**647.5 Three-Phase Systems.** Where 3-phase power is supplied, a separately derived 6-phase "wye" system with 60 volts to ground installed under this article shall be configured as three separately derived 120-volt single-phase systems having a combined total of no more than six disconnects.

#### 647.6 Grounding.

**(A) General.** The transformer secondary center tap of the 60/120-volt, 3-wire system shall be grounded as provided in 250.30.

A technical power system has two ungrounded conductors with 120 volts between them and a grounded reference conductor at 60 volts with respect to the ungrounded conductors.

**(B) Equipment Grounding Conductors Required.** Permanently wired utilization equipment and receptacles shall be grounded by means of an equipment grounding conductor run with the circuit conductors and connected to an equipment