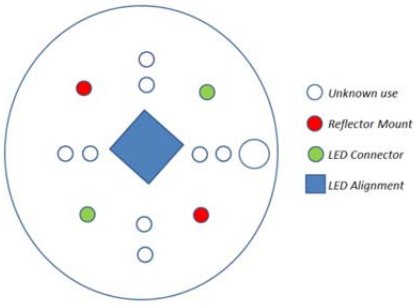
LED Light Assembly Notes

First, I find it to require a lot of trial and error. Pretty much everything I did had to be "re-done" in order to make it "right". I've provided some notes following in order to help others. Please note that these are extensive … I'd rather be anal and perfect than "close" … because when your only close you can "let the smoke out of the components" (remember … it's smoke that makes parts work because when the smoke gets out, they don't work anymore … geek humor). I suggest you read them all first, familiarize yourself with the parts, then re-read them. If you don't go "OH CRAP" at least twice, read them a third time.

1. **Take care when putting together the two halves of the stamped metal. Each has an arrow pattern in it and the arrows need to point to each other. I used pop rivets to secure the two halves. If you don't align the arrows, the holes for the boxes you mount will not line up (yes … my first mistake).**
2. **In this article, I interchange the terms LEDS and lights … same thing.**
3. **First, I mounted the heat sinks on the stamped metal. When mounting the heat sinks, make sure you align the large hole in the heat sink to the large hole in the stamped metal (second mistake).**
4. **In mounting the plastic junction box, you'll find that the cable grommet units are so large (picture on right) that there is little room to get tools in to hold them in place so you can tighten them … you can, but it's tight. I think the grommets are there to be "water tight", so that makes them large. There are better ones out there that would fit better (look on any appliance in your kitchen … expensive water tight ones are not needed IMHO).**

5. **For all the money spent on the metal strain reliefs, I found one cable that would not go in … the power line that drives the LEDs. This is probably because we used the wrong driver … the one we used has 16 gauge wire there, and the 'right one' uses 18 gauge (more on that later).**
6. **I won't talk much about the wiring in the junction box … it's pretty easy as the driver is well labeled (AC cord to AC in, dimmer wires to dimmer control, and + and – outputs to the LEDs (more on that later).**
7. **Wrong driver? Yes … we were told to use the HLG-320H-C1400 unit which is 252 mm long (http://tinyurl.com/h6ld4ex). The holes in the stamped metal didn't line up due to it's length. (the 320H is 252mm long). The HLG-320 is a 1400 ma unit, maintaining 114 to 229 volts to keep that current. Since the 36V LEDs are wired in series, that's 4x36, or 144 volts … so it will work. However, I think the right part should have been the HLG-240 which is 10mm shorter (http://tinyurl.com/z3jy5ys) … I think the holes would have aligned for the 240 (I don't have micrometers to verify it). The HLG-240-C1400 has the same 1400ma spec, and the voltage is 89 to 179, so again, the 144v is maintained. Yes, the 320 might last longer as it's 'beefier', but I don't think that's any reason to use it. Anyway, we had it, so we used the 320H by drilling a few extra holes (and again, the heavier output wire caused issues mentioned above).**

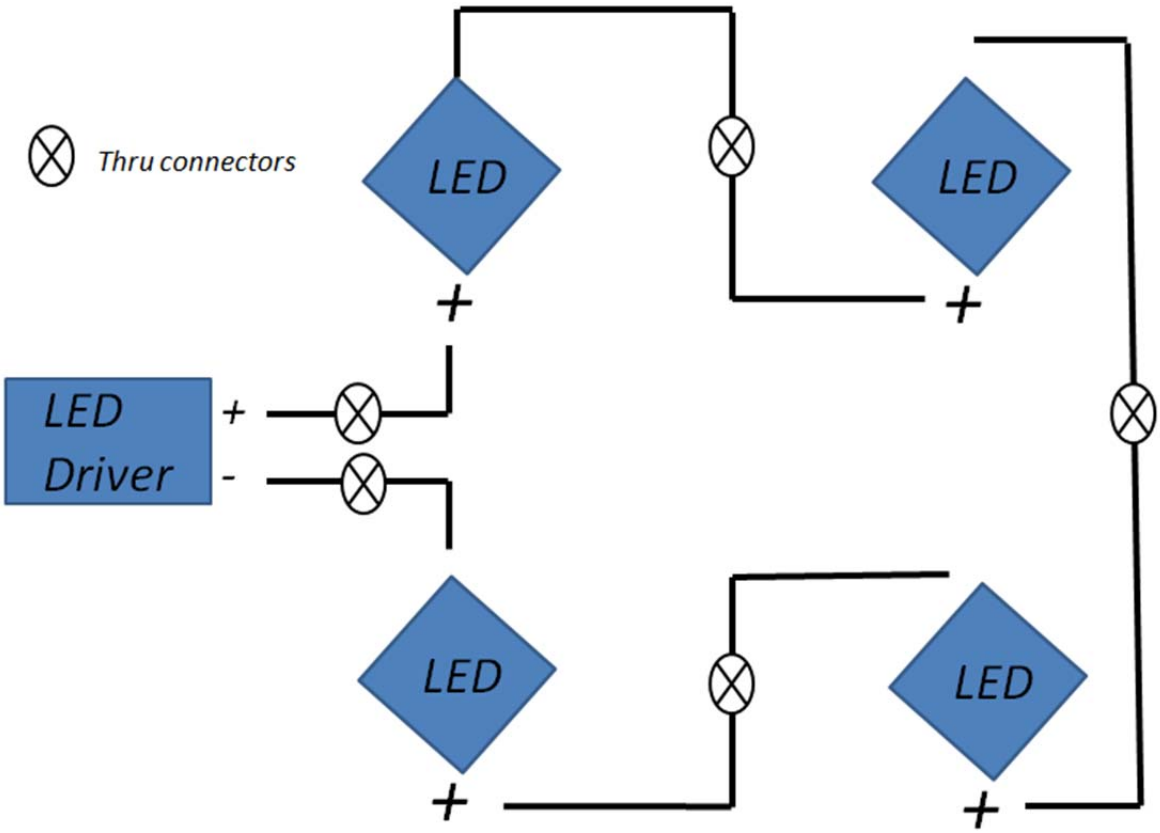
8. **The LEDs are Cree® XLamp® CXB3590 LEDs. Not sure which one as there are dozens of variations … but if you look up the spec sheet, you'll see that the maximum current is 3600ma, so the 1400ma that this driver provides should not over-work them. Frankly, we could have used HLG-320H-C1750 or HLG-320H-C2100 units to get more light, but the HLG-320H-C1400 should work just fine.**
9. **Just a note … as the LEDs are wired "in series", that means that if one light goes out, they all go out. For that reason, you should setup all "light to light" wiring with connectors in between so you can isolate them for troubleshooting. More on wiring later.**
10. **One topic of discussion is "what wire gauge to use". Well, if you again use Google and search for "wire gauge", you might find this handy chart (http://tinyurl.com/7rnjx) that shows that wire as thin as 28 gauge will handle the 1.4 amps (1400 ma) that the lights use … so anything thicker (such as 18 to 26 gauge) is more than adequate. I used 20 gauge because if I used 18 and tinned the ends, it sometimes would not fit in the LED connectors. If you look up the spec sheet for the LED holders, you'll see the connections support 18 to 24 gauge wire (solid or stranded - http://tinyurl.com/gmbfskr), so if you're like me, me you only have stranded so you'll need to tin the wire to hold it together so it will push into the connector.**
11. **There has been a lot of discussion on the "thermal paste" amount. I suggest you Google "thermal paste application" if you want to read up on it (here is but one of the example sites: http://tinyurl.com/go3z3kn). But the bottom line is this … thermal paste is like glue … if the two surfaces were PERFECT, you could just push them together without anything in between and the two parts would stay and conduct heat. But as nothing is perfect, you use thermal paste (like you use glue) to bridge that gap of imperfection … thus, you want to use as little as possible … a paper thin layer as the article says. Personally, I use a single-edged razorblade to spread out a small line of paste on BOTH the LED and the heat sink, then push the LED onto the heat sink, twisting it about to get out any air bubbles (bubbles make hot spots). I found that if I only put the paste on the LED, there were some places near the edge where the paste didn't touch. But if you use a razor to spread the paste on both parts, it will be ultra-thin and cover the surfaces well.**
12. **On the topic of paste … let's talk "cleanliness". That paste is a pain … sticks to everything. So trust me when I say "bring alcohol, paper towels, and LOTS MORE alcohol wipes" … the few in the kit won't be enough. Make sure you use wipes to clean the heat sink and LED light surfaces … and have a lot of THIN latex gloves around … change the gloves a lot to keep the LED lights clean … and use even MORE alcohol wipes to keep the lights clear of thermal paste.**
13. **The mounting onto the heat sinks is also a pain. The heat sinks have too many holes to keep straight … so let's try this diagram and wording. First, there are "8 x 2" hole pairs (16 holes) for something … I don't know what. These hole "pairs" are every 90 degrees. There is also a large hole to run wires through … use it or not … up to you. The holes you ARE interested in are the 4 single holes (one pair shown here in red and one pair in green), each 90 degrees**



apart. Two 180 degrees apart are for the LED light holder, and the other two (180 degrees apart) are for the reflector holder. These pairs of holes are NOT interchangeable … the green are where you mount the chip holder and the red are when you mount the plastic reflector holder. If confused, sit the holder in place and make sure the other holes can be seen through the LED holder.

14. **Now, when mounting the LED holders (or LED connectors … does both … call it what you want), there are two different screws supplied … ones with a wide head (and short) and ones with a narrow head (and long). Well, the LED holders have a keyhole slot, which means that to any Mechanical Engineer, you are supposed to install the screws, mount the holder OVER the screws, rotate the holder about 10 degrees to lock it in place, then tighten. I say this because to do that means you have to use the longer narrow head screws as the wide head screws won't fit through the keyhole slot. Well … THIS IS WRONG. For some reason, the shorter wide head screws are what are needed because you need the long screws for the reflector holder attachment. All screws should have been narrow headed screws IMHO. Anyway, this means you need to sit the LED holder in place, and then install the screws through the keyholes, and hold the assembly in place while you tighten the screws. Wrong screws, but it works.**
15. **Next, when installing the LED holders / connectors onto the LEDs … make sure you get the PLUS (+) of the holder connected to the PLUS (+) on the CREE LED.**
16. **As your tightening the holders, you'll want to be moving the LEDs and scooting them into place … you're trying to make sure your connections are good.**
17. **Finally, remember that when you're tightening the screws for the LED holders and for the reflector holders, DO NOT tighten one all the way and then the other … go back and forth. Tighten one screw until slight resistance, then the other a little more … then back to the first and a little more … go back and forth. That makes sure that the mountings do not get misaligned (if you know how to change a car tire … same principal).**
18. **Once you have the LED holders in place, I suggest you use a multi-meter to do an ohms check to ensure you have the electrical connections right. Specifically, you'll want to use an ohm meter to check each unit before power it up the first time to make sure you have the LED holders properly connected to the LEDs. Once you do that, you'll be assured of being able to hook up all the wires and power it on.**
19. **When you do check the connections to ensure that the holders are properly placed, remember that this "light" is an LED, and resistance in one direction will be one number, while the other direction will be very high (infinity). So put your black lead on the positive and the red on the other (negative) and you should read something … on mine, it was in the 80 to 83 Kohm range … if you reverse the leads, you should be "open" or infinity. Make sure you do this with the correct "black to plus, red to minus" because if only one is wrong, the unit will NOT power on.**

20. **Now that you have all LEDs mounted and verified, you can do the "point to point" wiring. The wiring diagram to the right says it all well. Bring out the + of the driver and run it to the + of the first LED (LED 1). Then you go from LED1's other connector (called minus, or '-') to the + of the second (LED2). Then out the other connector of LED2 to the + of LED3 … then to LED4. Finally, the last LED minus side to the minus of the LED driver.**



Note the "thru connectors". As stated previously, since these are wired "in serial", if one light dies, the whole string dies. To help in troubleshooting in later years, I installed solderless connectors (like these) so that I can disconnect each LED and test it with an ohm meter.

21. **At this point, one last check of all LEDs to make sure they are clean, attach the lens, and power it on. Remember when you apply power, it takes about a second before the driver actually turns on and supplies power.**

Hope this helps someone.