

Building my caving torch by John Wellbelove

Here's how I built a caving torch from easily available parts.

The torch has a main switchable beam running at 700mA and 'always on' backup LEDs running at 20mA each.

The brightness of the lamp is equivalent to a Speleo Technics Nova Plus

It can use a power supply voltage anywhere between 5v and 30v.

A 4500mAH battery pack, would give about 11 hours runtime.

A 3000mAH pack would give about 7.5 hours.

Take care with wiring and assembly, especially around the battery cables and connectors, as high currents can occur in a short circuit.

Parts used

Gelert style AA headtorch

CREE XR-E 7090 Q5 high power LED (Supplier <http://www.led-tech.de/en>)

Lenses for CREE. (Supplier <http://www.led-tech.de/en>)

5mm white LED x 3

180** Ohm resistor x 3 (**this is for a the 7.2 V battery pack. See table for resistor values for other battery voltages)

220µF sub-miniature electrolytic capacitor.

Plastic box (Maplins N46CA - BM11 ABS Box Black)

Bulgin Micro Buccaneer connectors.

Luxdrive 700mA LED power supply. 3023-D-N-700mA Wired BuckPuck . (Supplier www.ultraleds.co.uk)

(Alternative part: Recom RCD-24-0.70/W , available from RS Components,

RS Stock No.667-1661, <http://uk.rs-online.com/web/>)

2 core round mains cable.

Tamiya connector.

Grommets (Maplins QT93B)

7.2 volt NiMH RC battery pack.

Glue

Thermal adhesive tape. (Maplins A18HH)

Various wire & heatshrink sleeving.

Aluminium strip. (30mm angle & 8mm U)

**** Resistor values for different battery voltages.**

6V: 120 Ohms: (Lead Acid or 5 x NiMH)

7.2V: 180 Ohms: (6 x NiMH)

8.4V: 240 Ohms: (7 x NiMH)

9.6V: 300 Ohms: (8 x NiMH)

10.8V: 360 Ohms: (9 x NiMH)

12V: 430 Ohms: (Lead Acid or 10 x NiMH)

The rough cost for the torch was £35 and for the battery pack £32

The torch body

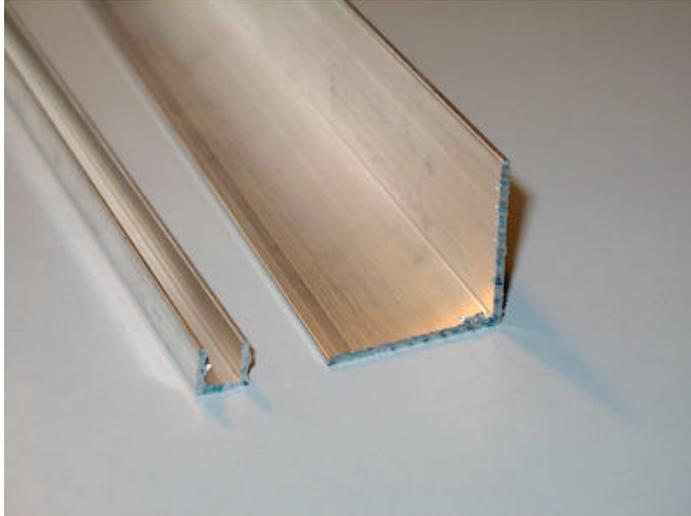
The torch is based on a standard Gelert type head torch.

They are made by several different manufacturers, but the design is essentially the same.

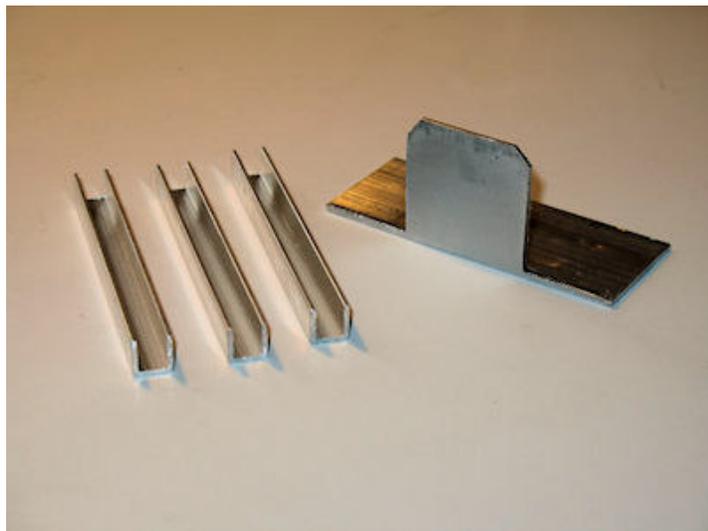


Making the heatsink parts

Cut the aluminium strips to size.



Cut one length of the angle strip and three lengths of the U strip to 70mm.
Cut away part of the 30mm angle strip to make a 30mm wide 'tongue'
The face of the can be lapped to create an even flatter surface for the LED to attach to.
This will enhance the heat transfer from the LED to the heatsink.



Modifying the torch body

Dismantle the torch.
You should have a switch assembly, body and lens.
The head strap and bracket are not shown.



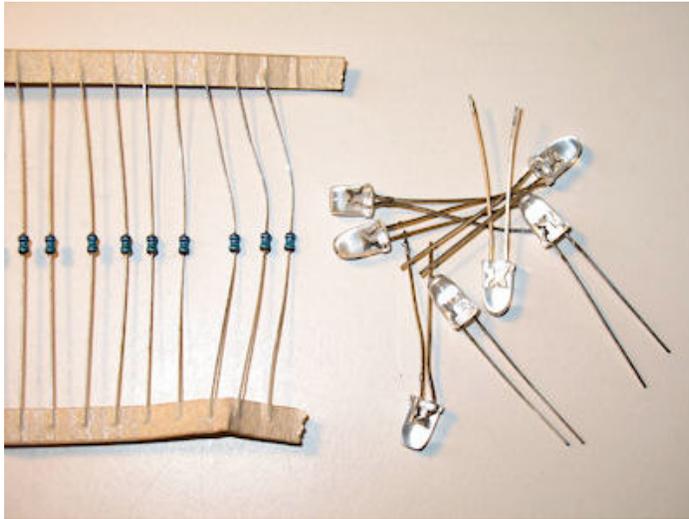
Cut away most of the internal plastic where the bulb sat.
Also remove any metal strips from the battery compartment.
Cut a slot for the 'tongue' using a hacksaw to start and finish with a needle file.
Make the slot only just big enough to slide the tongue in. The less gap the better.
Drill a 5mm hole from the bulb compartment into the battery compartment for the wiring to pass through.



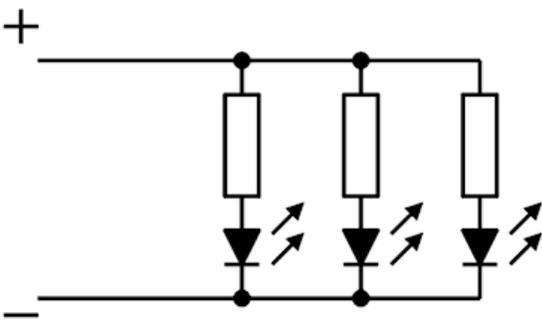
Drill a 5mm hole in the end of the battery compartment and fit the grommet.
The hole may need a little filing to open it up a touch, though not too much as we are looking for a watertight seal.
Soften the grommet in hot water before fitting.

Making the backup LEDs

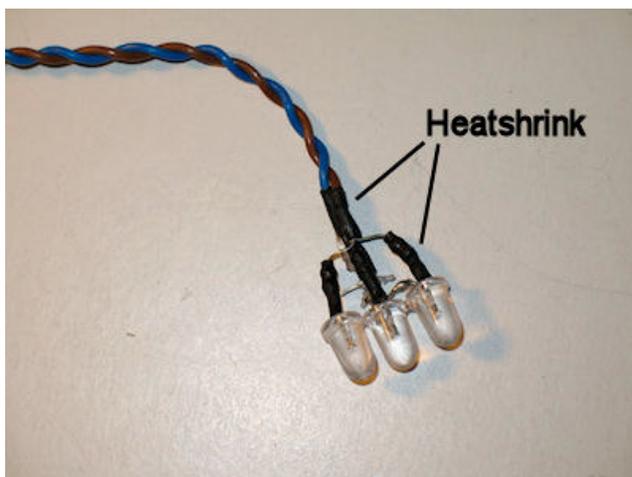
These are three low current LEDs that provide an 'always on' backup should the switch, LED driver or main LED fail.



Connect the LEDs as below.



The finished LED assembly.
The solder joints are insulated with heatshrink.



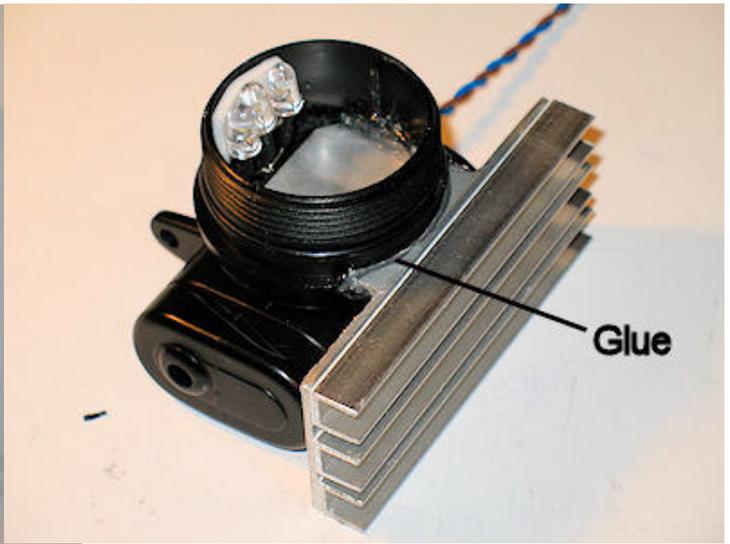
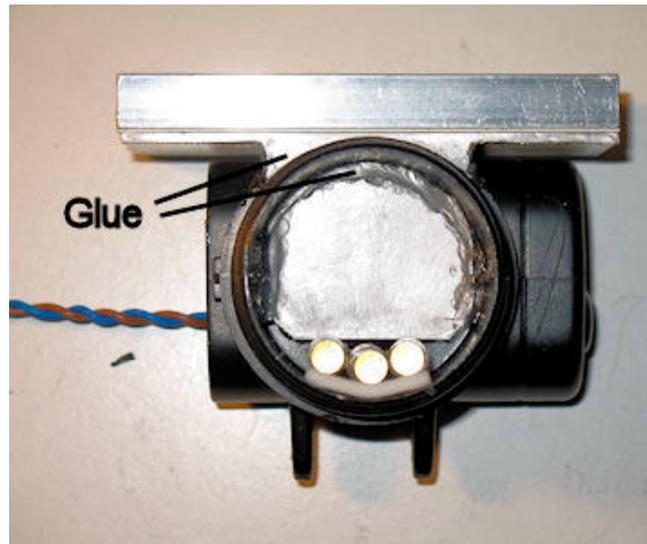
Fitting the heatsink and backup LEDs

Attach the U strips to the angle strip using the thermal transfer tape to make the complete heatsink.

High powers LEDs can generate a lot of heat and require a heatsink to keep them within their operating temperature range.



Push the backup LED wires through the hole and fix in place. A sticky pad works well. Glue the heatsink into place, ensuring the slot is filled all around the tongue. Evo-Stik 'Serious Glue' gives a strong but waterproof and flexible seal.

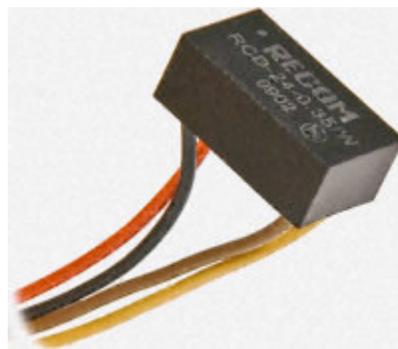
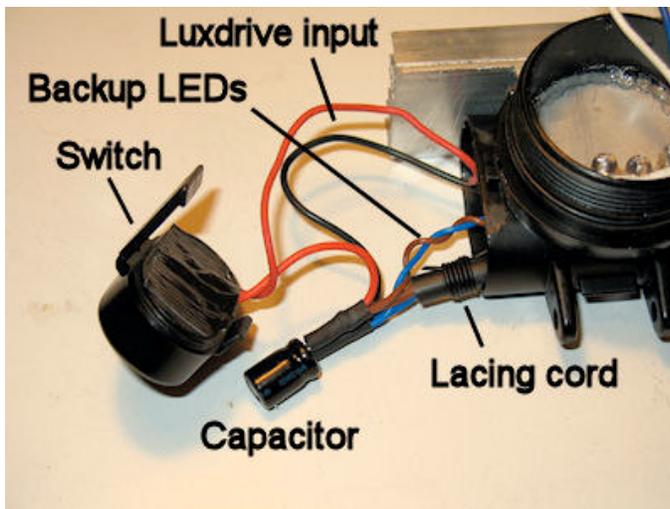


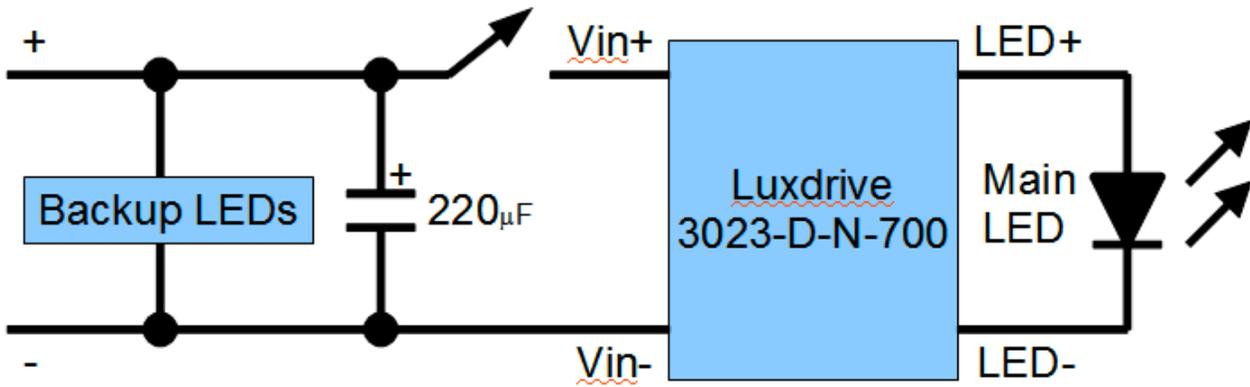
Connecting the power supply

Cut a 1.2m length of cable and feed through the grommet in the torch body.
Lubricate with a touch of silicone grease.



Connect the power supply, switch and capacitor, passing the white & blue LED wire through the hole to the bulb compartment.
A few turns of lacing cord or something similar will be needed to stop the cable from being pulled back out of the grommet.





Smear a little silicone grease around the edge of the switch assembly before refitting.

Fitting the main LED and lens

Cut a piece of thermal transfer tape to fit the back of the LED and attach.

Before fitting the LED connect the blue & white power leads.

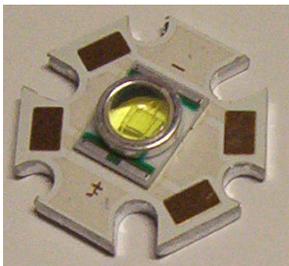
Peel off the backing from the tape on the LED and carefully press it onto the heatsink tongue.

Make sure there is enough clearance for the lens.

The lens will require a part of the base to be ground back to allow clearance for the LED wires.

A little bit of experiment before fitting helps.

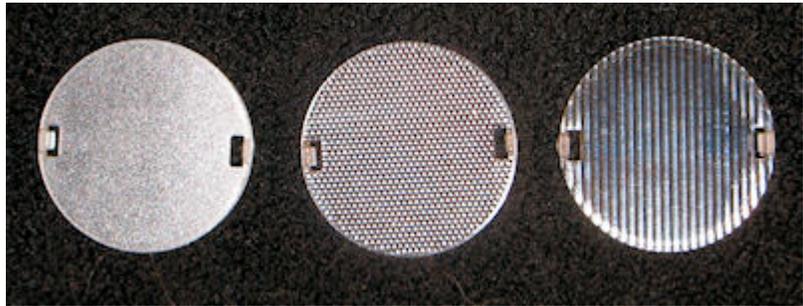
The lens comes with a sticky backing, but I removed this and attached the lens with more 'Serious Glue'.



The standard lens throws a 6° narrow beam. 'Clip on' diffusers are available to widen the beam spread.

There are 8°, 16° and 8° x 25° patterns available.

The 16° diffuser gives a good compromise between distance and spread.



Finishing the torch body

Screw on the front lens cover (touch of silicone grease on the threads) and attach the head strap bracket.



Building the battery pack

The battery packs are built around 7.2 Volt NiMH radio control sealed units.

Below is a 4500mAh pack, which would give about 11 hours runtime.

A 3000mAh pack would give about 7.5 hours.



The battery pack is housed in a plastic box. (Maplins N46CA - BM11 ABS Box Black)



Separate the box and drill a 5mm hole in one half.



Insert a grommet.
The hole may need a little filing to open it up a touch, though not too much as we are looking for a watertight seal.
Soften the grommet in hot water before fitting.



Cut a 200mm length of cable and feed through the grommet.
Lubricate with a touch of silicone grease.
Attach the Tamiya connector.



Connect the battery pack and fit into the case. This is a snug fit!



Refit the case lid. To make the case watertight apply a small amount of sealant around the edges and screw holes.



The connectors

There are many different connectors that can be used to attach the battery pack to the torch. I used Bulgin's 'Micro Buccaneer' series.



Torch connector



Battery connector



If you have any questions you can contact me on swcc <at> wellbelove.co.uk