

NEC-70 ARTICLE 411

ARTICLE 411 Lighting Systems Operating at 30 Volts or Less

411.1 Scope.

This article covers lighting systems operating at 30 volts or less and their associated components.

411.2 Definition.

Lighting Systems Operating at 30 Volts or Less. A lighting system consisting of an isolating power supply, the low-voltage luminaires, and associated equipment that are all identified for the use. The output circuits of the power supply are rated for not more than 25 amperes and operate at 30 volts (42.4 volts peak) or less under all load conditions.

411.3 Listing Required.

Lighting systems operating at 30 volts or less shall comply with 411.3(A) or 411.3(B).

(A) Listed System. Lighting systems operating at 30 volts or less shall be listed as a complete system. The luminaires, power supply, and luminaire fittings (including the exposed bare conductors) of an exposed bare conductor lighting system shall be listed for the 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
 - (2) **Low-voltage luminaire power supply**
 - (3) Class 2 power supply
 - (4) Low-voltage luminaire fittings
 - (5) Cord (secondary circuit) for which the luminaires and power supply are listed for use
 - (6) Cable, conductors in conduit, or other fixed wiring method for the secondary circuit
- The luminaires, power supply, and luminaire fittings (including the exposed bare conductors) of an exposed bare conductor lighting system shall be listed for use as part of the same identified lighting system.

411.4 Specific Location Requirements.

(A) Walls, Floors, and Ceilings. Conductors concealed or extended through a wall, floor, or ceiling shall be in accordance with (1) or (2):

- (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 by Article 680.

411.5 Secondary Circuits.

(A) Grounding. Secondary circuits shall not 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.

(D) Insulated Conductors. Exposed insulated secondary circuit conductors shall be of the type, and installed as, described in (1), (2), or (3):

- (1) Class 2 cable supplied by a Class 2 power source and installed in accordance with Parts I and III of Article 725.
- (2) Conductors, cord, or cable of the listed system and installed not less than 2.1 m (7 ft) above the finished floor unless the system is specifically listed for a lower installation height.
- (3) Wiring methods described in Chapter 3

411.6 Branch Circuit.

Lighting systems operating at 30 volts or less shall be supplied from a maximum 20-ampere branch circuit.

411.7 Hazardous (Classified) Locations.

Where installed in hazardous (classified) locations, these systems shall conform with Articles 500 through 517 in addition to this article.

NEC-70 Annex A Product Safety Standards

Product Standard Name Product Standard Number

Low-Voltage Landscape Lighting Systems	UL 1838
Low-Voltage Luminaires	UL 2108



NEC Code & UL Standards for Lighting Systems Operating at 30 Volts or Less



Read Across & Down

		SECONDARY WIRE & BURIAL DEPTH				MAX VOLTS	UL NEC	LUMINAIRE LISTING	POWER SUPPLY TRANSFORMER				
Grade	Wire Type & Burial Depth					☒ 15V AC 30V DC	UL 1838 NEC Annex A	Low Voltage Landscape Lighting Luminaires					
	6"	Conduit	UF-B (Q-Wire)	UF-B (Q-Wire)	L.V. Cable	☒ 15V AC ONLY	UL Pool & Spa NEC 680	Low Voltage Pool & Spa Luminaires					
	Below Grade	Conduit	UF-B (Q-Wire)	UF-B (Q-Wire)	L.V. Cable	30V AC 30V DC	UL 2108 NEC 411 NEC Annex A	Low Voltage Lighting Luminaires					
		Conduit	UF-B (Q-Wire)	UF-B (Q-Wire)	L.V. Cable	30V AC 30V DC	UL 1598 NEC 410	Luminaires	☒	☒	☒	☒	
		Wire to Class 1 NEC - Chapter 3 UF-B = Underground Feeder - Burial Q-Wire = Underground Feeder - Burial				Max Secondary Volts at Power Supply with no load (Open Circuit) NEC = NATIONAL ELECTRIC CODE NFPA-70 UL = UNDERWRITERS LABORATORIES, INC.	Article 411.3 (B-2) Listed NEC - 2008 Grounded Isolation for LV Wet Location Secondary Circuit Protector 25A Max Open / Bare Conductor (When Tested)		●	⊕	⊕	⊕	
									□	●	●	●	
									●	●	●	●	
									●	●	●	●	
Wet	Landscape	UL 1838 - LV Landscape Lighting System: 15V AC / 30V DC Max Output at Power Supply - No Load ☒ Luminaires + Power Supplies must be UL 1838 Listed as complimentary components for lighting garden, walkway, patio areas, trees and similar outdoor locations with in ground and above ground fixtures; and for certain indoor locations such as atriums and shopping malls. This listing also covers luminaires submersed in or floating on ponds, rivers, water features and lakes or a portable self contained fountains per NEC Article 682 where immersed persons would not be present as defined by luminaire installation instructions. ☒ UL 1838 allows LV Underground Lighting Cable - no other listing permits this wire type. 120V Primary only. Not for indoor use. <i>Note: NEC Annex A = UL 1838 120V Only Low Voltage Luminaire Primarily for Wet Locations</i>											
Submersed	Pool & Spa	UL Pool & Spa Listing: 15V AC only Max Output at Power Supply - No Load ☒ Indoor & Outdoor Luminaires + Power Supplies must be UL Pool & Spa Listed as complimentary components for lighting a Pool, Spa, permanent fountain or other bodies of water intended to contain immersed persons. All wiring must be Class 1 per NEC Chapter 3. 120V Primary only. <i>Install per NEC Article 680 120V Only Low Voltage Luminaire for Submersed Locations with immersed persons</i>											
Dry or Damp	Landscape	UL 2108 - LV Lighting System: 30V AC / 30V DC Max Output at Power Supply - No load Luminaires + Power Supplies must be UL 2108 Listed as complimentary components. This Standard covers: 411.3 (A) Listed Systems for exposed bare conductor systems comprised of cable, linear track or the like where the support structure is exposed and current carrying; here the Power Supply must be listed as part of the same identified lighting systems. <i>Note: Use Power Supply as defined in Luminaire installation instructions.</i> 411.3 (B) Assembly of Listed Parts covers mono, dual or multi point LV Luminaires which are an assembly of listed parts if a UL 2108 Low Voltage Luminaire Power Supply is utilized. For wet Location luminaires UL 2108 covers luminaires with up to 30 volt input provided they are Class 1 wired per NEC Chapter 3. For wet Location luminaires with inputs not exceeding 15 volts, UL 1838 applies. <i>Note: NEC Article 411 + Annex A = UL 2108. Low Voltage Luminaire Primarily for Dry and Damp Locations</i>											
Dry or Damp	Indoor	UL 1598 - Luminaires: 30V AC / 30V DC Max Output at Power Supply - No load This UL Standard applies to line voltage luminaires for use in non-hazardous locations and allows up to 600 volts input and all wiring must be Class 1 per NEC Chapter 3. Low Voltage luminaires powered by remote transformer are NOT covered by this standard. This Listing does not cover: <ul style="list-style-type: none"> LV Landscape Lighting products and Submersible Luminaires installed in the United States at 15V or less. (UL 1838 is the Standard per NEC-Annex A) Swimming Pool & Spa Luminaires (UL Pool & Spa is the Standard per NEC Article 680) Low Voltage Lighting Systems powered by remote transformers (UL 2108 is the Standard per NEC 411 & Annex A) <i>Note: NEC Article 410 Intended for Line Voltage Luminaires for Dry, Damp and Wet Locations</i>											
Obscure for LV Remote - Dry, Damp & Wet	Landscape	UL 506-General Purpose or Specialty Transformers: 600V Max This UL Standard is a transformer standard only and is not a complimentary component to any luminaire standard. UL 1838, Pool & Spa and 2108 does not permit the use of UL 506 transformers unless the transformer is additionally tested and subsequently listed to UL 1838, Pool & Spa or 2108. A UL-506 transformer may be tested as an internal components to a UL-1598 luminaire, to be an integral transformer. ☒ The Scope of UL-506 (Section 1.2) specifically excludes use in Landscape Lighting Systems and for use in Pool & Spa Lighting Systems. Additionally, a Cord and Plug connection is not permitted. In no instance can a UL-506 transformer be used in Landscape or Pool & Spa Lighting. A UL 1838, UL Pool Spa and UL 2108 Power Supply may power a UL-1598 luminaire that was listed prior to the UL-2108 effective date since these Luminaires are required to be Class 1 wired per NEC Chapter 3. General Purpose Transformer											
	Indoor												
	Landscape												
	Indoor												
Key													
		Transformer	Power Supply	Complimentary Component									
		●	□	⊕									
		Yes	Optional	No									
		☒	☒	☒									
		Exceeds Standard											
		☒ The UL limit of 15 volts AC at the Power Supply under no load (Open Circuit) was established for life safety due to shock potential in wet conditions. The Standard also requires a grounded isolation barrier between the primary and secondary windings. In the Pool & Spa Standard the primary must be 120V & the connection must be in a separate junction box or compartment.											
		UL 1838 UL 1838 UL 1838											