IEEE 802.3af Power over Ethernet (PoE) classifications & Power availability

Class	Usage	Minimum power out of PSE*	Supplied voltage & current	Range of Max. power used by the PD**	802.3af Tolerated cable loss†	Typical max cable loss@
0	Default	15.4 W	44 V to 57 V 0.350 A max.	0.44 to 12.95W	2.45 W	1.225 W
1	Optional	4.0 W		0.44 to 3.84 W	0.16 W	
2	Optional	7.0 W		3.84 to 6.49 W	0.11 W	
3	Optional	15.4 W		6.49 to 12.95W	2.45 W	
4	Reserved	Treat as class 0		Reserved		

*NOTE— This is the minimum power provided by the Power Sourcing Equipment (PSE)
**NOTE— PD is the Powered Device

Supporting Calculations

From 802.3af: 33.3.5.7 PD power supply turn on / turn off voltages

"The PD shall turn on at V_{On} and turn off at V_{Off} when connected to a PSE through a 20ohm series resistor. The PD shall turn on or off without startup oscillation and within the first trial at any load value……".

20 ohms (actually 18.8 ohms) is the maximum loop resistance for 100m Cat5e UTP cabling according to TIA.

Voltage Drop in (worst case) data cable

Assuming the 20 ohm conductor resistance per wire, for class 0 device drawing maximum current (0.350A), there is 0.175A on each of two wires, which drop voltage on both send and return pairs yielding a loop resistance of 20 ohms, and a voltage drop of:

2 * (0.175A)* 20 = 7.0V maximum voltage drop across data cable to powered device

†Power dissipated (Pd) in (Worst case) data cable

Pd per wire is $(0.175A)^2$ * 20 ohms = 0.612 W per wire
Power dissipated on 2 wires on 2 pairs is:

4 * 0.612 = 2.45 W maximum typical power dissipated per data cable

Typical DC power resistance loss in CAT5e

Typical Cat5e UTP has a 10ohm/100m conductor resistance, resulting in a 10ohm/100m loop resistance. This is ½ the (worst case) loop resistance the 802.3af standard will accept.

Voltage Drop in typical data cable

2* (0.175)*10 =3.5V

@Power dissipated (Pd) in typical data cable

Pd per wire is $(0.175A)^2$ * 10 ohms = 0.306 W per wire
Power dissipated on 2 wires on 2 pairs is:

4 * 0.306 = 1.225 W maximum typical power dissipated per data cable

Note that the 802.3af standard tolerates a 2.45W cable loss, but typical Cat5e UTP cable will result in only 1.225 W power DC loss over 100m.

Typical DC power resistance loss in CAT6

Typical Cat6 UTP has a 7ohm/100m conductor resistance, resulting in a 7ohm/100m loop resistance. This is 1/3 the (worst case) loop resistance the 802.3af standard will accept.

Voltage Drop in typical data cable

2* (0.175)*7 =2.5V

@Power dissipated (Pd) in typical data cable

Pd per wire is $(0.175A)^2$ * 7 ohms = 0.214 W per wire
Power dissipated on 2 wires on 2 pairs is:

4 * 0.214 = 0.858 W maximum typical power dissipated per data cable

Note that the 802.3af standard tolerates a 2.45W cable loss, but typical Cat6 UTP cable will result in only 0.858 W DC power loss over 100m.