# Building a Flash Steam Boiler



This live-steam boiler is very simple to produce and requires no silver soldering or machine work and can be used in many places around the workshop to provide drive for various steam model engines.

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## Building a Flash Steam Boiler

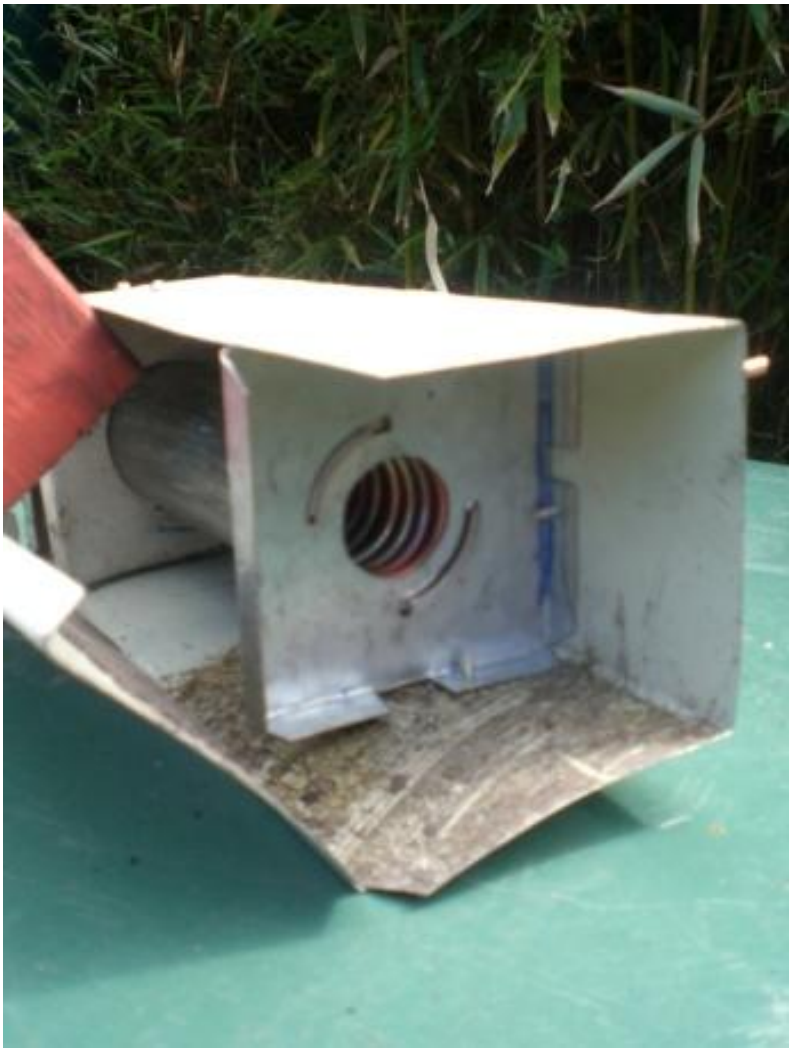
You want to build a **Simple Flash Steam Boiler** to drive your steam models?

And does "**simple**" to you mean no silver soldering, no machine work or anything complicated in the construction? And what if you could make it up for next to nothing?

Then maybe you can pick up some tips here with my first attempts at building a first live steam boiler.

It was produced as a trial run, with a proper one intended once the trial one was working properly, but I have to admit I moved on to other things once it was working nicely.

The first consideration was the need of a very simple design in the construction of this boiler and for this I used a 6 metre length of 5mm diameter copper tube (called a flash tube) that was originally for central heating, wound round a piece of timber I had handy with the outside diameter of the tube just fitting into the inside of another tube I had, being steel (but copper or brass will do just as well, as in the picture below, but do not use aluminium as should you run it dry, you may end up with molten aluminium in your boiler, plus aluminium is brittle if you try to use it for piping and will break at such a small diameter).

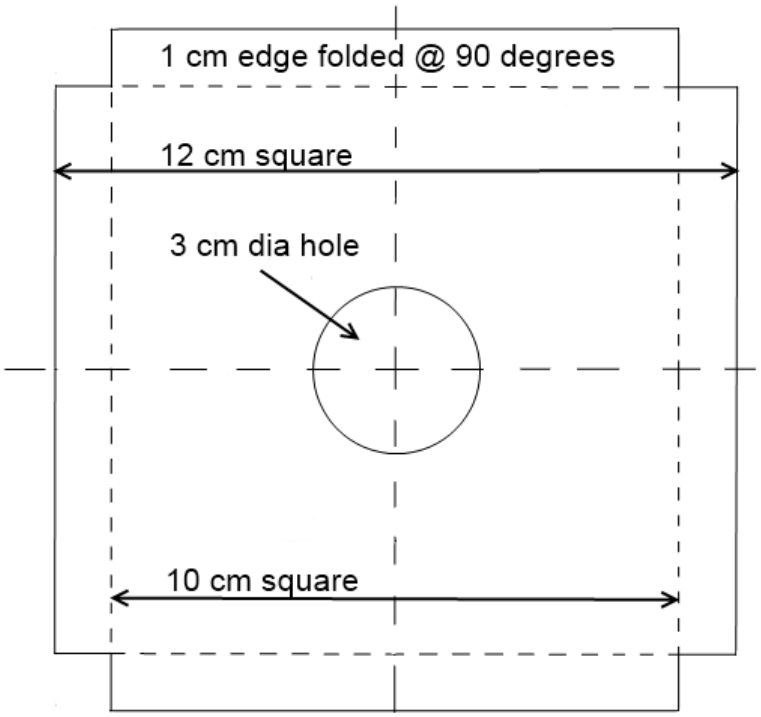


This second tube, let's call it the boiler barrel, was 20cm long with an outside diameter of 50mm - the wall thickness was 3mm if I remember rightly - it was a lump of tube I had to hand, but as this part does not need strength using half that thickness is fine.

All this barrel is for is to direct the flame along its length that way heating the coiled copper tube inside. Another point here is that the thinner the tube, the less metal needs to be heated, so the flash tube takes in more heat and the boiler is ready for action that bit sooner, and an added bonus is it is also easier to work with.

The barrel needed some plates making to keep it in line inside the main boiler body, keeping it in an upright position, and these plates were 12cm squares (cut from old computer side panels) with lips on the edges to provide fastening points to the main body itself as can be seen in the picture above *(the missing piece of the edge at the bottom of the plate lip was already cut away in the original computer design*).

There were three of these plates, all twelve cm square and folded in at one cm along the edges with the corners cut away to help the folding.




**TOP PLATE ARRANGEMENT**

The top one has a hole in the centre at 3cm diameter for exhaust purposes (nothing hard and fast here as the hole can be larger and partly blocked easily if needs be) and is secured in place with self tapping screws.

The mid plate, sitting around 3 cm from the top, is used to keep the boiler barrel sitting centrally in the main boiler body, that way keeping the exhaust way open. It sits on the outside of the boiler barrel, a tight fit - in my case 5cm, and is secured to the main boiler body in the same way as the top plate.

The bottom plate is the same as the top plate with a little extra metal removed (later).

## BOILER BARREL

The top of this simple steam boiler barrel needs a hole filing from the end inwards to allow the flash tube to pass from below the top plate inside the boiler barrel to the outside of the boiler body as can be seen in the drawing below, while the same needs doing for the bottom plate.

Also at the bottom two grooves need filing away to allow two tongues at the base of the boiler tube to stick through the bottom plate as can be seen in this picture, that way keeping the bottom of the boiler barrel central once again. Fine, it is not sitting level here, but it is central as required.

As my boiler tube was 3mm thick I needed to drill and file away two slots in the bottom plate for the tongues at the bottom of the boiler tube to sit in, all marked from the centre of the bottom plate.

The tongue positions were arrived at by dividing the end of the boiler tube into four equal segments and marking the end. From there it was a matter of using a hacksaw to cut down the length of the barrel in these positions to a depth slightly over the thickness of the bottom plate so that the tongues would just poke through.

To find the positions on the lower plate, each side was marked centrally and where these crossed the inner and outer diameter marks of the boiler tube on the plate, were drilled smaller at first and opened out with a small file. (Please ignore the blackness on the inside as this was where the adhesive was for the heat pad inside the microwave body).

The lower end of the flash tube needs to sit directly above the bottom plate (not seen in the bottom up picture above), and for this reason needs the slot filing in the bottom of the barrel to allow the flash tube to poke out through the side of the box at just above the bottom plate level.

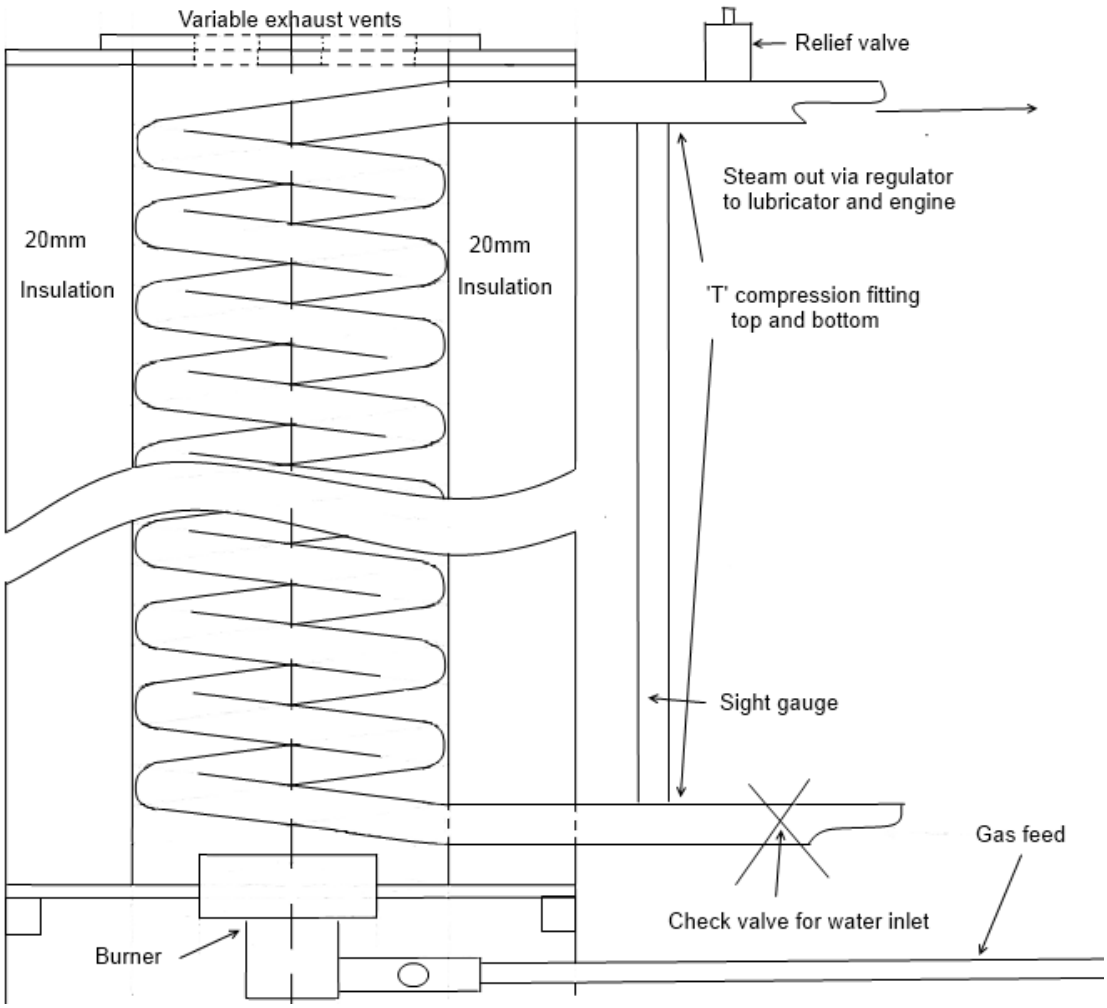
Here you can see the layout of the piping sticking from the boiler shell with a similar boiler tube containing a fire tube (although wound the opposite way to produce a matched pair initially) to the rear. These boiler tubes were originally pressure vessels for carbon dioxide for beer and wine making purposes with both the top and bottom removed.

The outer cover for the boiler is in this case a single sheet recovered from a microwave measuring 25cm tall (plus 1 cm for the lip at the top) X 42cm (allowing a surplus for the lip on the left of this picture).

Also included in this picture is the burner (*suppliers at the bottom*) for this simple steam boiler, having a 28mm internal diameter neck on it so that a 30mm hole in the centre of the bottom plate is a snug fit and keeps it in place with the hot flame rising upwards between the coils of the flash tube.

The burner itself sits on a block of metal to support it so that it just sits in the hole - it can be secured if you wish, while the gas pipe is fed from a propane/butane gas bottle.

The drawing below is from a later version and shows a 20mm insulation gap around the outside of the boiler tube, but for this first one the thickness was 25mm. It also has thicker tubing for the flash tube but it gives you an idea of how things fit together and shows how it should look if done properly rather than codged like my first.




My first boiler was built from gathered together bits and pieces, using nothing more than a hammer, screwdriver, hacksaw and files, along with a drill and various bits. It was very inexpensive to produce, the costliest parts being the heating arrangement, with the copper tube and fittings adding to the price. The remainder were recovered from an old computer and an old microwave which were both destined for the tip. These were used for the bodywork.

Fibreglass roofing insulation is pushed in between the boiler tube and the boiler body to retain the heat.

To complete this boiler a sight glass is needed to make sure there is water in the boiler, and for this you need two 5mm (7/32nds of an inch) “T” connectors fitting to the inlet and outlet pipes, preferably sitting close to the boiler body. These are compression fittings and can be sealed with a small “O” ring for the glass connections.

This will give a top and bottom connection for a short length of 5mm pipe with a 5mm glass at the bottom, along with a connection at the top for a relief valve (most important), a

regulator to control the flow of steam, with a lubricator feed before entering your steam engine.

The bottom connection working away from the boiler needs a one way (check) valve to keep the pressure in the boiler, then a hand pump fed from a water tank.

All that has so far been described can be made without any silver soldering which is normally necessary for steam engines, but requires you to use the pump frequently in very small quantities to keep a regular amount of steam production going and keep the water at the right level.

An extra way of improving this is to have a larger pressure vessel sat between the sight gauge and the pump on the bottom boiler tube to hold water and compressed air, that way feeding the boiler as the boiler pressure drops. This tube needs to be upright with the connection at the bottom, maybe a 21mm tube of 100mm length, and a fitting across the top to seal it. What will happen is that when you assemble this the tube will contain air, so that as you pump water into your boiler, some will go into this tube.

Now as your boiler pressure builds and you try to pump in more water, the tube will take in more water as the pressure in the tube matches the pressure in the boiler, and this allows you more time between refills.

This type of boiler is called a mono-tube or a flash tube boiler as it contains water to a height of around 2 or 3cm and any water inside the upper part of the tube is flashed quickly into steam.

Because there is a very limited amount of water contained within the boiler tube itself, there is less likelihood of any dangerous explosion normally associated with steam boilers, as should there be a leak, more than likely it will be inside the boiler itself, which is double walled, and the exhaust gases carry the minimal volume of steam to atmosphere. So providing you do not decide to look directly down the boiler barrel from above, you should be safe.

This type of boiler is really well suited to an oscillating engine in that it can give a high pressure in a relatively quick and safe manner, but can also provide a lower pressure if needed very easily, just by adjusting the gas flame, blocking up the exhaust hole a little or changing the volume of water being pumped in.

As a general rule, I would run this at 50lbs/sq inch (3.5 atmospheres) in a very safe manner, as these copper tubes are able to withstand more than 1,000lbs/sq inch before rupturing, although I doubt the fittings would get anywhere near that pressure.

The limiting factor here is the compression fittings for this simple steam boiler, so best stay safe and keep the pressure to a sensible level for you own safety.

One other point is that there needs to be a good air supply below the bottom plate to feed the gas burner.

**Suppliers**

http://www.steamshed.com - beginner's guide to steam related topics, plus **PYRTE**, the easy build **P**ull **Y**ou **R**ound **T**raction **E**ngine.

http://www.maccmodels.co.uk - steam fittings supplies, plus tubing.

http://www.clevedonsteam.co.uk - gas burners, jets and camping gas bottle fittings.

Happy steaming,

Lima (Supervised by my dad - George Hughes of Steamshed.com fame – he helped with the drawing.)