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

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

*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:

\[
2 \times (0.175A)^* \times 20 = 7.0V \text{ maximum voltage drop across data cable to powered device}
\]

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

\[
Pd \text{ per wire is } (0.175A)^2 \times 20 \text{ ohms} = 0.612 \text{ W per wire}
Power dissipated on 2 wires on 2 pairs is:
\[
4 \times 0.612 = 2.45 \text{ W maximum typical power dissipated per data cable}
\]
**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**

\[ 2 \times (0.175) \times 10 = 3.5V \]

**Power dissipated (Pd) in typical data cable**

Pd per wire is \((0.175A)^2 \times 10\) ohms = 0.306 W per wire  
Power dissipated on 2 wires on 2 pairs is:  
\[ 4 \times 0.306 = 1.225 \text{ W maximum typical power dissipated per data cable} \]

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.

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**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**

\[ 2 \times (0.175) \times 7 = 2.5V \]

**Power dissipated (Pd) in typical data cable**

Pd per wire is \((0.175A)^2 \times 7\) ohms = 0.214 W per wire  
Power dissipated on 2 wires on 2 pairs is:  
\[ 4 \times 0.214 = 0.858 \text{ W maximum typical power dissipated per data cable} \]

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.