

SPI/UL Cable Heating Study

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Overview

- Increasing power demands
 - Increasing power creates a potential problem
 - The National Electrical Code (NEC) controls installations
 - Where does the NEC apply
 - Installations with high cable loading
 - The problem
 - A solution
 - SPI/UL Project
 - Some initial findings
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Increasing Power Demands

- Providing power over communications cabling is a rapidly growing area of the industry
- Formation of IEEE 802.3bt Task Force
 - Current up to 1 amp/pair
 - Power potentially up to 100 watts
- Other powering schemes
 - HDBaseT (PoH) potentially up to 200 watts
 - Other proprietary powering systems

Increasing Power Creates a Potential Concern

-Heat

- Dissipation decreases with the number of cables grouped together
 - Smaller wire gauges generally produce more heat
 - Raceway (conduit) selection and fill ratio can affect heat dissipation
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The NEC Controls Installation

- TIA and other standards as well as manufacturers warranties provide guidance on installation
- The NEC (National Electrical Code) is law where it is adopted
 - Installations are based on the requirements of the NEC
 - Installations are inspected based on the requirements of the NEC
- The NEC controls copper communications/data cabling in two primary places
 - Article 725 Class1, Class 2 and Class 3 Remote-control, Signaling and Power Limited Circuits
 - Chapter 8 Communications Systems
- The NEC does not have any specific provisions for powering of communications equipment**
 - Most applications fall under Article 725 Class 2 Power Limited Circuits
 - Most communications applications have no guidance. Most AHJ's will reference Article 725 as the applications are similar

NEC Article 725

-Class 2 Power Limited Circuits have the following limits from Table 11(B)

- Max 100 VA
- Max current =1.67 amps

-Article 310.15(3) Temperature Limitation of Conductors.

- No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved.

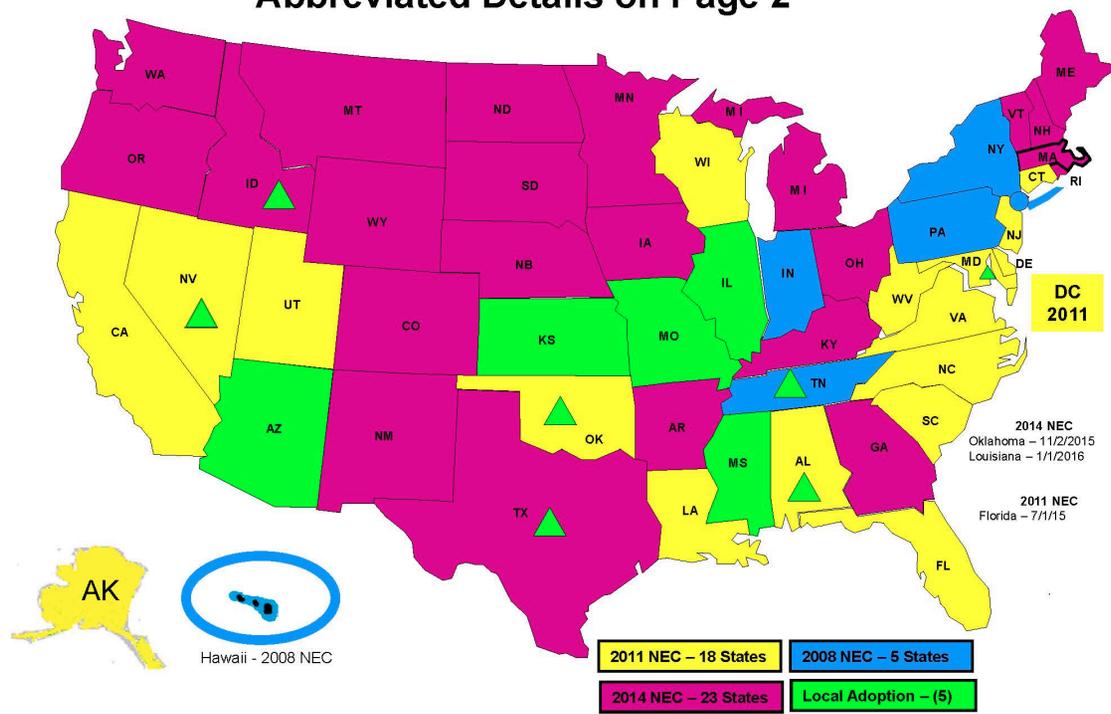
-Listed information technology equipment limited-power circuits references UL 60950-1

-UL interpretation of UL 609050-1

- Up to 100 watts per circuit allowable
 - Up to 400 watts possible with 4 pair twisted pair cable.
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Where does the NEC apply

NEC Adoption by State ▲ = Subject to local adoptions
Abbreviated Details on Page 2



Revised - June 2015

Note: Some local adoption states have earlier than 2008 adoptions in some jurisdictions

Installations with high cable loading



Installations with high cable loading



The Problem

-The NEC has no guidelines for powering over communications cabling as it is currently being implemented

-Many existing cabling installations aren't designed to manage the heat from higher power levels

-The potential exists for cable overheating with:

- Previously installed cabling plants when higher (allowable) currents or power is used by newly installed higher power devices
- New installations that don't make provision for heating during installation

-The overheating of cables is a safety concern for the NEC

A Solution

-Provide a solution before someone else does

-Make changes to the NEC to provide guidance on the safe application of powering over communications cables

- SPI submitted a number of PI's to enable powering over communications cabling in Articles 725 and 840 and to supplement existing ampacity tables
- Data is needed to support the PI's
- The SPI/UL study was initiated to provide data to support and optimize the PI's

-The PI's specifically provide for the use of existing and newly installed Category cable

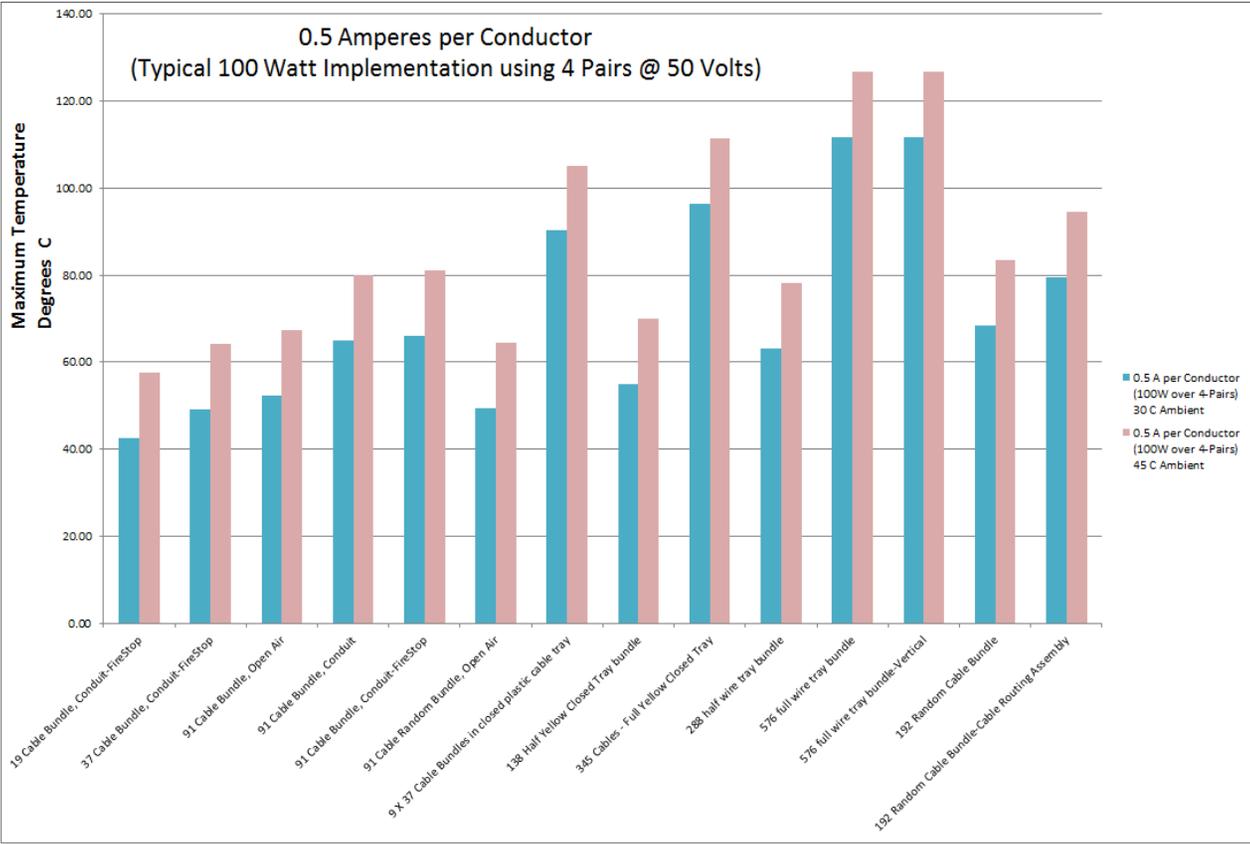
-One PI proposes a listed and labeled cable that can be used for most applications without concern

- **This may have some restrictions**

SPI/UL Project

- SPI manages the study at UL
 - Most communications cabling manufacturers were approached to participate in the study
 - All members of CCCA (Communications Cabling and Connectivity Association) were invited to join the study.
 - Phase 1 of the project is developing data to support the SPI PI's that enable the safe use of existing and new installations of powered communications cabling within the NEC
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Some Initial Findings



Initial findings from Phase 1 as of mid June

- Larger bundles get hotter with less current applied
- Enclosed cables get hotter
- Cables exceed 60°C at current levels well below that permitted by the NEC Class 2 tables
- Cable failures occurred at current levels well below that permitted by the NEC Class 2 tables
- In some configurations, cable failures occurred at current levels permitted by UL60950-1 (1.3 amperes) and even at the lower current used by high Power Source Modules (1 ampere)