



Impact of 2017 National Electric Code on Power over Ethernet Cabling

Introduction

The 2017 National Electric Code (NEC[®]) has been revised and will now impose new requirements on cables running the highest power level of the next generation Power over Ethernet (PoE) standard. The majority of PoE

installations will not be affected by the new rules due to their lower power levels. However, for those that do, the 2017 NEC recognizes a new UL listing for cables referred to as Limited Power, or LP. Per the 2017 NEC, **LP is not required to run PoE** but cables with this classification can simplify the installation and inspection of cables running next generation PoE. The 2017 NEC is focused on the overall bundling sizes of cables running the highest PoE power level and applies only to cables permanently installed. The goal of this document is to provide information on the new 2017 code and what the new UL LP cable listing means.

Next Generation Power over Ethernet

The next generation of Power over Ethernet (called PoE++ or 4PPoE) introduces Type 3 and Type 4 PoE. The new standard, IEEE 802.3bt allows power to be provided on all 4 pairs with up to 60W on Type 3 and 99W on Type 4 at the source. The 2017 NEC code and LP designation applies only for systems with power levels above 60W or PoE++ Type 4. Therefore, the NEC 2017 should only impose new requirements for a small fraction of installations as most PoE applications are Type 3 or lower.

Type	Standards	Maximum Current Per Pair	Number of Energized Pairs	Power at Source	Power at Device
PoE	IEEE 802.3af (802.3at Type 1)	350 mA	2	15.4 W	13 W
PoE+	IEEE 802.3at Type 2	600 mA	2	30 W	25.5 W
PoE++ (4PPoE)	IEEE 802.3bt Type 3	600 mA	4	60 W	51 W
PoE++ (4PPoE)	IEEE 802.3bt Type 4	960 mA	4	99 W	71.3 W

NEC 2017 not a concern



NEC 2017 imposes new requirements



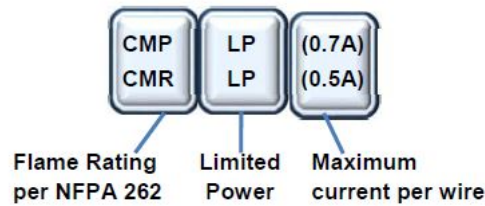
What is LP?

LP is an acronym for a new UL certification - Limited Power. This new certification applies to communications cables permanently installed in the United States, being used in Power over Ethernet (PoE) applications. Per UL, "the "-LP" cable designation indicates that the cable has been evaluated to carry the marked current under installation scenarios without exceeding the temperature rating of the cable." Patch cords are not subject to the 2017 NEC code.

Cables with the LP designation are not restricted in bundle size for carrying currents up to the UL-certified current rating. To be clear, the LP certification is not required to run PoE. Per the 2017 NEC code, cable without the LP designation is only limited in bundle size in Type 4 PoE applications. The maximum bundle sizes

for non-LP cables is provided by an ampacity table in the code. Hence, while LP is not required for PoE, it may simplify the installation and inspection process.

There will be new markings on the print string of LP certified cables. Below are two examples and what each portion of the marking means:



PoE transmits power per pair, meaning that half the current is transmitted down each wire of the twisted pair. Therefore, the 960-mA current for Type 4 PoE refers to 960 mA being transmitted over both wires of the pair. However, the LP designation only shows the maximum current per wire. What that means is that you must double the LP cable rating to determine the maximum current per pair. The maximum current per pair is then directly related to the maximum power that can be supplied to the end device(s). See the table below:

<i>LP Rating (A)</i>	<i>Max Current per Pair</i>	<i>Power (W)</i>
0.5	1.0	100
0.6	1.2	120
0.7	1.4	140

Having a higher designation indicates that the cable has superior PoE performance and will be able to handle the heat load better than a lower rated LP cable. However, there are no PoE standards beyond 100W. Therefore, a LP rating of 0.5A is suitable for all current applications including the pending IEEE 802.3bt Type 4 and will be for the foreseeable future.

If running Type 4 PoE, cables without LP certification are subject to inspection to ensure bundle size and current limitations per the ampacity table below are not exceeded.

Panduit cables have received an LP listing to the levels listed below. All these cables have obtained a rating equal to or greater than those required by current and future PoE standards.

Category	Fire/Construction	Panduit Part Number	LP Rating
Cat 6	Plenum UTP	PUP6504**-UY	0.5A
		PUP6004**-WLP	0.5A
		PUP6C04**-ULP	0.5A
Riser UTP	PUR6504**-ULP	0.5A	
Cat 6A	Plenum UTP	PUP6AV04**-G	0.7A
		PUP6AS04**-G	0.6A
		PUP6AM04**-UG	0.6A
	Riser UTP	PUR6AM04**-CG	0.5A
	Plenum F/UTP	PFP6X04**-UG	0.7A
	Riser F/UTP	PFR6X04**-CG	0.5A

Ampacity Table for Type 4 PoE with non-LP Cables

To use the ampacity table, one must understand:

- Cable wire gauge (likely 23AWG for standard Cat 6 and 6A cables)
- Temperature rating of the cable
- Ampacity of the PoE circuit. A 0.5A rating is sufficient to support all current PoE applications
- An LP rating is NOT required to run PoE++, however, cables without the LP listing will require inspection (**Type 4 only**) to ensure that bundle sizes meet the ampacity table guidelines

For the following examples, let's assume a switch is powering an end device requiring the highest level of PoE. As we have shown previously, this corresponds to a 0.5A ampacity. A standard 23AWG cable rated at 60°C, the maximum bundle size is highlighted with the green circle as being 91 cables. For a 23 AWG cable rated at 75°C, the maximum bundle size is highlighted with a blue circle as being 192 cables. The installer and inspector would both need to verify the wire gauge, temperature rating of the cable, and bundle sizes to ensure the ampacity table is being met. With LP cables, all that will need to be verified is that the cable has an LP 0.5A listing. To be clear, LP certification is not mandatory but will streamline the installation and inspection process by removing the need to use the table below.

AWG	Number of 4-Pair Cables in a Bundle																				
	1			2-7			8-19			20-37			38-61			62-91			92-192		
	Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp 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	0.7	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.

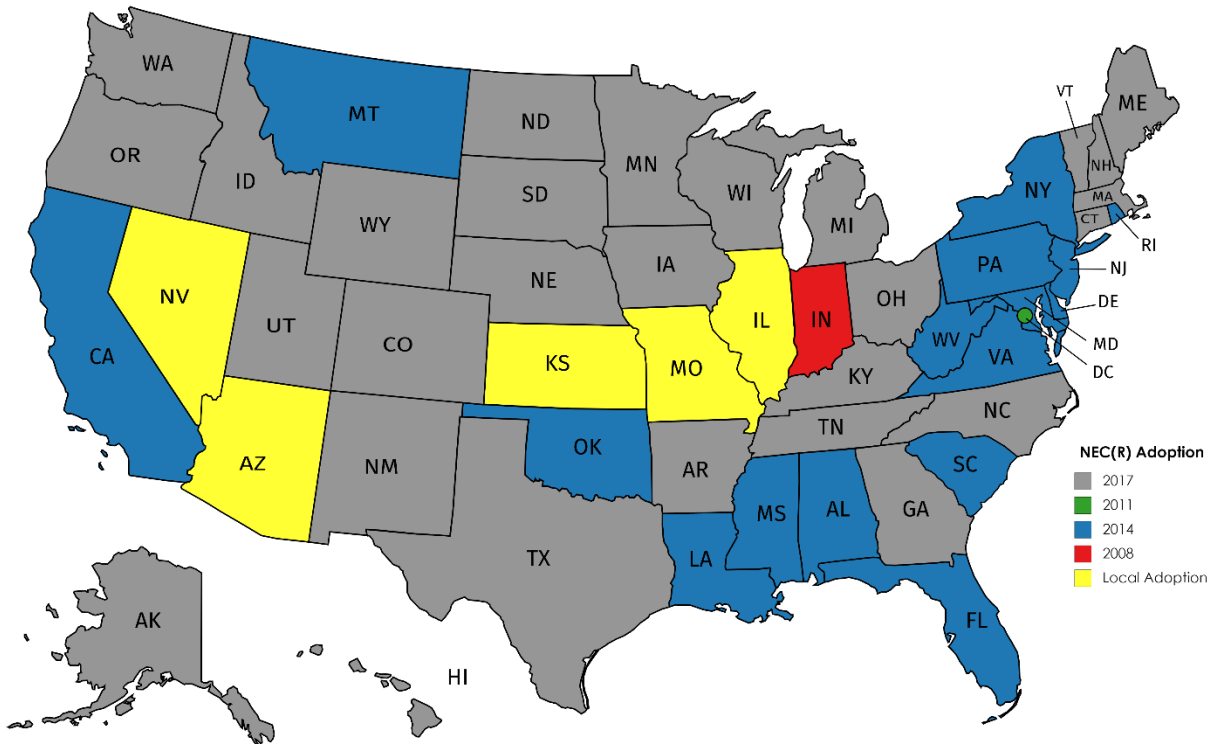
Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a

Why is the LP rating important?

The LP rating provides installers, designers, and engineers the ability to ensure their installation will be compliant to the 2017 NEC code without an inspection to the ampacity table.

It is important to note that although the latest revision of the NEC has been passed, it is up to state or local governments to adopt and enforce it. Therefore, the timing of when the 2017 code will be enforced varies greatly depending upon location. The map below shows the different NEC versions currently in use in each state, as of the publication time of this document.

Note that several states, such as Illinois, have no statewide adoption of the code; instead adoption is at the local level. At the publication time of this document, it is unclear how inspection will occur. The most common speculation is that inspection will be by application type.



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What products are affected?

The new regulations only apply to permanent horizontal communications cable that will power end devices at levels over 60W. Patch cables will be unaffected.

Summary

- The 2017 NEC code applies to permanently installed cables running PoE++ Type 4; PoE Type 1, 2, and 3 are not affected by the NEC code
- Patch cords are not affected
- The code created a new Limited Power (LP) listing
- An LP rating is NOT required to run PoE++, however, cables without the LP listing will require inspection to ensure that bundle sizes meet the ampacity table guidelines
- An LP rating of 0.5A or higher is required for PoE++ Type 4 installations without inspection

More information regarding PoE

For more information regarding PoE, please see the Panduit Technology Brief entitled [Power over Ethernet with Panduit Copper Cabling](#) at Panduit.com.