



BT1 Boiler and Gas Tank type A

Installation and Operating Instructions for the BT1 Boiler and/or Gas Tank type A

These instructions cover the gas fired boiler and equipment whether supplied as the **BT1** set or any items if supplied separately.

The **BT1** set contains the following:-

Boiler 2" x 6 3/8" (162mm x 51mm) single flue boiler.
Brass boiler wrapper.
Boiler filling plug and 'O' ring.
Safety valve (40 psi blow off).
Pressure gauge (0 - 80 psi).
Steam regulator and handle (manual type).
1 Union nut & nipple fitted to regulator.
'FG' type Gas burner.

Gas tank Gas tank, complete with:
Gas filler valve.
Gas regulator.
8" of 1/8" dia. copper pipe.
2 union nuts and nipples.

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Gas Fired Boiler and Fittings

Boiler and steam fittings

The boiler is a single flue type, of copper construction, fully silver soldered and pressure tested. It is designed to operate at a pressure of 40 psi. A brass boiler wrapper is provided to make painting easier and protect the soft copper boiler from dints and scratches.

A cast brass smokebox is available from **ROUNDHOUSE** (part number CSB) which provides the front mounting. If however you are fabricating your own, it must be substantial enough to withstand the temperatures generated by the gas burner and any solder used must be silver solder. The gas system is totally enclosed in the boiler flue and requires ventilation at the front to operate correctly. To achieve this, the chimney size should be not less than 3/8" internal diameter and an air hole is required in the bottom of the smoke box, directly below the chimney of not less than 5/8" diameter.

No forced draft from either blowers or exhaust is required and indeed could have a detrimental effect on the burner. Ensure that exhaust pipes are taken up into the base of the chimney to minimise this effect.

Before mounting the boiler, remove the gas burner (2 brass screws) and all the steam fittings. These are just loosely screwed on for ease of packing.

On **ROUNDHOUSE** locomotives, the main steam pipe passes down the single flue of the boiler on its way to the cylinders to give a certain amount of superheating to the steam. If using this system, the steam pipe must be of stainless steel to withstand the hot gasses within the flue tube. A suitable superheater (part number SS) is available from **ROUNDHOUSE**.

The steam pipe to the cylinders should be installed before the boiler and smokebox which are then threaded over the pipe.

The brass boiler wrapper is to give extra protection to the boiler and make painting easier. External fittings could also be added by soldering or screwing to the wrapper, but ensure that nothing stands proud on the inside as this could damage the actual boiler.

The boiler is held at the front by plugging into the rear of the smokebox which should first be screwed firmly to the chassis. If using the Roundhouse smokebox, the boiler should be pushed in no less than 5mm and no more than 15mm.

The rear boiler mounting is by a single screw which passes vertically down through the mounting foot and into a suitable frame spacer or bracket.

Steam regulator

The steam regulator screws onto the male thread on the rear of the combined steam turret and safety valve bush on top of the boiler. Decide in what position the steam pipe connector is required to suit the layout of the model and, using the fibre washer supplied, screw on the regulator. It should screw on finger tight until it is about 45 degrees from the required position. If it does not, the fibre washer can be reduced in thickness by rubbing it on a flat file until this is achieved.

Now the regulator can be fixed in place using a little plumbers thread sealer or PTFE tape, with the final 45 degrees of rotation compressing the fibre washer a little to give a good firm seal, but do not over tighten.

Pressure gauge

The pressure gauge does not require sealing as the cone fitting takes care of this. If required, the siphon tube can be bent to suit the cab layout and place the gauge in a more convenient position but this must be done with care.

You will need two 4BA open ended spanners to tighten the union.

Safety valve

The safety valve uses 'O' rings both internally and externally to take care of the seals. It should be screwed into the boiler bush until finger tight. It is a 'slow release' type, which means, it gradually starts to blow off as the pre-set pressure is reached. It is factory set to start lifting at just under 40 psi. The normal working pressure of this boiler is 40 psi and during the first steaming, check that the safety valve is not allowing the pressure to rise above this pressure. The pressure at which the safety valve operates can be reduced or increased by screwing in or out the fitting in the top of the valve that the stainless steel rod protrudes through. A pair of tweezers or fine nosed pliers If screwed clockwise (down), then this will compress the internal spring and increase the boiler pressure. If screwed anticlockwise the pressure on the internal spring is reduced and the boiler pressure will lower. Usually no adjustment is required, but, if necessary, usually no more than half a turn is needed. Be aware that whilst you are adjusting the safety valve, hot steam will be released by the safety valve so wear gloves and take precautions.

Boiler filling plug

The boiler filling plug screws into the threaded bush on top of the boiler and again, uses an 'O' ring to seal. It is used to fill the boiler with water, and the correct level can be set by filling completely to the top and then removing 30 mls of water.

Gas System

Gas burner

The **ROUNDHOUSE** 'FG' type gas burner has been designed to operate efficiently within the confines of the centre flue and requires no adjustment other than initial positioning and the screw holes on the mounting flange are slotted to allow for this. Ensure that the superheater tube (if fitted) is well over to the left of the flue for its full length, then fit the burner to the boiler using the two brass screws provided. A cut-out is provided on the left hand side of the mounting flange to accommodate a superheater.

The right hand mounting slot allows the burner tube to be raised or lowered inside the flue and for optimum performance, it should be positioned to the bottom to allow maximum space above the burner for the gas to burn correctly.

Check that the jet is tight in the jet block (4BA spanner) then push the jet block into the burner body as far as it will go, (up to the step in the jet block) before nipping up the retaining screw.

Check all unions and connections and make sure they are tight.

Gas tank

The gas tank is constructed of heavy gauge metal, fully silver soldered and pressure tested to 500 psi at the factory.

Positioning of the tank is very important for both safety and good operation. Butane gas is stored in the tank as a liquid, but changes to a gas as it mixes with air. As gas from the top of the 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 tank. To offset this temperature drop, **ROUNDHOUSE** gas tanks are designed to fit in the locomotive cab or bunker where they can make use of the conducted and radiated heat from the boiler to maintain a good working pressure within.

If allowed to get cold, then the pressure of gas can drop until it is insufficient to

maintain steam production so it must be kept slightly warm to combat this.

If however, it is allowed to get too hot, the pressure of the gas inside the 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. Under normal operating conditions, the temperature of the tank should not be allowed to get higher than 40 degrees Celsius. Ideally, it should be mounted in the side or rear of the cab and the filler valve must always be to the top where it can be easily accessed. It can be disguised by a roof vent, dummy coal or other suitable item if required.

The standard system is supplied with a 1" (25.4mm) dia. by 3 3/4" (95mm) high tank, but if this does not fit your requirement, alternative types are available for fitting in rear bunkers or under cab roofs.

Please contact the factory for further details.

Gas filler valve

This is a self venting type and is supplied ready fitted to the gas tank and pressure tested for leaks at the factory.

The term self venting refers to the way it allows gas to vent out of the side of the valve as liquid is injected into the tank. This ensures that a full charge of liquid is received by the tank.

Should it be necessary to replace at any time, it simply screws out of the tank, and is sealed by a small 'O' ring.

Gas regulator

This is a needle valve and the body can be rotated to any angle by slackening the union.

It has an internal 'O' ring as its main seal, and, if not lubricated from time to time this can become dry with a consequent loss of fine adjustment to the burner. See the **Trouble Shooting** section.

Gas pipe.

When the tank and regulator have been fitted, the gas pipe can be made up with the union nuts and nipples. Use the 1/8" dia. copper pipe supplied and cut to a suitable length to reach from the regulator to the gas jet block. Avoid contact with any other pipes or fittings and silver solder the nipples to the ends of the pipe, remembering to first slide the union nuts over the pipe, checking they are

the correct way around so that they will then slide over the nipples to fix the pipe to the gas tank regulator, and the gas jet block..

Preparing for Operation

Filling the Fuel Tank

The filling of the gas tank should only be carried out in a well-ventilated area, where there are no naked lights or other lighted locomotives close by. Ordinary Butane or Iso-butane gas (as used in gas cigarette lighters) is the preferred fuel, though for economy, the larger canisters as used for blowlamps or camping stoves etc. are better. The larger canisters have an EN417 threaded self sealing valve on top and require a special adapter to couple up to the filler valve on the locomotive. A special brass gas filler adapter is obtainable from your local garden railway supplier or direct from **ROUNDHOUSE**.

Mixed gasses are also available and may be used if ordinary butane or iso-butane are not available, but see the 'Trouble Shooting' section for more information on this subject.

Before attempting to fill the gas tank, make sure that the gas control valve is closed by turning it clockwise.

The filler valve for the gas tank is on top of the tank. Invert the gas canister and place its nozzle over the gas filler valve. Support the tank from underneath and press the canister down. The gas will be heard hissing as it enters the tank and a small amount will escape around the valve. This is quite normal and is the tank venting as the liquid enters. After about 20 to 30 seconds, liquid gas will emerge from the valve showing that the tank is full. Remove the canister immediately.

Filling the Boiler

The boiler is filled through the boiler filling plug in the top middle of the boiler. Distilled water is recommended, as sold for battery topping up, but clean soft water can be used if this is not available. Rain water is also an acceptable alternative, provided that it is adequately filtered. We know of several people that use the paper wine filters for this purpose, with good results. Do not use de-mineralised 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, if using a syringe, fill the boiler right to the

top with clean water. There has to be a space above the water to allow steam to be raised so, insert the end of the plastic pipe into the boiler and withdraw 30ml of water with the syringe.

Replace the boiler filling plug finger tight.

Lighting the Burner

WARNING: Before lighting read the section on gas system troubleshooting and be aware of potential problems. If the gas system is not operating correctly, **shut it off immediately** or damage may result.

Move the locomotive to another location before lighting. Butane is heavier than air and small pockets of gas can collect around the locomotive during filling. To light the burner, hold a lighted match or cigarette lighter over the top of the chimney and **slowly** open the gas regulator by turning it anti-clockwise. The gas should ignite almost immediately with a pop as the flame travels down the chimney and into the boiler tube. The burner should be audible but not too loud.

NOTE as stated above, the gas regulator should be opened slowly until the burner ignites. If opened too quickly, particularly when the engine is cold or if the gas tank has just been filled, it is possible that the flame may not travel back into the boiler flue but stay in the smokebox. If this should happen, the burner will sound quite different to normal and the blue flame will be visible in the smokebox if viewed down the chimney from a safe height. Should this happen, turn off the gas immediately or damage may result and then re-light it. If the problem persists, and it is not possible to ignite the burner correctly, then a dirty jet should be suspected and cleaned as detailed in the '**Trouble Shooting**' section.

For the first couple of minutes keep the burner on low. This is important, as until it warms up, the flame will be a little unstable and turning it up too much could cause it to go out. Also, with a completely full tank, liquid gas could be drawn off instead of vaporized gas, which can also extinguish the flame.

After a couple of minutes, the gas control valve can be opened more to speed up steam raising. Open the gas regulator slowly to about one full turn.

The full range of adjustment (closed to fully open) is achieved within the **first full rotation** of the gas regulator knob any more is unnecessary.

Trouble Shooting

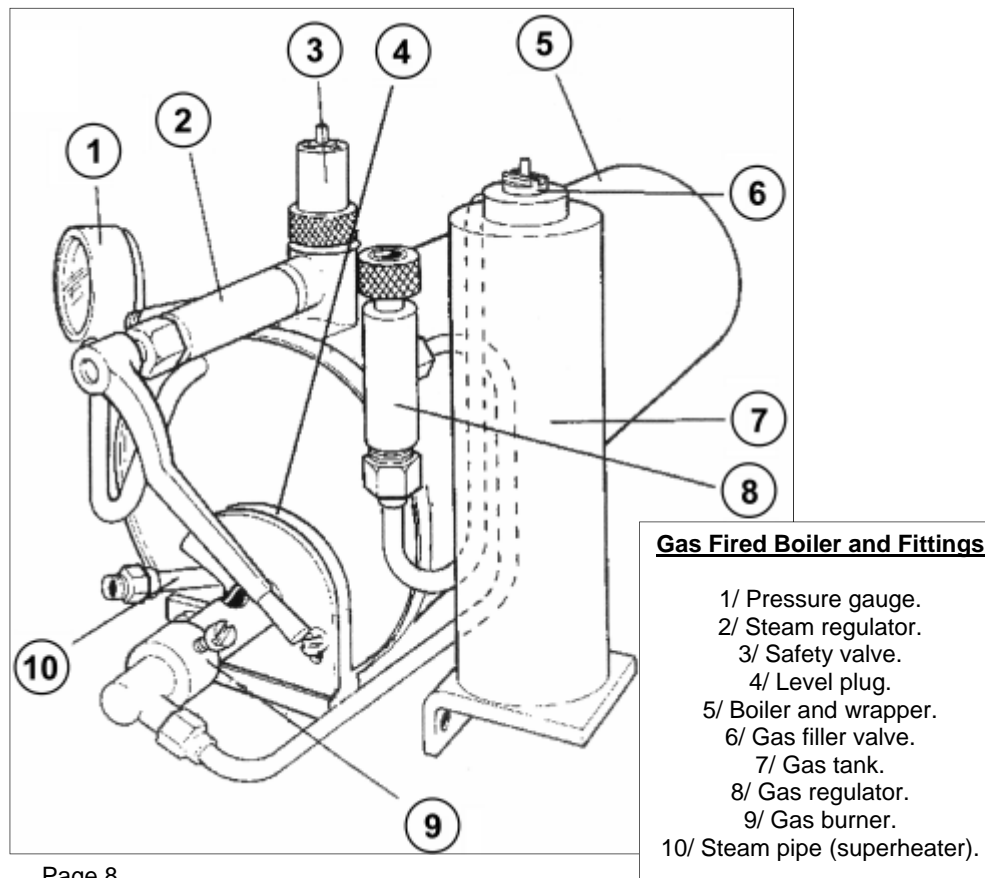
This system is designed for use with Butane or Iso-Butane gas. Mixed gasses, i.e. Butane with a proportion of Propane mixed in, are available, and may be used if straight Butane is unavailable. These come in a variety of mixes ranging

from 90/10 to 60/40 with one of the most common being 70/30. The figures refer to the proportions of the mix i.e. 70/30 contains 70% butane and 30% propane. If using mixed gasses, always choose the one with the largest proportion of butane. The addition of propane slightly alters the gasses properties. This can make the burner a little more difficult to light when cold or after filling the gas tank. Always open the regulator very slowly when lighting, and only just sufficient for ignition to take place. Opening too much too soon may extinguish the flame until the burner reaches normal operating temperature.

The tiny jet in these units can become blocked by small particles of dirt making the burner difficult to light, burn weakly at normal operating temperatures*, burn in the smokebox or fail completely. If any of these should happen, clean out the jet as follows.

(* On very cold days, a burner may start off burning weakly due to the temperature of the gas but should increase to its normal level as the engine

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Pressure Vessel Certificate (side A)

Roundhouse Engineering Company Limited Units 6 -9 Churchill Business Park Churchill Road Wheatley Doncaster DN1 2TF	
<u>EC Declaration Of Conformity</u>	
I hereby declare that the model described:	
Model: Boiler and/or tank supplied separately.	
Conforms to Pressure Equipment Directive 97/23/EC All components and assemblies have been designed and manufactured according to sound engineering practice (SEP)	
Description and specification of equipment covered	
Vessel for storage of Liquefied Petroleum Gas and associated pipe work and fittings.	
Model: Type 'A' gas	Serial No.:
Test pressure: 34 bar	Test date:
Volume: 32.29 ml	
Maximum permissible working pressure: 17 bar	
Maximum working temperature: 65°C	
Intended use: storage of Liquefied Petroleum Gas (LPG)	
Year of manufacture: Same as test date	
Steam Generator and associated pipe work and fittings	
Model: Type 1 boiler	Serial No.:
Test pressure: 5.4 bar	Test date:
Volume: 255 ml	
Max working pressure: 2.7 bar	
Safety valve set pressure: 2.7 bar	
Maximum filling volume: 225 ml	
Year of manufacture: Same as test date.	
Dated:	

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Pressure Vessel Certificate (side B)

Please refer to the relevant section of this instruction manual for details on correct use of these pressure vessels.

Pressure vessel care and maintenance

Gas tank

The gas tank is used for the storage of LPG (liquefied petroleum gas) in the form of butane, iso-butane or as set out in the 'owners handbook'.

The tank is fitted with a self-venting filler valve which contains no serviceable parts. Should the filler valve become defective in any way, it must be replaced with a new item.

It is recommended that the gas tank should undergo the following checks, carried out by a 'competent person', club, society or pressure vessel manufacturer, every year:-

1/ thorough visual inspection.

And every five to ten years:-

1/ hydrostatic pressure test to not less than 1.5 and not more than 2 times the maximum working pressure.

Boiler

The boiler is fitted with a safety valve to prevent the steam pressure rising above the maximum allowable working pressure. This is pre-set to open at between 2.38 bar (35 psi) and 2.72 bar (40 psi) and must not be adjusted to increase this value.

If the safety valve becomes defective in any way, it should be replaced or returned to the factory for service and calibration.

It is recommended that the boiler 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 test to check the correct functioning of all steam controls, gauge and safety valve.

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warms up. This is quite normal). Carefully, disconnect the gas pipe from the jet block using a 2BA spanner

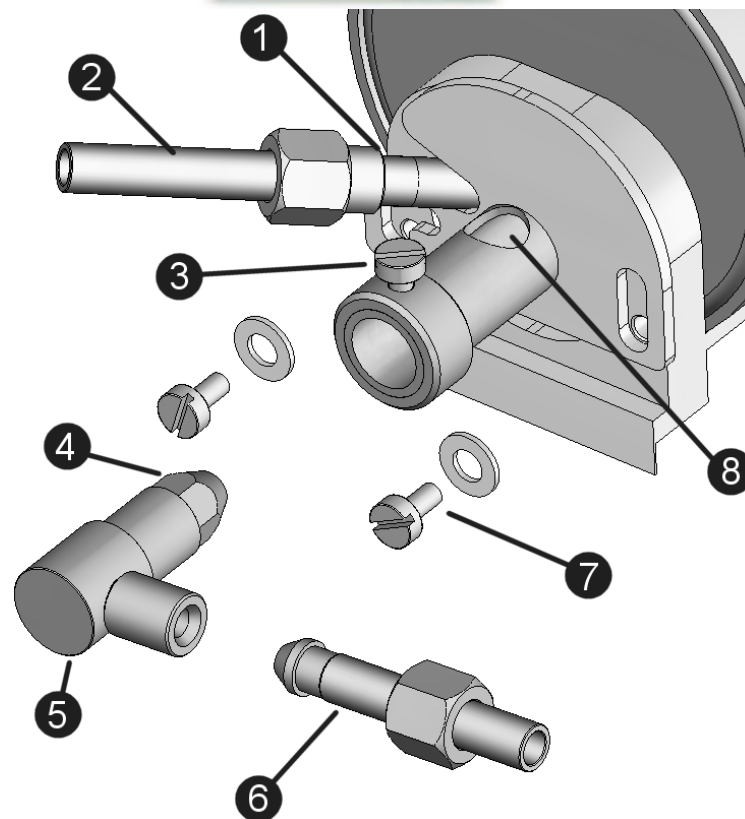
Note when connecting or disconnecting the gas pipe and jet block, do not use excessive force. Always hold the end of the gas burner near the air holes to support it otherwise it is possible to cause damage by bending the body. Slacken the screw retaining the jet block and slide it out to the rear. Remove the jet from the jet block using a 4BA spanner. Wash out the jet in fast evaporating thinner (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. A spare gas jet is included with the toolkit. 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. Reassemble in the reverse order, putting a small amount of PTFE tape round the thread of the jet. Ensure all connections are tight. When re-positioning the jet block in the burner, ensure that it is pushed in as far as it will go.

The gas regulator has a spindle 'O' ring housed inside the body which may need lubrication from time to time if the control becomes 'spongy' in operation, making precise gas control difficult.

As stated previously in the lighting instructions, the full range of adjustment for normal burner operation is achieved within the first full rotation of the regulator knob, and it should only be unscrewed more than this for maintenance purposes and when the tank is empty, and there are no naked lights nearby.

To lubricate it, remove the knurled knob which is retained by a 4BA socket grub screw (.100" AF Allen key required) in the side. Beneath the knob is a back-lash spring and white PTFE washer which will slide off the spindle. Unscrew the hexagon retaining nut then screw the spindle out of the body. The 'O' ring can now be lubricated.

Replace the spindle followed by the retaining nut. Slide the white PTFE washer and backlash spring over the spindle and replace the knob. Note that the grub screw that holds the knob in place tightens into a groove near the end of the spindle.



Gas Burner

- 1). Superheater Pipe. 2). Lubricator Pipe.
- 3). Gas Jet Block retaining screw. 4). Gas Jet.
- 5). Gas Jet Block. 6). Gas Pipe.
- 7). Gas Burner fixing screw. 8). Air Inlet Holes.

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