NFPA 70 2017 & PoE v130

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NFPA 70

The National Electrical Code (NFPA 70) is a regionally adoptable standard for the safe installation of electrical wiring and equipment in the United States. It is part of the National Fire Codes series published by the National Fire Protection Association (NFPA), a global nonprofit organization, established in 1896.

Despite the use of the term “national”, it is not a federal law. It is typically adopted by states and municipalities in an effort to standardize their enforcement of safe electrical practices.

The NEC is updated using a 3-year cycle. The most recent version is the 2014 NEC.

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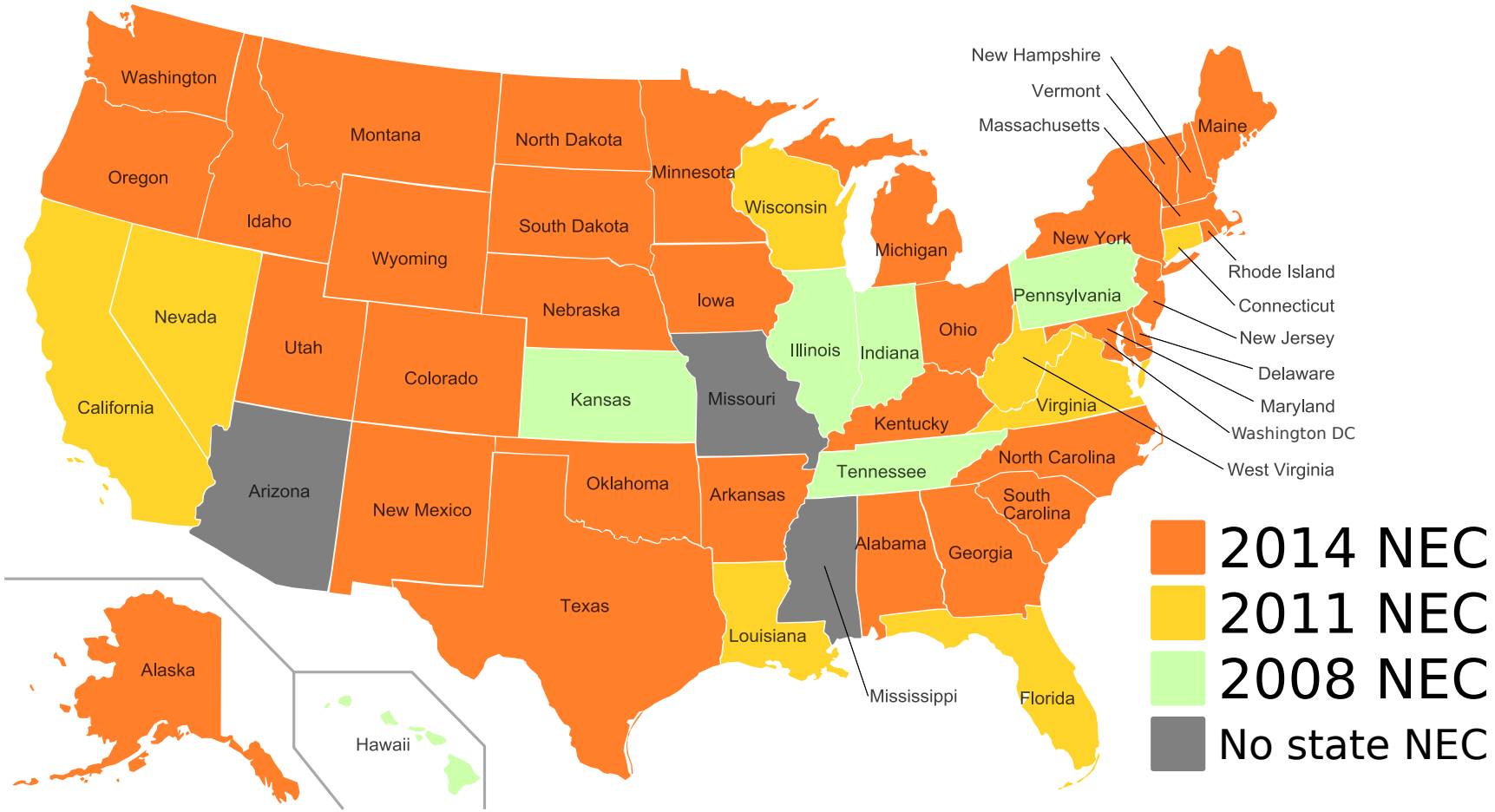
Code adoption



The NEC is adopted on a state by state basis at a different rate. Municipalities may adopt modifications. Most states have by now adopted the 2014 Code.

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NEC and Power over Ethernet

The 2017 NEC, which is close to publication, contains new material that impacts Power over Ethernet installations. Earlier Code versions did not specifically deal with these kinds of installations.

NEC Article 725 deals with “Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits”.

NEC Article 840 deals with “Premises-Powered Broadband Communications Systems”. This article is separate from the other articles unless references are made. The 2014 version of this Article only dealt with ‘premises-powered optical fiber-based broadband communications systems’. In the 2017 version, the scope is expanded to also include copper based communications systems.

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Adopted text 725.144

Table 725.144, Ampacities of Each Conductor (in Amperes) in a 4-Pair Class 2 or Class 3 Data Cables, Based on Copper Conductors at Ambient Temperature of 30°C (86° F) with all Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F) and 90°C (194°F) Rated Cables

AWG	Number of 4-Pair Cables in a Bundle																				
	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	1.0	1.0	1.0	1.0	1.0	1.0	0.7	0.8	1.0	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2.0	2.0	2.0	1.0	1.4	1.6	0.8	1.0	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	3.0	3.0	3.0	1.4	1.8	2.1	1.0	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.7	0.8	0.5	0.6	0.7

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.

Informational Note: The conductor sizes in data cables in wide-spread use are typically 22 – 26 AWG.

New article 725.144 introduces an ampacity table, which shows the maximum permitted current for a given cable configuration. The article also introduces LP cables which can be installed in any cable configuration, provided the LP current limit is respected.

See ➠zimmerman_3bt_01b_0516 for the complete text (slide 4+5)

Code Making Panel 3 is responsible for this article.

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LP cable

The requirements for LP cable can be found in ➠UL13 CRD (LP cable specific) and ➠UL444 CRD (communications cables).

An LP rating is always coupled to a specific current. This current is the current the cable can handle on each conductor without exceeding its temperature rating under LP test conditions. Possible LP ratings are LP-0.5 through LP-1.0 in 100mA increments.

LP Rating	Source voltage	Source power
LP-0.5	52V	104.0 W
LP-0.6	52V	124.8 W
LP-0.7	52V	145.6 W
LP-0.8	52V	166.4 W
LP-0.9	52V	187.2 W
LP-1.0	52V	208.0 W

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LP Cable requirements

A cable can be certified as LP cable if, corrected for an ambient temperature of 45°C, it does not exceed its temperature rating under the following conditions:

- An inner bundle of 37 cables, arranged in a hexagonal densest packing structure
- A further 155 cables packed around this in random fashion
- The resulting 192 cable bundle is enclosed in a non-metallic conduit of 6 foot length
- The ends of this conduit filled with insulation material
- Each conductor to carry the rated LP current (0.5A, 0.6A, …)
- The temperature is measured at the outer jacket and the conductor isolation of the center cable at the midpoint of the conduit

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Adopted text 840.160

Article 840 is dedicated to “premises-powered broadband communication systems”. The scope of Article 840 was increased to include copper networking in the 2017 cycle, next to optical networking.

The following new section is added (840.160):
Communications cables, in addition to carrying the communications circuit shall also be permitted to carry circuits for powering communications equipment. Where the power supplied over a communications cable to communications equipment is more than 60 watts, communications cable and the powering circuits shall comply with 725.144 where communications cables are used as substitute to Class 2 and 3 cables.

Code Making Panel 16 is responsible for this article.

725.144 - PoE specific view

This table (based on 725.144) shows the highest Class that can be support by a non-LP cable configuration.

◀ AWG	BUNDLESIZE												
	1 - 37			38 - 61			62 - 91			92 - 192			>192
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	any
26				7			7						
24							7			6	7		
23										7			
22													

- Requires engineering supervision
- 6 Maximum Class 6 (60W) permitted
- 7 Maximum Class 7 (75W) permitted
- Full Type 4 power permitted

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Conclusions

- DTE Power via MDI is now specified in the NEC, with rules on what is allowed and what not. This takes us out of the grey zone.
  - Type 3 (up to Class 6) power levels require no special considerations with regards to PoE.
  - Type 4 (Class 7 & 8) power levels are not permitted for all cable plant configurations. Careful consideration of cable plant configuration (bundle size) and cable type(s) is needed.
- PoE is given a clean bill of health by an extensive UL report, which was used as the basis for the requirements in the NEC $\rightarrow$ it takes multiple parameter corner cases before temperature ratings of cables are exceeded.
- Complexity of inspections is a concern, since these new requirements have inspectors deal with details of communication cable installations they may not be familiar with.

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Recommendations for the 2020 cycle

- Inspecting an installation requires detailed knowledge of the PSE, PD and installed cabling. Some of this information is typically not available during the inspection phase of the building.
- PSEs or PDs may get upgraded/changed over the life of the installation
- An easier to inspect/verify set of requirements is needed.
- Further measurement data and more balanced determination of worst-case installation instructions may warrant tweaking of the specific limits.
- Deeper involvement of the IEEE 802 community and communication cable industry is encouraged to improve these new sections in the 2020 Code.

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