

410.176 Locations Not Permitted.

(A) **General Lighting.** Lighting equipment identified for horticultural use shall not be installed as lighting for general illumination unless such use is indicated in the manufacturer's instructions.

(B) **Installed Location.** Lighting equipment identified for horticultural use shall not be installed where it is likely to be subject to physical damage or where concealed.

410.178 Flexible Cord. Flexible cord shall only be permitted when provided as part of listed lighting equipment identified for horticultural use for any of the following uses:

- (1) Connecting a horticultural lighting luminaire directly to a branch circuit outlet
- (2) Interconnecting horticultural lighting luminaires
- (3) Connecting a horticultural lighting luminaire to a remote power source

Informational Note: Remote power sources include LED drivers, fluorescent ballasts, or HID ballasts.

410.180 Fittings and Connectors. Fittings and connectors attached to flexible cords shall be provided as part of a listed horticultural lighting equipment device or system and installed in accordance with the instructions provided as part of that listing.

410.182 Equipment Grounding Conductor. Lighting equipment identified for horticultural use shall be connected to the equipment grounding conductor in accordance with Part V of this article.

410.184 Ground-Fault Circuit-Interrupter (GFCI) Protection and Special Purpose Ground-Fault Circuit-Interrupter (SPGFCI) Protection. Lighting equipment identified for horticultural use and employing flexible cord(s) with one or more separable connector(s) or attachment plug(s) shall be supplied by lighting outlets protected by a listed GFCI.

Exception: Circuits exceeding 150 volts to ground shall be protected by a listed SPGFCI.

Informational Note: See UL 943C, *Outline of Investigation for Special Purpose Ground-Fault Circuit-Interrupters*, for information on special purpose ground-fault circuit interrupters.

Δ **410.186 Support.** Fittings identified for support of horticultural lighting equipment shall be used in accordance with the installation instructions provided and shall be securely fastened.

N Part XVII. Special Provisions for Germicidal Irradiation Luminaires

N 410.190 General.

N 410.191 Listing. Luminaires intended to emit germicidal irradiation shall be listed and identified as germicidal equipment.

N 410.193 Installation. Luminaires shall be installed in accordance with the manufacturer's instructions and equipment markings.

N 410.195 Locations Not Permitted.

N (A) General Lighting. Luminaires shall not be installed as lighting for general illumination unless such use is indicated in the manufacturer's instructions.

N (B) Installed Location. Luminaires shall not be installed where likely to be subject to physical damage.

N (C) Dwellings. Luminaires shall not be installed in a dwelling unless listed and identified for use in dwellings.

N (D) Mounting Height. Luminaires installed in a building space that will be occupied during luminaire operation shall not be mounted below the minimum height specified by its listing and installation instructions.

N 410.197 Germicidal Irradiation Systems.

N (A) Listing. A germicidal irradiation system intended to provide a safeguard against UV exposure by ensuring that a building space will not be occupied during luminaire operation shall be listed and identified as a germicidal system.

N (B) System Components. All system components shall be provided by the system manufacturer or clearly specified in the installation instructions as a component that the installer is required to source separately.

N (C) Installation. A germicidal irradiation system shall be installed in accordance with the manufacturer's installation instructions and installation markings.

N (D) Dwellings. A germicidal irradiation system shall not be installed in a dwelling unless listed and identified for use in dwellings.

ARTICLE

411

Low-Voltage Lighting

Δ **411.1 Scope.** This article covers low voltage lighting systems and their associated components.

Δ **411.2 Reconditioned Equipment.** Listed low-voltage lighting systems or a lighting system assembled from listed parts shall not be reconditioned.

Δ **(A) Listed System.** The luminaires, power supply, and luminaire fittings (including the exposed bare conductors) of a low-voltage lighting system shall be listed for use as part of the same identified lighting system.

(B) Assembly of Listed Parts. A lighting system assembled from the following listed parts shall be permitted:

- (1) Low-voltage luminaires identified for the use
- (2) Power supply identified for the use
- (3) Low-voltage luminaire fittings identified for the use
- (4) Suitably rated cord or cable, or any Chapter 3 wiring method for the secondary circuit

A lighting system may be a complete listed system or an assembly of listed parts. Lighting systems have long been field assembled from individually listed low-voltage luminaires, a power supply, and a suitably rated cord or other fixed Chapter 3 wiring method. Installers typically verify that individually listed lighting system parts (regularly from multiple manufacturers) are intended for the use and have the needed ratings to create and assemble a low-voltage lighting system.

N 411.3 Voltage Limitations. The operating voltage of low-voltage lighting systems and their associated components shall not exceed 30 volts ac or 60 volts dc. If wet contact is likely to occur, the operating voltage of low-voltage lighting systems and their associated components shall not exceed 15 volts ac or 30 volts dc.

Informational Note: See 680.1 for swimming pools, fountains, and similar installations.

Article 411 covers low-voltage interior and exterior (landscape) lighting systems consisting of a maximum 30-volt isolating ac or 60-volt dc power supply. In wet locations where contact with the lighting system might occur, the maximum voltage limit is 15 volts ac or 30 volts dc.

411.4 Low-Voltage Lighting Systems. Low voltage lighting systems shall consist of an isolating power supply, low-voltage luminaires, and associated equipment that are all identified for the use. The output circuits of the power supply shall be rated for 25 amperes maximum under all load conditions.

Article 411 also applies to Class 2 luminaires operating above 30 volts (42.4 volts peak voltage). This permits luminaires operating up to 60 volts dc to be installed without grounding, in accordance with 411.7(A) of the NEC®. Grounding is not a necessary safety measure for products operating from an isolating source, especially where voltages are within Class 2 limits. What distinguishes Article 411 from Article 410 is the voltage limitation and isolation requirement, both of which allow for a different scheme for protection against electric shock injury.

411.6 Specific Location Requirements.

(A) Walls, Floors, and Ceilings. Conductors concealed or extended through a wall, floor, or ceiling shall be in accordance with one of the following:

- (1) Installed using any of the wiring methods specified in Chapter 3
- (2) Installed using wiring supplied by a listed Class 2 power source and installed in accordance with 725.130

(B) Pools, Spas, Fountains, and Similar Locations. Lighting systems shall be installed not less than 3 m (10 ft) horizontally from the nearest edge of the water, unless permitted elsewhere in this Code.

The installation requirements of 411.6 recognize that shock and fire hazards exist even with low-voltage systems.

411.7 Secondary Circuits.

(A) Grounding. Secondary circuits shall not be grounded.

Exception: Secondary circuits supplied by a Class 2 power source listed and identified as suitable for secondary grounding shall be permitted to be grounded.

(B) Isolation. The secondary circuit shall be insulated from the branch circuit by an isolating transformer.

(C) Bare Conductors. Exposed bare conductors and current-carrying parts shall be permitted for indoor installations only. Bare conductors shall not be installed less than 2.1 m (7 ft) above the finished floor, unless specifically listed for a lower installation height.

Low-voltage bare conductor systems (i.e., trapeze lights) must be listed as a system. A system listing is necessary for these products because they often rely on special detection circuitry to address the fire risk associated with a conductive material shorting across the exposed conductors.

411.8 Branch Circuit. Lighting systems covered by this article shall be supplied from a maximum 20-ampere branch circuit.

ARTICLE

422

Appliances

Part I. General

422.1 Scope. This article covers electrical appliances used in any occupancy.

Article 422 covers appliances that are fastened in place or cord-and-plug-connected, such as air-conditioning units, dishwashers, heating appliances, water heaters, and infrared heating lamps. See Article 100 for the definition of *appliance*.

422.5 GFCI Protection.

Δ (A) General. Appliances identified in 422.5(A)(1) through (A)(7) 150 volts or less to ground and 60 amperes or less, single- or 3-phase, shall be provided with Class A protection for personnel. Multiple Class A protective devices shall be permitted but shall not be required.

- (1) Automotive vacuum machines
- (2) Drinking water coolers and bottle fill stations