NEC 2011
National Electrical Code
Major Revisions for Computer Rooms

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TODAY’S DISCUSSION

An unofficial overview of changes in the National Electrical Code for Information Technology Equipment (ITE)

• Application & Highlights of Article 645
• Details
  – New Definitions
  – New rules for disconnecting means (“EPO”)
  – IT vs. Telecom
  – Significance
  – Other Articles
Define what Article 645 is here

Define What EPO means here

Dan Kennefick, 7/22/2011
The largest NEC revision for ITE in almost 50 years!

WHY?

– EPO* is perceived as:
  - a single point of failure
  - a major cause of unintended data center shut down with life-threatening consequences
– NEC 2008 contains obsolete requirements
– Some code enforcers misinterpret the requirements
– Some requirements are unnecessary or obsolete
– Definitions are needed – new & revised
– Fuzzy distinction between what is IT vs. Communication Equipment
– Inappropriate application of Article 645 to communications equipment and wiring

*EPO* = “Emergency Power Off”, officially “disconnecting means”
Define what ITE means here
Dan Kennefick, 7/22/2011
Article 645 is NOT MANDATORY

• Just because there is IT equipment in the room does not mean that Article 645 must be applied

• Article 645 allows alternate construction from Chapters 1-4 (general wiring methods) of the Code
  – Permits certain non-plenum rated cable under floors
What do chapters 104 of the code cover in general?

Dan Kennefick, 7/22/2011
Article 645 – Mandatory?

• The text of earlier editions could have been (and sometimes was) interpreted to make it mandatory.

• Article 645 is intended to be available as an alternate to the general wiring rules of Chapters 1 through 4.
  – Earlier editions stated “This article shall apply, provided all of the following conditions are met:”
    • 5 special fire protection requirements listed
  – The words “shall apply” (which denote mandatory) disappear in the 2011 edition.
Article 645 – Now “Voluntary”

645.4 (*Special Requirements for ITE room*) states:

“This article *shall be permitted* to provide alternate wiring methods to the provisions of:

- Chapters 1 through 4 for power wiring,
- 725.154 for signaling wiring, and
- 770.113(C) and Table 770.154(a) for optical fiber cabling when all of the following conditions are met:”
Article 645 – Information Technology Equipment (ITE)

5 CONDITIONS HAVE ALWAYS BEEN REQUIRED: (645.4)

- Disconnecting means (a.k.a. “EPO”)
  - Dedicated HVAC* for the space
  - Listed IT equipment
  - Limited access – authorized personnel only
  - Fire resistant construction

A 6th REQUIREMENT WAS ADDED IN 2011:

- No equipment is permitted in the computer room that is not associated with the operation of the room

*[HVAC = Heating, Ventilation & Air Conditioning]*
Art. 645 allows alternate wiring methods for:

- signaling wiring [725.154]
- optical fiber cabling [770.113(C)] & [Table 770.154(a)]
  - The above sections require plenum wiring in ceiling and under-floor plenums
  - Types CL2P, CL3P, OFNP & OFCP
- Article 645 permits non-plenum cable in the under-floor plenum
  - (CL2, CL3, OFN & OFC)
After plenum wiring add, "in a ceiling plenum cavity space."

Dan Kennefick, 7/22/2011
Communications Circuits

- Article 645 does **not** cover communications circuits  (See future slides)  

- **Cables in the ceiling and under-floor plenums are required to be plenum cable (CMP & CATVP)**

- Article 645 **does** apply to the *power* wiring for communications equipment
Add "Ceiling and" before under-floor plenum in bullet two

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Communications Circuits are covered in Article 800

- Definition: (800.2)
  Communications Circuit: The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), outside wiring for fire alarm and burglar alarm from the communications utility to the customer's communications equipment up to and including terminal equipment such as a telephone, fax machine, or answering machine.
**Communications Equipment** is defined in Article **100**

- **Definition:**
  
  **Communications Equipment:** The electronic equipment that performs the telecommunications operations for the transmission of **audio, video, and data**, and includes power equipment (e.g., dc converters, inverters, and batteries) and technical support equipment (e.g., computers)
• Data circuits are class 2 or 3 circuits  

[725.121(A)(4)]

• When a class 2 or 3 circuit and a communications circuit are in the same cable, the class 2 or 3 circuit is reclassified as a communications circuit

[725.139(D)(1) and 800.133(A)(1)(c)]
Changes to Article 645

New definitions [discussed in detail later] (645.2)

- Information Technology Equipment (ITE)
  - note: The term “information and communications technology equipment” (ICTE) does not appear in the NEC

- Information Technology Equipment Room

- Zone

- Critical Operations Data System

- Remote Disconnect Control
INFORMATION TECHNOLOGY EQUIPMENT (ITE)

“Equipment and systems

• rated 600 volts or less

• normally found in offices or other business establishments and similar environments classified as ordinary locations, that are
  – used for creation and manipulation of data, voice, video and similar signals that
  – are not communications equipment as defined in Part I of Article 100 and
  – do not process communications circuits as defined in 800.2”

Reference NEC 2011 section 645.2
Combined IT and Communications Equipment

• When a piece of equipment performs both IT and communications functions (e.g., VoIP) the equipment is classified as communications equipment and the provisions of Article 800 (not 645) apply to the signaling circuits.

  – Communication cables in the ceiling and under-floor plenums are required to be Type CMP (unless in raceway).
Add "ceiling and" before under-floor plenum

Dan Kennefick, 7/22/2011
Convergence

Information Technology Equipment (ITE)
Article 645

Communications Equipment
Chapter 8

Bicsi
Not Sure of the Equipment Classification?

• If you’re not sure if the equipment is IT or communications, or if the classification may change...
  – Use Types CMP, OFNP & OFCP cables
    • Note: Conductive optical fiber cables require grounding
  
  – Types CL2P and CL3P are not permitted to be used for communications
CRITICAL OPERATIONS DATA SYSTEM

“An information technology equipment system that requires continuous operation for reasons of:

– public safety,
– emergency management,
– national security, or
– business continuity”

CODS is Significant for applying EPO “Method B” (discussed later)
• Additional active and passive fire protection is required, including plenum cable, in the under-floor plenum

645.10(B)(5)

– Only Types CL2P, CL3P, OFNP, OFCP, CMP and CATVP are permitted to be installed exposed to the airflow (not in raceway)
Not Sure if it’s Critical?

• If you are not sure if it is a critical operations data system, or if it may become one in the future...
  
  – Use Types CMP, OFNP & OFCP cables
    • Note: Conductive optical fiber cables require grounding

645.3(C)
INFORMATION TECHNOLOGY EQUIPMENT ROOM

“A room within the information technology equipment area that contains the information technology equipment”

[ From NFPA 75 ]
ZONE

“A physically identifiable area
(such as barriers or separation by distance)
• within an information technology equipment room,
• with dedicated power and cooling systems for IT equipment or systems.”

It must be able to prevent the spread of the products of combustion.
A Hot Aisle Containment System might qualify as a “zone” – subject to AHJ approval.
REMOTE DISCONNECT CONTROL (a.k.a. “EPO”)*

“An electric device and circuit that controls a disconnecting means through a relay or equivalent device”

The actual “disconnecting means” (such as a circuit breaker) can be located in a different location, such as an electrical room.

* EPO = Emergency Power Off – slang term for “disconnecting means”
Method “A”: Similar to 2008 NEC rules 645.10(A)

- Located at “approved locations” readily accessible to fire fighters
  - **Do not have to be at main doors!** - can be in another part of the building

- Grouped & identified for power & HVAC*

- “Zones” have approved means to control fire & smoke within the zone
  - “Identifiable area” is subject to AHJ* interpretation

- Specifically permits additional means to prevent unintentional operation
  - i.e., does not have to be “one button”
  - Can be key operated, break-glass, covered, 2-stage, or other methods

* HVAC = Heating, Ventilation, & Air Conditioning  
AHJ = Authority Having Jurisdiction
Remote Disconnect Controls: “EPO”

2 Methods

Method “B” : Disconnect Control is NOT REQUIRED when:

• Approved procedures are established & maintained to remove power to HVAC and to IT equipment
  – Written procedure must be created & updated regularly, & personnel must be trained

• Qualified personnel (trained & documented) are continuously available
  – 24/7 operation; advise fire fighters on disconnecting means

• Smoke-sensing fire detection system is in place

• Approved fire suppression system is in place

• Signaling cables under the floor, exposed to the airflow (not in raceway) are listed plenum cables, Types CL2P, CL3P, OFNP, OFCP, CMP & CATVP
(Note on Applying Remote Disconnect)

The code does NOT require that ALL electricity be removed in the IT equipment room.

• It never has.
• Lots of equipment – such as lighting – remains energized
• Only the IT equipment must be shut down -- not the feeders

*If you have a Power Distribution Unit (PDU), you can shunt trip its main circuit breaker (if one is available in the PDU);
The PDU, transformer, panelboards and branch circuits and connected IT loads will all be de-energized.*
Define PDU and CB
Dan Kennefick, 7/22/2011
Changes to Article 645 (Cont’d)

- “OTHER ARTICLES”
  Article 645 does not exclude the rest of the Code

- “Other” applicable sections of the Code that apply in a data center
  - penetrations of fire-resistant boundary
  - ceiling cavity plenums
  - grounding of optical cables
  - electrical classification of data circuits
  - critical operations power systems
  - fire alarm equipment
  - communications equipment
  - CATV equipment
NOT REQUIRED TO BE SECURED IN PLACE:

- Power cables
- Communications cables
- Connecting cables
- Interconnecting cables
- Associated boxes, plugs & receptacles
  ...when listed as part of – or for – IT equipment

Relief from securing cables to the building structure, and relief from requirements to use plenum cable under a raised floor, are the main reasons why people use Article 645.
Cables extending *beyond* the ITE room are subject to other applicable sections of the NEC
Clarifications

POWER SUPPLY CORDS

645.5(B)

• IT and communications equipment are permitted to be connected to a branch circuit under the floor when it is:
  – Not longer than 15 ft
  – Listed & a type listed for use on listed ITE; or
    • Constructed of listed flex cord & listed attachment plugs/connectors

[ e.g., input cord on rack-mounted power strip ]
Clarifications

POWER INTERCONNECT CABLES

- Must be listed
- Can be longer than 15 ft

[Eliminates confusion between power supply cords & interconnect cables]
Unchanged in Article 645

- All the wiring rules for data/comm cables in an information technology equipment room deal with cabling **under** the computer room in the under-floor plenum.

- There are no requirements for wiring **in** the computer room (e.g., overhead cable racks).
  - *Exception:* Cables exposed to physical damage are required to be protected.
What’s this cable for?

The accessible portion of abandoned supply circuit and interconnecting cables must be removed **unless** contained in a raceway.

Power cables identified for **future use** must be marked with a **tag** of sufficient durability to withstand the environment involved.

The tag must include:

- Date identified for future use
- Date of intended use
- Information relating to the intended future use
Abandoned Signal Cable Definition

Abandoned Class 2, Class 3, and PLTC Cable -

Installed Class 2, Class 3, and PLTC cable that is not terminated at equipment and not identified for future use with a tag.
Define PLTC cable
Dan Kennefick, 7/22/2011
• **725.25 Abandoned Cables.**
The accessible portion of abandoned Class 2, Class 3, and PLTC cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.
Abandoned Optical Cable Definition

Abandoned Optical Fiber Cable –

Installed optical fiber cable that is not terminated at equipment other than a connector and not identified for future use with a tag

— Informational Note: See Article 100 for a definition of Equipment.
Abandoned Optical Fiber Cable Rules

• 770.25 Abandoned Cables.

The accessible portion of abandoned optical fiber cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.
Abandoned Communications Cable - 
Installed communications cable that is not terminated at both ends at a connector or other equipment and not identified for future use with a tag.

– Informational Note: See Article 100 for a definition of Equipment.
800.25 Abandoned Cables.

The accessible portion of abandoned communications cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.
• **Feeder and service calculations** for new or existing loads can be performed by qualified persons under engineering supervision.
  - Allows an alternative to the feeder & service load calculations required by Parts III & IV of Article 220.
    - Can prevent **over-sizing of utility feeders**
    - Feeder & service load calculations performed w/ the current equipment in place may not always provide an accurate calculation over the life of the installation.
    - Diversity of the load, if based solely on the sum of *nameplate* ratings, may not reflect the actual load that occurs when equipment is operated simultaneously.
PDUs are permitted to have multiple panelboards within a single cabinet

- Removes the prohibition of >42 CB pole positions in a cabinet
- 72-pole panelboards are OK

- Formalizes a TIA submitted by APC 3 years ago
• **Uninterruptible Power Supply (UPS)**

  A power supply used to provide alternating current power to a load for some period of time in the event of a power failure

  — INFORMATIONAL NOTE

  In addition it may provide a more constant voltage and frequency supply to the load, reducing the effects of voltage and frequency variations.

  **Note:** A UPS provides ac output.

  If it provides dc output, the correct term would be “dc power supply”, “rectifier,” or “charger”.

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**Bicsi**
Choosing a Data/Comm Cable

Cables permitted to connect to IT equipment in the under floor plenum:

- Types CMP, CL2P, CL3P, OFNP & OFCP
- Types CMR, CL2R, CL3R, OFNR & OFCR
- Types CM, CMG, CL2, CL3, PLTC, OFN, OFC & DP
Choosing a Data/Comm Cable

Cables permitted to connect to communications equipment in the under floor plenum

- Types CMP, OFNP & OFCP
Nonmetallic Raceways

Nonmetallic raceways permitted in the under floor plenum

• Plenum signaling raceways
  – Only Types CL2P and CL3P cables are permitted to be installed in plenum signaling raceways

• Plenum Optical Fiber Raceways
  – Only Types OFNP and OFCP cables are permitted to be installed in plenum optical fiber raceways
Nonmetallic Raceways

Nonmetallic raceways permitted in the under floor plenum (cont’d)

• Plenum communications raceways
  – Types CMP, OFNP, OFCP, CL2P and CL3P cables are permitted to be installed in plenum communications raceways
Universal Cable and Raceways

Suitable for communications and IT, critical operations data centers and non-critical-operations data centers

- Types CMP, OFNP & OFCP
- Types CMP, OFNP & OFCP in plenum communications raceways
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