

# Standards and Codes



This is where 'standards' and 'codes' differ:

- NFPA 70 (the NEC) is a code – it gets written into law (when incorporated, everything can be followed)
- TIA 568, IEEE 802.3, etc. are standards – they are not written in a way compatible to write them into law

← What to do

← How to do it

BUT neither is law or regulation until adopted by a piece of legislation or a rule making

# CODE CONSIDERATIONS

## Key Codes that Apply to Design and Installation of PoE lighting:

- Building Code: International Building Code (IBC) – *Exit and Egress Lighting*
- Electrical Code: National Electrical Code (NEC) – *Wiring, Protection, Materials, Equipment, and Installation*
- Energy Code: International Energy Conservation Code (IECC) or ASHRAE/IES 90.1 – *Lighting Control System*
- State and Local Licensing Requirements – *What licenses are required for designers and installers and what work must be permitted*
- Local Amendments to Adopted Codes

Fire, Safety, Shock



# CODE CONSIDERATIONS

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## NFPA 70– A Few Important Articles for PoE Lighting Systems

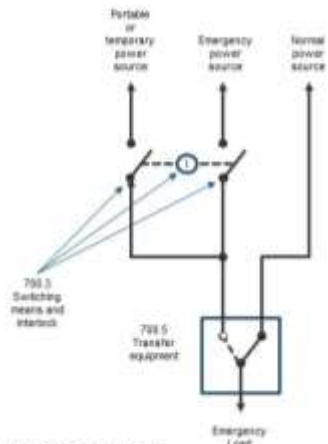
### Free Access to the NEC:

<https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>

- 410 – Luminaires, Lampholders, and Lamps
- 411 – Low-Voltage Lighting
- 700 – Emergency Systems (see especially Part V. Control - Emergency Lighting Circuits, for light fixture controls and listing requirements)
- 725 – Part III. Class 2 and Class 3 Circuits
  - 725.121 for power sources
  - 725.144 for cables used for transmission of power and data, and Table 725.144 for ampacity of 4-pair twisted-pair cables
- 725 – Part IV. Listing Requirements

# 700 – Emergency Systems

## Emergency Lighting



POE Emergency Lighting has generally approved on case-by-case basis

### Code Elements:

- Power Source
- Power Distribution (Cabling and associated elements)
- Driver (node/gateway/endpoint)  
700.2 Emergency Luminaire, Directly Controlled → [ANSI/UL924](#)

### POE Options:

- 1) **Uncontrolled Emergency Lighting (lights always on, no control)**  
Requires switch power from UL-924 Listed UPS
- 2) **Controlled Emergency Lighting (UL-924 LED Driver)**
- 3) **Unit based battery pack on UL-924 light**  
Dependent on POE Lighting partner. The network switch is passive just like an electrical junction box.
- 4) **Hybrid POE – Line Voltage Approach**



# 725.121 NEC 2020 Class 1,2,3 circuits

POE is a Class 2 Circuit:

**Class 2 Circuit.** The portion of the wiring system between the load side of a Class 2 power source and the connected equipment. Due to its power limitations, a Class 2 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock.

POE Benefits:

- Circuit (port) is de-energized until the source detects a proper load
- Removes power on overcurrent fault or load removal
- Is efficient:
  - Only provides the power requested
  - Protects from faults by policing power supplied relative to what the device asked for

**The POE switch, as Power Source Equipment (PSE) must be listed per 725.121(A)(3)**

Informational Note: One way to determine applicable requirements for listing of information technology (computer) equipment is to refer to **UL 60950-2011**, Standard for Safety of Information Technology Equipment.

→ As of 12/20/2020, UL 62368 replaces 60950



# 725.121(C) Required Marking

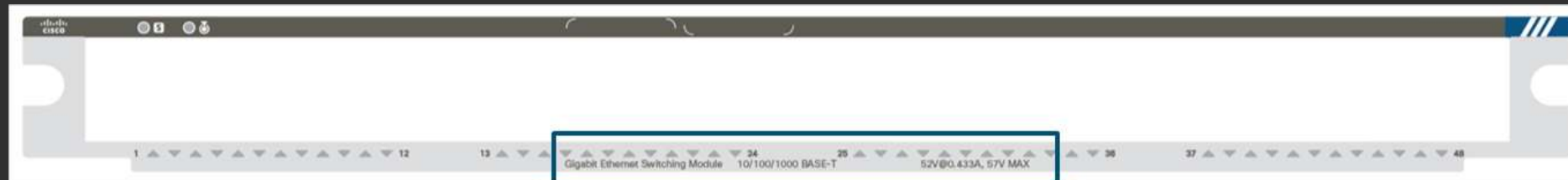
New in 2020 →

## (C) Marking.

The power sources for limited power circuits in 725.121(A)(3), limited power circuits for listed audio/video equipment, listed information technology equipment, listed communications equipment, and listed industrial equipment in 725.121(A)(4) shall have a label indicating the maximum voltage and rated current output per conductor for each connection point on the power source. Where multiple connection points have the same rating, a single label shall be permitted to be used. For equipment with a rated current per conductor less than 0.3 amperes, the effective date shall be January 1, 2021.

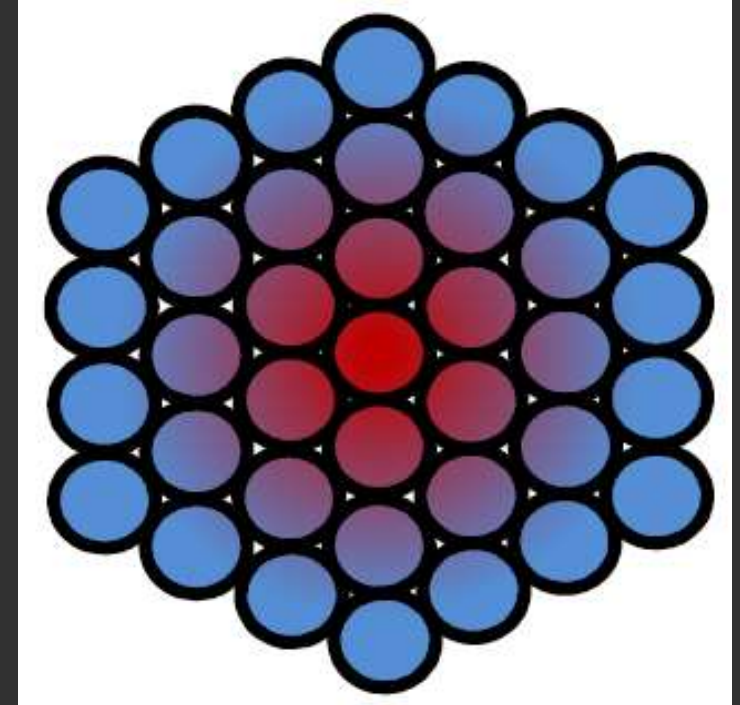
Informational Note No. 1: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer.

Informational Note No. 2: An example of a label is "52V @ 0.433A, 57V MAX" for an IEEE 802.3 compliant Class 8 power source.



# The basics of bundle heating

- If all the cables in a bundle are carrying current, they will all contribute heat
- Naturally, the cable in the center of the bundle will be the hottest
- PoE has existed since 1999, the industry has taken this into account
- Heating of bundles of cables carrying data and class 2 power entered the NEC in [2017](#)
  - NEC 725.144(A) requires Class 2 and Class 3 cables used to transmit power and data to comply with Table 725.144 to determine code-compliant ampacities for each conductor in an installation.
  - NEC 725.144(B) permits the use of Class 2-LP or Class 3-LP cables to supply power to equipment at current levels up to the marked ampere limit located immediately following the -LP suffix
- The 2020 NEC refines the 2017 NEC for PoE



# 725.144 NEC©-2020

## Transmission of Power and Data: New Informational Notes

Informational Note No. 3: The requirements of Table 725.144 were derived for carrying power and data over 4-pair copper balanced twisted pair cabling. This type of cabling is described in ANSI/TIA 568-C.2-2009, *Commercial Building Telecommunications Cabling Standard — Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components*.

Informational Note No. 4: See TIA-TSB-184-A-2017, *Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling*, for information on installation and management of balanced twisted pair cabling supporting power delivery.

Informational Note No. 5: See [ANSI/NEMA C137.3-2017](#), *American National Standard for Lighting Systems — Minimum Requirements for Installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems*, for information on installation of cables for PoE lighting systems.

Informational Note No. 6: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer. In the design of these systems, the actual current in a given conductor might vary from the rated current per conductor by as much as 20 percent. An increase in current in one conductor is offset by a corresponding decrease in current in one or more conductors of the same cable.



# Is the Network Centralized or Distributed?



- More Cabling Required
  - Must meet NEC 725.144 cable bundling requirements
  - Controlled Access in IDF
  - Greater IDF Cooling Requirements
  - Power needed in IDF
- Less Cabling, patch cables to endpoints
  - Allows for ring and daisy chain topologies
  - Ceiling may be less secure, service requires ladder
  - Less Cooling in IDF, lower cost switches
  - Distributed Power required in ceiling



# 725.144(A) NEC©-2020

## **(A) Use of Class 2 or Class 3 Cables to Transmit Power and Data.**

Where Types CL3P, CL2P, CL3R, CL2R, CL3, or CL2 transmit power and data, the rated current per conductor of the power source shall not exceed the ampacities in Table 725.144 at an ambient temperature of 30°C (86°F). For ambient temperatures above 30°C (86°F), the correction factors in Table 310.15(B)(1) or in Equation 310.15(B) shall apply.

*Exception: Compliance with Table 725.144 shall not be required for installations where conductors are 24 AWG or larger and the rated current per conductor of the power source does not exceed 0.3 amperes.*

Informational Note: One example of the use of Class 2 cables is a network of closed-circuit TV cameras using 24 AWG, 60°C rated, Type CL2R, Category 5e balanced twisted-pair cabling.



# 725.144(B) NEC©-2020

## **(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data.**

Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power to equipment from a power source with a rated current per conductor up to the marked current limit located immediately following the suffix “-LP” and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:

- (1) Cables with the suffix “-LP” shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.
- (2) Cables with the suffix “-LP” and a marked current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix “-LP” and without the marked current limit.
- (3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of a limited power (LP) cable is a cable marked Type CL2-LP(0.5A), 23 AWG.

# Table 725.144 NEC©-2017 to NEC©-2020

AWG	1			2-7			8-19			20-37			38-61			62-91			92-192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1	1	1	1	1	1	0.7	0.8	1	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2	2	2	1	1.4	1.6	0.8	1	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3	3	3	1.4	1.8	2.1	1	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.8	0.9	0.5	0.6	0.7

	Number of 4-Pair Cables in a Bundle																	
	1–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	NA	NA	NA
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.28	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72



***THANK YOU***