

3" Centre Flue Vertical Boiler Operating and Safety Instructions



Thank you for purchasing a model steam boiler from Chiltern Model Steam.

PLEASE CONTACT US IF YOU HAVE ANY QUESTIONS OR COMMENTS ON IMPROVEMENTS

NOTE: PLEASE CLOSELY FOLLOW THE FOLLOWING INSTRUCTIONS AS INCORRECT OPERATION OF THE BOILER CAN CAUSE DAMAGE AND INJURY TO YOURSELF AND OTHERS.

The 3" Centre Flue Vertical Boiler has been designed to run small to medium pressure model steam engines of up to:

- Single cylinder; 14mm (9/16") bore and 19mm (3/4") stroke
- Twin cylinder; 12mm (1/2") bore and stroke

Overall Dimensions:

- Cylinder Diameter: 3 inch (75 mm)
- Max Length (inc burner and valves): 4.25 inch (105 mm)
- Height of Boiler: 5 inch (125mm)
- Height to top of steam flue: 9.25 inch (235 mm)
- Weight dry: 2.2lb (1.02 kg)
- Working pressure: 35 psi (2.5bar)
- Test pressure: 120 psi (8 bar)
- Boiler fill capacity (75% of total volume): 355ml

General

With a little care the boiler should last many years without any decrease in efficiency or output.

Water level gauge sight glass/tube, chimneys, pressure gauges and some other fittings may be removed for transit to avoid damage. They can be found in their own packaging inside the box.

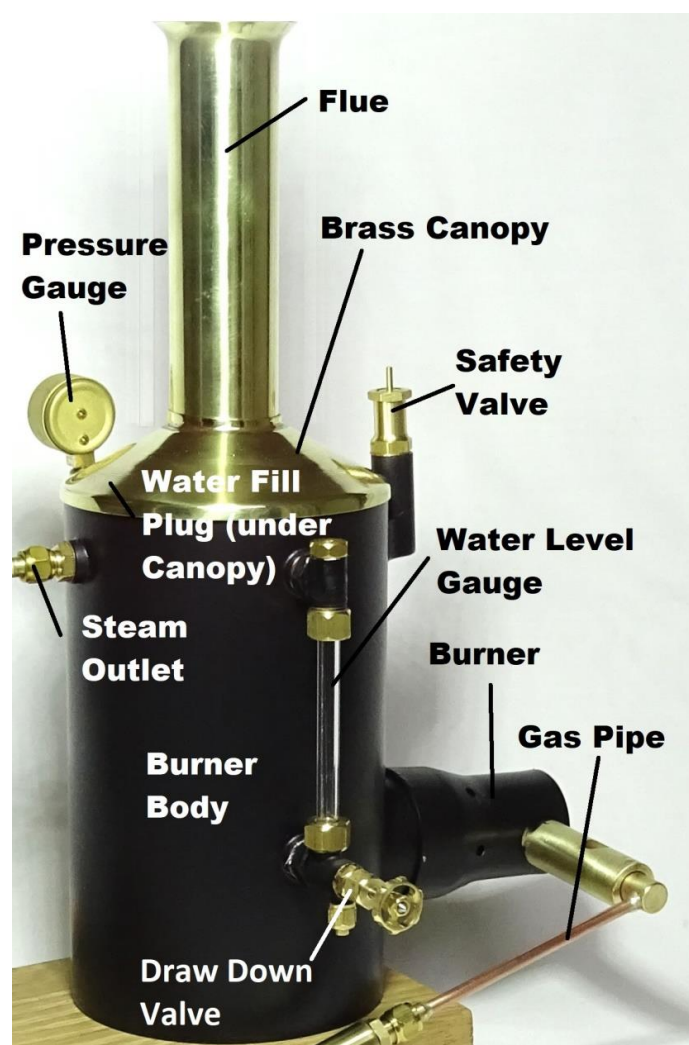
Water level gauge sight glass O rings and nuts require only to be finger tight and should not require additional tightening. Similarly pressure gauge and safety valves.

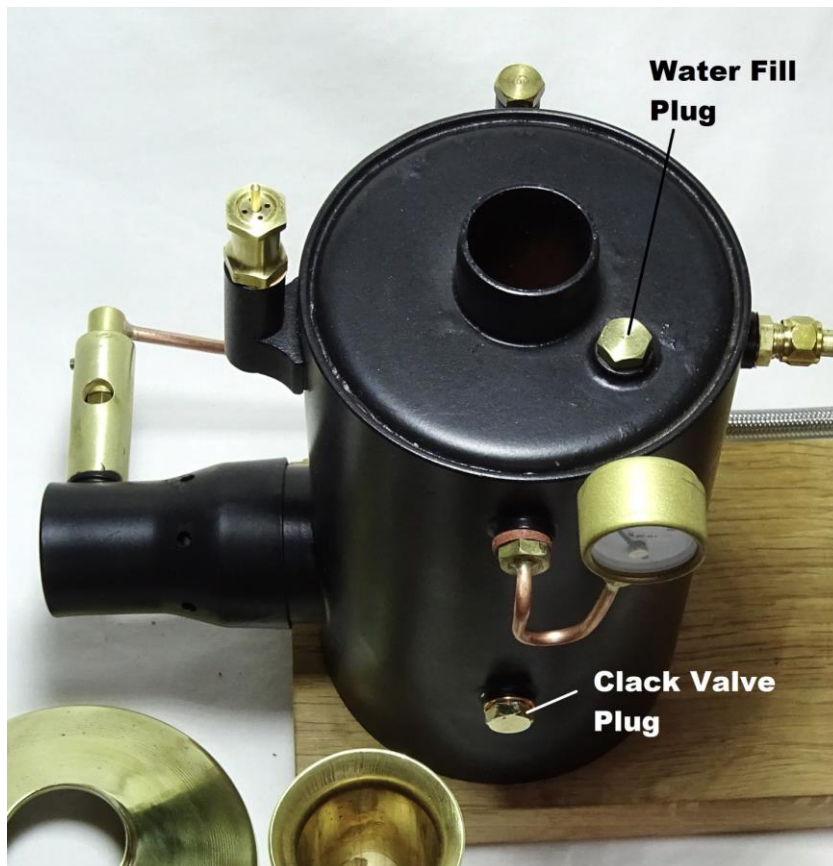
When new, the boiler has during construction been heat treated and so is very ductile. Great care must therefore be taken when handling the boiler to avoid denting and to not over-tighten any threads - never tighten with a spanner. Over time the whole boiler will work harden making it much harder.

IMPORTANT SAFETY NOTICE

THE BOILER MUST BE OPERATED IN A WELL VENTILLATED AREA TO PREVENT THE BUILD UP OF CARBON MONOXIDE. NEVER LEAVE THE BOILER UNATTENDED WHEN THE BURNER IS LIT - ALWAYS TURN OFF THE GAS. THE USE OF A CARBON MONOXIDE ALARM IS ADVISED.

NOT SUITABLE FOR CHILDREN UNDER 16 YEARS OLD.





Safety Pressure Valve

The boiler is fitted with a safety valve to prevent the steam pressure rising above the maximum allowable working pressure. It must not be adapted to increase this value.

The safety valve will start to release/blow off as the pre-set operating pressure is reached. It is factory set to start venting steam as per the test certificate/specification.

During operation, check that the safety valve is releasing and not allowing the pressure to continue to rise - do this by opening the outlet valve.

If the safety valve does not appear to be working properly it can be removed by unscrewing. The valve consists of a ball bearing/spring which needs to move freely. Clean and lubricate as needed or replace.

If the safety valve becomes defective in any way do not use the boiler and repair or replace the valve.

Pressure Gauge

The pressure gauge and its siphon pipe are easily damaged and can if needed be removed. The cone fitting does not require sealing but be careful not to overtighten when replacing. If required, the siphon pipe can be bent to a more convenient position but this must be done with care.

Steam Connection to Engine

The boiler should be securely connected to the steam engine by a pipe specifically designed to withstand the operating temperature and pressure of the boiler - preferably a copper pipe with silver soldered connections - these are available ready made from Chiltern Model Steam.

The boiler's steam outlet valve has a 1/4"x40tpi ME connector which takes 5/32" or 1/8" pipe ferrules. This thread is the same as the inlet/outlet on all Chiltern Model Steam engines.

Boiler Filling

The boiler fill plug, as shown on the above photo, is used to fill the boiler with water whilst the boiler is inactive, i.e. the burner is not ignited and unpressurised.

Distilled water is recommended, as sold for battery topping up, but clean soft water can be used if this is not available. Dehumidifier, condensing tumble dryer or even rain water is also an acceptable alternative, provided that it is adequately filtered for example with paper wine filters. Do not use demineralised or de-ionised water, as this is not the same as distilled water and could cause long term damage.

Remove the boiler filling plug and fill the boiler with clean water. There has to be a space above the water to allow steam to be raised - ideally fill to just below the level of the steam outlet to the engine.

A tube from a garden pressure sprayer or large syringe can be used to fill the boiler. To allow air to escape while water is being pumped into the boiler, disconnect the steam outlet pipe and open the outlet steam valve.

Replace the boiler filling plug - do not over tighten.

TIP: Using hot water will reduce the time taken to get the boiler up to steam, hence saving gas.

Boiler Water Level

Care should be taken to always ensure that there is sufficient water in the boiler whilst the burner is lit. The boiler could otherwise be damaged.

Turn off the gas to the burner immediately if it is suspected the boiler is running low or if steam stops coming from the boiler.

Boiler Water Level Gauge

The water level gauge if fitted will provide a visual indication of the amount of water in the boiler.

If bubbles get trapped in the water gauge's glass tube making it difficult to get an accurate reading, use the draw down valve on the base of the water gauge to vent a little air/steam. Take precautions as this will be scolding hot.

The water gauge has a replaceable 5mm glass tube which can be accessed by removing the blanking nut on top of the gauge. Replacement tubes are available from multiple model engineering suppliers. Only finger tighten the tube retaining nuts.

Gas Regulator/Valve and Pipe

The connection of the gas supply should be checked before every use.

If the optional Chiltern Model Steam Gas Canister Regulator and Pipe is not being used, ensure that there is a valve connected directly to the gas canister or tank which can be used to turn off the gas supply. The gas regulator/valve should also be capable of graduated control of the supply to the gas burner once the boiler is up to steam.

The supply pipe from the canister/tank must be connected securely to the burner's gas jet carrier, use PTFE tape to get a good seal on the threads. Check this if the optional regulator/pipe adapter is purchased from Chiltern Model Steam. Also check the connection of the regulator to the canister/tank is secure.

Pressure Vessel Care and Maintenance

It is recommended that the boiler be drained after use.

Boilers do have a finite life so it is recommended that if the boiler is used regularly or operated in public it should undergo the following checks, carried out by a “competent person”, club, society, or pressure vessel manufacturer, every one to two years:-

1. Thorough visual inspection.
2. Hydrostatic pressure test to not less than 1.5 and not more than 2 times the maximum working pressure.
3. Steam pressure test to check the correct functioning of the safety valve.

Burner Setup

The ceramic burner converts gas into heat by burning a gas and air mixture in the burner assembly to create heat.

There are two components that enable the adjustment of the burner flame.



The first is the gas pipe that delivers gas from the gas tank to the burner. It is attached to the gas canister by a pipe/regulator, nut and adapter.

The burner end of the gas pipe is soldered into a brass bar that holds the gas jet. The jet limits the amount of gas allowed into the burner.

The second component is the gas mixer tube fixed to the body of the burner and allows the jet holder to slide in and out. It has a locking screw for securing the jet holder.

Setup or calibration of the burner flame is carried out by sliding the jet holder in/out of the gas mixer tube which allows more or less air to mix with the gas via the hole in the mixer tube.

Please note that when the burner “roars” with a steady sound it is operating efficiently.

Recommended burner setup procedure:

- Connect the gas canister to the burner gas pipe and insert the jet holder into the gas mixer tube.
- Remove the burner assembly from the boiler and place it on a firm surface with the burner facing up. NOTE: the burner will become hot during the setup/calibration process.
- Start by sliding the jet holder in the gas mixer tube to leave the air holes about 2/3 closed.
- Turn on the gas a small amount using the canister regulator and light the burner. There should be a “lazy” flame flecked with yellow. If not, adjust the jet holder to achieve this. This position indicates that insufficient air is being added to the gas/air mix.
- Slide the jet holder to expose more of the mixer tube air holes until the flame becomes blue “dancing” on the surface of the burner. This indicates that there is too much air in the gas/air mix.
- Move the jet holder back to reduce the air hole exposure until a stable blue flame is evident. This is the optimum setting for the air/gas mixture.
- Secure the jet holder in the gas mixer tube in this position by tightening the screw.



- Turn the gas off and allow the burner to cool a little before reinserting it in the boiler fire tube.

Igniting the Burner

Once the burner is fitted in position on the boiler, it is lit by opening the gas valve and applying a lighted gas torch to the top of the flue/stack. The gas "pops" and burns back to the burner.

If the burner does not appear to ignite turn the gas off and allow the gas to dissipate. Then turn on the gas with a reduced minimum flow and then attempt to ignite.

Do not attempt to increase gas pressure until the burner has been lit for at least 30 seconds. If the gas pressure is increased too quickly the burner flame may blow out. Adjust the gas pressure until a stable burn is achieved. Every boiler/burner combination is slightly different so please expect a little 'learning' time to get to know what works best.

NOTE: using a lighted match is not recommended as burning gas at the top of the flue may burn the hand.

First Steaming

Although the boiler has been chemically cleaned there may still be traces of flux left inside. These will free themselves when the boiler gets hot and so it is recommended that the boiler be brought to operating pressure/temperature (20-30 psi) and the contents allowed to vent to atmosphere at least once prior to full operation.

It is important to not allow the water level to drop below the bottom of the water gauge glass whilst the burner is lit. The glass gauge indicates when the water level is getting low.

As mentioned above, do not completely fill the boiler with water as there needs to be space for steam to build at the top of the boiler – ideally fill to just below the level of the steam outlet to the engine.

Burner Gas Jet Troubleshooting

The tiny gas jet hole can become blocked by small particles of dirt or if left unused, making the burner difficult to light, burn weakly on cold days or fail completely. If any of these should happen, clean out the jet as follows:

1. Disconnect the gas supply pipe from the jet carrier. Note when connecting or disconnecting the gas pipe, do not use excessive force as it is possible to cause damage by bending the pipe.
2. Slacken the screw retaining the jet carrier in the burner mixer tube and slide it out.
3. Remove the jet from the jet carrier using a 4BA spanner. Wash out the jet in fast evaporating thinners (Cellulose or similar). Blow through the jet from the front, which should clear most blockages. Although the hole through the jet is tiny, if you hold it up to the light you should be able to see quite clearly if it is blocked or not. If in doubt, fit a new jet - they can be purchased from model engineering suppliers – the boiler is fitted with a No. 8 Gas Jet. Do not use wire to clean the jet as this can damage the precision hole and may upset the delicate balance of the gas system.
4. Reassemble in the reverse order, wrap a little plumbers PTFE tape around the jet's and other connection threads and ensure all gas connections are tight. Re-position the gas jet carrier in the burner mixer tube, as described above.

Boiler Mounting

The boiler should be secured to a base mounting board using M4 screws into the 2 M4 threaded bosses on the bottom of the boiler. Allow plenty of space around the boiler's base to ensure a free flow of air to the burner.

Gas Canisters/Tanks

For safety reasons ensure the gas canister or tank is located away from the burner in a secure location.

After extended use the pipe, gas canister or tank's surface can, in exceptional circumstances, become cold enough to stick to your skin, so use gloves.

If a gas tank is used please follow the supplier's installation and operational instructions especially for filling.

Positioning of the canister/tank is very important for both safety and good operation. Propane/Butane gas is stored as a liquid, but changes to a gas as it mixes with air. As gas from the top of the canister/tank is drawn off, more of the liquid below it turns to gas and this process causes a drop in temperature which also lowers the pressure within the canister/tank. If allowed to get too cold, then the pressure of gas can drop until it is insufficient to maintain steam production.

To offset this temperature drop, turn off the gas and let the canister/tank warm up naturally. It is also possible to make use of the conducted and radiated heat from the boiler to maintain a good working pressure within the canister/tank – this is not recommended for less experienced operators/builders.

If however, the canister/tank is allowed to get too hot, the pressure of the gas inside the canister/tank can become dangerously high and this must never be allowed to happen. It is important therefore that there is plenty of air space between it and any hot items such as boiler or steam pipes. The gas canister/tank should be slightly warm to the touch, no warmer.

Please refer to manufacturer's guidance and ensure that their maximum operating temperature is never exceeded. Usually the temperature of the canister/tank should not be allowed to get higher than 30 degrees Celsius.