

[http://club.cycom.co.uk/hotwire/Hot\\_wire\\_cutter\\_for\\_polystyrene\\_foam.html](http://club.cycom.co.uk/hotwire/Hot_wire_cutter_for_polystyrene_foam.html)

## Instructions to construct a hot-wire polystyrene foam cutter

These instructions are intended to make a cutter for expanded polystyrene foam sheet of 5cm thickness. The cutter is suitable for cutting wind turbine blade sections designed using the [club cycom software](#). Only use to cut polystyrene foam since other materials (such as polyurethane foam) will give off toxic fumes.

Buy 1 standard 100 watt soft soldering gun . The cheapest (maybe 10 Euros), most basic model should be purchased with no controls other than the on-off trigger.

This gun will contain a transformer which transforms the mains supply voltage down to a very safe 0.3 volts AC. This very safe low voltage can then cause a high current (100s of amps) to flow in a low resistance copper loop.

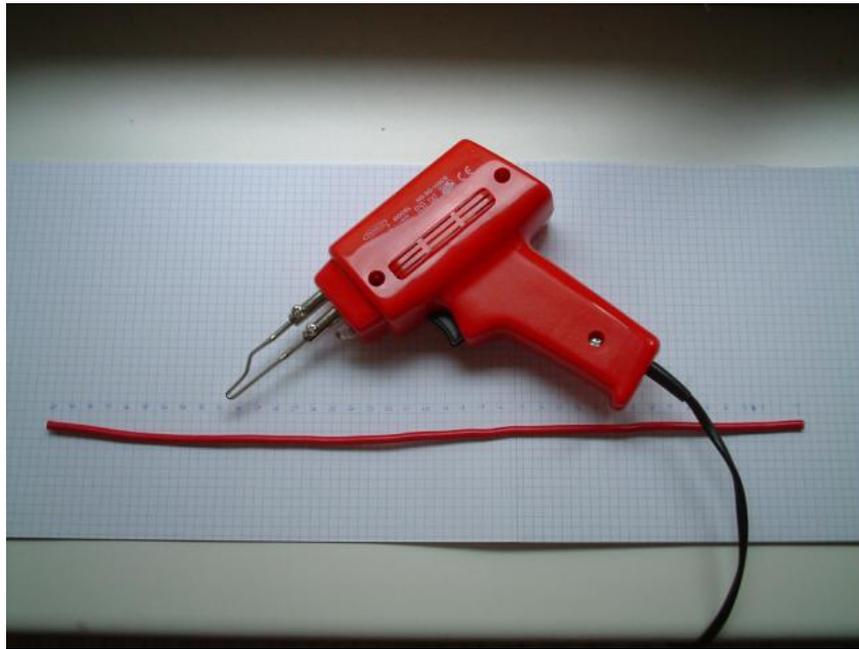
The gun is supplied with a copper loop, plated to minimize corrosion, and will get hot enough to melt solder. Less power is required to melt polystyrene foam and so we can replace the loop intended for soldering with another loop with higher resistance (still copper wire but with less cross-sectional area, and/or a longer length). The higher resistance loop will cause less power to be dissipated both in the loop and inside the transformer and so this modification will not damage or overload the soldering gun.

Buy a couple of meters of mains wire, intended to carry around 40 Amps in normal use (e.g. European Electric shower cable) which has a bundle of 7 wires per conductor such that the copper bundle of 7 wires will have a diameter of around 3 millimeters and will fit into the low voltage terminal posts of the soldering gun.

If present, remove the white outer sheath that binds the live-neutral-earth together so that you can separate the individually colored insulated conductors. You will use just one of the individually colored insulated conductors.

The 2 raw ingredients, (i.e. the solder gun, and the individually colored insulated conductor) are shown below.

Obtained from  
Omarshantedtrail.com



The example above uses a 40cm length of wire. Strip the insulation from the ends for 2 cm to allow insertion into the solder gun terminal posts.

Strip the insulation from the centre 10 cm and cut the outer 6 of the 7 wires leaving just the centre wire intact. The conductor will now have a high resistance section for the centre 10 cm and low resistance elsewhere.

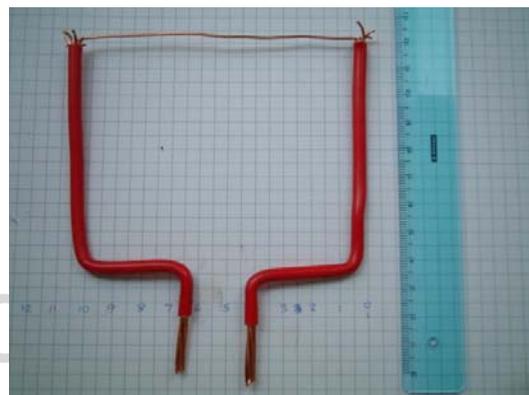
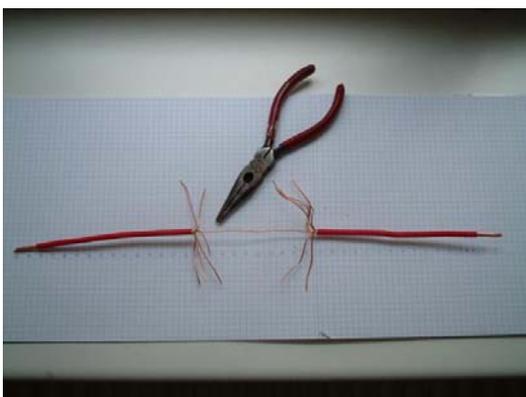
Ensure that each end of the conductor still has 7 wires and that you have not accidentally pulled the centre wire out.

The conductor should now appear as shown below.

Cut off the unused wires from the centre section, then bend the conductor into an appropriate shape for connection to the solder gun terminal posts.

The final conductor loop will now look as shown below.

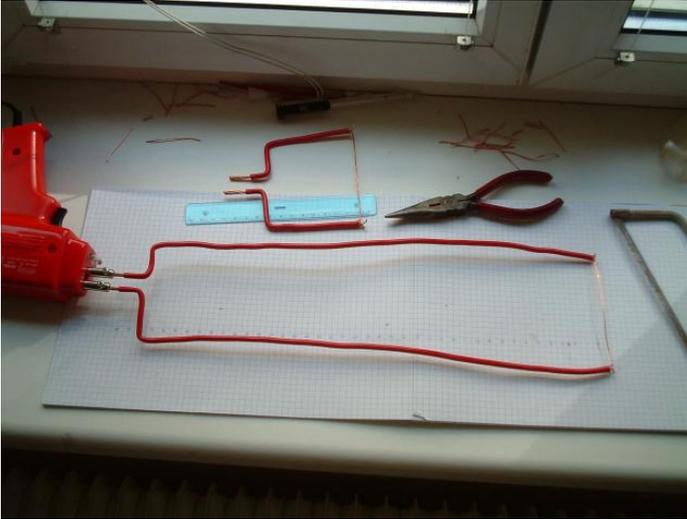
Connect the loop to the solder gun and tighten the screws of the terminal posts. The hot-wire cutter is now ready for use and will look as shown below.





If you are concerned, you can compare the AC voltage (with trigger pressed) at the terminal posts with the new loop fitted, with the voltage when the original soldering loop was fitted. If the voltage with the new loop is the same or higher than the voltage with the original loop then the power taken from the gun is not more than its design value and it will not overheat.

You can also construct a deeper loop (using 1m of conductor) for reducing a large polystyrene sheet to more workable rectangles. This loop is shown below.



You can download [an mpg movie of the small loop in operation \(348kb\)](#) or [an mpg movie of the big loop in operation \(481kb\)](#).

You can obtain an alternative source of high current/low voltage by threading the 40Amp cable once through the magnetic circuit of any > 100 watt transformer. (e.g. through the central hole of a toroidal transformer). If attempting to use a 12V car battery you will need to use a much longer (3 meters!) hot wire section, or switch the wire to a higher resistance material (e.g. nichrome wire from an electric fire or hairdryer).