
Temperature Rise Test Data: 850mA and 1A applied to all 4-pairs in bundled configurations

IEEE 802.3bt DTE Power via MDI over 4-Pair
Task Force
January, 2014
Indian Wells, CA

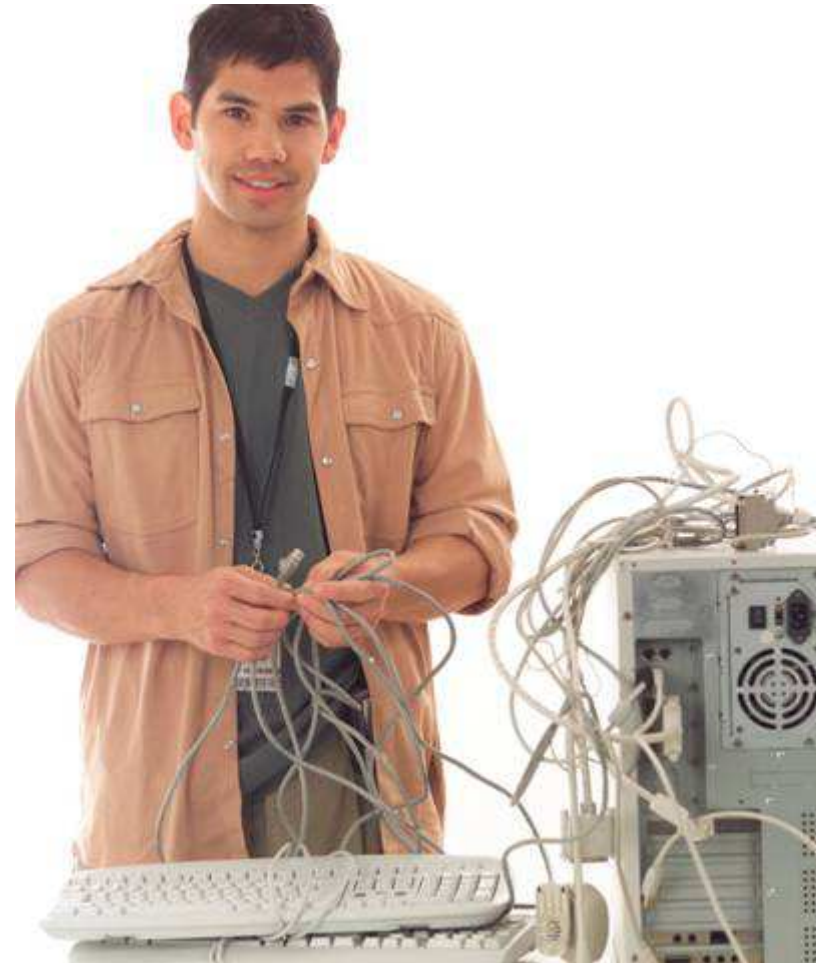
Valerie Maguire, The Siemon Company

Supporters

- Alan Flatman, LAN Technologies
- Prof. Albrecht Oehler, Reutlingen University
- Bryan Sparrowhawk, Leviton
- Dr. Dieter Schicketanz, Reutlingen University
- Harry Forbes, Nexans
- Jeff Heath, Linear Technology
- Koussalya Balasubramanian, Cisco
- Ron Nordin, Panduit
- Sterling Vaden, Vaden Enterprises
- Yair Darshan, Microsemi
- Yvan Engels, LEONI Kerpen

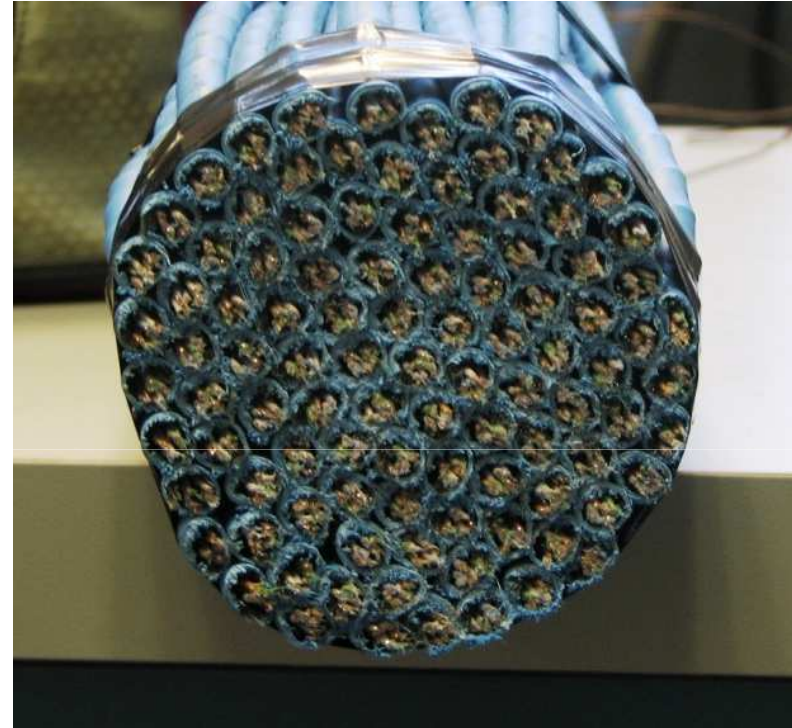
Contribution outline

- Test set-up
 - 100-around-1 bundle
 - Thermocouple placement
- Measured data
 - Category 6A UTP (CMR and CMP)
 - Category 6A F/UTP (CMR and CMP)
 - Category 7_A S/FTP (CMR and CMP)
- Extrapolated data
 - Category 5e (CMR and CMP)
- Conclusions



Test set-up: 100-around-1 bundle construction

- 1.2m cable loops folded over each other to create a continuous loop construction
- Each layer wrapped in electrical tape
- Insulation foam applied to bundle ends to prevent heat loss
- Cable conductors twisted and soldered to 0.3m (1 ft) test leads for attachment to power supply



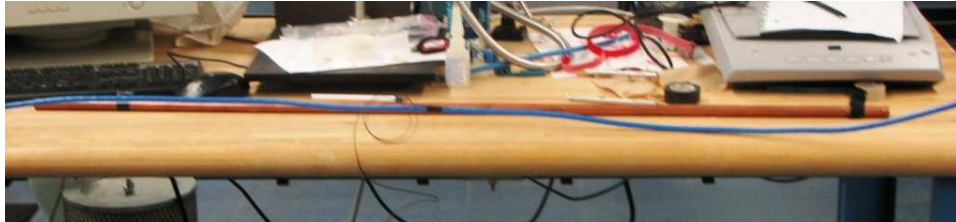
100-around-1 cable
bundle cross-section

Test set-up: thermocouple placement



- Thermocouples embedded into surface of jacket (longitudinally centered)
- Thermocouples placed directly over each other for all layers
- Highest measurement used for profiles

Test set-up: wrapping of layers

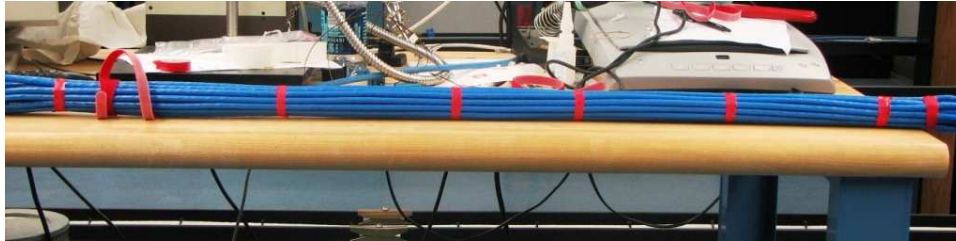


- 1 cable

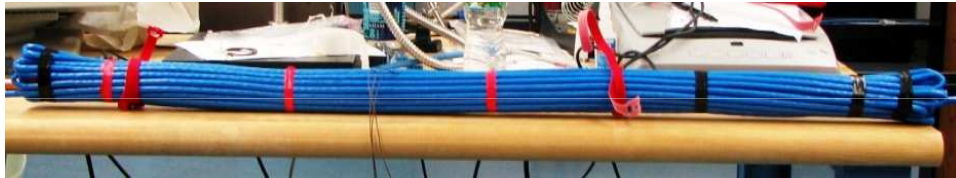


- 6-around-1

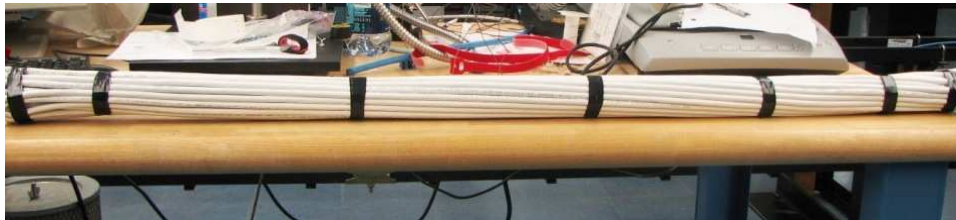
Test set-up: wrapping of layers



- 18-around-1



- 36-around-1



- 60-around-1

Test set-up: wrapping of layers



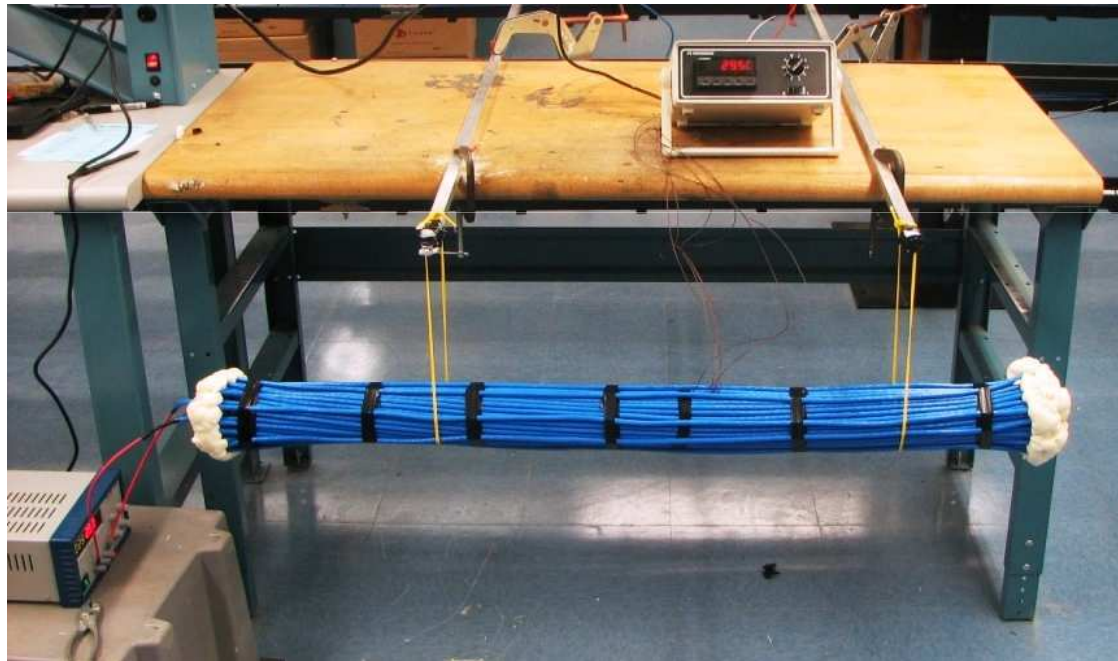
- 90-around-1



- 100-around-1

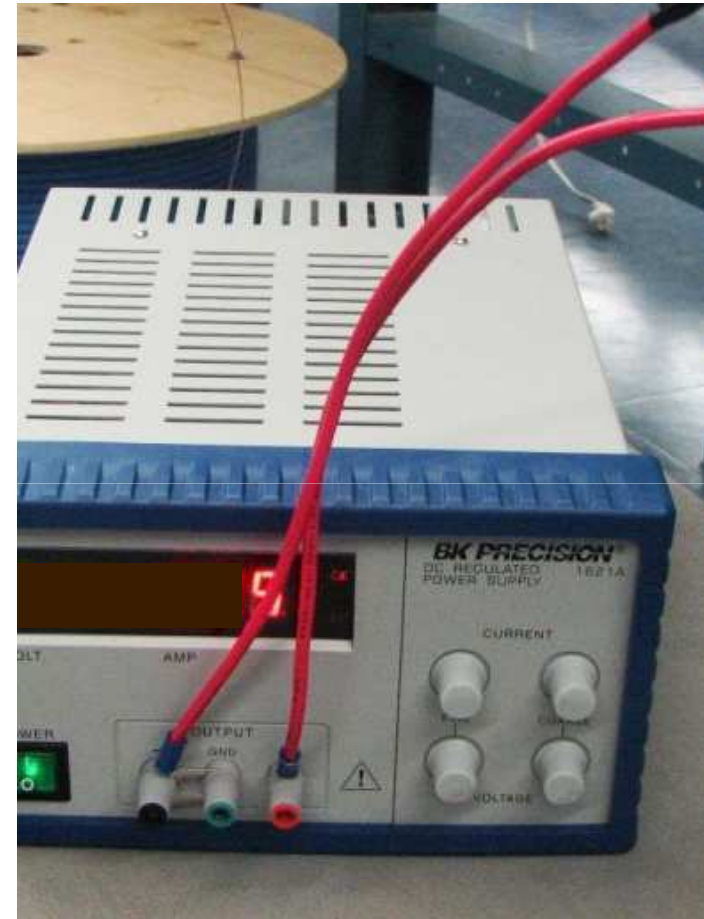
Test set-up: bundle steady-state

Bundle suspended at distance of 0.3m (12 in) from any object in all directions



Temperature rise data collection

- Thermocouples attached to meter
- Test leads attached to power supply
- Current set to 850mA or 1A for each pair
- Initial temperature measured and recorded
- Readings recorded at intervals and at stabilized temperature
- Profiles developed for a range of bundle sizes

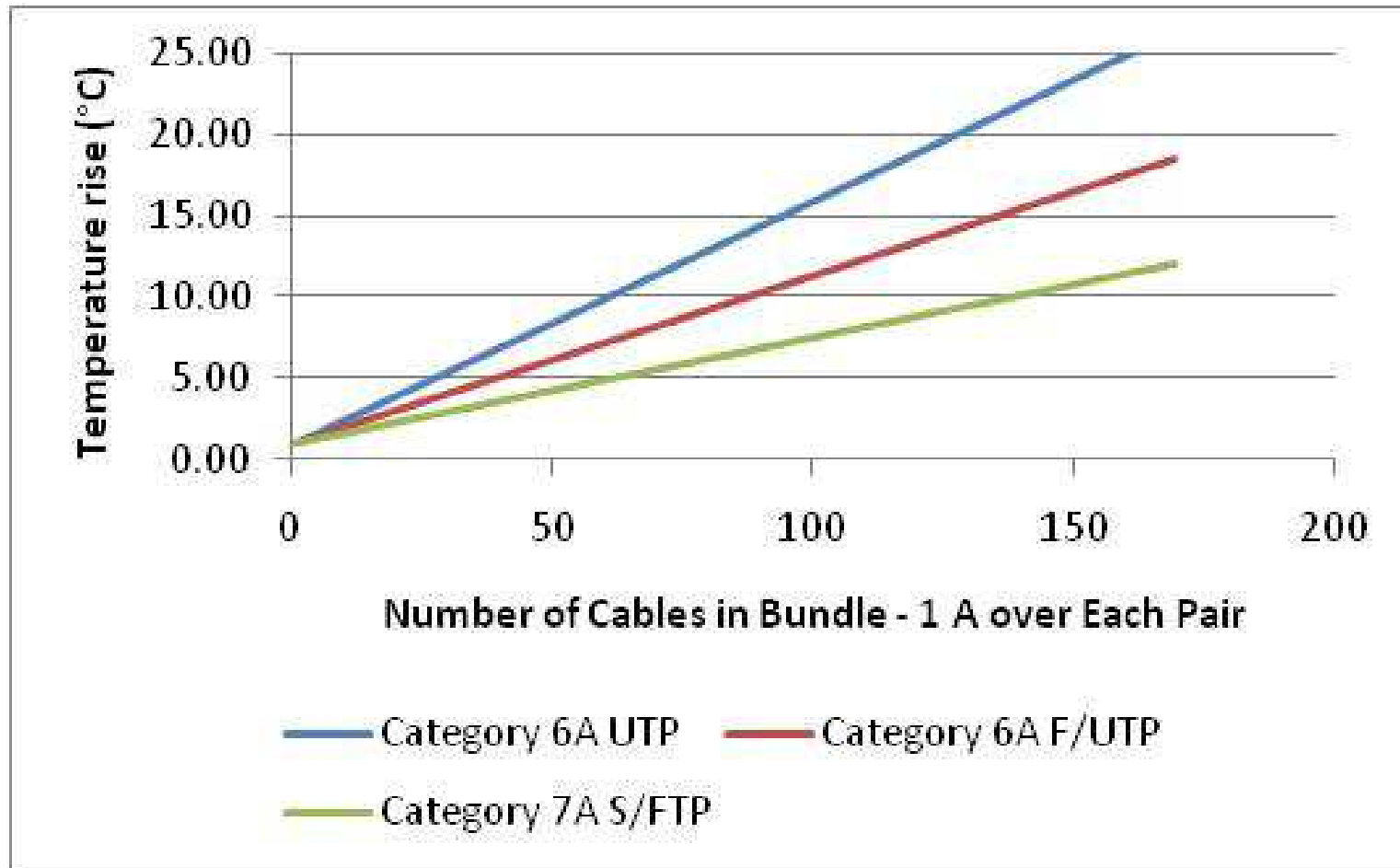


Test cable diameter dimensions

Siemon Temperature Rise Test Cable Dimensions		
	Insulation Diameter (mm)	Conductor Diameter (mm)
Category 6A UTP (riser)	0.93 - 1.17mm	0.52 - 0.58mm
Category 6A UTP (plenum)	0.91 - 1.20mm	0.53 - 0.56mm
Category 6A F/UTP (riser)	1.04 - 1.07mm	0.53 - 0.54mm
Category 6A F/UTP (plenum)	1.02 - 1.03mm	0.53 mm
Category 7A S/FTP (riser)	1.37 - 1.39mm	0.62 - 0.64mm
Category 7A S/FTP (plenum)	1.48 - 1.53mm	0.62 - 0.63mm

Riser cables consistently exhibited the same or only slightly higher temperature rise than plenum cables

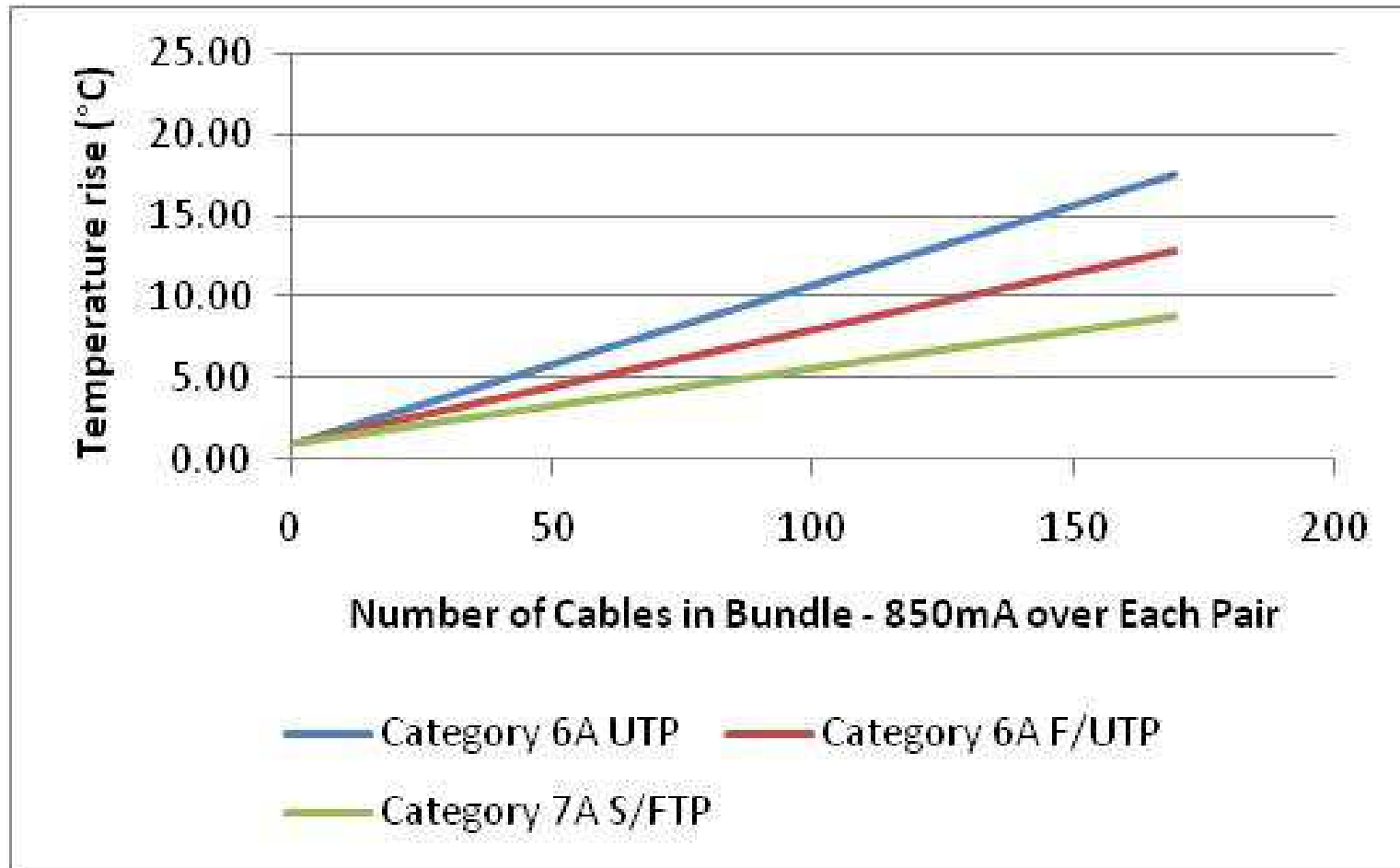
1A per pair temperature rise profiles



Category vs. bundle size table - 1A

Number of cables in Bundle	Temperature rise (°C) (1A over Each Pair)		
	Category 6A UTP	Category 6A F/UTP	Category 7A S/FTP
1	1.00	1.00	1.00
7	1.90	1.62	1.39
19	3.71	2.87	2.18
37	6.42	4.74	3.37
61	10.03	7.24	4.94
91	14.55	10.36	6.91
100	15.90	11.30	7.50
127	19.96	14.10	9.28
169	26.28	18.47	12.04

850mA per pair temperature rise profiles



Category vs. bundle size table - 850mA

Number of cables in Bundle	Temperature rise (°C) (850mA over Each Pair)		
	Category 6A UTP	Category 6A F/UTP	Category 7A S/FTP
1	1.00	1.00	1.00
7	1.59	1.42	1.28
19	2.76	2.27	1.84
37	4.53	3.55	2.67
61	6.88	5.24	3.79
91	9.82	7.36	5.19
100	10.70	8.00	5.60
127	13.35	9.91	6.86
169	17.46	12.88	8.81

10° C and 7.5° C temperature rise bundle size

	Number of cables in Bundle	
	(1A over Each Pair)	
	Temperature rise (10°C)	Temperature rise (7.5°C)
Category 6A UTP	61	44
Category 6A F/UTP	88	63
Category 7A S/FTP	138	100

- 1A per pair

	Number of cables in Bundle	
	(850mA over Each Pair)	
	Temperature rise (10°C)	Temperature rise (7.5°C)
Category 6A UTP	93	67
Category 6A F/UTP	129	93
Category 7A S/FTP	195	141

- 850mA per pair

Conclusions

- Siemon's measured data correlated extremely well with predicted data using models
- Siemon predicts that the category 5e bundle temperature rise will be up to 10 degrees higher than the category 6A UTP temperature rise
- Siemon supports the bundle sizes that equate to a 7.5° C temperature rise for each category (as shown in the tables at the end of this presentation) as being representative of the number of cables that would deliver a worst case maximum 10° C temperature rise under all conditions

Bundle sizes representative of worst case 10° C rise

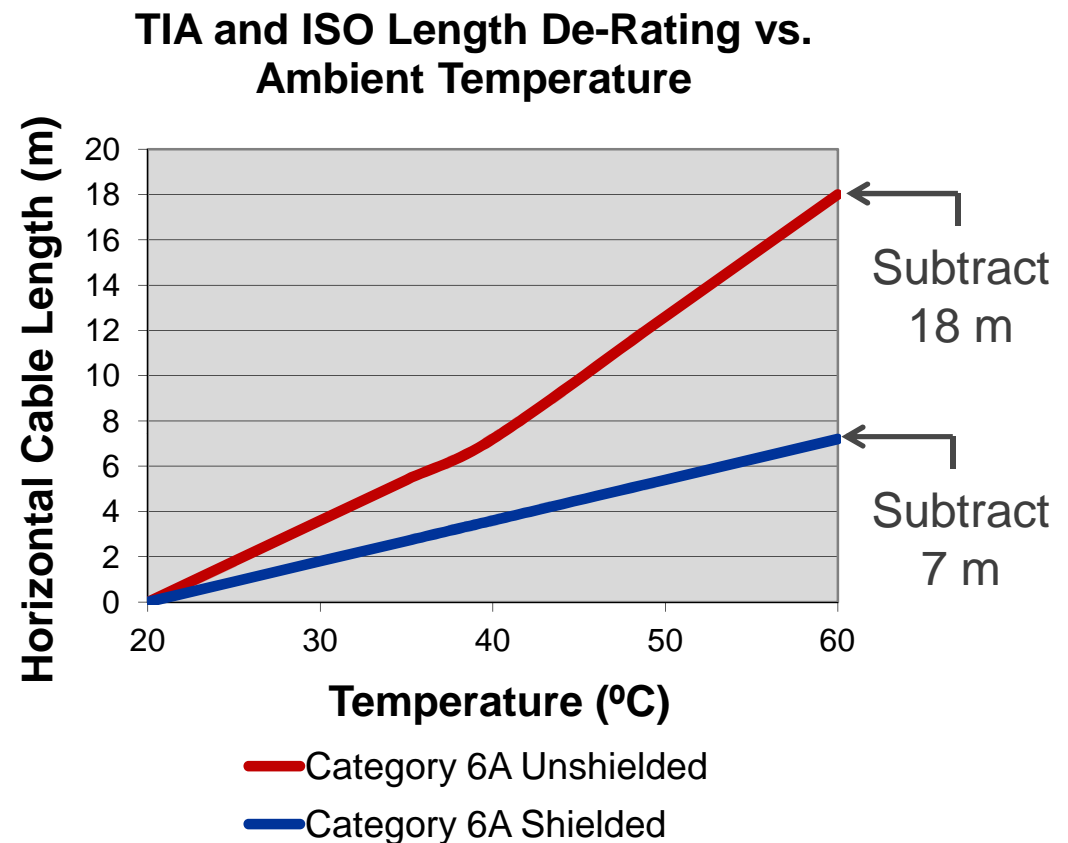
	Number of cables in Bundle
	(1A over Each Pair)
	Worst Case Temperature Rise of 10°C
Category 5e	22
Category 6A UTP	44
Category 6A F/UTP	63
Category 7A S/FTP	100

	Number of cables in Bundle
	(850mA over Each Pair)
	Worst Case Temperature Rise of 10°C
Category 5e	33
Category 6A UTP	67
Category 6A F/UTP	93
Category 7A S/FTP	141

Bundle sizes recommended by Siemon as being representative of the number of cables that would deliver a worst case maximum 10° C temperature rise under all conditions

Insertion loss de-rating versus ambient temperature

- Insertion loss increases as cabling temperature increases
- TIA and ISO specify a temperature dependent de-rating factor for use in determining horizontal cable length at temperatures above 20 °C



Contact information

Valerie Maguire
The Siemon Company
101 Siemon Company Drive
Watertown, CT 06795

phone: (602) 228-7943

valerie_maguire@siemon.com