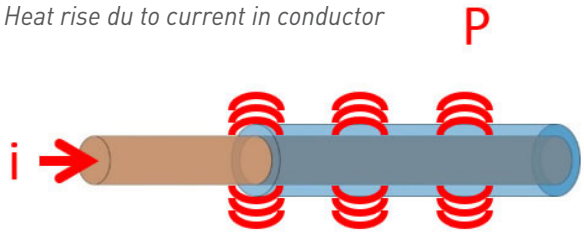
DESIGNING PoE COMPLIANT INFRASTRUCTURE

an introduction

THE RISE OF POE

PoE first appeared in the standards in 2003 under IEEE 802.3af to allow some devices to be powered through the communications cables. At the time, the objective was to allow some IP phones and wireless access points to be installed without the need to add an electrical cable. The capacity was about 15w, and the heat rise due to current through copper conductions was estimated to be less than 5°C.

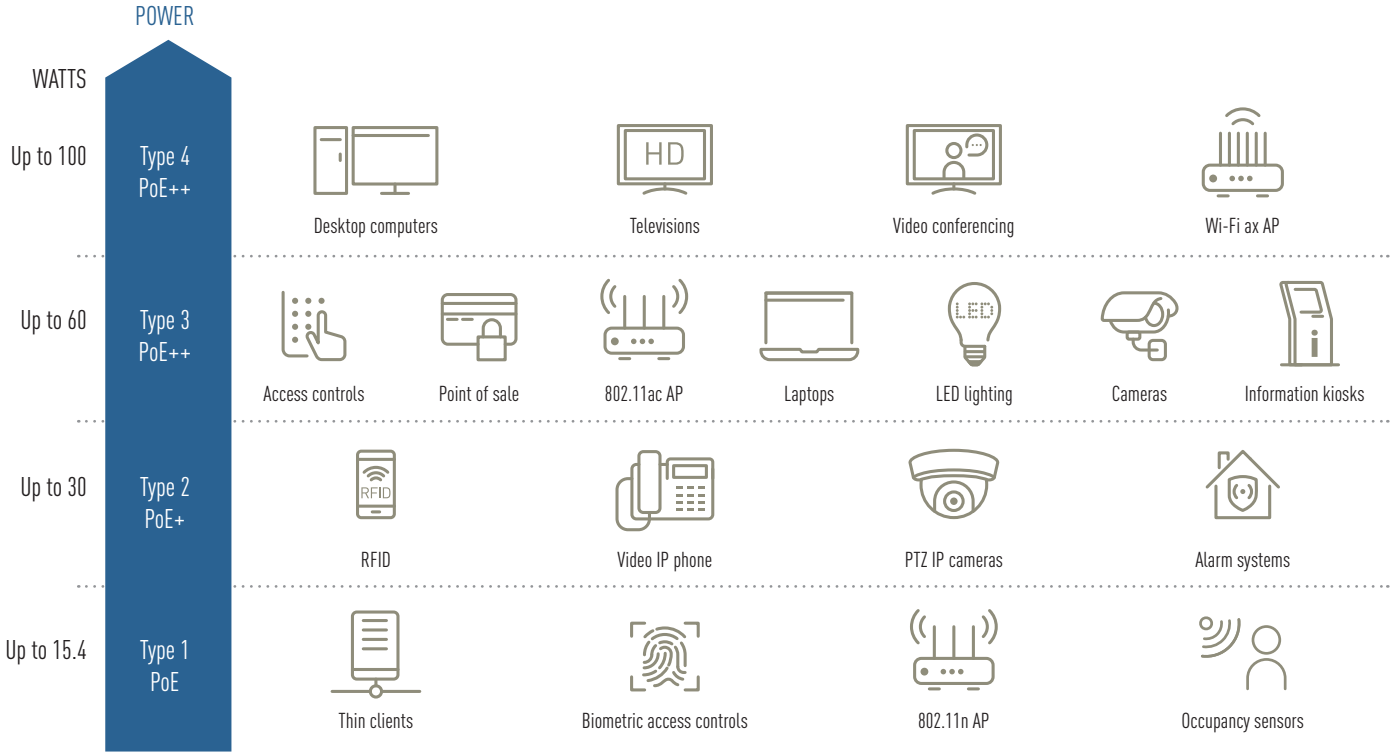
Heat rise du to current in conductor



Heat rise due to current in the conductor is $P = R \times i^2$

Where R is the resistance of the conductor, inversely proportional to the conductor diameter.

With evolution of needs, PoE has improved to support a wider selection of devices and is now capable of 90w through the same type of cable originally designed only for data.



STANDARD COMPLIANT CABLING

The higher power is only possible thanks to higher current, which in turn leads to higher heat increase in the cables. The experimentation has shown that this could be above 70°C in some configurations, which when added to an ambient temperature of 30°C, could bring cables to more than 100°C. The possible issues are the following:

- Higher heat of the cables leads to higher attenuation, and therefore reduced performance.
- Structured cabling systems are defined in the standards only up to 60°C. Beyond this, performance is no longer defined and therefore cannot be guaranteed.

Considering the expected growth of PoE, it seems that PoE devices will be in all buildings in the near future, and therefore all structured cabling systems should be designed to accept them.

The installation standard ISO/IEC 14763-2, to which compliance is required for any ISO/IEC 11801 compliant cabling, has therefore included in the latest revision all necessary obligations for ensuring PoE while still maintaining the promised performance. Three categories of Remote Powering (RP) cabling are defined:

Category	$i_{c\text{-}average}$	i_c	Controls required during	
			Attachement of remote powering equipment	Planning of subsequent cabling installation
RP1	⩽ 212 mA	⩽ 500 mA	Yes	Yes
RP2	> 212 mA < 500 mA	⩽ 500 mA	Yes	Yes
RP3	-	⩽ 500 mA	No	Yes

RP categories as defined in ISO/IEC 14763-2

However, due to the complexity of administration of RP1 and RP2, only RP3 is considered for standard compliant cabling. In simple terms the RP3 Category allows:

- Full power (90W) on all links.
- No specific control is required during connection of devices.
- Control is required only for subsequent planning of cabling installation.

This is achieved by two main aspects:

1. Choosing the right products. For example, Category 6A has generally larger diameter conductors than Category 5, hence has less resistance. This not only allows lower heat rise, but also more efficient power supply.
2. Installing the products to ensure better evacuation of the heat such as:
    - Ventilated cable trays;
    - Smaller bundles of cables;
    - Spacing between cables;
    - Etc.

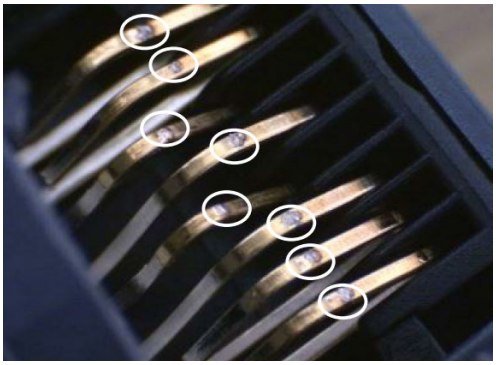
The performance is ensured by reducing the maximum allowable distance based on the average temperature of the cables. Here is a simplified version of the allowable permanent link length:

T (°C)	Permanent Link (m)
20	90
25	88
30	85
35	83
40	80
45	78
50	75
55	73
60	70

Assuming 10m of cords a 20°C

Finally, Connectors need to avoid being damaged during the disconnection of the power. This is linked to a spark that is always created while separating contacts of a current carrying circuit. This has been defined in the following standards:

- IEC 60512-99-001, for assurance of PoE up to 30W. (Type 1 and Type 2)
- IEC 60512-99-002, for assurance of PoE up to 90W. (Type 1 through Type 4)



SUMMARY

In conclusion, Structured cabling is defined as a system that allows all listed applications without restrictions. PoE is one of the applications and must be allowed on all links.

An ISO/IEC 11801 standard compliant cabling must be installed according to ISO/IEC 14763-2, which requires all links to be capable of maximum power at the same time, while still ensuring the performance of the system.

Connectors should also comply to PoE standards to ensure that they are not destroyed during disconnection of power.

It should be noted that, as for all standards, manufacturers generally provide guides to assist designers and installers in understanding these documents. Customers should not hesitate to request the Legrand LCS PoE Guide.

Gautier HUMBERT
Standards Coordinator
Digital Infrastructures

LG181

Legrand Nederland B.V.
Van Salmstraat, 76
5281 RS Boxtel
T +31 (0)411 653 111
F +31 (0)411 682 895
www.legrand.nl