# Light Up Your Modified Car

Some Hot Rod lights are hard to see. Your teardrop lights may look cool, but the 5W incandescent lamp that came with it just doesn't light up bright enough to show others you are on the brakes. Using Harley Davidson type indicators might pass the inspection, and they might look cool, but they don't exactly alert other drivers of your intentions.

To make your indications clear, you might consider brighter lights. Most people think that raising the Wattage of the lights will do the trick, but that's not a good idea. Incandescent lights produce a lot of heat, and when you raise the power consumption from 4 Watts to 10 Watts in your parker lights, the first thing you'll succeed in doing is melting the plastic lenses! Even if you have glass lenses, the actual increase on power consumption (from 4W to 10W) does little in the way of increasing brightness.

## Incandescent vs LED

One solution is to convert your Hot Rod lighting to LED lights. LED stands for Light Emitting Diode, but you don't need to know that. What you DO need to know is that LEDs switch on way faster than incandescent lamps, they draw far less current for equivalent brightness and LEDs will last the life of the car. There are also a wide range of lamp configurations and bases, which means that you can find an LED replacement for just about any lighting function.

Sounds great, right? Well, obviously, there are several considerations you need to make before you replace all your lights. Even if you start your project with the intention of using all LED lamps, you need to know a few things if you have only dealt with incandescent lighting up until now.

**Note**: Do NOT mix LED and incandescent lamps in the same circuit!

## Choosing an Equivalent LED: Lumens, not Watts

You're probably accustomed to measuring a lamp's brightness by Watts. That's OK for incandescent lamps, but for LEDs, brightness is measured in *Lumens*.

Wattage isn't an indication of brightness, it's a measurement of how much power the lamp consumes. LEDs don't draw enough current to accurately measure power consumption in degrees of brightness. For example, an LED lamp with comparable brightness to a 60W incandescent only consumes 8 to 12 Watts.

The Lumen (lm) is the real measurement of brightness provided by a light bulb, and is the number you should look for when shopping for LEDs. For reference, here's a chart that shows the watt-lumen conversion for incandescent and LEDs.

*Table 1 Lumens vs Watts*

| Lumens | Incandescent | LED |
|---|---|---|
| 2600 | 150W | 25-28W |
| 1600 | 100W | 16-20W |
| 1100 | 75W | 9-13W |
| 800 | 60W | 8-12W |
| 450 | 40W | 6-9W |
| 375 | 25W | 6W |
| 150 | 10W | 2.5W |
| 75 | 5W | 1.25W |

## Choosing the Right Socket Base and Lamp

Every project is different, but this article is all about old(er) cars, so let's keep it simple. The lights you would most want to convert to LED are stop, tail, indicator, number plate and (maybe) reverse lights. Interior lighting (courtesy lights, instrument lights) may also be converted to LED.

**NOTE**: Choose an LED that will fit your socket and clear the lens. Many LEDs are rather long.

There are many socket configurations across a wide number of cars, but they fall under three main types:

- Bayonet
- Wedge
- Festoon

More modern cars (from, say the late 80s onwards) use a Wedge style base. For a list of the various types of lights and sockets, try Wikipedia (https://en.wikipedia.org/wiki/List_of_automotive_light_bulb_types).

The classification of Festoon are things like interior lights and side lights.

### Bayonet Configuration

The Bayonet types are by far the most common for Street Rods and pre-1980 Custom cars :

- BA9S Single Contact Bayonet, 9mm
- BA15S Single Contact Bayonet, 15mm
- BAY15D Twin Contact Bayonet, 15mm

#### *BA9S*

BA9S, also known as T4W, has a 9mm diameter base to take a single contact bayonet lamp.

*Figure 1 - BA9S Socket*

You can replace the original lamps with an LED lamp. Typically used for number plate lights, instrument lights, or interior lighting.

*Figure 2 - BA9S LED*

### *BA15D*

BAY15D, also known as 1157, P21/4W, P21/5W has a 16mm diameter base and is a double contact, offset pin socket.

*Figure 3 - BA15D Socket*

Typically, these sockets are used for tail (parker) and brake light combos. The incandescent lamp is usually a 21W (brake light) and 5W (tail) combo, and can be replaced with an LED lamp.

*Figure 4 - BA15D*

There are a variety of BA15D LED colour, base and dimension choices, so when looking for a replacement, check the specifications to ensure it will fit and it is the correct colour.

### *BAY15D Switchback Lamp*

The BAY15D Switchback LED lamp has the same base as the BA15D but has a static white light as taillight and an orange turn signal light. The tail light shuts off when the turn signal is used. This might be OK in the USA where flashing brake lights used as indicators are common, but in Australia, this combo may not be legal. However, it is a good replacement for a backup/indicator combo, which is what I used on my 56 Ford Crown Victoria project.

### *BA15S*

BA15S or P21W (equivalent to 21W incandescent lamps) has a 15mm diameter base typically used for turn signal lamps and reverse lamps.

You can use BA15S single contact bayonet LED lamps in these sockets. They come in a variety of colours and dimensions.

*Figure 5 - BA15S*

## Wedge Configuration

Wedge bases have been used in automotive applications as indicators, brake and tail lamps since the 90s, for incandescent lamps and, more recently, factory LED lamps. The configurations commonly used are the T8, T10, T15, T20 and T25. T8 – T15 are miniature sockets with a 10mm wedge, typically used for number plate lights, side lights, interior lights and instrument lights. The T20/T25 is a large socket typically used for indicator, brake and tail lamps.

**Note**: The T designation means 'Tubular' and the number is increments of one eighth of an inch. For example, a T10 is a Tubular lamp that is 10 x 1/8 inch which is 1 ¼ inches.

*Figure 6 - T20 Socket*

If you are wiring your project from scratch, you might want to consider using wedge sockets (you can buy them separately) or use wedge socket adapters.

Different makes and models use designations for wedge lamps that are a mixture of old and new standards. The filament designation (or Light Type) for the most common configurations are as follows:

- 7443: Standard Type with 2 filaments, same functions as 1157/3157 (BAY15D)
- 7440 : Standard Type with 1 filament, same functions as 1156/3156 (BA15S)
- 3157: Standard Type with 2 filaments, same functions as 1157/7443
- 3156 : Standard Type with 1 filament, same functions as 1156/7440

## Wiring LED Lamps

So you've fitted LEDs into all your lighting sockets, and they don't work, or they are working erratically. Welcome to the club. The problems you are having are due to the low load properties of LEDs and the way electricity flows through LEDs. Put simply, old fashioned incandescent lamps don't care which way the electricity flows through them, but LED lamps DO care.

On the other hand, many of the LED manufacturers have reconfigured the internal circuitry of their LEDs so converting to their LEDs won't present you with any problems. If you are experiencing issues after swapping your old incandescent lights for LEDs, the following will fix it.

## LED Flasher Can

The first thing you'll need to do is replace the flasher can with something that will work with LEDs. Traditional flasher cans are thermal relays. When current flows, a bi-metal strip heats up and disconnects the circuit, cools down and re-connects the circuit, heats up and disconnects, and so on, creating an on-off-on-off flashing circuit. LEDs don't draw enough current to activate a thermal flasher, so you need to replace it with a solid state, or low-load, flasher can. Strangely enough, the best place to get one of these is from Jaycar Electronics. Auto parts stores carry a range of thermal flashers and a few factory LED flashers that might be suitable, but if you want to replace your two or three pin Thermal Flasher with a two pin or three pin LED flasher, Jaycar have them.

## LED Brake/Tail Lights

The other problems you might face are erratic operation of parkers and brake lights. You put the parkers on, and the brake AND parkers light up together. You put the brakes on, and they don't work unless you physically disconnect the parkers. Sometimes, the front parkers might come on when you step on the brakes. Or a combination of these problems. That's because LEDs flow current in one direction, and in the other direction they look for the nearest ground. Because LEDs have such low loads, your electrical system "sees" another LED in the circuit as the nearest ground and all sorts of things might happen. Also, when using dual filament LEDs (for combo brake and tail lamps, for example) the selection of the bright light (brakes) or the dim light (tail) is done internally.

To fix this, you need to place Diodes in series with the brake and parker LEDS. A Diode only allows current to flow in one direction, from the Anode to the Cathode. The Cathode is designated as a stripe on the Diode, so it needs to point TOWARDS the light.

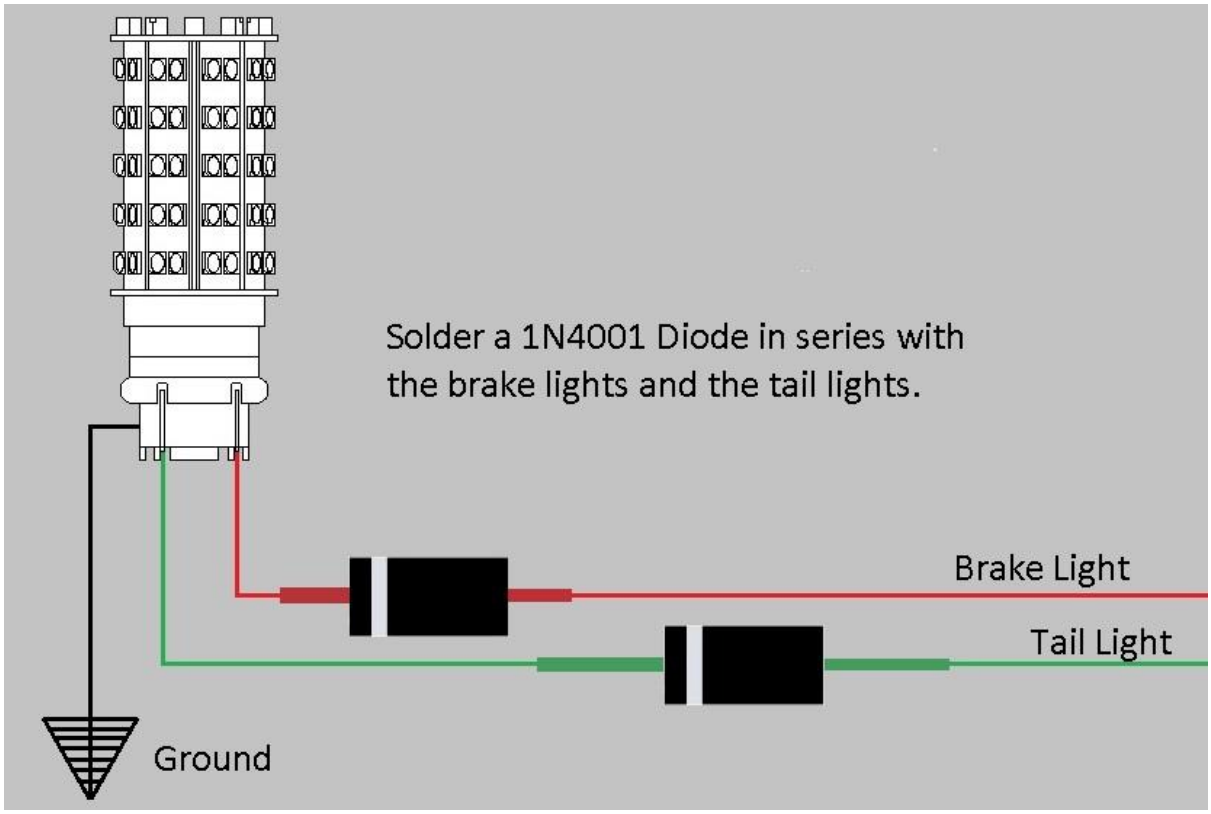


*Figure 7 - Diodes in Series*

Use a common 1A or better rectifier diode such as a 1N4001 (or any 4000 series) or equivalent. The diodes will prevent the internal circuit of the LED from feeding back to other lamps in the circuit. The Diodes are fairly small, so trim the leads to about 1cm in length, then solder them to the wires.

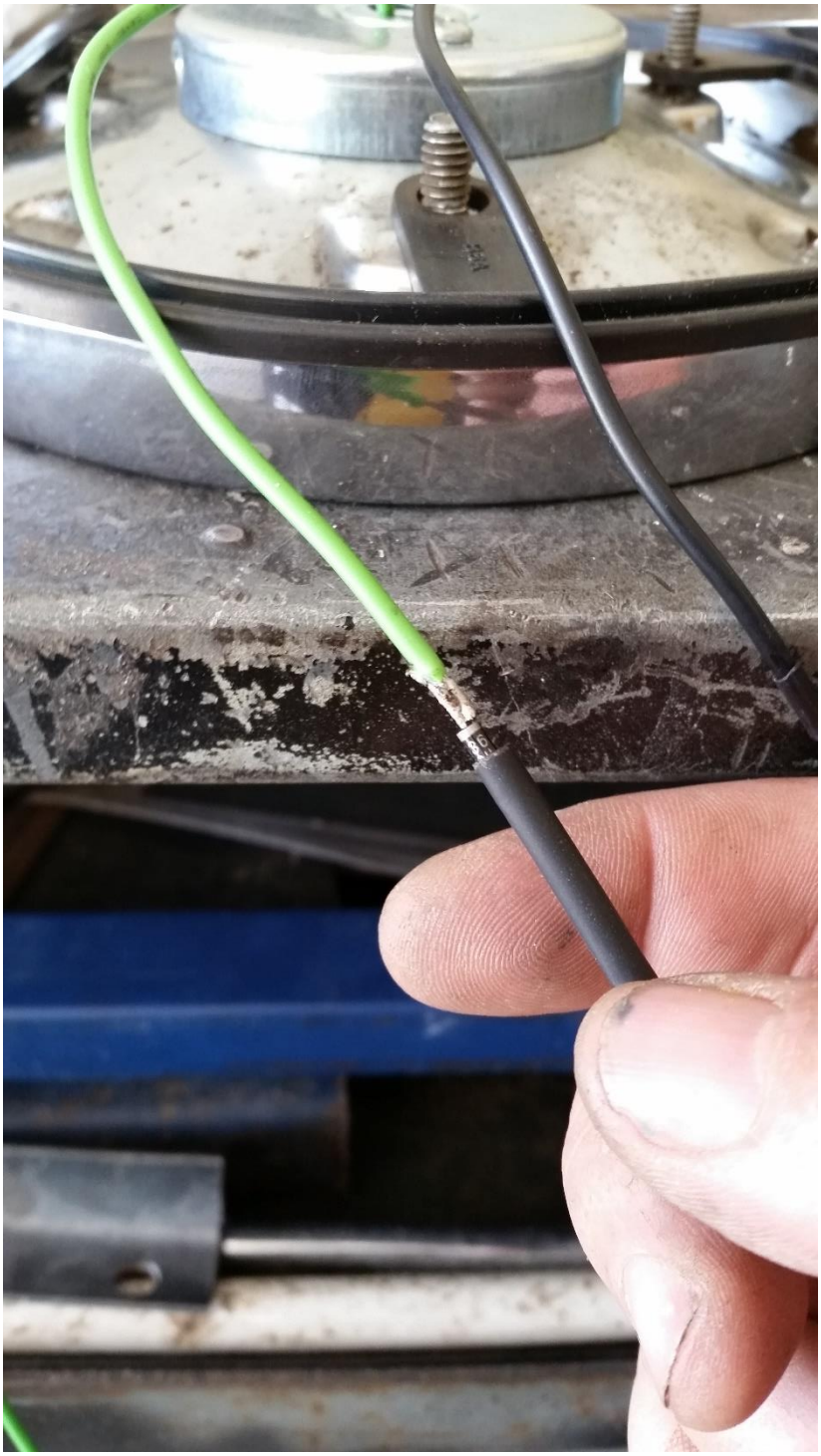

*Figure 8 - Soldering Diodes Into the Light Circuit*

Use heat shrink to cover and seal the diodes, and hook your lighting system up. You only need to do this for the rear brake and tail lights. The front parkers will be protected, too.

Stand-alone circuits like reversing lights, or independent brake and tail lights will not need isolating Diodes.

## Headlights

Factory headlights of the 30s, 40s and 50s are almost useless on today's highways. Sealed beam headlights of the 60s and 70s are not much better. Later sealed beam lights have the 100W/75W configuration which is probably the minimum you would use in any Hot Rod project. The Halogen H4 conversion (often called 'semi-sealed beam') is the next step up, and is the most popular conversion around. HID (High Intensity Discharge) lamps, also called Xenon HID, are used on many late model cars, and provide a bright, bluish beam that reaches a bit further than H4 lights. HID lights require a ballast (actually a transformer) to work, as they operate ate higher voltage than the car's 12V system (typically around the 85V mark, and they require a 20,000V ignitor to start). The HID Conversion kits come with the requisite hardware for almost any project.

## LED Headlights

There are a number of LED Headlight options coming into the market. Some of the latest cars have them factory fitted. The retro-fit kits come in sealed beam or replacement LED lamp form. LED Headlights are super-bright, even at low beam. Some are rated at 4000 Lumen each! That's 8000 Lumen headlights! If you are looking for a LED Headlight kit, be aware that they are not ADR compliant just yet, and some of them are NOT polarity sensitive. They are expensive, too! At the time of writing this, it is probably better to stick with H4 Halogen lights, or HID lights if you want to melt the asphalt in front of you.