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TECHNICAL WORKSHOP

Planning for a Power Over Ethernet Environment

Planning for a Power Over Ethernet Environment

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Pathways and Spaces Planning for a PoE Environment

TIA-569-Open Pathways (Current Standard)

- ✓ Limit Conduit Use

  9.9.1 Use of conduit

  The use of conduit as a horizontal raceway system for telecommunications cabling is considered when: it is required by code, outlet locations are permanent, device densities are low, special mechanical protection is required, or flexibility is not required. In-floor conduit systems are especially inflexible as they are usually buried in concrete.

- ✓ J Hook Supports @ 5' Spacing Max

  9.8 Non-continuous support

  Non-continuous supports shall be located at intervals not to exceed 1.5 m (5 ft).

- ✓ Access Requirements and Power and Data Separation

  Trays may be divided with a barrier to allow for physical separation between power and conductive telecommunications cables. Power and telecommunications cables shall be installed per electrical code. A minimum of 200 mm (8 in) access headroom shall be provided and maintained above a cable tray system or cable runway. The recommended access headroom above cable trays and runways is 300 mm (12 in). Care shall be taken to ensure that other building components (e.g., air conditioning ducts) do not restrict access.

- ✓ Reference NEMA VE2

  NOTE – NEMA VE2 contains useful information regarding additional cable tray support and installation.

- ✓ Cable Tray Fill 25-50%

  9.7.1.1 Cable trays

  Cable trays shall be planned for an initial maximum calculated fill of 25% (see example 1). The maximum fill of any cable tray shall be 50%. The maximum fill depth of any cable tray shall be 150 mm (6 in).

  NOTE – A calculated fill of 50% for four-pair and similar diameter cables will physically fill the entire tray due to spaces between cables, and random placement.

TIA-569-Open Pathways (Current Standards)

50% Fill is Full!

- ✓ NEC or TIA - 50% Max Fill

Let's Do the Math

Example:

- ✓ 2" x 6" Cablofil Wire Mesh = 12 sq in of area
- ✓ Per NEC 50% rule 12/2 = 6 sq in space for cables
- ✓ Cat 5e Cable = .21 in (DIA) = 3.14(.21)2/4= 0.4 sq in
- ✓ 6 sq in / .04 sq in = 150 cables

So what does 150 cat 5e cables look like in a 2x6 wire mesh tray?

No Rules for cable "Bundles"

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Primary PoE concern

Watts vs Amps

TIA – focused on Watts

NEC – focused on Amps

POE standards Evolution

- 1993 – IEEE 802.3af - 13W (350 mA)
- 2009 – IEEE 802.3at - 25.5W (600mA)
- 20xx – IEEE 802.3bt - 9 Power classifications

Table 1: Power Sourcing Equipment Classifications

Class	Min Power from PSE (Watts)	Min Guaranteed Available Power at PD (Watts)
0 and 3	15.4	13.0
1	4.0	3.84
2	7.0	6.49
4	30.0	25.5
5	45.0	40.0
6	60.0	51.0
7	75.0	62.0
8	90.0	71.3

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NEC 2017 PoE (Section 725)

- ✓ Cable Type Separation
  - ✓ Class 2 or 3 circuits require barrier from Power, Class 1, Lighting
  - ✓ No strapping cables to conduit
- ✓ Cable Ampacity and Bundle Sizes
  - ✓ Limited to capacity of cable gage & connectors
  - ✓ No derate for "Loose Fill"

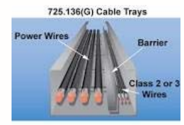

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Data Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

AWG	Number of 4-Pair Cables in a Bundle																				
	1			2–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature 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	0.8	0.9	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 factor of 1.4.
Informational Note: The conductor sizes in data cables in wide-spread use are typically 22–26 AWG.

NEC 2017 PoE (Section 725) vs 392 (Data non – PoE Cat 6 cables)

- ✓ Space requirement Class 2 or 3 circuits
  - ✓ DATA ONLY (.22" dia -24 AWG)
    - ✓ 2x6" space – 159 cables
    - ✓ 2x24" space – 636 cables
    - ✓ Limited by physical space available
  - ✓ POE ONLY (.22" dia -24 AWG)
    - ✓ 2x6" space – 159 cables@ .5 amps if bundled or 159 cables@1 amp if loose
    - ✓ 2x24" space – 636 cables
    - ✓ Limited Ampacity based on bundle size
  - ✓ ½ POE + ½ Data (.22" dia -24 AWG)
    - ✓ 2x6" space – 159 cables
    - ✓ 2x24" space – 636 cables
    - ✓ 40% increase in bundle size

DATA CABLE FILL TABLE

TRAY	MAX NUMBERS OF CABLES PER NEC CODE 392.22 (A)(2)			
	Cat 5e 4-pr Plenum (.17")	Cat 5e 4-pr Non-Plenum (.19")	Cat 6e 4-pr Plenum (.22")	Cat 6a 4-pr Plenum (.35")
CF54/50(2x2)	88 cbls	71 cbls	53 cbls	20 cbls
CF54/100(2x4)	177 cbls	142 cbls	106 cbls	41 cbls
CF54/150(2x6)	266 cbls	213 cbls	159 cbls	62 cbls
CF54/200(2x8)	355 cbls	284 cbls	212 cbls	83 cbls
CF54/300(2x12)	532 cbls	426 cbls	318 cbls	125 cbls
CF54/400(2x16)	710 cbls	568 cbls	424 cbls	167 cbls
CF54/450(2x18)	798 cbls	639 cbls	477 cbls	188 cbls
CF54/500(2x20)	887 cbls	710 cbls	530 cbls	209 cbls
CF54/600(2x24)	1065 cbls	852 cbls	636 cbls	251 cbls

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Data Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

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	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature 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
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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
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Why are PoE amps important?

Cable overheating

- **% of PoE deployment**
- **Cable bundles**
  Loose fill vs cable bundles

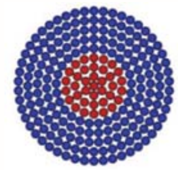

Figure 9: Inner 37 cables of 259-cable bundle energized

- **Cable type matters**
  Twist
  Insulation thickness
  Construction type (Foil wrapped = best at heat dissipation)
- **Pathway system matters**
  Closed systems vs Open systems
  - No suprise – open systems run cooler
  - Steel conduit most heat rise (not a thermal sink)

New Addendum to TIA-569

(Pathway & Spaces Standard)

Additional considerations for supporting remote power over balanced twisted pair cabling

- ✓ TIA TR-42.3 subcommittee is working hard on a 2nd addendum to the 569 Pathway and Spaces standard
  - ✓ 40% fill max
  - ✓ Focus on Bundled and Un-Bundled state
  - ✓ Table for guidance on head dissipation depending on cable quantity and bundled state.
  - ✓ RJ45 rated for 2.0 amp (new connection designs in review to allow greater ampacity)
  - ✓ Going out for 2nd Committee Ballot
  - ✓ Will be published as ANSI/TIA-569-D-2

Future

Power over balanced twisted pair cabling

- ✓ PoE will continue to grow
- ✓ PoE is a dramatic technology shift
- ✓ PoE Connectivity is critical
  (Life safety not just performance)
- ✓ Additional coordination of NEC/TIA required
- ✓ Cable installation techniques will need to be reviewed & revised
  - ✓ Must plan! Can no longer "pull cables until its full"
  - ✓ Power cable rules will apply to data cables!
    - ✓ Data cable voltage drop calculations (length * twist rate factor)
    - ✓ Data cable ampacity calculations
    - ✓ Data cable connection fill calculations
    - ✓ Data cable splice/connection heating tests

Questions?

For more Information:

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