A non-intrusive LED Conversion
of
the Zeiss 12v 60w Lamphouse

by Forbes Pettigrew

The reason I originally embarked on the conversion was due to the fact that the 12v 60w Zeiss external lamphouse that came with a Zeiss Standard RA I bought as a build project was missing the bulb socket. Since finding just that part was going to be difficult, it was suggested that I convert the lamphouse to LED.

This led to an initial research on the subject while I was attempting to source the rest of the parts I needed to get the Standard RA up and running.

When I managed to get a working 12v 60w Zeiss lamphouse locally I shelved the project for a time as I was quite happy with the 12v 60w tungsten light source - until that is a search for replacement light bulbs revealed their cost and the extent of their working life ... 100 hours at 12v

That is not quite as bad as it sounds, as the working life of incandescent light bulbs is directly related to the voltage applied.
By limiting the applied voltage from 12v to 10v ‡, the working life can be extended from 100 to around 1000 hours. (See calculation below)

Rerated life = $(V_a/V_d)^{-13}$ × Life at design voltage.
Where V_a is *applied voltage* and V_d is *designed voltage*.

See steps to take to input the data in a scientific calculator.

10 [÷] 12 [=] 0.8333 [y^x] 13 [=] 0.0935 [1/x] 10.6993 [×] 100 [=] 1069.9321

The type of LED used is a Cree Xlamp XM-L U2. This next link shows an array of Cree LED modules that quite usefully includes the size for each one.

The Cree Xlamp XM-L LED is 3mm x 3mm, which compares favourably with the original tungsten bulb filament of 4mm x 3mm and the newer bulb filaments of 4mm x 2mm

Note: Cree claims that the LED is 5mm x 5mm, that measurement actually refers to the chip it sits on rather than to the LED itself. (See Fig. 1)

‡ See Fig. 6 for the penalty in Candela that limiting output to 10v entails.

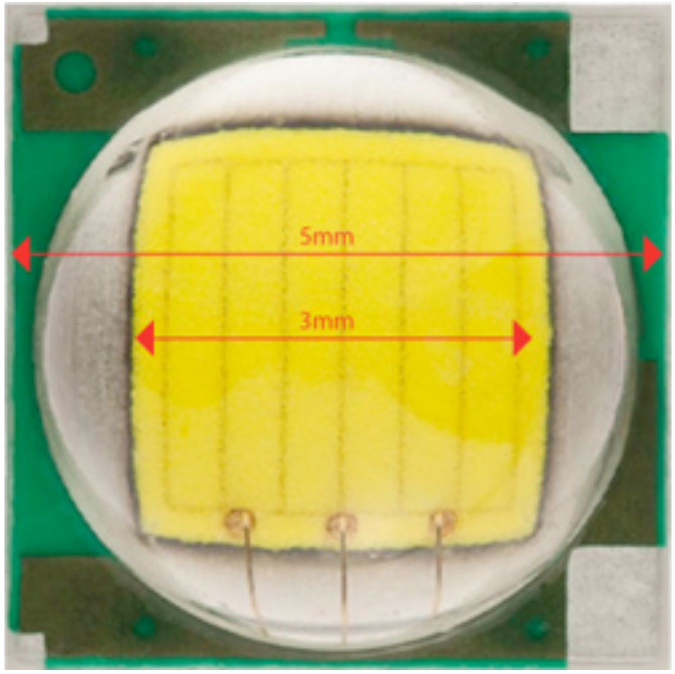

Fig. 1


Fig. 2

Note how the LED in Fig. 2 (seen reflected on an angled slide) has been slightly offset in order to reveal one of its edges and show that it is indeed focused on the condenser diaphragm.
The crenulated edge is due to the shadows cast by the 3 wires seen in Fig. 1

The aluminum rod the LED is fixed to, (See Fig. 3) is designed to be adjustable, thus permitting the fine-tuning needed to place the LED in the same position as the filament of the original bulb. This allows it to be focused on the *front focal plane* - a requirement to achieve Köhler.
As there is no permanent modification to the bulb holder casing, this means that a complete lamphouse may be converted provisionally by simply removing the bulb holder and rear cap and placing the rod in its place.

Fig.3

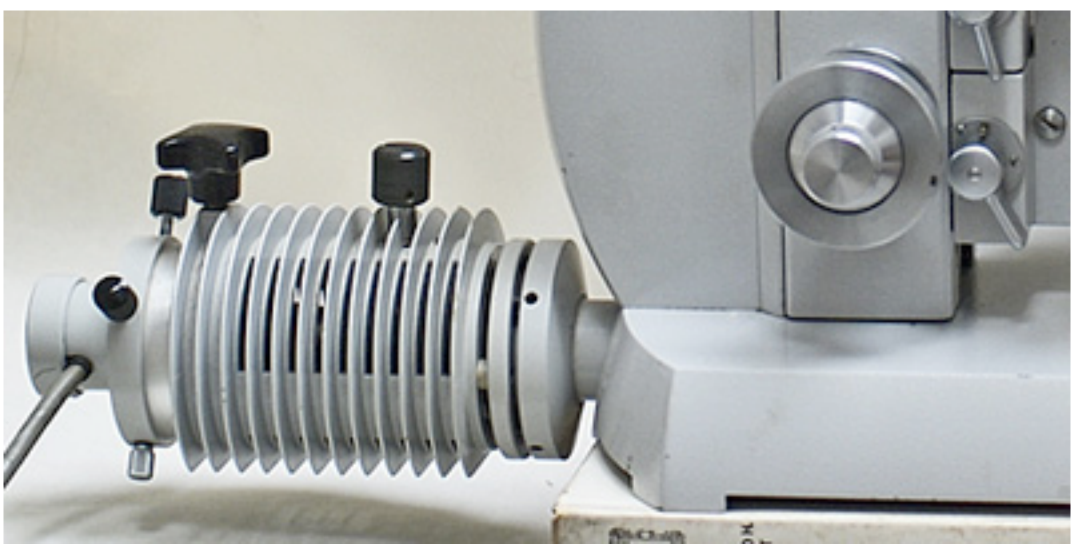

Fig. 4

The Lamphouse, (See Fig. 4), can be used with both the LED and the original Tungsten bulb by simply swopping the bulb holder casings, (See Fig. 3), and switching power supplies.

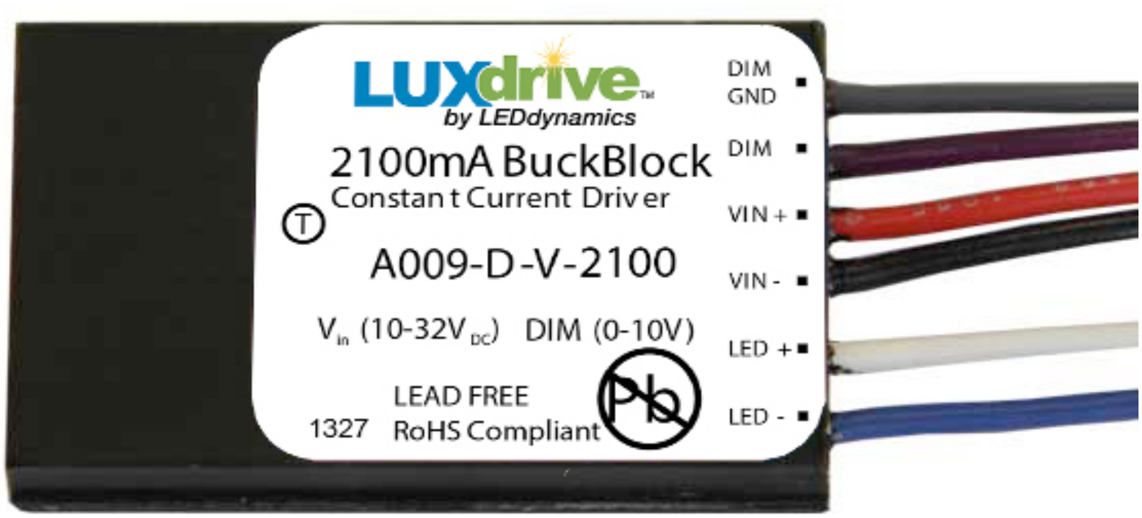

Fig. 5

I ended up choosing a Luxdrive constant current driver to see if it were possible to lower the minimum light output and also to avoid the flickering of the pulse-width modulation (PWM) controller, which I had tried first.

It solved the flickering and reduced the minimum light output - though not as much as I would have liked. I think it is a characteristic of LEDs to have a rather sharp drop rather than turning on and off smoothly. See the start of the LED graph line in Fig. 6 - which does not maintain its curve until reaching 0. This basically leaves one having to use a Neutral Density (ND) or crossed polarizing filters to lower the light output sufficiently to set up Köhler and use the low magnification objectives, which do not need much light. †

Fortunately the light output from the LED is such that one can effectively leave the ND filter or the combination of polarizing filters on most of the time, despite the fact that it reduces the light output throughout its range. In this I suppose it is similar to a high intensity halogen bulb.

All in all this has turned out to be a good conversion that provides a very bright light that is long lasting, affordable and procurable while allowing the flexibility to alternate light sources when needed.

† I have yet to test a Logarithmic Potentiometer, which several people have suggested may help with the fine control of the minimum brightness.

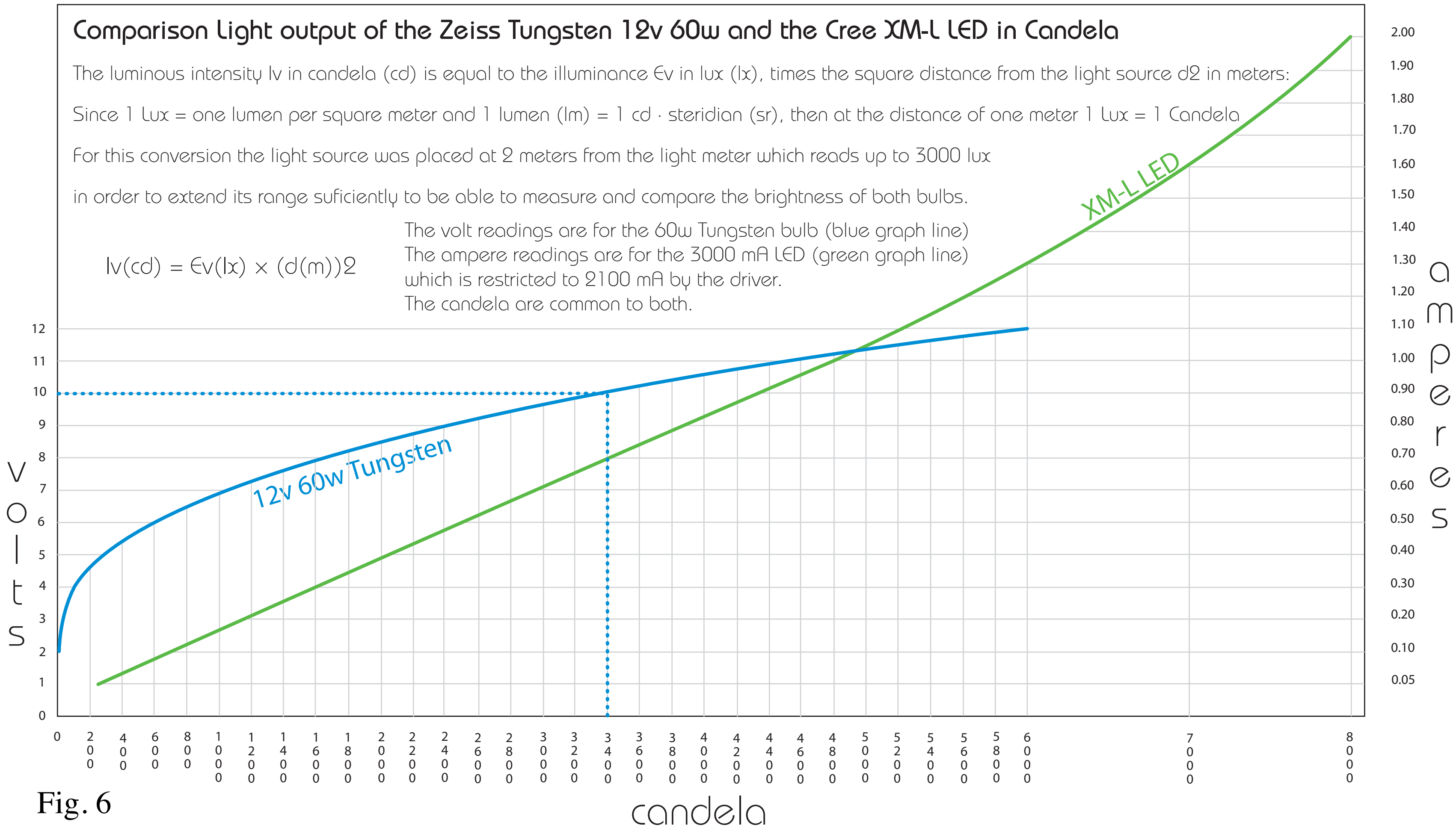

Fig. 6

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