

LED's (Light Emitting Diodes): What I think I Know

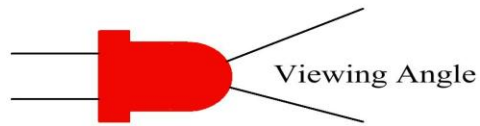
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I will tell you what I use and do. I deal with 3mm, 5mm and 10mm (diameter) LEDs that are called Standard LEDs. These LEDs will have 2 legs with one longer than the other. The longer is positive (+) voltage. If you are using recycled LEDs, the shorter leg will be the flat side of the dome. This is the Ground side (or negative) of the LED. It will not hurt the LED if you get them backwards. It will just not work. LEDs will have a lot of data with them, so let's go through what is necessary to know. The color of an LED is determined by two things: the color source and the lens color. The color source is the color of light emitted from the actual electronic part inside the dome-shaped plastic. Most of the time, this is where the color comes from because the dome is usually clear. They do make LEDs that have a white emitter and a colored dome to achieve the color. I only deal with white LEDs with clear domes. I air-brush my LEDs to achieve the color I want. More on this later.

The next thing is "Lumin intensity" (MCD). This is how bright the LED is. This can range from 1 (very dim) to 28,500 and higher. I use the 28,500 MCD as spotlights. They are 10mm in diameter with a 10-degree viewing angle and are available at Radio Shack (Part # 276-0005). For general deck, running and work lights, I use 3mm and 5mm LEDs that are 500-1000 MCD intensity and I add coats of paint to tone down the brightness as needed and add color.

The next item is the "viewing angle". It is defined as "the full angle at which brightness is half of the brightness from dead center". I use 10 degrees for spotlights and up to 130 degrees for deck lights. 90 degree viewing angles make good work and deck lights. You can get a rough idea of the viewing angle by shining the LED on the wall from 12 inches or so away.



As you can tell, the narrower (smaller) the viewing angle, the better for a spotlight. The wider the viewing angle, the better for deck running and work lights.

The next item is Forward Voltage. This is the voltage drop across an LED at its' rated AMP Draw. If your LED is rated at .020 amps and 3.5 volts, it will work with a power supply of 3.5 volts and draw .020 amps. The supplied voltage and the rated voltage are critical. Too many supplied volts and you will draw too many amps through the LED and fry it. I power the 3.5 volt LEDs with a 2-cell (Alkaline Battery) pack and have had good success. The pack provides 3.4 to 2.9 volts and the LEDs draw around 15-18 milliamps. It is important to know the forward voltage rating of the LED you are using. If you apply too little voltage, the LED will not light. Too much voltage and you will destroy the LED (fry it).

If you are using a power source that provides more volts than the forward voltage rating of your LED, you will need to add a resistor in-series with the LED. This will drop the excessive volts and limit the amp flow through the LED and avoid frying it. There is an excellent article about this topic on our website with the required formulas by Club member Allan Wing.

To color the LEDs for Port (Red) and Starboard (Green) running lights, I use Tamiya Clear Red # X-27 for Port and Tamiya Clear Green # X-25 for Starboard. Several coats can be applied to achieve the darkness desired. I also use clear tubing which I paint and insert the unpainted LED into. The tubing can be cut to the desired length with a top glued on and painted black to achieve the proper viewing angle (not to be confused with the LED viewing angle) needed to conform to Coast Guard Regulations. To get amber stern lights as used on River Towboats, I use Tamiya Clear Orange # X-26. It's

more amber than orange. Deck lights can be made yellow with Tamiya Clear Yellow # X-24. These are too bright for my liking, so I use Tamiya # XF-3 Flat Yellow. It's a solid color, but really dims down the LED for a realistic look. It also visually increases the viewing angle and a soft glow can be achieved with this method. Another method is to sand the domes with 400 sandpaper before painting. This will defuse the light and increase the viewing angle greatly and take the harshness out of the LED.

So in summary:

I use 10mm Radio Shack # 276-0005 / 28,500 Lumin (MCD) with a 10-degree viewing angle for 1:35 and 1:20 scale spotlights.

5mm Radio Shack #276-0017 / 7000 (MCD) Lumin with a 30-degree viewing angle for 1:48 and 1:96 scale spotlights.

My 3mm LEDs are my mainstay. 3.5 volts 90-degree viewing angle and 520 Lumin (MCD). I paint or sand and paint these or use them in painted clear tubes to achieve what I want.

A good source for LEDs and pre-made LED running and work lights is: Aimee Eng (aimee.eng@frontier.com).

In closing: LEDs are not rocket science. However, we do have a few guys in our Club that ARE Rocket Scientists and can supply you with any info you need.

So get a bunch of LEDs and play with them. If you fry a few, so what. Now you know what I know....or think I know about LEDs.