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**Comments#99  
IEEE P802.3bt/D3.3**

**Rosemont, IL**

**March 2018**

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# Purpose

- Provide supporting information for Comment#99

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CI 145      SC 145.1.4      P115      L19      # r03-99

Diminico, Christopher

*Comment Type*    **G**      *Comment Status*    **X**

The cautionary note on the use of cables with conductors smaller than 26 AWG should be replaced with reference to TIA-TSB-184-A Annex E. which is to provide installation guidelines to support the delivery of power over installations with 28 AWG cord cable.

*Suggested Remedy*



Replace cautionary note with reference to TIA-TSB-184-A Annex E in development under TR42.7 which is to provide installation guidelines to support the delivery of power over installations with 28 AWG cord cable.

Presentation to be provided.

*Proposed Response*      *Response Status*    **O**

# TIA TR-42: TSB-184-A-1

## TIA TR-42 Activities

- **TR-42.7 (Copper Cabling):**
  -  - New project: ANSI/TIA-568.2-D, “Balanced Twisted-Pair Telecommunications Cabling and Components Standard” circulating for default ballot
  -  - New project: TSB-184-A-1, “Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling: Addendum 1, Guidance to Support 28 AWG Cords” circulating for committee ballot

[http://www.ieee802.org/3/minutes/mar18/0318\\_TIA\\_TR42\\_report\\_to\\_802d3.pdf](http://www.ieee802.org/3/minutes/mar18/0318_TIA_TR42_report_to_802d3.pdf)

# TIA TR-42: TSB-184-A-1

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## TR-42.7 Meeting - 01/30/2018 - 01/31/2018

- Task Group chartered to draft text for 184-A-1 for impact of managing cord cables.

### **Content under discussion in TG:**

#### **Section: Impact of adjacent 28 AWG cord cable bundles**

- Cord cable bundling
- Current limits for cord cables
- Vertical management (equipment rack configurations)
- IL margin for 28 AWG cord cables.
- Cord cables smaller than 28 AWG are not recommended.

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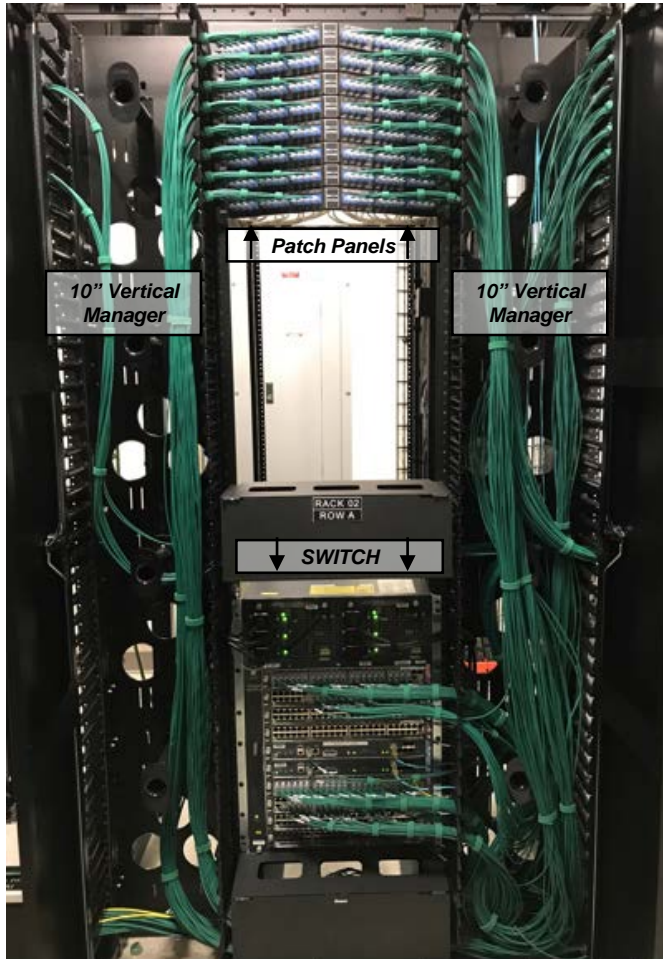
## **28 AWG Patch Cord PoE Testing**

**(Temperature Rise over Ambient in high density Switching Cabinets)**

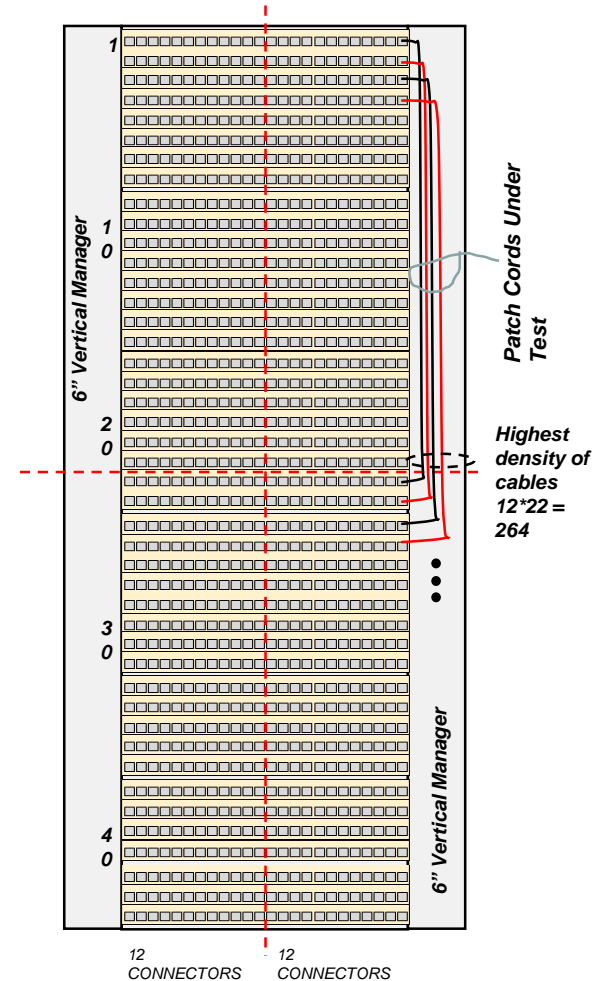
Source: Panduit

# 28 AWG Patch Cord Application

Patch Cords from top 22 Patch panels connected to the bottom 22 Patch panels in a one to one correspondence (only Right vertical manager used, only right ½ patch panel used)



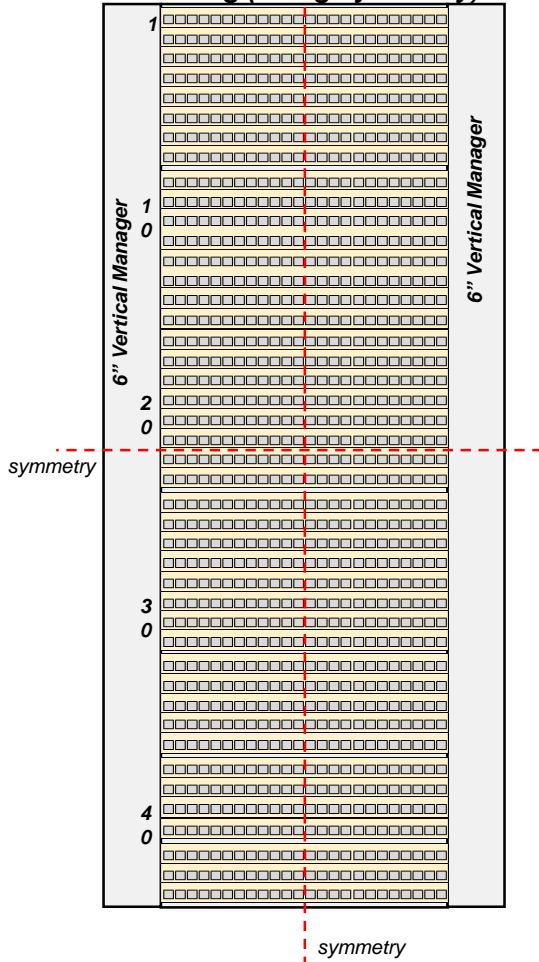
←  
*Simulating the Application*  
→



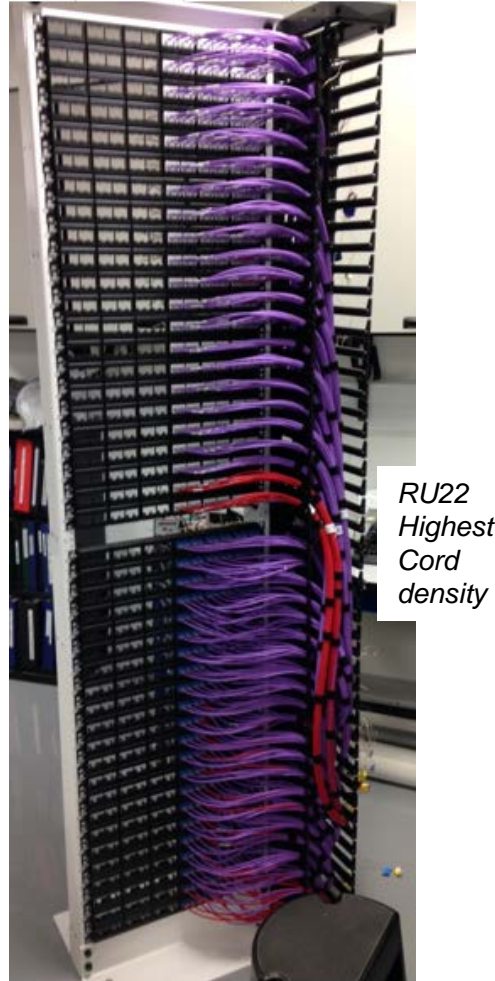
Source: Panduit

# 28 AWG Patch Cord Application

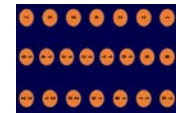
28 AWG Patch Cord Application Modeling (using symmetry)



Patch Cord - Rack Under Test



- 22 bundles of 12 cables per bundle (e.g., 1 bundle per RU – ½ patch panel)
- 1A per pair for all 264 cables
- Vertical manager door shut during tests
- All bundles have 3 thermocouples placed in the center cable
  - One placed at RU22
  - One placed at Top (where it leaves vertical manager into Patch panel)
  - One placed at Bottom (where it leaves vertical manager into Patch panel)
- Measurements are done with the vertical manger door closed and:
  - In still air and with slight air movement
  - 28 AWG and 24 AWG patch cords
  - 6" & 10" wide Vertical Managers
- Bundles are configured as
  - Optimized in physical orientation



Airgaps between bundles

- Non-optimized (natural location)

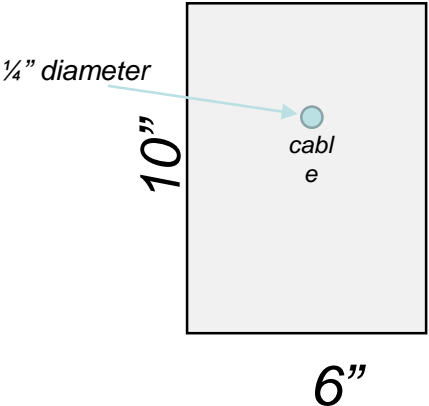


No airgaps between bundles (super bundle)

Source: Panduit

# Experimental Setup: Vertical Manager

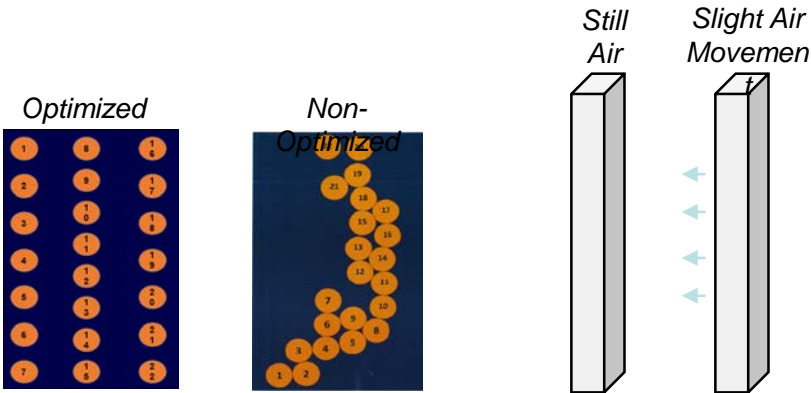
Cross Section Vertical Cable Manager (Top View)



Used during measurements

		Vertical Manager Cable Fill Percentage				
		30%	40%	50%	60%	
Used during measurements	6"	261	347	434	521	Cat 6 Cable (24AWG)
	8"	347	463	579	695	
	10"	434	579	724	869	
	12"	521	695	869	1042	
Used during measurements	6"	640	853	1066	1279	Cat 6 Cable (28AWG)
	8"	853	1137	1422	1706	
	10"	1066	1422	1777	2132	
	12"	1279	1706	2132	2559	

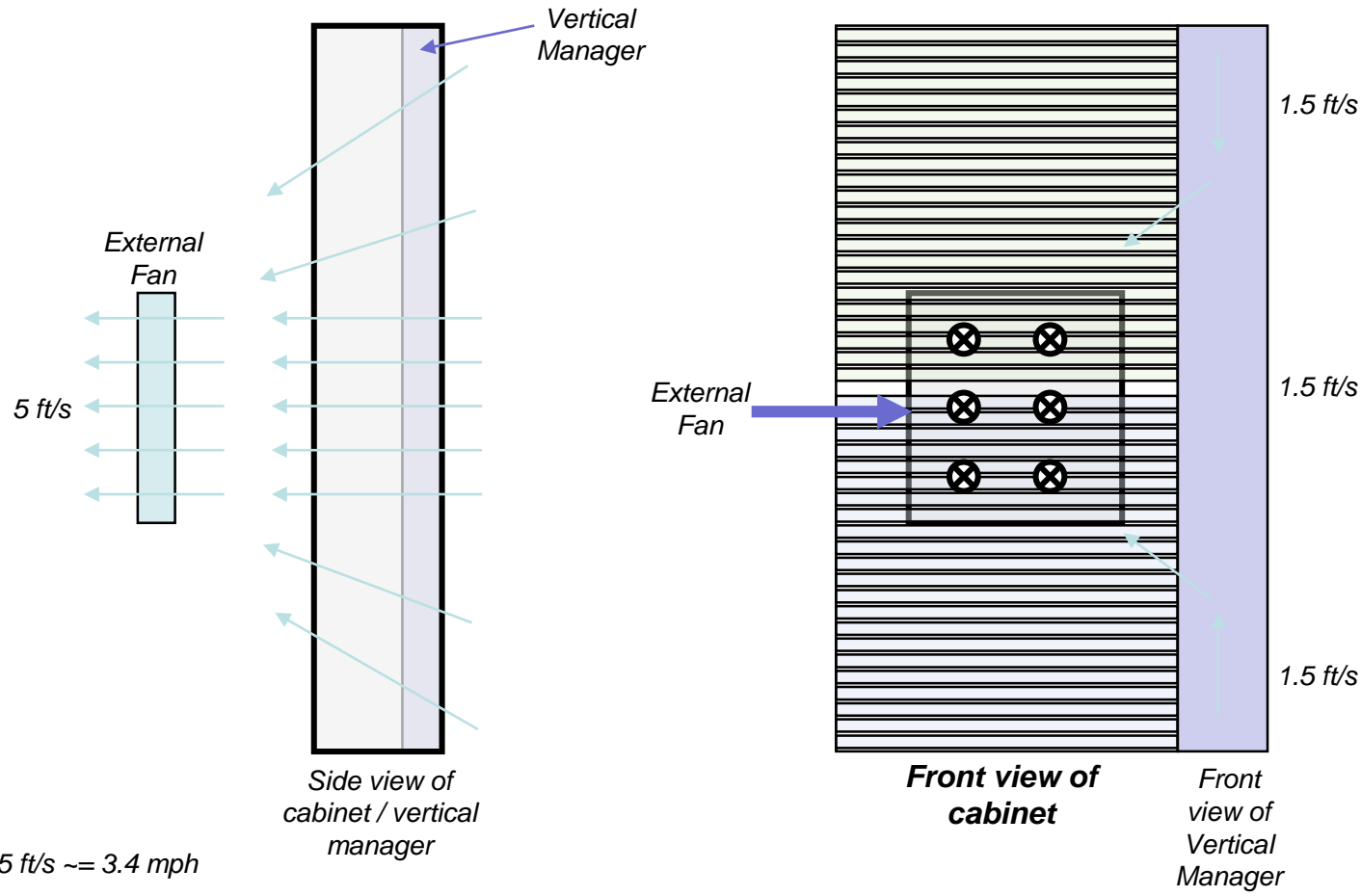
## Cable Bundle Test Conditions:



Assumed Cable Diameter (in) = 0.235	24 AWG
Assumed Cable Diameter (in) = 0.150	28 AWG
circular packing efficiency =	78.5%
Vert Mangr Dimension efficiency =	80.0%
depth of Vertical Manager =	10"

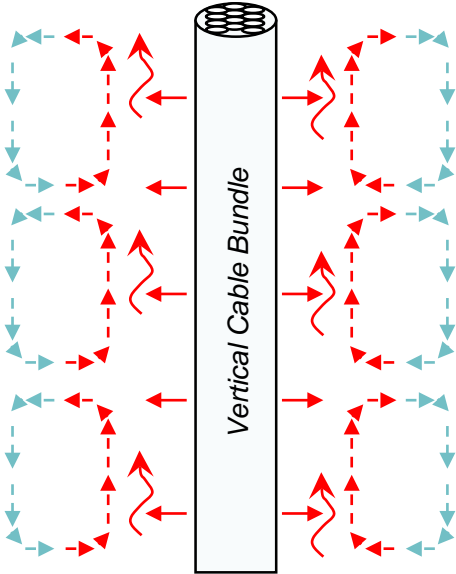


# Experimental Setup: Slight air flow in the Vertical Manager

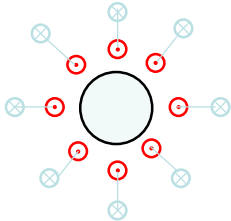


# Calibration:

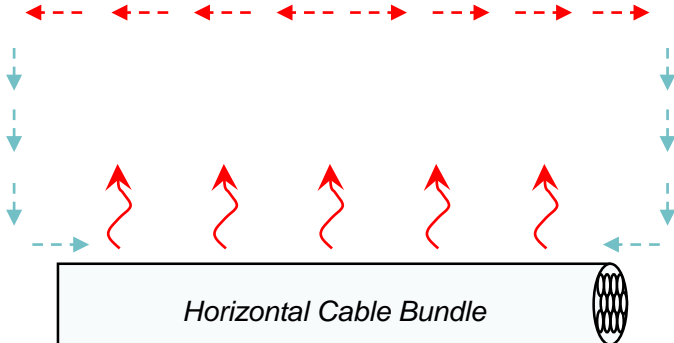
## Calibration: What is the Temperature Rise over Ambient (TRoA) for a single 12-cable 28 AWG bundle



Small amount of self cooling due to convection air current



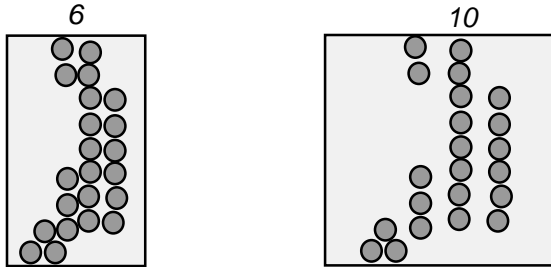
**Measured Data**  
**10.02 °C**



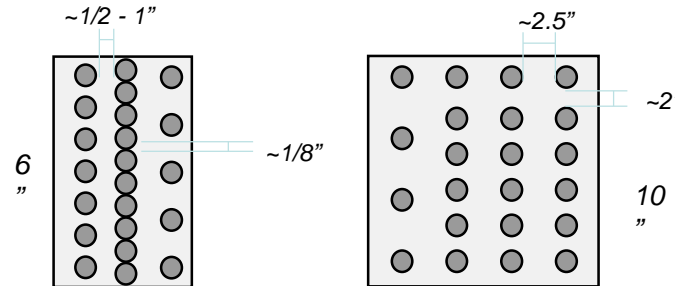
**Using TIA TSB-184a**  
**10.4 °C**

# Summary

## Non-organized



## Organized



### Class 8 Power - No air

Organized Bundles in a 6" vertical manager – temp rise = 19

Organized Bundles in a 10" vertical manager – temp rise = 12

Non-Organized Bundles in a 6" vertical manager – temp rise = 27

Non-Organized Bundles in a 10" vertical manager – temp rise = did not measure but estimated to be <17

### Class 8 Power - With slight amount of air

Organized Bundles in a 6" vertical manager – temp rise = 13

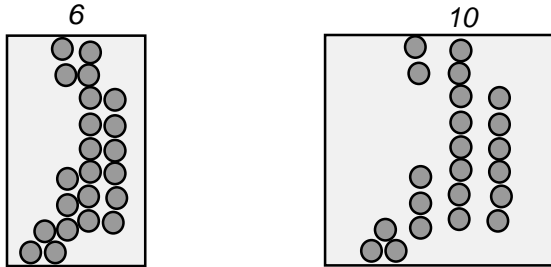
Organized Bundles in a 10" vertical manager – temp rise = 10

Non-Organized Bundles in a 6" vertical manager – temp rise = 25

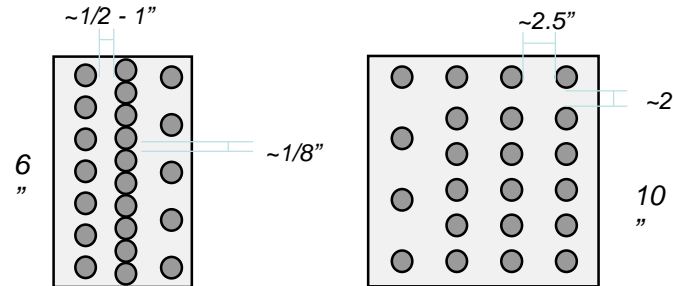
Non-Organized Bundles in a 10" vertical manager – temp rise = did not measure but estimated to be <17

# Summary

## Non-organized



## Organized



### Class 6 Power - No air

Organized Bundles in a 6" vertical manager – temp rise = 11.6

Organized Bundles in a 10" vertical manager – temp rise = 7.2

Non-Organized Bundles in a 6" vertical manager – temp rise = 16.4

Non-Organized Bundles in a 10" vertical manager – temp rise = did not measure but estimated to be < 16

### Class 6 Power - With slight amount of air

Organized Bundles in a 6" vertical manager – temp rise = 6.8

Organized Bundles in a 10" vertical manager – temp rise = 6.1

Non-Organized Bundles in a 6" vertical manager – temp rise = 14

Non-Organized Bundles in a 10" vertical manager – temp rise = did not measure but estimated to be <14

# Recommendation

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Replace sentence P302, L45: “Using cable smaller than 26 AWG is not recommended in powering applications.”

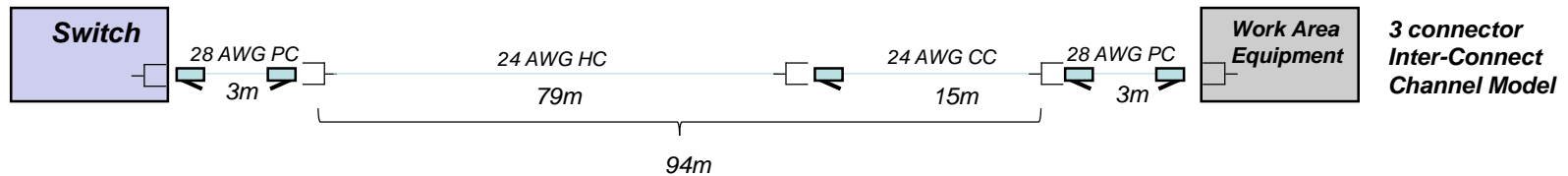
With:

Cable cords smaller than 26 AWG are not recommended for Class 8 or Class 7 powering applications. See TIA-TSB-A Annex E for installation guidelines when delivering power using 28 AWG cord cable.

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# BACKUP

# What does this mean in regards to Ethernet performance when the TRoA of these 28 AWG Patch Cords are high?



## Determine the following:

- 1.) Insertion loss in the above model except using 24/26/28 AWG Patch Cords (all cables at 20°C)
  - a.) IL when all cable at 20°C except for equipment room Patch Cord(s) at 35°C
  - b.) IL when all cable at 40°C
  - c.) IL when all cable at 40°C except for equipment room Patch Cord(s) at 55°C

Cat 6 Max Insertion Loss Specification (dB)	Max Frequency 250MHz			Cat 6a Max Insertion Loss Specification (dB)	Max Frequency 500MHz		
	35.94 at 20°C	all cable at 40°C	all cable at 40°C PC = 55°C		49.31 at 20°C	all cable at 40°C	all cable at 40°C PC = 55°C
(24 AWG PCs) Total (dB) =	34.19	36.85	37.06	(24 AWG PCs) Total (dB) =	47.14	50.81	51.10
derating horizontal cable length	0.00	3.00	4.00	derating horizontal cable length	0.00	3.00	4.00
(26 AWG PCs) Total (dB) =	34.78	37.49	37.76	(26 AWG PCs) Total (dB) =	47.96	51.69	52.05
derating horizontal cable length	0.00	5.00	6.00	derating horizontal cable length	0.00	5.00	6.00
(28 AWG PCs) Total (dB) =	35.57	38.34	38.68	(28 AWG PCs) Total (dB) =	49.04	52.86	53.32
derating horizontal cable length	0.00	7.00	8.00	derating horizontal cable length	0.00	8.00	9.00

Note: max combined Patch Cord Lengths for 24AWG = 10m, 26AWG = 8m, and for 28AWG = 6m