AMERICAN LIGHTING
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# ADVANCED LED RETROFIT BULB INSTRUCTIONS

The American Lighting S14, C7, and C9 bulbs are low power replacements for 120V AC incandescent lamps. The challenge in designing with LEDs is that they run on very low voltage - typically 3.5V DC for a white LED. To reduce the 120V AC line voltage to a few volts, the manufacturer uses a component called a capacitor. The capacitor is able to reduce the voltage without wasting power. A by-product of the capacitor is that the current and voltage are shifted mostly out of phase with each other. The out-of-phase power must now be represented in Volt-Amps and the in-phase power in Watts.

The consequence of this phase shift is that there are two different power figures that must be used to design a 120V LED display. The Apparent Power of one American Lighting LED lamps is about 2 Volt-Amps (VA). In designing a display, this figure must be used to specify wire size, connector size, breaker, and fuse size. The good news is that the power consumption is proportional to the lower Real Power figure which is in the range of 0.5 to 1.5 Watts.

## BASICS

If the electrical load is a pure resistance, such as an electric stove, heater, or incandescent lamp, the Real Power in Watts and the Apparent Power in Volt-Amps are approximately equal. If, however, the load contains coiled wire such as an electric motor, the voltage and the current are shifted out of phase with each other and the power is represented in Volt-Amps.

Power in Watts = 100 bulbs X 5 Watts/bulb = 500 Watts

Power in Volt-Amps = 100 bulbs X 2 Volt-Amps/bulb = 200 Volt-Amps

**For example:**

| QUANTITY | WATTS/BULB | REAL POWER | APPARENT POWER |
|---|---|---|---|
| 500 C7 Incandescent | 5 Watts | 500 C7s X 5W = 2500W | 500 C7s X 5VA = 2500VA |
| 500 C7 LEDs | 0.32 Watts | 500 C7s X 0.32W = 160W | 500 C7s X 2VA = 1000VA |

The wire gauge for displays and installations using these 500 American Lighting LED bulbs must accommodate the 8 Amps. However, the electric bill will reflect the lower 480 Watt power consumption.

In summary:

**Choosing Electrical Components** (Wire Gauge, Breakers, Fuses)

Use the 2VA/bulb figure to determine the rating of all electrical components such as wire gauge, receptacle size and circuit breaker rating. The power figure will have to be converted to current for almost every electrical device.

For example:

700 bulbs x 2VA/bulb = 1400 VA
Current = Power/voltage = 1400VA/120 V = 11.7 Amps

Note: Wire can carry its maximum rated current but circuit breaker manufacturers recommend that breakers be loaded to no more 80% of maximum rating to prevent nuisance tripping. For example, a 15 Amp breaker should be loaded to 12 Amps. The lower the ambient temperature, the less breaker nuisance tripping will be an issue.

**Calculating Power Costs**

Use the 0.32W/bulb figure to calculate power cost

700 bulbs x 0.32W/bulb = 224W

Cost = power consumption x time
= 224W x 1 hour = 224 Watt hours = 0.224KWh

e.g. assuming a cost of $0.10/KWh

Operating cost 0.224KWh x $0.10/KWh = $0.02 per hour

**SPECIFICATIONS**

| LAMP STYLE | REAL POWER WATTS/LAMP | APPARENT POWER VOLT-AMPS/LAMP |
|---|---|---|
| C7 LED | 0.32 | 2 |
| C9 LED | 0.57 | 2 |
| S14 LED | 1.5 | 2 |
| S14 LED | 1 | 2 |