

Understanding Electrical Load for LED Retrofit Bulbs

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LED replacement bulbs, known as retrofit bulbs have exploded in popularity in recent years. Here at ChristmasDesigners.com we now sell significantly more LED retrofit bulbs than regular incandescent bulbs. With recent improvements in quality, illumination intensity and longer life spans, LEDs have become the top choice for commercial and high end residential applications. While the benefits of using LED retrofit bulbs are clear, what does tend to be very confusing is how electrical load is measured when using these bulbs.

Before understanding how power consumption of a LED bulb is calculated, there are two terms that you need to be familiar with: Real Power and Apparent Power.

Next it's important to understand how power in Watts is calculated:

Volts X Amps = Power in Watts (e.g. 120 Volts x 3 Amps = 360 Watts)

But what if you know the Watts, but need to know the Amps? Then you would switch the formula around so that it works like this:

Watts/Volts = Amps (e.g. 360 Watts/120 Volts = 3 Amps)

If an electrical load is pure resistance such as a heater, electric stove or incandescent light bulb, the Real Power and the Apparent Power are approximately the same.

When it comes to LED retrofit bulbs, things are not as simple. These bulbs run on very low voltage, about 3.5 VDC (Volts Direct Current). But the power coming into the bulb is generally about 120 VAC (Volts Alternating Current). In order to take the 120 VAC and convert it to 3.5 VDC, a component called a capacitor is used. The capacitor reduces the voltage to where it needs to be in order to power the LED bulb. A byproduct of the capacitor is that the current and voltage are shifted out of phase with each other. As a result, the out of phase power and in phase power are not the same.

ChristmasDesigners.com's LED retrofit bulbs have a Real Power rating of about 2 Watts (.017 Amps), however, the Apparent Power is actually .96 Watts (.008 Amps) and some are as low as .35 Watts (.0029 Amps). What exactly does this mean? Basically it means that when using LED retrofit bulbs, you will need the infrastructure, i.e. cords, plugs, electrical circuit, etc, to support up to 2 Watts per bulb, which is the Real Power. However, the good news is that when it comes to the actual electricity that you are using, you are only paying the electric company for the Apparent Power, which, as you can see, is much lower.

Let's take a look at a real life example:

For the roofline of your business you decided to install 500 feet of C9 perimeter light line. Each LED bulb is spaced 12 inches apart. Here's how it works out on paper:

Real Power (This is how much infrastructure you will need)

500 LED Retrofit Bulbs @ 2 Watts per bulb = 1,000 Watts

Apparent Power (This is the amount of electricity you are actually paying for)

500 LED Retrofit Bulbs @ .96 Watts per bulb = 480 Watts

As you can see, even though you need to have cords, plugs and a circuit that can hold 1,000 Watts, you are only paying for about half of that due to the much lower Apparent Power.



Okay, so now you know the Watts, but most cords and plugs are rated for the maximum number of Amps they can hold. So all you need to do is to convert the Watts into Amps. But remember, since you are looking to determine if you have adequate cords, plugs, etc, then you need to be sure and use the Real Power Wattage. In the example above that would be 1,000 Watts. To get the total Amps, we'll use the same formula that was shown previously:

$1,000 \text{ Watts} / 120 \text{ Volts} = 8.33 \text{ Amps}$

If you want to see how much electricity you'll actually be paying for then use the same formula, but use the Watts that was calculated above for Apparent Power:

$480 \text{ Watts} / 120 \text{ Volts} = 4 \text{ Amps}$

So basically, you need to have the electrical infrastructure in place to support 8.33 Amps, but you are only paying for 4 Amps of electricity.

While all the numbers above can be a bit confusing, and many of us tend to glaze over when we start seeing calculations and hearing talk about Amps and Watts, but all you have to remember are two things:

- 1) Apparent power is how much infrastructure you need.
- 2) Real Power is how much electricity you are actually using.

If you would like more information on LED Retrofit bulbs, visit us online at ChristmasDesigners.com or shoot us an email at sales@christmasdesigners.com.