

2 Simple Ways to Comply with the 2017 National Electrical Code®

Changes to the 2017 National Electrical Code® and its Impact on the ICT Industry

As recently as 2015, it's likely that a network cable installer's only concern was system performance - installing a compliant system that would meet the bandwidth and transmission requirements requested by the customer. Now, as the number of applications utilizing Power over Ethernet (PoE) technologies continues to grow, 4-pair cables are increasingly being used to transmit both data *and* power. This convergence of previously separate cabling systems is adding new dimensions to cabling performance and safety requirements, as is evidenced by the 2017 revisions to the National Electrical Code® (NEC®).

Predictably, a 4-pair cable carrying up to 100W of power is prone to generating heat. Heat generation in a single cable is not generally a problem on its own, as most compliant category cables are rated to withstand above-ambient conditions. However, when these cables are bundled together, that heat rise can become a very significant safety issue. Depending on variables like wire gauge, the amount of current being carried, and the number of cables in a bundle, it's very easy to see how certain bundles could be prone to overheating, exceeding the max temperature rating of the cable. In fact, a 2015 Underwriters Laboratories (UL) fact finding study confirmed the reality of this issue and developed a roadmap to ensure safety in use.

This is where the NFPA got involved and the 2017 revisions to the NEC® come into play. The 2017 revision of the NEC® (*Article 725*) features an "Ampacity Table" for Class 2 & 3 data cabling in applications involving power over 4-pair cables (Table 1). The ampacity table provides the necessary guidance of maximum allowable number of cables in a bundle for users and installers who intend to carry power to connected devices (accounting for wire gauge and maximum current). Following the guidance provided by the ampacity table ensures cables in a given bundle will not exceed their temperature ratings.

Ampacities of each conductor (in amperes) in a 4-pair Class 2 or Class 3 data cable, based on copper conductors are ambient temperatures of 30°C (86°F) with all conductors in all cables carrying current, for 60°C (140°F), 75°C (167°F), & 90°C (194°F) rated cables																					
AWG	1			2-7			8-19			20-37			38-61			62-91			92-192		
	Temp Rating (°C)			Temp Rating (°C)			Temp Rating (°C)			Temp Rating (°C)			Temp Rating (°C)			Temp Rating (°C)			Temp Rating (°C)		
	60	75	90	60	75	90	60	75	90	60	75	90	60	75	90	60	75	90	60	75	90
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	N/A	N/A	N/A
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	2.25	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

Table 1: NEC® Table 725.144, i.e. Ampacity Table

In addition to following the guidance of the ampacity table, the 2017 NEC[®] offers an alternative path to compliance through something called an “LP” or “limited power” designation. “LP” is an optional designation and cable marking that may be added to listed cable at a given amperage to attest that the cable fully complies with the requirements of the NEC[®], regardless of cable bundle size (provided that the rated current limit per conductor is not exceeded.) To achieve “LP” designation, cables are further tested to ensure they will not exceed their temperature rating at the maximum current limit of each conductor, see Figure 1.



Figure 1: Example of "LP" test set-up

“LP” designation allows installers and designers a simple installation option by not restricting bundle sizes, and eliminating the need to count cables.

While organizations like IEEE, TIA, and the IEC continue working to address the *performance* issues associated with cable heating, there remains an important need for distinction between performance and safety standards. Though the purpose of the NEC[®] is not intended to be a design specification or instruction manual, following the requirements of the 2017 NEC[®] through design choices or “LP” cable specifications will serve as a means of complying with the NEC’s goal of “safeguarding people and property from hazards associated with the use of electricity”. While enforcement of NEC[®] requirements still reside with the local Authority Having Jurisdiction (AHJ), installers and users should find both the guidance of the ampacity table and the optional “LP” marking as simple ways to comply with the newest requirements of the National Electrical Code[®].