IEEE 802.3bt 4PPoE Standard: new requirements for LAN cabling

Matthias Gerber,
Market Manager LAN Cabling, R&M
November 2018

Development of PoE

- Power increase

	Power	Name	Code	IEEE
Level 1	13 W	Power over Ethernet	PoE	802.3af
Level 2	22 W	PoE Plus	PoEP	802.3at
Level 3	55 W	4-Pair PoE	4PPoE	802.3bt
Level 4	90 W	4-Pair PoE	4PPoE	802.3bt

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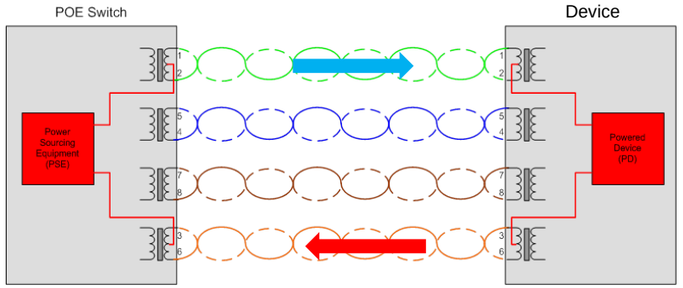

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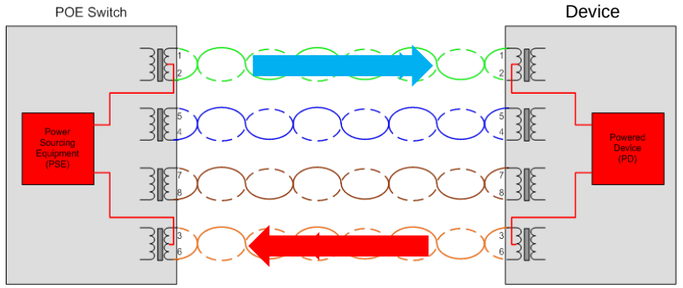

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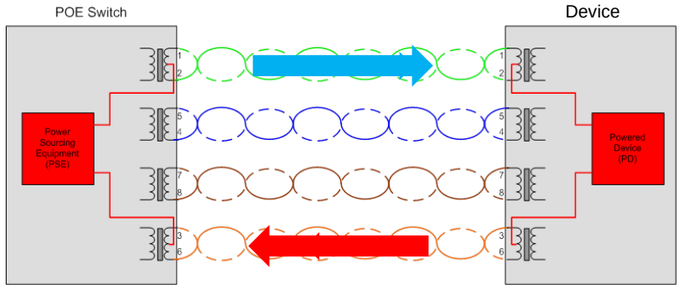

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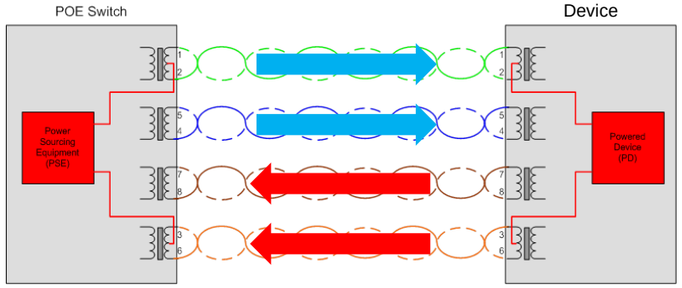

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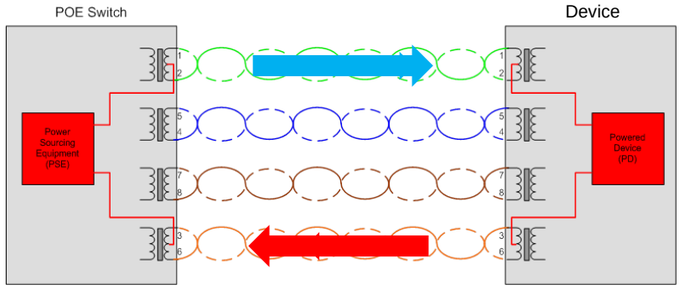

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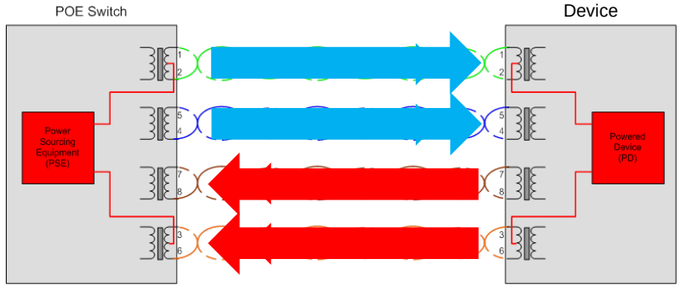

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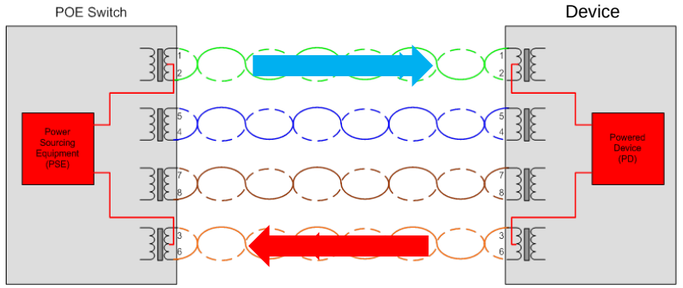

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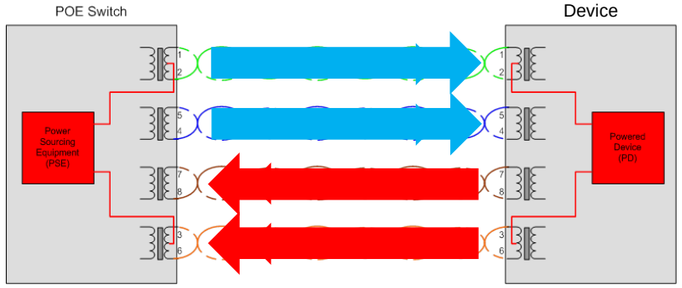

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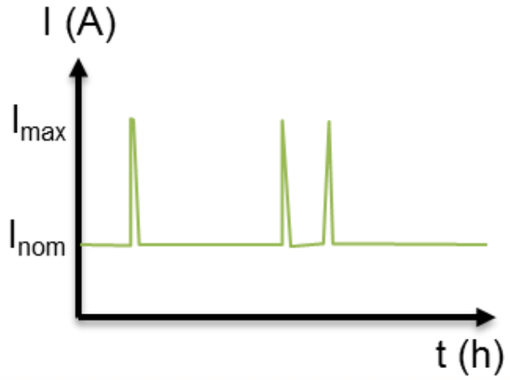
- Change in usage condition



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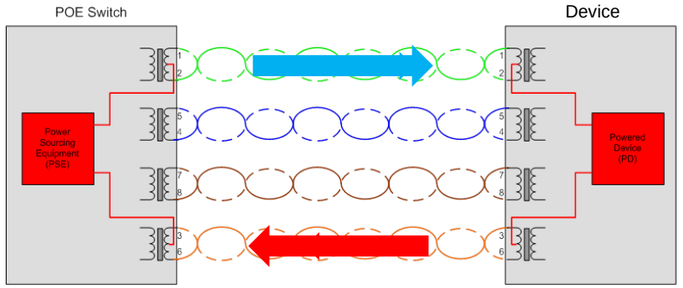

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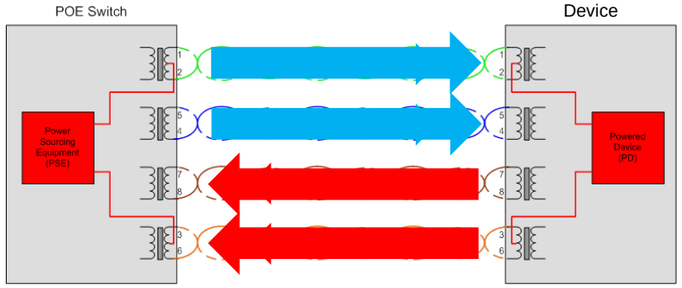

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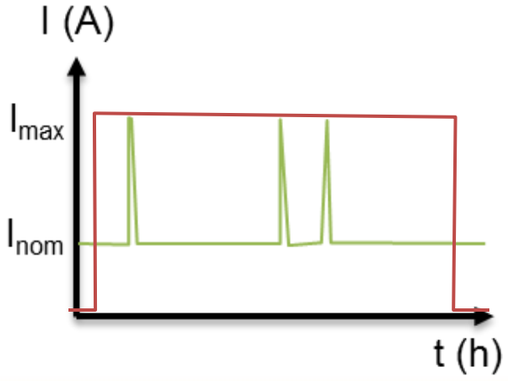
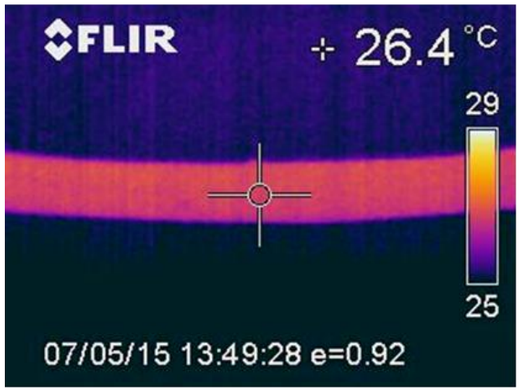
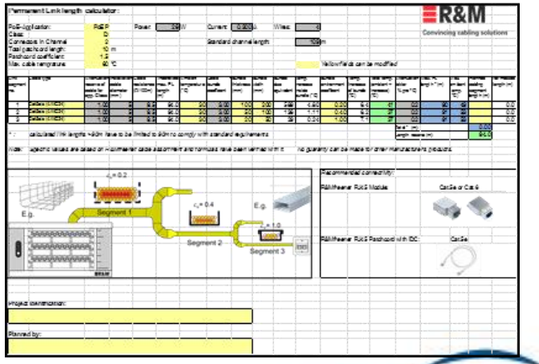


PoE: Impact of on cabling

- PoE current can produces significant heat
- Cable temperature increases depending on installation conditions (e.g. bundle size, environmental conditions)
- Higher cable temperatures increase the link attenuation (IL)
- Attenuation budget can result in reduced link lengths
- Cable temperatures rating must be observed
- Guidance: EN TR 50174-99-1 or ISO/IEC TR 29125
- Planning and execution determine PoE capability → use a planning tool





Example of free PoE planning tool:

Permanent Link length calculator:

R&M

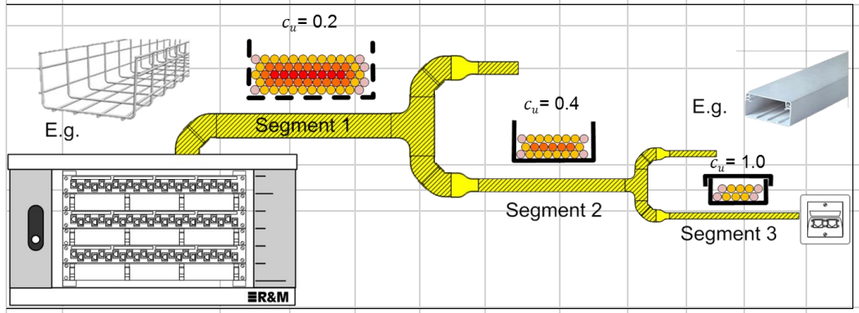
PoE-Application:	PoEP	Power:	26	W	Current:	0.300	A	Wires:	4
Class:	D								
Connectors in Channel	2				Standard channel length:				109 m
Total patchcord length:	10 m								
Patchcord coefficient:	1.5								
Max. cable temprature:	60 °C								

Yellow fields can be modified

Link segment no.	Cable type	Attenuation reserve of cable for app. Class	Installation cable diameter (mm)	Cable resistance (Ω/100m)	Theoretical max. PL length (m)	Ambient temperature (°C)	Cable bundle coefficent	Bundle thickness (mm)	Bundle width (mm)	Bundel size equivalent	Temp. increase inside bundle (°C)	Bundle environment coefficent	Temp. Increase of bundle (°C)	Total temp. (ambient + increase) (°C)	Attenuation faktor (% pro °C)	Max. PL length * (m)	Max. ambient temp. (°C)	Planned cabling segment length (m)	Normalized length (m)
1	Cat5e/s (AWG24)	1.00	5	9.5	94.0	30	3.00	100	200	589	4.80	0.20	6.4	41	0.2	90	49		0.0
2	Cat5e/s (AWG24)	1.00	5	9.5	94.0	30	3.00	50	100	136	1.11	0.40	6.2	37	0.2	91	53		0.0
3	Cat5e/s (AWG24)	1.00	5	9.5	94.0	30	3.00	20	50	29	0.24	1.00	7.1	37	0.2	91	53		0.0
															Total * (m):			0.00	
															Length reserve (m):			94.0	

** : calculated link lengths >90m have to be limited to 90m to comply with standard requirements*

Note: Specific values are based on R&Mfreenet cable assortment and formulas have been verified with it. No guaranty can be made for other manufacturer's products.



Recommended connectivity:

R&M*freenet* RJ45 Module: Cat.5e or Cat.6

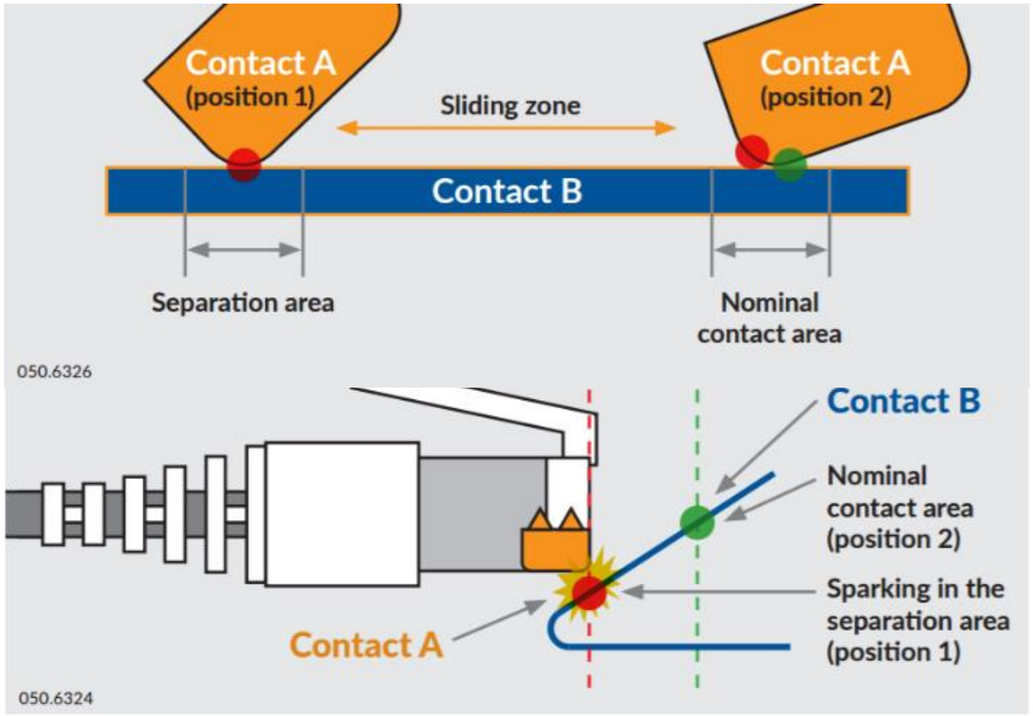
R&M*freenet* RJ45 Patchcord with IDC: Cat.5e

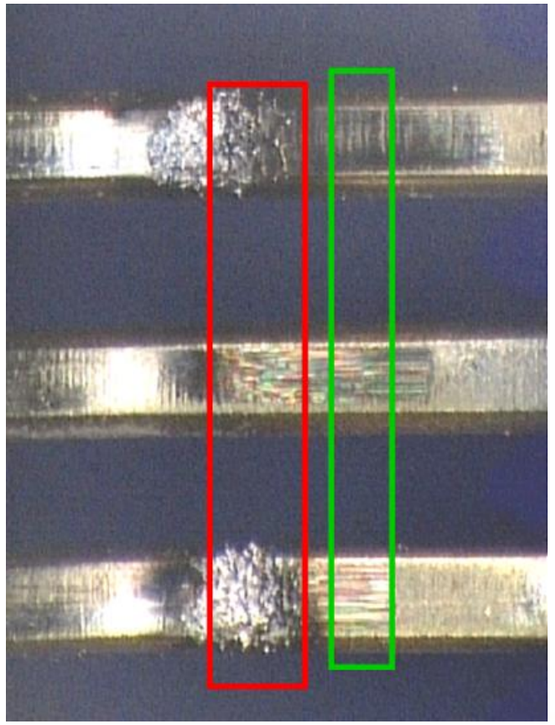
Project Identification:

Planned by:

Connectivity: spark erosion

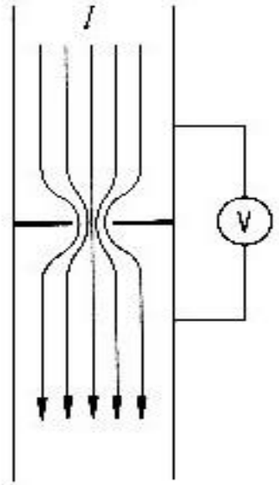
- Unplugging under load creates sparks that can destroy the contacts
- The higher the transmitted power the higher the destruction
- IEC 60512-99-2 tests, whether a RJ45 connection supports 4PPoE





Contact resistance vs. temperature

- Current through a contact resistance produces heat
- FEM simulation of contact temperature increase due to PoE



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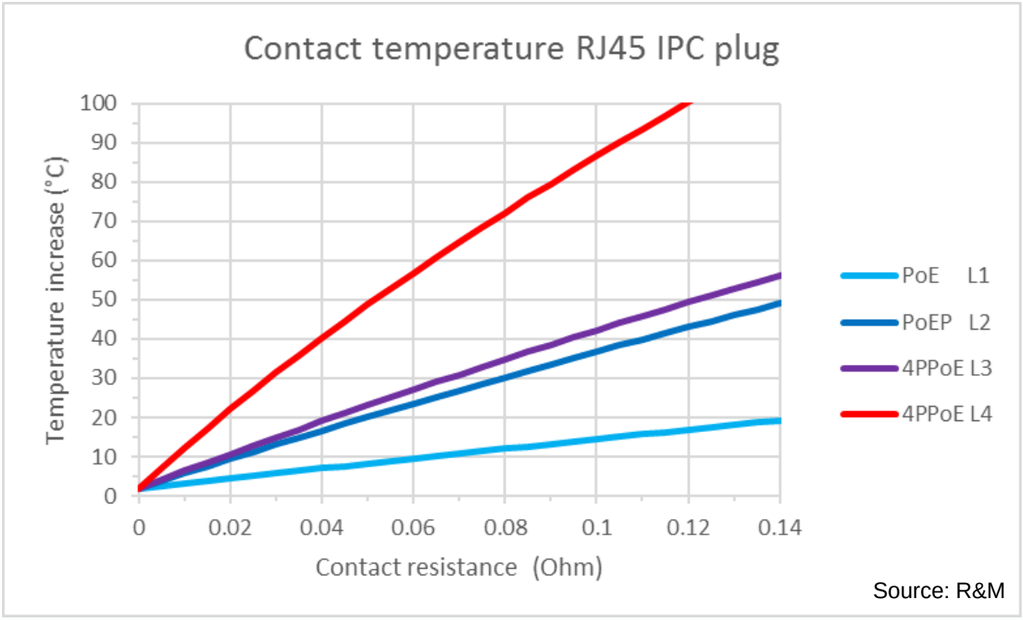

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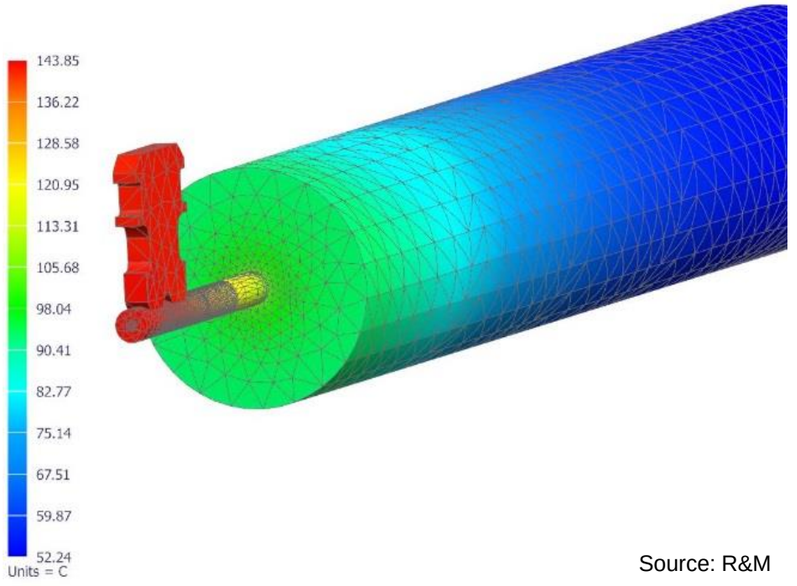

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Contact resistance vs. temperature

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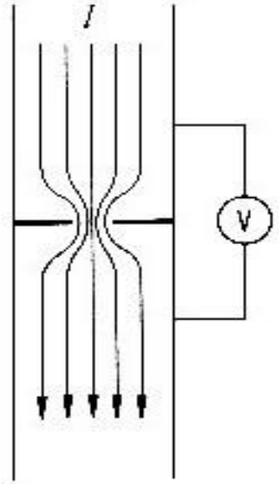
- Wire insulation: PE-HD (continuous use 80° C, melting: 130° C)
- @ 45° C ambient temperature: 85° C increase to melt down



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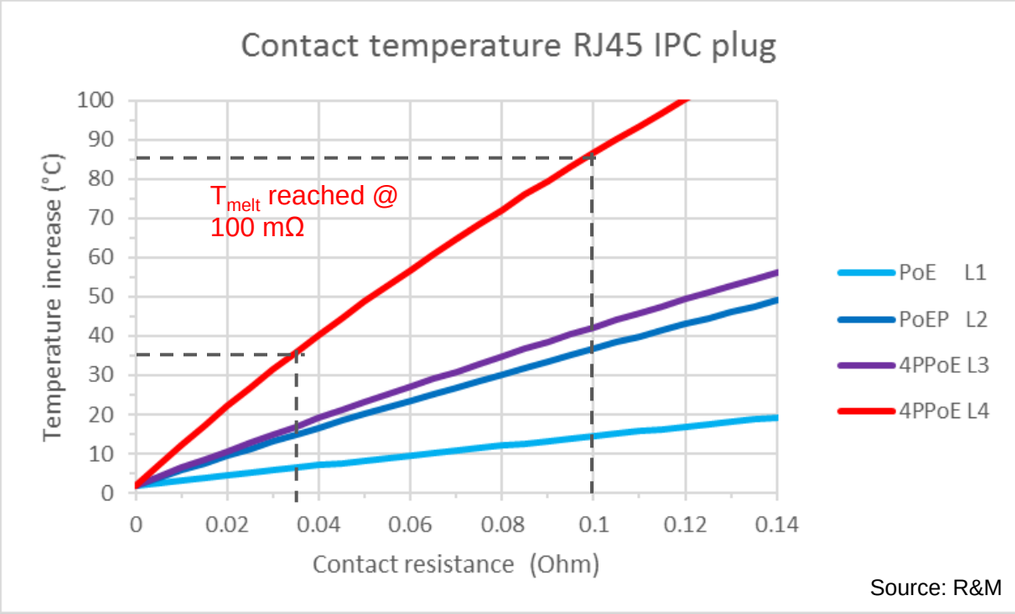

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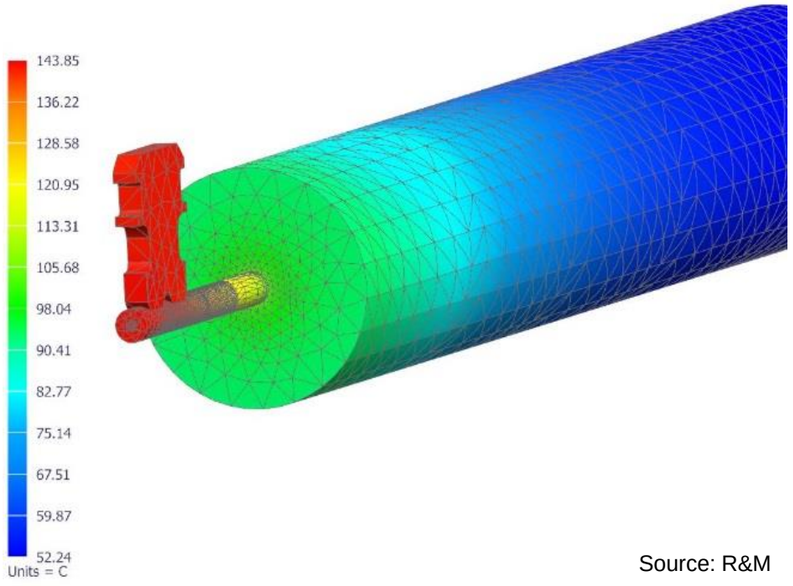

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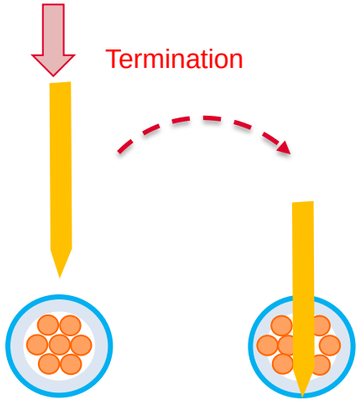
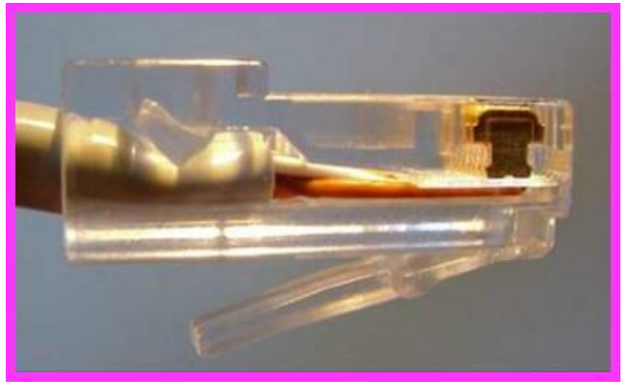
- IPC termination: rigid contact plate is pushed through the stranded wire
- Contact force (wire to contact) is built up by wire material properties





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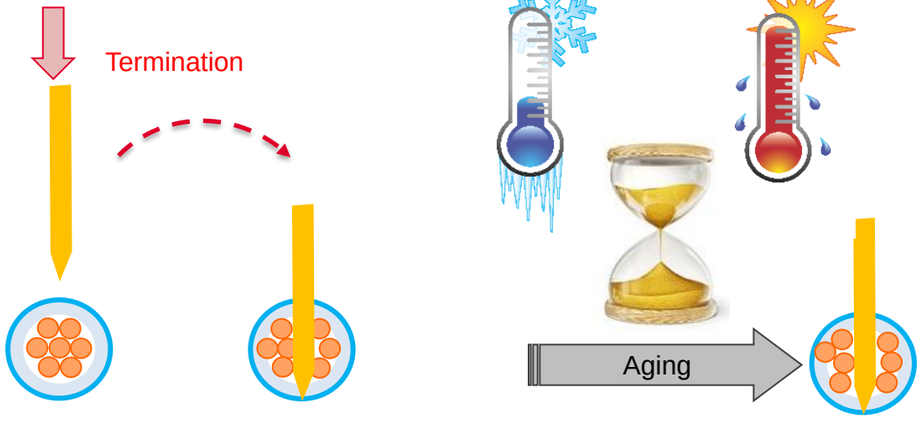

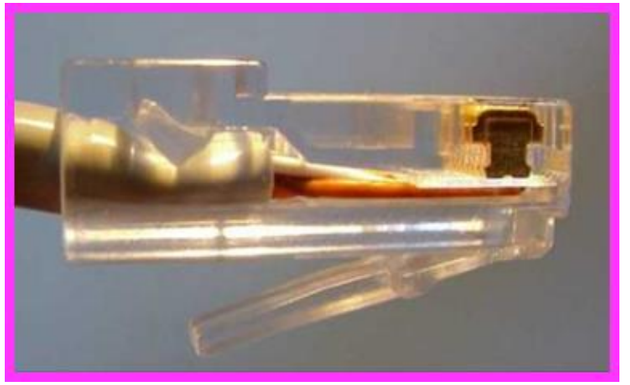

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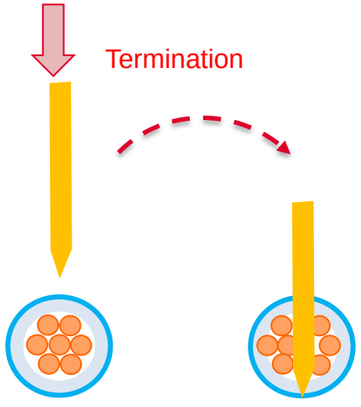

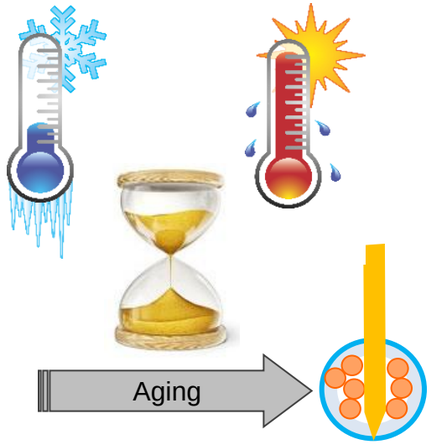

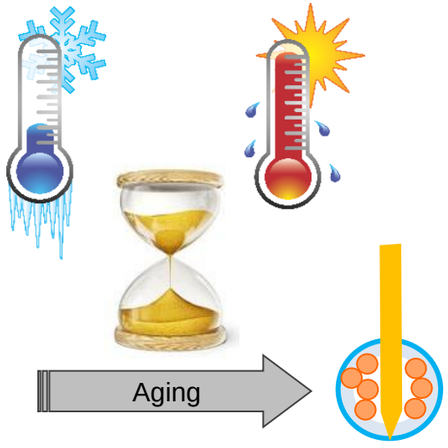

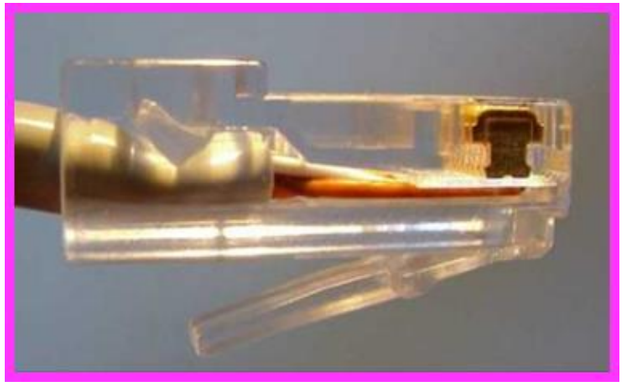

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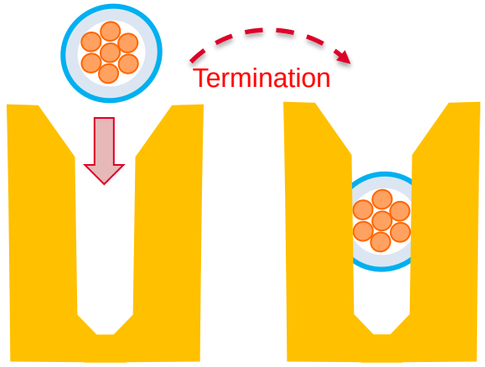

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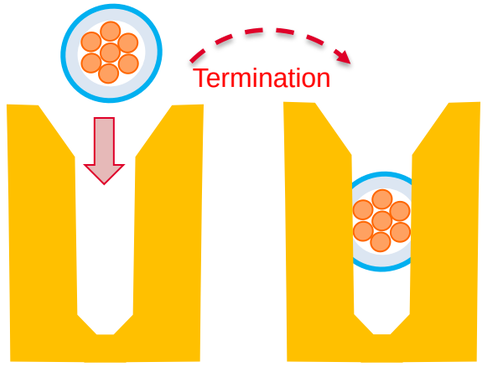

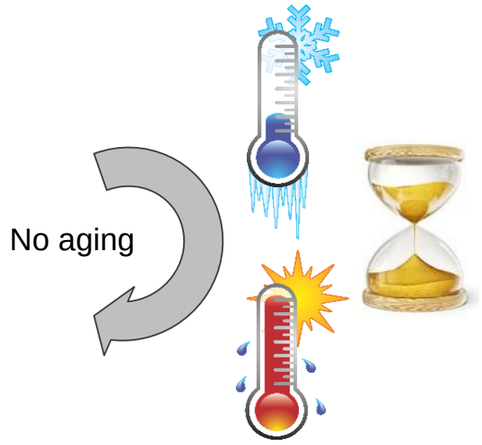

Comparison of terminations

- Termination technologies should be tested according IEC 60352-x
- Artificial aging test with dry heat at 70° C for 40 days / ΔR < 15 mΩ
- IDC: stabilizing at low resistance level
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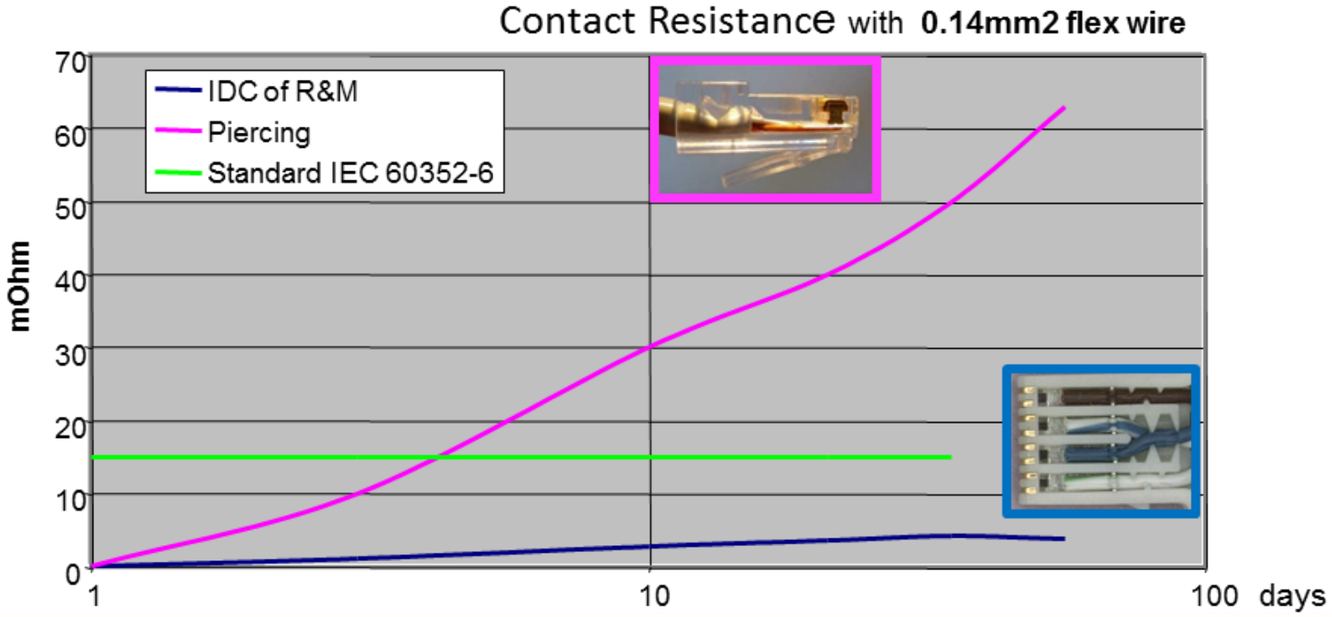

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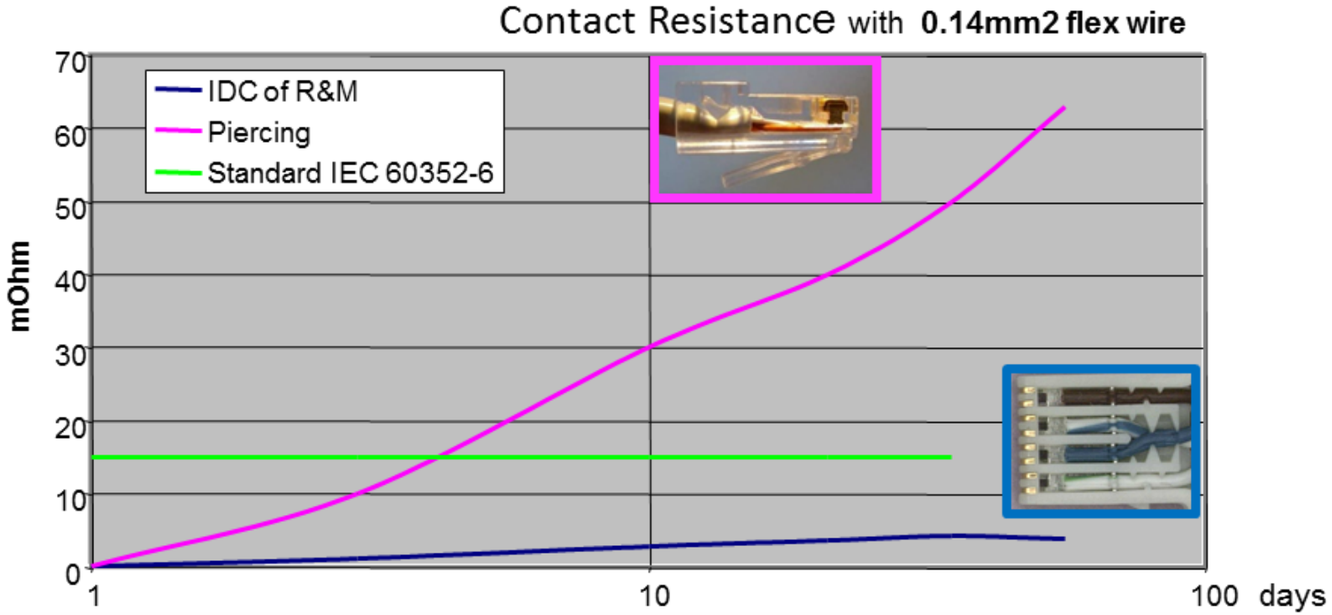
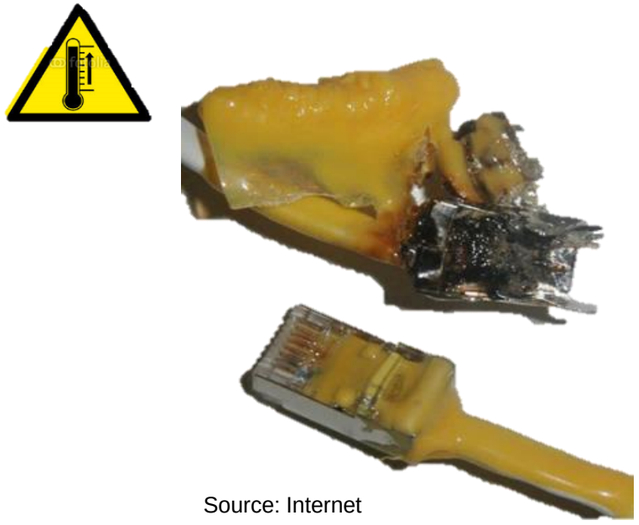
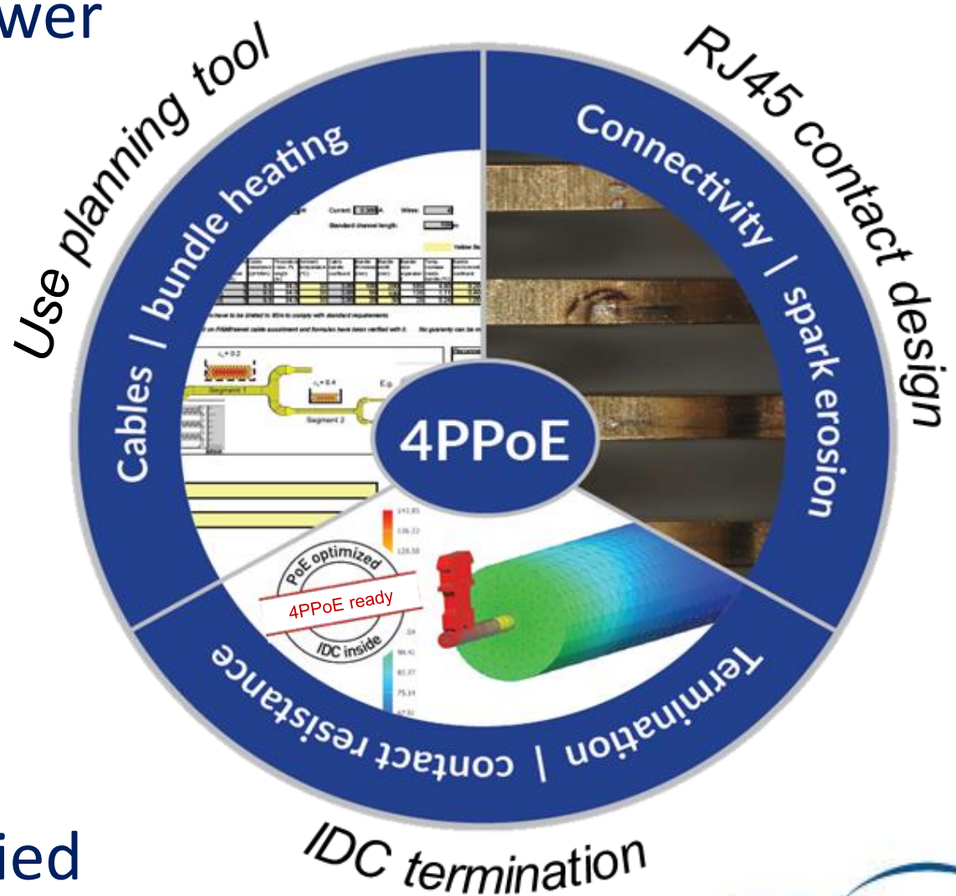




Source: Internet

Summary and Conclusions

- 4PPoE applications with continuous high power demands change requirements
- Planning, installation and product selection have to work together to support 4PPoE
- Over time, IPC connections are not sufficient to support these demands
- IDC connections are the perfect choice for wire terminations used for 4PPoE
- For reliable, long term 4PPoE support patch cords with IDC termination should be specified



Thank you !

Matthias Gerber

Market Manager LAN Cabling

matthias.gerber@rdm.com

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