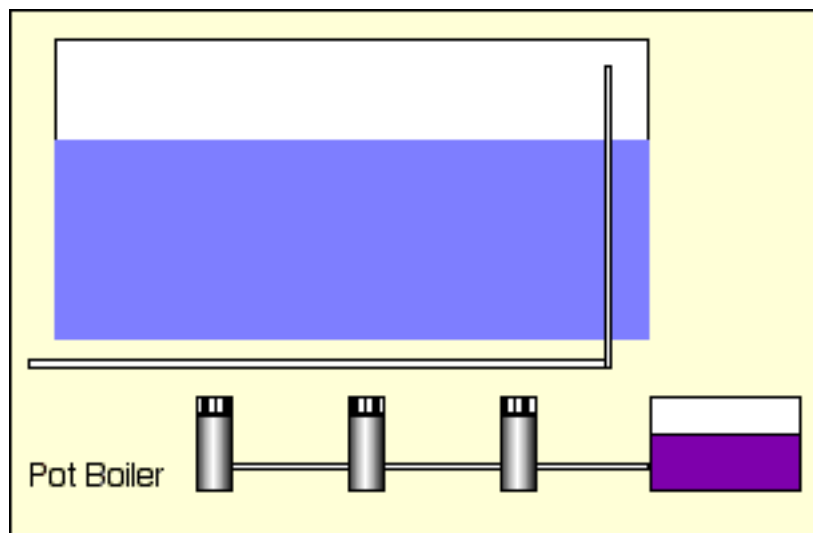


Types of Boiler for Model Locomotives

While the steam locomotive boiler has been made in scales as small as 7mm and electrically heated ones for 4mm scale, at Gauge '3' there are several choices of boiler to power the cylinders. All the boilers described below are made from copper and with superheaters normally made from stainless steel. For ease of drawing all but one of the drawings show "meths" burners being used.

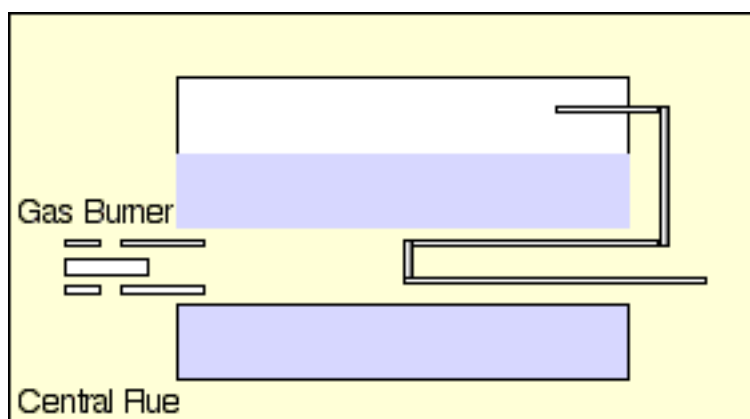
1: The Pot Boiler.

This is normally seen as the lowest common denominator of locomotive boilers. However it is very simple to build and has few design problems. The most common application for this type of boiler would be in a "tank" engine where the outer tank walls would disguise the enlarged "Combustion Chamber", around the boiler barrel and thus surround the boiler with hot fumes cutting down on thermal losses.



The steam collected then passes through the flames to provide some form of superheating, (although given the amount of thermal efficiency -this could accurately be termed as a "drier"). It is cheap simple and reliable and has much to commend it for a first time builder -or a builder without a large amount of equipment. It could power one medium size single acting cylinder or two small size single acting cylinders.

2: The Gas fired Central Flue Boiler.



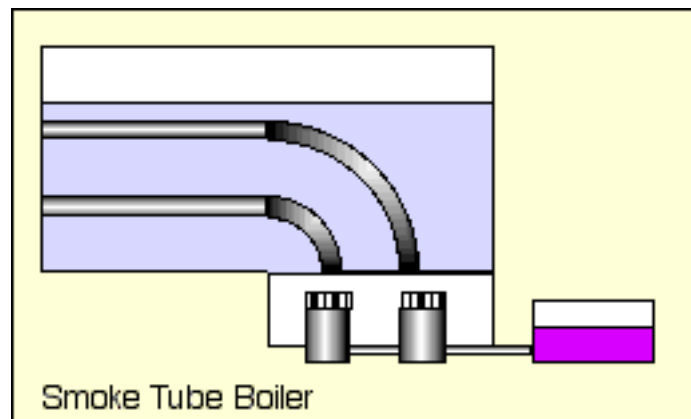
This type of boiler has been popularised by the 16mm scale producer "Roundhouse" and has become almost the "de facto" method of producing a boiler at this scale. The type of

burner used varies from a simple, “bunsen bar”, (a tube with slots in it), to sophisticated ceramic radiants similar to gas fires, (these are claimed to be far more thermally efficient). Information about types of gasses used and types of gas burners are covered elsewhere in the Technical Manual. Much of the strength of the boiler is due to the large central flue -but additional longitudinal stays should always be added. This may be classed as a slightly harder boiler to build as it introduces the concept of “step soldering” to the construction of the boiler. Please refer to the section on silver soldering for more information. The superheater is a simple U fed down the central flue.

This boiler is slightly harder to build than a Pot boiler -but is thermally more efficient as none of the hot gasses escape without coming into contact with a water surface. Some theories state that this is not an ideal boiler due to the low surface available for heating -but there are examples of multiple flues each with their own burner. This type of boiler has been described by an owner as; “boringly easy to get going”.

3: The Smoke Tube Boiler

This is the next progression after the “Central Flue” type. Here the exhaust fumes from the burners pass through tubes on their way to the smoke box. This type requires an external fan to produce the suction to draw the hot gasses through the tubes. The tubes provide a larger heating area at the price of more complex construction.

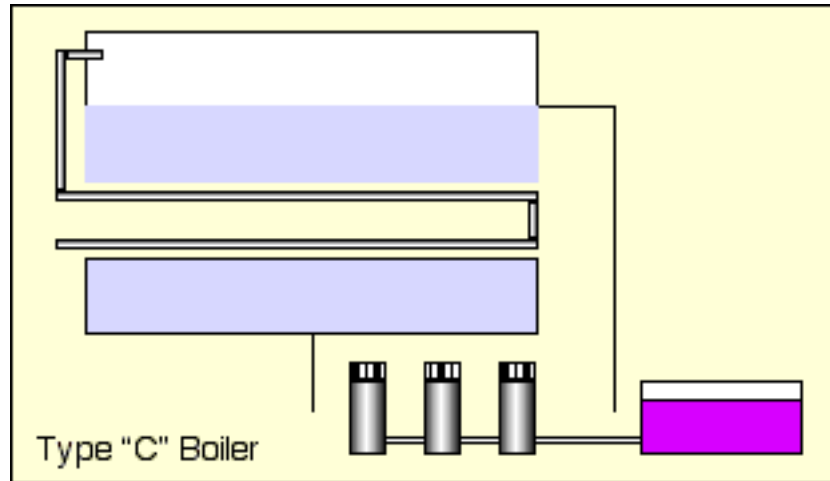


This is thermally quite efficient as the flame and all the exhaust gasses come into contact with water surfaces. Care must be taken that the rate of flow through the smoke tubes is high enough to provide the burners with air and not “choke” them. Superheating is normally done via a coil in the “firebox” . The 1:60 ratio of smoke tube bore to length has to be closely calculated as it can be seen that the tubes follow differing arcs and are thus of differing lengths... Because the smoke tubes exit the boiler at right angles at both ends the production of the holes is not that difficult. Careful clamping of the boiler barrel against the side thrust of the curve of the barrel against the drill will ensure a clean **vertically circular** hole. A common ploy is to use an old “end mill” and take it **SLOWLY** vertically down into the boiler barrel using a pillar drill -however this method is **VERY** noisy... The main problem with this boiler is fixing the longitudinal stays between the smoke tubes at the smoke box end.

This would be classed as a boiler that has to be designed and calculated quite precisely -but has no real complex flanging or build problems. Assembly and care with “step soldering” are the main constructional problems here. The sheet metal fire box can be soldered on, and apart from using an external suction fan - then progressing to a blower operating it is fairly easy. This type of boiler has been described by a builder/owner as: “a fiddly b@st@rd to build, but I like them -and all eight of my locomotives have them”.

4: The Type "C" Boiler.

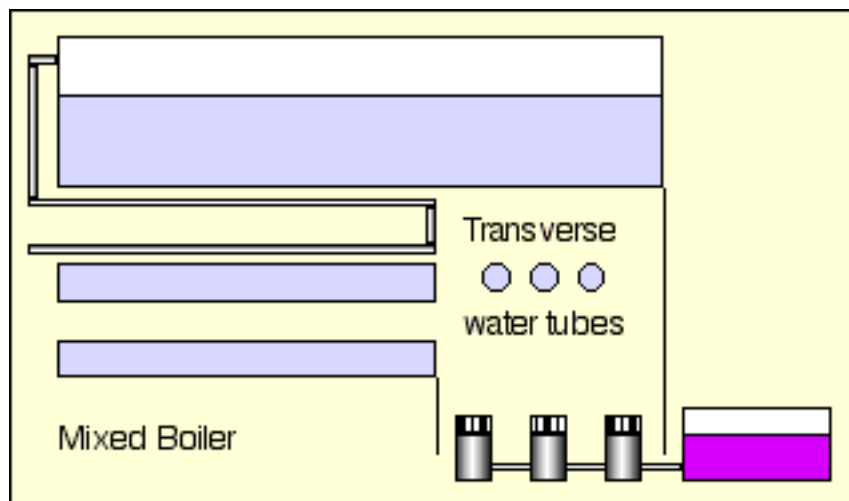
This was developed by John T. van Riemsdijk of G1MRA and is very popular with G1MRA members. It can be seen to be a cross between a central flue and a pot boiler, in that the flames from the burners heat the surface of the boiler and the waste gasses pass through a flue in which sits the U shaped superheater. Thermally this boiler is at least as efficient as possible in that only the firebox does not have a water surface.



There are no great construction problems simple flanging to produce the barrel ends and the flue hole are all that are really required. However there is one problem with this boiler, and it has to do with the thermal stresses on the firebox. The firebox is normally of sheet metal and VERY CAREFUL choice of silver solders and thickness of metal are required to ensure that the firebox does not impose too high an expansion stress on the rear of the boiler barrel when uniting the two. Other than this constructional problem this boiler has much to commend it and it is justifiably popular.

5: The Mixed Boiler.

This type of boiler is the one used by G1MRA for both their "Project" and "Dee" locomotives. It consists of three lateral inclined water tubes within an inverted U section at the top of the rear of the boiler with the exhaust gasses passing through the flues. The use of an inverted U produces a more rigid and stronger section and eliminates complex transverse staying.



The firebox is of simple sheet metal and is soldered on. This type is commercially available

for both locos and is normally listed on most commercial sites. It is very robust and a good steam raiser. There are no real constructional problems other than the construction and fixing of the transverse inclined water tubes in their U shape. Close attention to step soldering is required when assembling.

6: The Stephenson Locomotive Boiler.

This the most difficult to build of the designs here. It is however, thermally the most efficient. There are several published designs for various locomotives and the builder is advised to stick to one of those. This is not to say that a good design cannot be roughed out by the builder and it is assumed that the builder has had a good mathematical “look” at the figures... The design requires calculations of stays, flanging lengths, and metal thickness.

