

NFPA 70

NEC Article 645  
2011 Changes

# Presentation Material



- Material presented today is a combination of many publications and presentations by many in the data center industry over the years, plus of course the NEC 2008 and 2011

# Agenda



- History
- Today's Information Technology Equipment (ITE) and room, a.k.a. data centers
- Changes in Article 645
- Summary

# The Creation of NEC 645

**USAF Statistical Division,  
Pentagon, Washington, DC  
July 2, 1959**

- 4,000 sq ft unsprinklered area
- \$6,690,000 property damage
- Three IBM computers destroyed
- 5000-7000 reels of magnetic tape destroyed



# History – The Development of NEC 645



- **1959** – Government request to NFPA
- **1960** – NFPA “Electronic Computer Systems” Committee formed
- **1961** – NFPA 75-T Preliminary Standards
- **1962** – NFPA 75 “**Standard for the Protection of Electronic Computer Systems**”
- **1968** – NFPA 70 – National Electric Code (NEC) first addresses data processing systems

# Today's Data Center and the Risks

Medical Drug Interactions

Medical Orders & Procedures

Medical Diagnosis

Air Traffic Control

Airport & Border Security

Electrical Power Grid Control

Communications Systems

National Security

Personal Records

Financial Transaction

Today's data centers are much more complex, and lives are affected

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# Article 645



- The 2011 NEC has in it the most sweeping changes in article 645 since it first appeared in the code in the 60's.
- The biggest change is the modification of rules for a disconnecting means, which now permits operational considerations in the design of an ITE space

# Article 645



- Keeping in mind
  - Article 645 is written for Information technology equipment (ITE) rooms only
  - Communications Equipment (CE) is covered in Article 800
  - Information technology equipment (ITE) rooms that do not have raised floors or do not run wiring under raised floors may choose to not utilize Article 645. If wiring under raised floors is utilized, the space must comply with the entire set of conditions stated in Article 645.

# Article 645 Changes – New Definitions



- Critical Operations Data System
- Information Technology Equipment (ITE)
- Information Technology Equipment Room
- Remote Disconnect Control
- Zone

# Article 645 Changes - Definitions



- 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.
  - Document this and should be in agreement with your Authority Having Jurisdiction should you qualify

# Article 645 Changes - Definitions



- A “remote disconnect control” is defined as “An electrical device and circuit that controls a disconnecting means through a relay or equivalent device.”
  - Intent: The disconnecting means is for use by firefighters in case of emergency
- In 2011, there are revised rules for a disconnection means. a.k.a. Emergency Power Off, or commonly known as the EPO.

# Article 645 Changes - Definitions



- The term “zone” was introduced in Article 645 in 2008, but was not defined until 2011.
  - A zone is “a physically identifiable area (such as a barrier or separation by distance) within an ITE room, with dedicated power and cooling systems for the ITE room or systems”.
- Some newer centers are zoned on purpose for multiple Tier ratings, or leased\co-location space.
- Also, some of the new containment systems for cooling may qualify as a zone

# Article 645 Changes



- 645.3, Other articles, was added in 2011 in order to minimize misinterpretations. It links Article 645 to other key articles in the code and clarifies which requirements apply.

# Article 645 Changes



- **645.4 before 2011**, the voluntary nature of Article 645 was not clearly stated. It said, “This article shall apply, providing all of the following conditions are met”. The word “shall” implied to many that adherence to the article was mandatory no matter what type of center it was.
- **In 2011 645.4**, it now 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 the following conditions are met.

# Article 645 Changes



- Also before 2011 in Article 645.4, there were 5 conditions.
- In 2011, a sixth condition was added, stipulating that no equipment is permitted in the ITE room unless it is associated with the operation of that room.
  - An information note was added with examples of the equipment associated with the ITE room.

# Article 645 Changes

## Special Requirements for ITE Rooms

2008 NEC	2011 NEC
Article 645 <u>shall</u> apply only if the conditions below are met:	Article 645 <u>shall be permitted</u> to apply if the conditions below are met:
▪ Disconnecting means provided	▪ Disconnecting means provided
▪ Separate HVAC	▪ Separate HVAC
▪ Listed IT Equipment	▪ Listed IT Equipment
▪ Restricted occupancy	▪ Restricted occupancy
▪ Computer room separated by rated partitions	▪ Computer room separated by rated partitions
	▪ <u>No equipment in the computer room unless it is associated with the operation of the room</u>

# Article 645 Changes



- Prior to 2011, Article 645 required an “approved means” by principal exit doors to disconnect power to all electronic and heating, ventilating and air conditioning (HVAC) equipment in the ITE room or in designated zones within the room.
- 645.10 now distinguishes between the disconnecting means itself and the “remote disconnect control.”

# Article 645 Changes



- In NEC 2011, disconnecting means control can be implemented in one of two ways:

## 645.10(A) Remote Disconnect Controls

- (1) – Remote disconnect controls located at approved locations are readily accessible in case of fire to authorized personnel and emergency responders.
- (2) – The remote disconnect controls for the control of electronic equipment power and HVAC systems shall be grouped and identified. A single means to control both systems shall be permitted.

# Article 645 Changes



- Usually, the disconnect control is a selector switch or push-button panel located in the ITE room or elsewhere in the building.
- The disconnecting means may be a circuit breaker (maybe shunt trip) in an electrical room or on a power distribution unit (PDU) in the ITE room.

# Typical Remote Disconnect Control

Covered Push Button  
Near Exit



Figure #3

# Typical Remote Disconnect Control

Covered Switch  
With Alarm



# Typical Remote Disconnect Control

Concealed Switch  
With Alarm



# Article 645 Changes



## 645.10(A) Remote Disconnect Controls (cont)

- (3) – Where multiple zones exist within the ITE room, each zone must have an approved means to confine fire or products of combustion to within the zone.
  
- (4) – Additional means to prevent unintentional operation of remote disconnect controls shall be permitted

# Article 645 Changes



## 645.10(B) Critical Operations Data Systems

Remote disconnecting controls shall not be required for critical operations data systems when all of the following five conditions are met:

- (1) – An approved procedure is in place for removing power and air movement within the room or zone.
- (2) – Qualified personnel are continuously available to meet emergency responders and advise them of the disconnecting methods.

# Article 645 Changes



- (3) – A smoke–sensing fire detection system is in place.
- (4) – An approved fire suppression system is suitable for the application.
- (5) – Cables are installed under a raised floor, other than branch-circuit wiring and power cords installed in compliance with.... *many listed articles effectively requiring cable under a raised floor plenum, be plenum rated.*

# Summary



- **New definitions**
  - **Critical Operations Data System**
  - **Information Technology Equipment (ITE)**
  - **Information Technology Equipment Room**
  - **Remote Disconnect Control**
  - **Zone**
- **Notes**
  - The term “EPO” is not used;
    - the correct term is “disconnecting means”
  - The new code distinguishes between:
    - Disconnecting means (circuit breaker, switch, etc) vs.
    - Disconnecting means controls (push button, relay panel, etc.)

# Summary

## Remote Disconnect Controls (EPO) 2 Methods Permitted

- **Method 1:** Similar to the past rules
  - 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  
Note: “approved” means ‘acceptable to the authority having jurisdiction’ (AHJ)
  - Grouped & identified for power & HVAC
  - **Zones** must have approved means to control fire & smoke within the zone
    - Subject to AHJ interpretation and approval

# Summary



## **Method 1 (cont'd)**

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

# Summary

## Method 2: “EPO” is NOT REQUIRED when;

- Approved procedure is established & maintained to remove power & air from the ITE room
  - Written procedure must be created & updated regularly, & personnel **must be trained**
- Qualified personnel (trained & documented) are continuously available
  - 24/7 operation, or available personnel
  - advise fire fighters on disconnecting means
- A smoke-sensing fire detection system is in place

# Summary



## **Method 2 (Cont'd)**

**“EPO” is NOT REQUIRED** when:

- An approved fire suppression system is in place
- Cables under the floor, other than as specified in Art. 645, comply with applicable sections of the code

# Summary



- If the facility qualifies for designation as a critical operations data center, remote disconnecting controls, or what many know as the EPO buttons, are not required if ALL of the requirements are met.
- It is now thought by many, IT and at the NFPA governing level, the new rules will enhance the reliability and availability of the ITE, yet keep the safety of the individuals intact.

# Comments



- A huge thanks to AFCOM & Uptime Institute Network
  - Especially Stephen McCluer – AFCOM
  - And David Boston – (formerly) Uptime Institute Network
- These major changes could not have happened without their knowledge of how to write code articles correctly and their dedication to this work
  
- Material References, Rick Sawyer, EPO+: A Data Center Heart attack Waiting to Happen!; Stephen McCluer, Changes in NEC-2011, Stephen McCluer & Dr. Stanley Kaufman, BICSI News Magazine

# Thank you..

- Panel Discussion to follow for your questions