SL Shamrock

Operations Manual

Editor: Roger Calvert

12 June 2023

SL Shamrock – Operations Manual

Shamrock Operations manual - Table of Contents

Figures

1 The Lake

1.1 Weather forecasts

Windermere is notorious for changeable weather. Forecasts ~~are~~ rarely very good for more than a day or so in advance, and weather is extremely local, being very different over quite short distances.

Conditions on the lake are very dependent on wind direction; in particular a southerly or south-westerly wind will produce quite rough water around the ferry, while a northerly can make it rough just north of Bowness. An easterly wind can make it awkward to enter or leave the harbour at Wray. Bowness Bay is usually sheltered in any wind direction, but there are many fixed and moving hazards in the bay.

1.2 Lake knowledge

The lake is well mapped and many hazards are marked with spherical orange buoys or marker posts with a red triangle at the top. Orange buoys may mark an isolated hazard – keep well clear (to 'seaward' if it is near the shore), or may be in groups around a hazard – go outside the group. In some narrow passages, the deep water channel is marked with a pair of spherical yellow buoys – go between them. But the markers are not always very clear in their meaning, and there are many unmarked hazards such as outcrops of rock or shallows near the shore.

Most of the shores of the lake and islands are privately owned, and landing without permission is not allowed. Jetties and mooring buoys are also normally private.

The Lake Wardens and the Lake Rangers (both at Ferry Nab) can provide information and advice on all aspects of the Lake.

Comprehensive information about the Lake is available from the Lake Wardens' office at Ferry Nab and from local Tourist Information Offices.

1.3 Byelaws

Copies of the Windermere Byelaws are available from the Lake Wardens' office at Ferry Nab. The document is fairly lengthy, but in essence the rules are straightforward. They may be summed up as

(a) boats must be registered,

(b) speed limits must be obeyed,

(c) boats should observe normal good and courteous practice.

1.4 Collision rules

Collision rules on Windermere are essentially the same as the International Rules for the Prevention of Collisions at Sea:

(a) if there is no risk of collision, no action need be taken,

(b) if another vessel is restricted in its ability to manoeuvre, give way to it,

(c) powered vessels should give way to sailing vessels,

(d) vessels of similar size and status should pass port-to-port (i.e. keep right),

(e) if two vessels are on intersecting courses, give way to a vessel approaching

from your starboard side,

(f) the vessel with priority should maintain its course and speed,

(g) if, despite these rules, a collision seems imminent, either vessel may undertake any manoeuvre to avoid it.

Note that steamboats come at the bottom of the hierarchy – there is no class of vessel which is required to give way to a steamboat.

The most important of the rules are (a) and (g). On Windermere there are often many craft which are not clearly under full control, and a prudent course of action is to keep well clear of all of them.

2 Historical and theoretical

2.1 Shamrock

Shamrock is a Saloon Launch, built in 1906 by Nathaniel Shepherd at Bowness. Her length over all is: 45' 11" (13.8m), Beam 8' (2.44m). She is carvel built of teak planks on oak with elm timbers, varnished with a straight stem and a cruiser stern, aft saloon with a clerestory roof.

Shamrock was originally steam powered, but in 1948 she was converted to a motorboat for the purpose of giving trips on the lake. In 1974 she was laid up and put up for sale. In November 1976 Roger Mallinson, acquired her in a very derelict state, and between 1976 and 1979 undertook a huge restoration of the hull and cabin, then installed a steam plant. He built the current engine, which has two cylinders both using high pressure steam, in 2001. The boiler is a locomotive type, acquired from the Ravenglass and Eskdale Railway and modified to side firing.

The plant is non-condensing, using water straight from the lake.

Shamrock was badly damaged in the floods of November 2009, and the Shamrock Trust was formed to support the repairs. She was again damaged in December 2015, and repairs done under insurance.

Much more information on the history of Shamrock and details of the boat and her plant is available at http://www.shamrocktrustuk.org. and in the booklet *The Story of Shamrock* by Victor Middleton, available from The Shamrock Trust.

2.2 Buoyancy and Stability

A boat and her contents float by virtue of Archimedes Principle. The boat hull projects below the water surface, where the pressure increases as you go down. This pressure acting upwards on the bottom and sloping sides of the boat support its weight. It can be shown that the boat will be in equilibrium when the amount of water which is displaced by the boat (i.e. that would fill the hole the boat makes in the lake) has the same weight as the boat, its plant, crew, cargo, etc. This is a stable situation: if the boat is depressed lower into the water, the pressure tending to lift her back will increase, and vice versa.

This explanation only applies to *displacement* hulls. Speedboats and sailing dinghies are often *planing* hulls, and are held up near the water surface by dynamic forces as they move forward.

But in addition to floating, it is important that the boat floats with the funnel pointing more or less vertically upwards. This requires the shape of the hull and the distribution of weight within it to be correctly arranged. The key value is a quantity called the *metacentric height* (usually denoted by MG). This depends on the shape of the hull and where the centre of gravity of the boat and contents is. If MG is positive, the boat will float upright, if it is negative, it will overturn. In most boats, MG lies between 10 and 30 inches (250 to 750 mm).

The main way the metacentric height can change from day to day is by the load (coal, passengers, dogs) moving around. If they all go up on the cabin roof, the centre of gravity will rise and MG will fall. The fall will be detectable as increased 'tenderness' – the boat will roll much more in response to waves and people moving around. If it approaches zero, the roll will continue until the gunwales go under – a bad thing.

For more information and some actual steamboat measurements, see Roger Calvert's article in Funnel 62 (January 1990), published by the Steam Boat Association of Great Britain.

2.3 Boiler theory and practice

The purpose of the boiler is to use heat from burning fuel to boil water and increase the pressure of the resulting steam to the appropriate level to drive the engine. Shamrock's plant normally operates at a pressure about 80 pounds per square inch (psi) (5.4 bar). There are many different boiler designs; Shamrock's is known as a *Launch* boiler, and is very similar to the *Locomotive* boiler used in steam locomotives and traction engines. A diagram of a boiler of this type is shown in Appendix D.

A fire box at the rear of the boiler generates hot gases which pass forward through a number of steel tubes, which are surrounded by water. The resulting steam is drawn off at the top of the boiler to operate the engine and auxiliaries. The water so used is replaced by a feed pump or (as in Shamrock's case) injector.

Boiler design is a highly specialist skill; it is vital that all materials, components and joining methods are sufficient for the temperature and pressure concerned, and remain so during extended service. A boiler failing in service can be extremely dangerous, so boilers are subject to annual safety inspection and testing.

To ensure reliable and safe operation, the boiler is fitted with two principle instruments – the water level gauges, which show how much water is in the boiler, and the pressure gauge, which shows the pressure of the steam in the boiler. The boiler is also fitted with a safety valve, which operates automatically to release steam if the pressure rises above the maximum approved operating pressure. Shamrock's safety valves are set to 120 psi (8.2 bar).

2.4 Engine theory and practice

The engine takes steam from the boiler and converts it to mechanical power to drive the propeller. An illustration of how a simple steam engine works is shown in Appendix E : the steam pressure forces the piston down and turns the shaft by means of a crank. At the end of the stroke, the valve gear automatically cuts off the steam from above the piston, and applies it below instead, so that the piston is forced up again. The spent steam above the piston is released up the funnel, where it creates a draught which helps to keep the fire burning well. Shamrock’s exhaust steam is piped to a silencer before being released into the funnel. Some steam condenses in the silencer and this water is piped to the boiler ash pan below the fire box where it cools the ashes and reduces the heat radiating to the hull timbers.

Shamrock's engine is of the 'twin high pressure' type, with two sets of pistons and cylinders driving the same shaft. They are so arranged that when one is at the end of the stroke, the other is in the middle, so there is always one of them working to turn the shaft.

3 Operations

3.1 The Boat

Shamrock is an old and delicate boat, and must be handled with care at all times. Extreme care must be taken to avoid grounding or striking jetties etc. or other boats. Fenders must be used when coming alongside.

Varnish and paintwork must be kept clean, and so far as possible not exposed to bright sunlight. Brasswork and glass should be cleaned frequently, particularly if it has got wet.

Care should be taken to avoid bringing mud or gravel on board on shoes. All ropes and equipment should only be handled with clean hands. In particular, care must be taken that the white ropes are not made dirty or wet by mooring ropes. Care must be taken to avoid oil, metal polish or other chemicals getting on the carpets or seats.

3.2 Crew members and their duties

Shamrock normally requires a minimum of two people to operate. One of them is the skipper and is responsible for all activities. He/she must be fully qualified and approved by the Shamrock Trust to take charge of the boat.

The skipper will designate one or more persons to assist with the operation of the boat. For the purposes of this document these people are described as ‘Crew’.

Crew members must obey the instructions of the skipper, and will be required to assist with activities such as deploying fenders, mooring, casting off, anchoring, etc.

It is common for the skipper to manage the steam plant and to steer, but this is not essential – anyone with the required ability may be asked or allowed to do so by the skipper.

If there is more than one crew member, duties may be divided between them as agreed. Additional duties such as making tea are thereby simplified.

Any other people on board are described as ‘Passengers’.The total number of people on board, skipper and crew plus passengers (including children or babies), must not exceed twelve.

3.3 Risk Assessment

The skipper must assess the risk on every occasion the boat is taken out. This activity need not be onerous – it is a matter of getting into the habit of considering various potential hazards automatically. Generally, common sense, experience and established good practice will answer all the questions. The skipper may wish to seek the advice or opinion of others, including crew members and the Lake Wardens or Rangers.

If the decision is to go out, there are various potential hazards. Some of these are listed below (there may be others), together with the risk associated with them (which may depend on conditions) and possible ways of reducing that risk. (The risk is a combination of the probability of an occurrence and the seriousness of its consequences.)

A much more comprehensive version of this risk assessment is available on the Shamrock Trust Website under the heading ‘Our Aims and Goals’.

In no circumstances may the boat go out without a working mobile phone with signal, credit and charged battery.

1	**General Hazards**		
1.1	Slippage on jetties	Med	Remind people - particularly when wet. Do not run.
1.2	Bollards, cleats & ropes on jetties	Med	Keep mooring ropes tidy; remind participants of the possibility of tripping up
1.3	Young children and non-swimmers	Med	Children must be supervised by parents. Keep away from edge of jetties. All juniors & non-swimmers to wear buoyancy aids.
1.4	Coming alongside	Med	Instruct passengers not to put hands, feet etc. over the side and not to fend off.
1.5	Wind exposure, hypothermia	Med	Lake water can be very cold. Wind can develop very quickly. Make sure suitable protective clothing is available. Always look out for adverse weather
1.6	Weather deterioration	Med	Be aware of the weather. Be prepared to seek shelter in heavy rain, wind and thunder.
2	**Boating Hazards**		
2.1	Washes	Med	Watch out for large washes coming from the more powerful motor boats. Change course to take the wash on the bow or quarter.
2.2	Waves	Med	Water can become quite lumpy in moderate windy weather. Seek the shelter of the windward shore if possible.
2.3	Water hazards (rocks /shallows)	Med	Visual check to see sufficient depth of water. Keep a reasonable distance from the shore. Watch out for red hazard marker buoys. Watch out for submerged trees. In flat surrounding areas keep further away from the shore.
2.4	Swimmers and divers	Med	Swimmers are very difficult to see in slightly rough conditions. Divers may surface unexpectedly Both should be escorted by a boat with a blue and white flag (international signal flag Alpha), but this is often difficult to see as well. Alternatively, swimmers sometimes tow a high visibility float. A responsible swimmer is shown in Figure 3-1. Keep a good look out, especially if there is a very slow moving boat nearby. 
2.5	Collisions	Low	Always keep a lookout, particularly astern. Pass behind Lake Steamers and (two ferry lengths behind) the Windermere Ferry.
2.6	Other water users	Med	Be aware that numerous types of craft use the water including small dinghies, yachts, fishing boats, canoes, paddle boards long distance swimmers, hire craft and large ferry boats.
2.7	Night Navigation	High	Do not steam in the dark unless you have excellent knowledge of the area. Remember you may not be the only person using that stretch of water. Use the correct navigation lights.
3	**Steam Plant hazards**		
3.1	Hot Surfaces	Low	Advise any passengers of the possible hot areas. Carry some burn cream or freezing spray.

3.2	Smoke, ash, cinders	Low	Warn people of the possibility, particularly before raking ash or using the blower.
3.3	Noise and escaping steam	Low	Warn passengers that the safety valve may cause a sudden noise, and warn them before blowing the whistle.
4	**Emergencies**		Carry a mobile phone on a network which has a signal on the Lake, and make sure it is charged and has credit. Carry a list of contact numbers for emergency services.
4.1	Man overboard	Low	Keep rescue equipment (life buoy, boat hook, rope ladder) readily to hand and regularly checked. Crew to be aware of procedures, and practice in good weather.
4.2	Collision/extreme weather/grounding/ risk of sinking	Low	Call for assistance. Ensure everyone has adequate personal buoyancy. Get as close to land as possible.
4.3	Mechanical breakdown	Low	Call for assistance. Ensure everybody is warmly dressed and stays calm.
4.4	Serious Medical Emergency	High	Call 999 and ask for Coastguard, who will coordinate other services.

Figure 3-1: Swimmer with Escort, Flag and Float

3.4 Passengers

A passenger is any person on board who is not designated to participate in the operation of the boat. He/she is still, though, required to follow the instructions of the skipper, in particular as regards wearing a buoyancy aid, seating position and moving round the boat. Passengers may, if willing, assist crew members in some appropriate duties (e.g. washing up).

Passengers must wear suitable clothing for the expected conditions, and flat, clean, soft footwear. The skipper has the final word on whether any person's clothing is appropriate.

Non-swimmers, children and any others required to do so by the skipper should wear buoyancy aids. Passengers are responsible for providing their own buoyancy aids. If anybody makes buoyancy aids available for loan, the borrower is responsible for ensuring their suitability and correct use.

The total number of people on board, skipper and crew plus passengers (including children or babies), must not exceed twelve.

Children must normally be accompanied by a minimum of one responsible adult to every four children. This number may be varied by a small amount either way at the discretion of the skipper, for example a single unaccompanied teenager might be acceptable.

All passengers must be members of The Shamrock Trust or their close relatives or friends.

3.5 Briefing of Passengers

In briefing passengers, some or all of the following points need to be made, according to the circumstances:

- Please do not touch white ropes or polished brass;
- Beware of hot metal around the boiler area;
- There may be sudden loud noises – whistle or safety valve;
- Sit where you wish, except where the crew needs to work, but try to keep the boat balanced;
- You may move around, but not too many to move at a time;
- When near a jetty, boat or other such thing, keep hands, feet, heads, etc. well inside the boat; never attempt to fend off – the crew will do this if necessary.

3.6 Checklist for Departure

Check that appropriate supplies of equipment and consumables are on board before departure:

- Coal, Kindling, Matches/lighters
- Engine and Cylinder Oil
- Lamp oil if night steaming is expected
- Buoyancy Aids
- First Aid Kit
- Mobile phone with credit, a charged battery and a signal
- Mooring ropes and fenders should be on board even if mooring elsewhere is not foreseen
- Waterproofs and additional clothing for crew and passengers
- Drinking Water
- Tea, Coffee, Sugar, Milk
- Cleaning, polishing and washing up materials

4 The Plant

4.1 Starting up: lighting the boiler, raising steam, oiling, warming through

There is an aide-memoire check list on board covering the outline of the following procedures.

4.1.1 Ensure there is water in the boiler

Before the fire is lit, there must be adequate water in the boiler. If the water level is visible in the water level gauges (which are mounted high on the boiler) this is satisfactory. Otherwise, water must be added by removing the plug in the centre of the injector manifold and topping up using the cranked funnel provided. Water from the lake should be collected with a watering can with the spout below the surface, to avoid scum. The plug must then be replaced taking extreme care not to cross the threads.

Figure 4-2: Cranked Funnel and Spanner

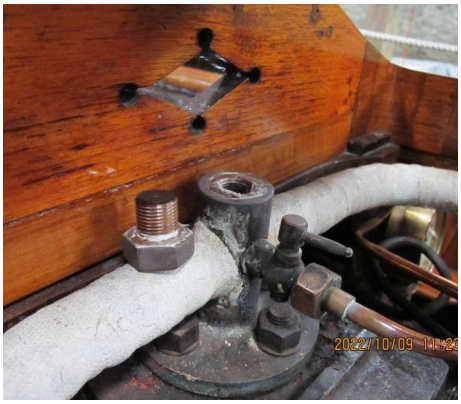


Figure 4-1: Manifold Plug

From time to time it will be appropriate to top up the boiler water treatment – see Appendix A .

Once steam has been raised, water is added to the boiler using one of the injectors (see Figure 4-4 and Figure 4-6). In normal operation, either injector may be used, but both should be tested on each outing. The procedure is:

(i) Ensure that the inlet skin fitting valves ('sea cocks') are open (they are normally left open). For the port injector, this is located in the bilge behind the port engine bearer, and is most easily operated from the driving position using a fire iron (see Figure 4-10). The valve for the starboard injector is in a similar position on the starboard side, under the floor board (Figure 4-3). Open the water control valve on the injector piping (Figure 4-10).

(ii) Open the water delivery (‘clack’) valve between the injector and the boiler.

(iii) Open the injector steam valve.

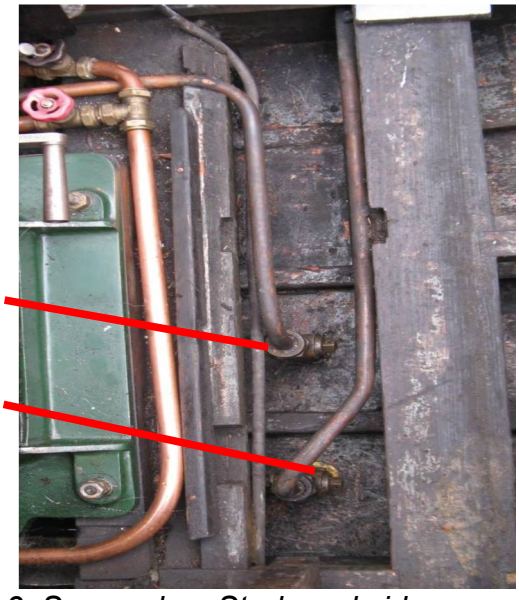


Figure 4-3: Sea cocks - Starboard side

The injector overflow pipe will run for a few moments, but should stop as soon as the injector 'picks up'. If it does not seem to be stopping, close the steam valve and try again. It may be helpful to adjust the water inlet valve a bit before re-trying.

4.1.2 Light the fire

Any ash or clinker remaining in the firebox from the previous occasion must be removed. Cinders (which will burn) may be left. Brush round the inside of the firebox to remove any loose soot. Open the air damper (the floor board below the stoke hole – see Figure 4-6) and ensure there is an inch or so of water in the ash pan. Open the stack blower valve (see Figure 4-5) to allow dissolved air to escape as the water heats up.

Lay the fire with a thin layer of coal at the bottom, then a number of sheets of loosely-rolled newspaper or one or more firelighters, with kindling on top. It helps if the fire is started at 2 or 3 different locations along the firebox. Some large pieces of coal may be placed round the edges. Try to cover most of the grate, so that air can only pass through the fire. Light the fire, and close the firedoor. Monitor from time to time – when the kindling is well alight, put some larger pieces of wood and a few lumps of coal onto of the fire, and progressively increase the amount of coal.

Raising steam will take around 60 minutes. When a small pressure (5 or 10 lb/in^2) is shown on the pressure gauge (Figure 4-4), the blower may be turned off, or kept very slightly open to increase draught.

The fire should not be lit inside a boathouse, and the blower should never be used inside a boathouse; doing so will result in ash and dust settling everywhere.

While the fire is coming up, the opportunity should be taken to clean and polish items which will later get hot – on the boiler face, the water gauges, injector pipework etc., on the engine, the cylinder cladding, oil boxes etc. and on the boiler top, the safety valves, whistle etc.

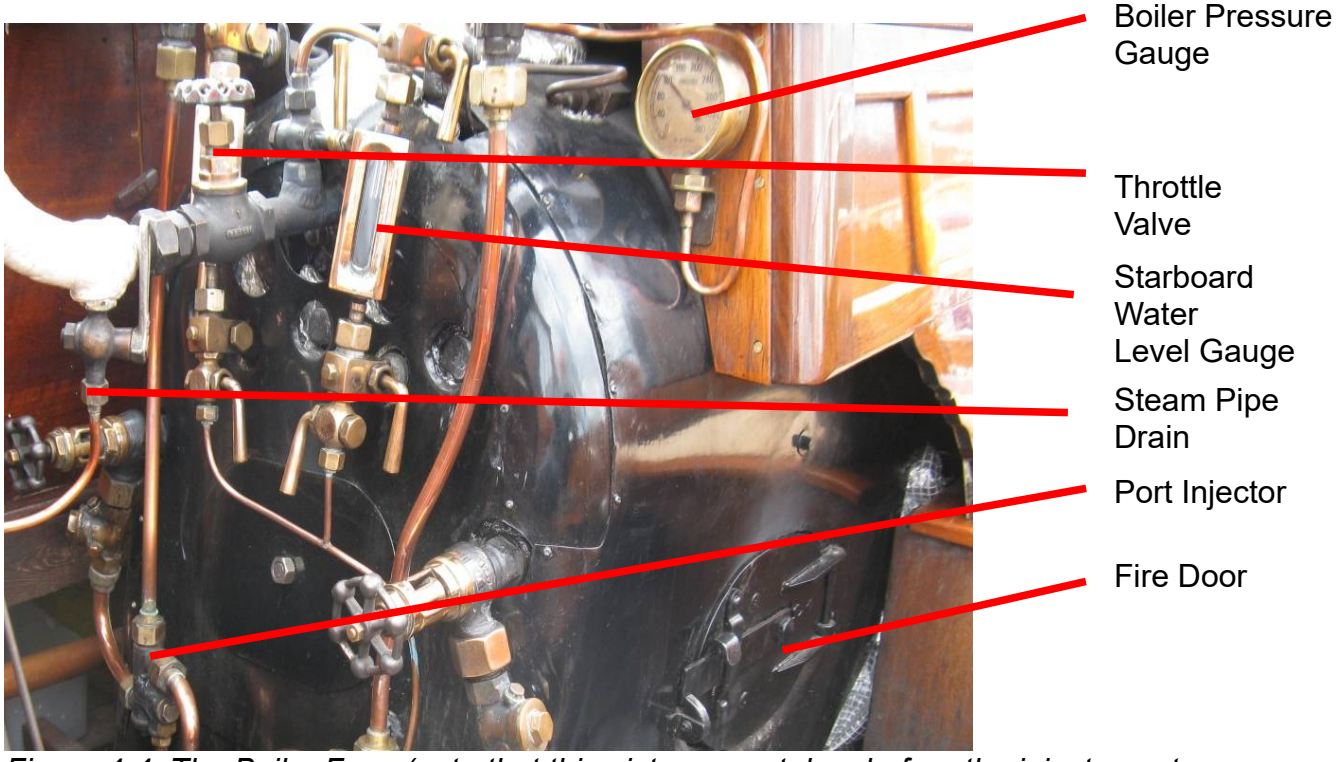


Figure 4-4: The Boiler Face (note that this picture was taken before the injector water control valves were installed – see Figure 4-6 and Figure 4-10)

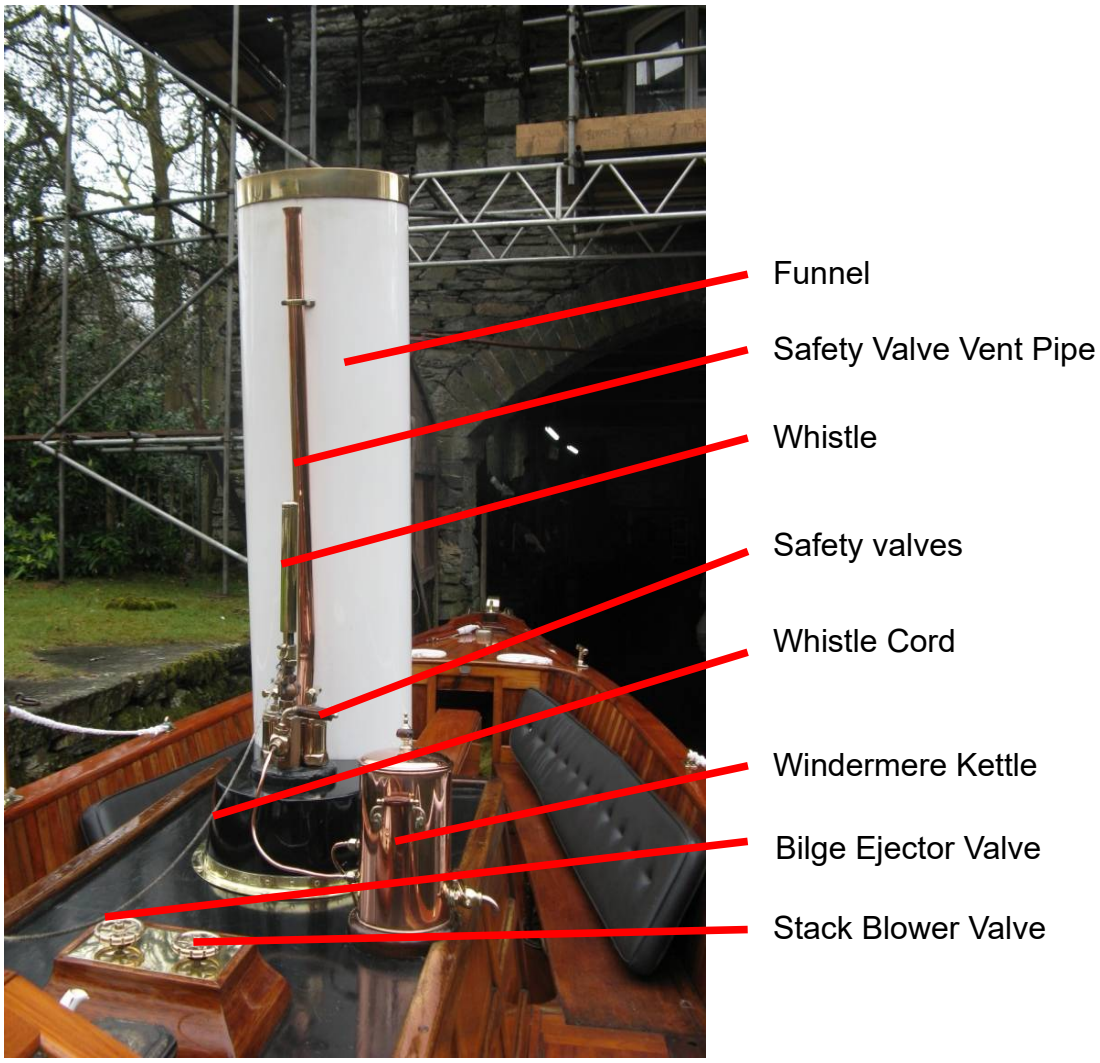


Figure 4-5: The Boiler Top

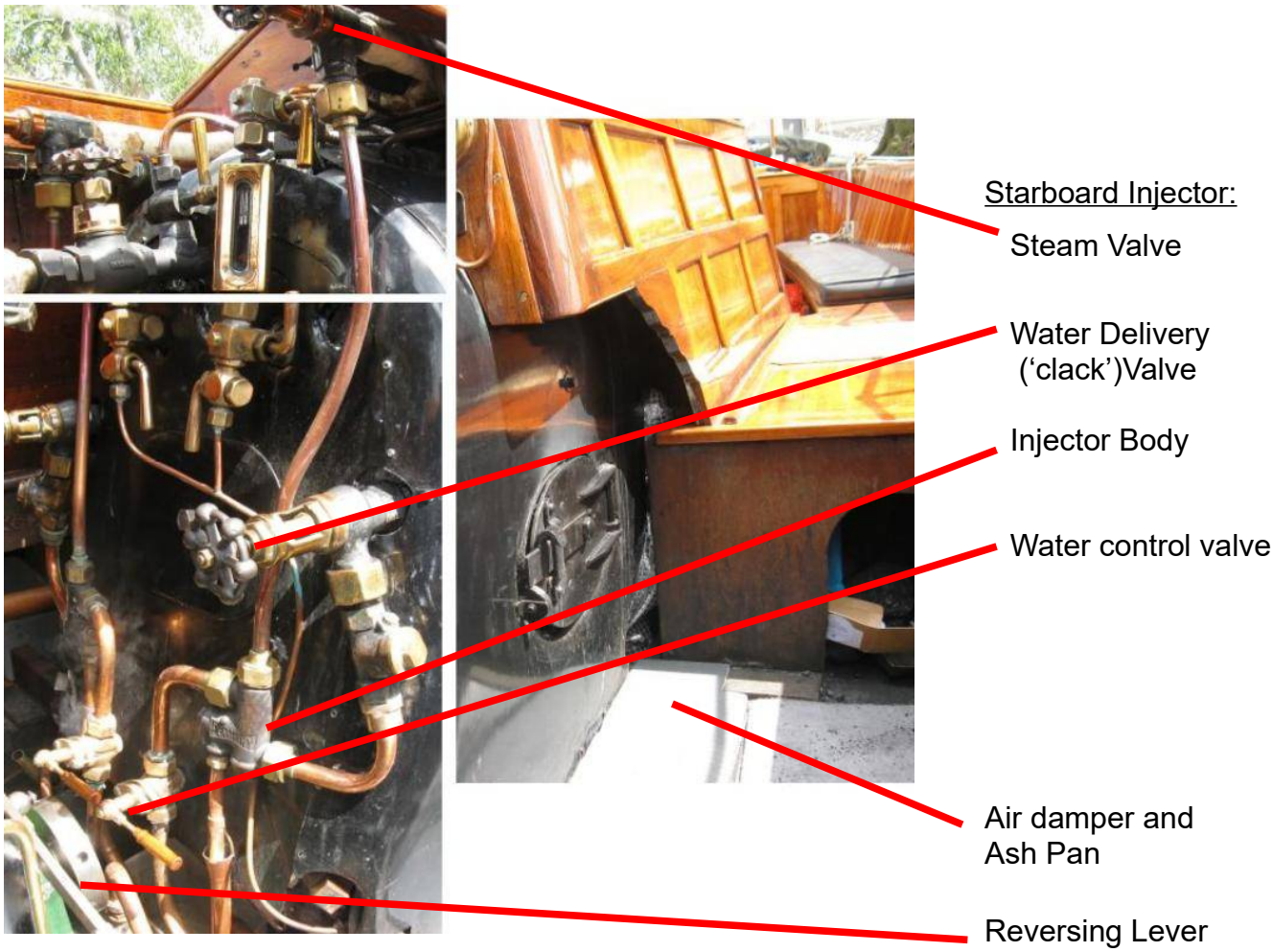


Figure 4-6: The Injector, Damper and Bunker

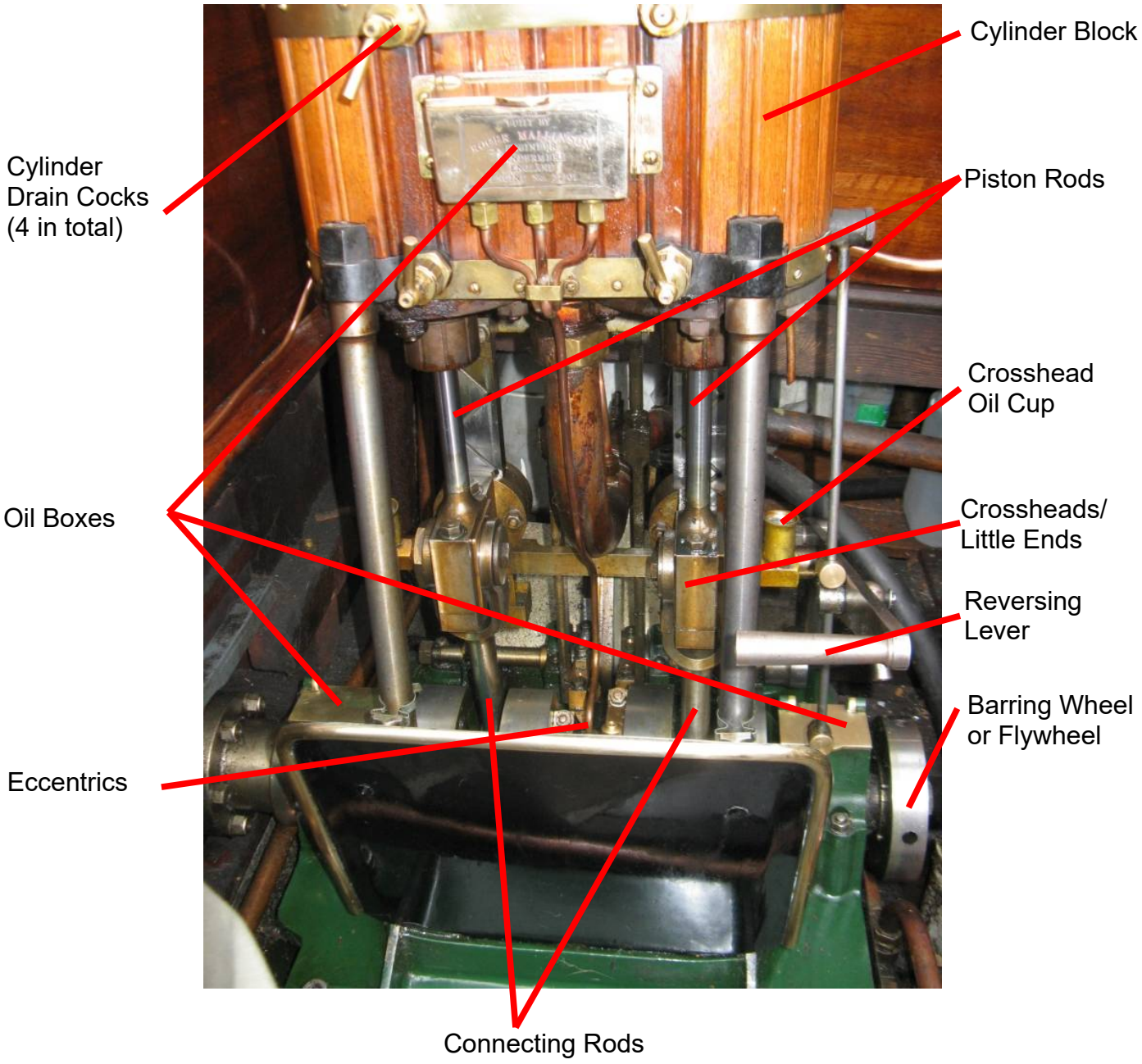


Figure 4-7: The Engine

4.1.3 Oil the engine

While raising steam, the engine (Figure 4-7) may be oiled. There are several elements to this:

(i) The big ends are lubricated through holes in the crankshaft from the main bearings: Using a bar in the holes in the barring wheel, bring the after crank to top dead centre. Open the top, rear and forward oil boxes. In the top oil box, remove the centre wick. Pump oil into its tube until a wick in the rear oil box rises slightly. Top up the rear oil box. Bar the engine until the forward crank is at top dead centre and repeat the process until a wick in the forward oil box rises. Top up the forward oil box. Replace the wick in the top oil box and top it up. Remove the bar!

(ii) Top up the two crosshead oil cups, as needed.

(iii) Linkwork – it may be helpful to remove the front engine screen for this. Squirt oil into all the relevant oil holes – 2 on each expansion link, 2 on the eccentrics, 4 on the rear lay shaft and 2 on the valve link little ends (not accessible from the front of the engine).

The engine should be re-oiled after any extended stop.

(iii) refill the oil can from the container.

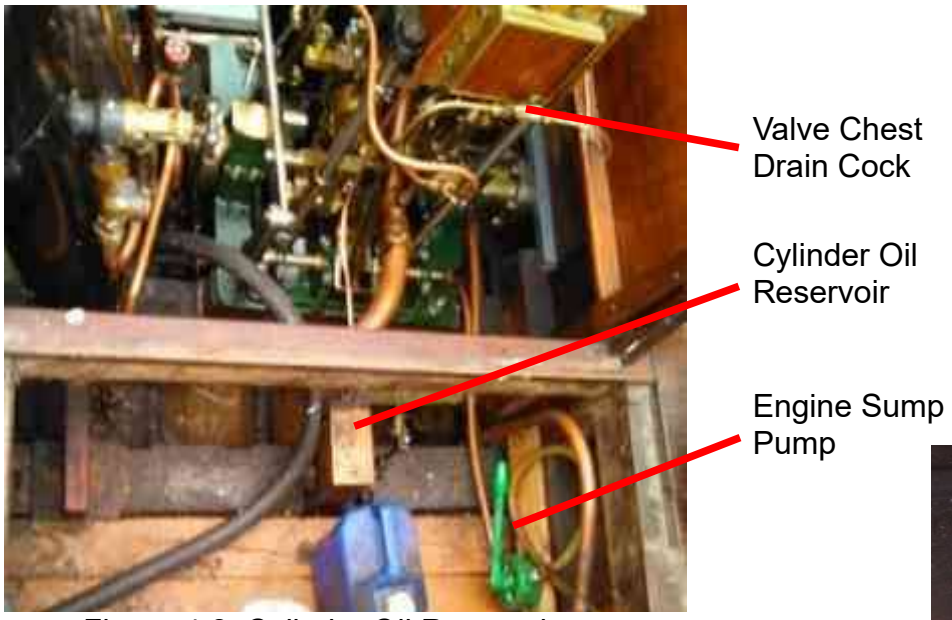


Figure 4-8: Cylinder Oil Reservoir

(iv) Cylinder oil ('Black Oil'): check and top up the cylinder oil reservoir which is under the floor on the port side of the engine (Figure 4-8).

The bearing oil system is total loss, and the lubricating oil ends up in the engine sump, mixed with condensate leaked from the glands. A hand pump (Figure 4-8) is fitted to pump out the sump. The oil/water mixture must be disposed of through an authorised hazardous waste organisation.

From time to time, the propeller shaft bearing under the saloon

Figure 4-9: Propeller Shaft Bearing

floor (Figure 4-9) should be greased. The grease gun is kept nearby.

4.1.4 Warm through

When the steam pressure has reached about 50 psi, the engine may be warmed through. Open the engine drains, the valve chest drain (on the back of the engine, Figure 4-8) and the main steam pipe drain, Figure 4-4 (it is open when the lever is horizontal. Like the gauge glass cocks, the normal running position is vertical). Open the main throttle (Figure 4-4) slightly until the crankshaft is seen to move. Move the reversing link (Figure 4-6 and Figure 4-7) gently from forward to reverse and back several times. The engine will rotate a little more each time. Once it is rotating continuously in either direction, the drains should be closed. The engine is then ready to operate.

4.1.5 Testing the Water Level Gauges

From time to time, preferably every time steam is raised, the water level gauges should be tested for blockage.

(i) Close the centre (water) cock. Briefly open the bottom (drain) cock. Steam should come out of the drain. Any dirt in the glass should be flushed out. Close the drain cock and reopen the water cock.

(ii) Close the top (steam) cock. Briefly open the bottom (drain) cock. Hot water should come out of the drain. Close the drain cock and reopen the steam cock.

The water level should re-establish itself in the gauge within a second or two after each of the above..

Note that all the cock handles are vertical in the normal running position.

4.2 Running: managing the boiler and engine;

The person managing the plant is responsible for:

- Maintaining the steam pressure at operational level. This requires appropriate care of the fire (stoking, raking, adjustment of the damper, use of the stack blower). In particular, allowing ‘holes’ to appear in the fire will lead to loss of pressure.
- Maintaining the boiler water level at a safe level. This requires use of the injectors when appropriate.

These requirements are to some extent in competition. Use of the injectors uses steam and adds cold water to the boiler; both of these tend to reduce the pressure temporarily. Adding fuel may also temporarily reduce pressure. However, use of too much air or blower while neglecting the fire will maintain steam pressure for a while, then quickly lose it. It is often hard to recover from this situation. Similarly allowing the water level to fall too far may have the same consequences.

4.2.1 The Bilge Ejector

Leakage/overflow from the injectors is collected in a container below the boiler face. This tends to fill up over a relatively short period, and may be emptied using the bilge ejector (Figure 4-5).

On the floor on the starboard side of the engine are two valves which control the suction of the bilge ejector (Figure 4-10). When the forward valve is open, water is taken from the

injector overflow container; when the other valve is open it takes water from the bilge. For the latter case, there is also a two-way valve nearby which directs the suction to the port or starboard side of the bilge.

In the event that the bilge requires pumping when there is no steam to work the ejector, there is a hand operated bilge pump under the floor on the port side of the boiler (Figure 4-11).

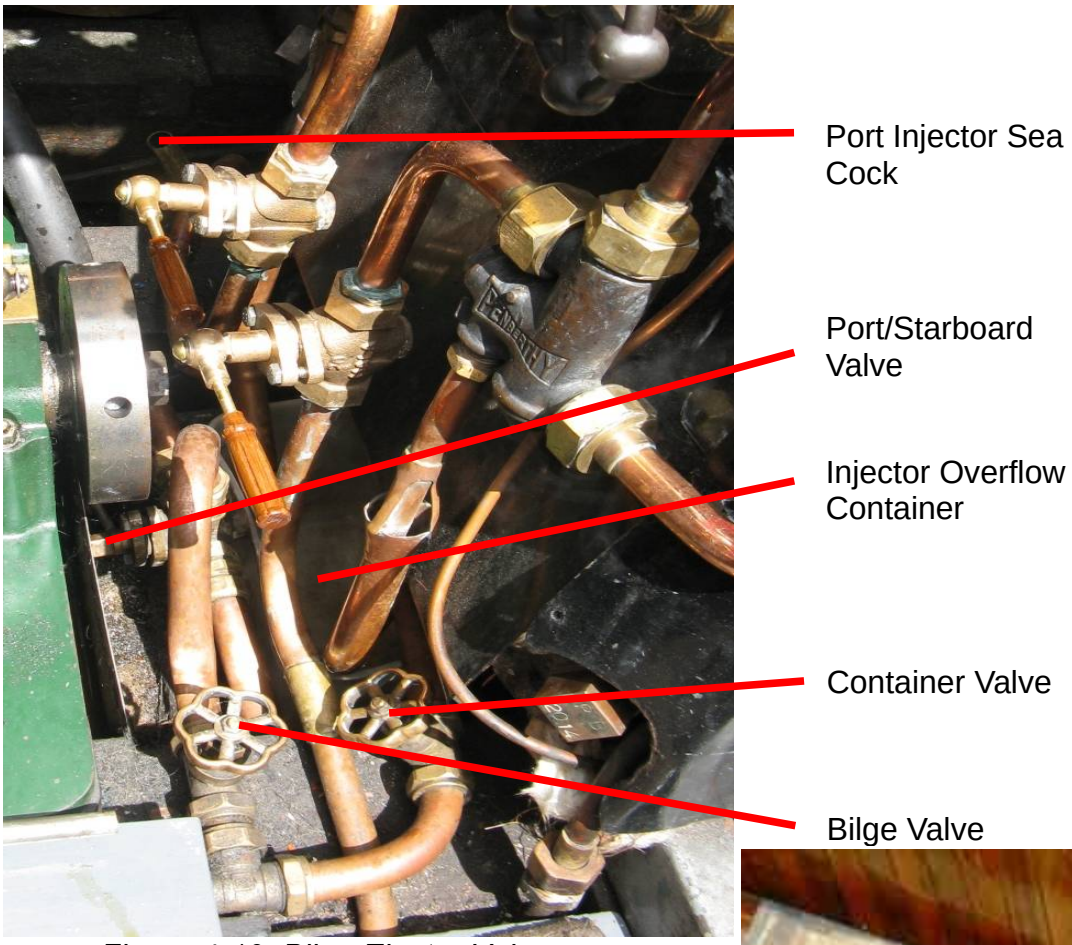


Figure 4-10: Bilge Ejector Valves

Water flows to the lowest level adjacent to the bilge ejector through limber holes in the frames. To keep these clear of debris, they have lengths of chain, fixed at the ends with lengths of elastic cord, running through them. To clear the limber holes lift the floor boards outside the cabin door to gain access to the chains. They may be moved a small amount either way from any point and will spring back when released.

Figure 4-11: Hand Bilge Pump

5 Navigation

5.1 Running: managing the boat – mooring, casting off, reversing, steering,

5.1.1 Mooring and Fenders

Mooring with a single line from the centre cleat is usually adequate for short stops. For longer stays, or if there is a wind or if the space is severely restricted, bow and stern mooring lines may be required. If there is a strong wind, a spring (a line from the downwind end of the boat to the jetty near the other end of the boat) should also be used.

Four mooring ropes about 30 ft long are kept under the seats at the four 'corners' of the boat. A short line is kept amidships for use on either side. The white coiled ropes are never used for mooring!

The full set of fenders needed alongside a stone jetty as at Wray, are placed as follows (on the Port or Starboard side as appropriate):

Figure 5-1: Placement of Fenders

- Large cylindrical fender between the foredeck cleat and forward fixing eye for the white ropes (note the tyres shown in the photograph are no longer in use);

- First and Second stanchions: pair of linked white cylindrical fenders;

- Third and Fourth stanchions: pair of linked white cylindrical fenders;

- Cabin fixing hook for white ropes: blue and orange fenders;

- First canopy stanchion: white spherical fender;

- Afterdeck cleat: white cylindrical fender.

(Note that these photographs do not show the current practice – they will be replaced when new ones are available.)

In many cases, the large forward fender will not be needed.

The working set of fenders are stored under the seats, forward for those used forward, aft for the stern ones. Spare fenders, for use e.g. when another boat come s alongside, are stored in the fore peak.

Whether fenders are needed or not depends to a large extent on the jetty. If it is solid wood or stone (such as the Wray Boathouse mooring), fenders are always needed. If it is built with piles outside the deck (for exampleFigure 5-2 or the Wray Castle public jetty) fenders may not be needed, although if there seems a tendency to bump, a large fender close to the pile may be helpful. If it is a jetty with the deck overhanging the water, with the piles inside, great care is needed, as, depending on the lake level, the deck may foul the stanchions or the cabin.

Figure 5-2: This Jetty may not need Fenders

5.1.2 Anchoring

When anchoring, extreme care must be taken to avoid the anchor snagging on nearby moorings or tree roots. A clear area with relatively shallow water is needed. In calm conditions, the anchor may be dropped from amidships, but if there is wind, it should be from the bow.

The anchor should be dropped vertically into the water and lowered until it reaches the bottom. Then at least twice as much rope should be paid out as is already out, and the rope secured to a cleat. The boat will drop back with the wind until the rope tightens and the anchor grabs.

While anchored, the relative positions of nearby boats, trees etc. should be monitored to check for the anchor dragging or swinging due to wind.

Before the anchor is hauled in, the fire and engine should be readied for departure. The crew member hauling in should inform the skipper when the rope is vertical. To avoid dirt and damage, the anchor should be cleared of all mud etc. and lifted on board with care.

5.2 Handling Characteristics

The shape of Shamrock's hull means it is essential to turn the vessel so it meets large waves and wash from other vessels at right angles either on the bow or the stern.

5.2.1 Good Weather

Shamrock handles very easily in fine weather. She answers the helm promptly both ahead and astern. Due to her fine lines, she will shoot a considerable distance when power is turned off. Reverse may be used to stop her; this can lead to the stern swinging in and should be done with care.

The cabin tends to catch the wind; in light winds this effect can be used to bring her crabwise into a jetty from upwind.

5.2.2 Poor weather - Wind

Shamrock is very susceptible to wind because of the large cabin aft. The effect of this is to make her tend to turn to point upwind. More helm will be needed to turn out of the wind and less to turn up-wind than expected.

The wind will also tend to move her sideways while turning, and extra space should be allowed for this in restricted spaces.

5.2.3 Poor weather - Waves

The long, narrow shape of the hull makes Shamrock roll easily when hit sideways on by waves. While this is uncomfortable, it is not usually unsafe. However, it can make the injectors fail, and could break china or people. It is therefore best to take waves bow on whenever possible. For extensive rough water, seek the shelter of the windward shore. In a southerly wind, the western shore is usually more sheltered because of the bays and headlands.

5.2.4 Poor weather - Fog

If fog appears likely, a safe mooring should be sought. If caught out in fog, proceed extremely cautiously if it is safe to do so. If this is not possible, and sense of position or direction is lost, it is best to anchor. If the water is too deep, drift until either something is sighted or the water becomes shallow enough (there is usually no wind when it is foggy).

5.3 Vessel handling – dusk and dark

5.3.1 General

There is a small electric light in the engine compartment, which is adequate to see the pressure gauge and water level gauges. However this only works while the engine is running. A torch should be available to the helmsman at all times.

In the dark, the fire appears to be much brighter than in the daylight. Make sure there is enough fire! It may be appropriate for a separate person to manage the fire, to avoid the helmsman's night vision being spoilt.

It is very difficult to see hazard and mooring buoys and moored boats in the dark, and most jetties and islands are unlit – it is prudent to stay near the centre of the lake (except in the region just south of the ferry where there are rocks and shallows in the middle).

When coming in to a jetty or mooring, a crew member with a torch should illuminate it just ahead of the bow.

If a return to the boathouse in the dark is planned, it is useful to leave one of the boathouse lights on – these can be seen through the slats of the doors.

5.3.2 Navigation lights and their fittings

Four navigation lights are used: the tail light, hung on a shackle from the canopy in the after well (stored near the sink), the port and starboard lights, attached to boxes near the front of the cabin roof (stored with their boxes behind the cabin doors on their respective sides) and the headlight attached to the bracket on the funnel (stored on a hook on the

starboard side in the front locker).

Before use, the level of oil should be checked and the wicks trimmed if necessary. Lamp oil is stored under the floor on the port side of the engine. The wicks should be turned up sufficiently to give a steady light, but not enough to smoke. They should be checked a few minutes after lighting as the flame will burn higher as the lamp warms up.

The port and starboard lamps fit in boxes which fit under the handrails on the cabin roof. They should be positioned a few inches back from the front, to avoid casting light into the engine area. On the starboard side, it may be necessary to move the boat hook to fit the light box.

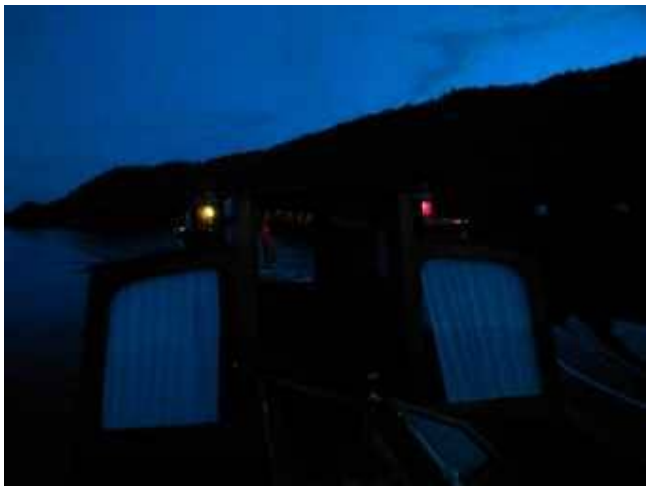


Figure 5-3: Port and Starboard Navigation Lights

5.4 Miscellaneous

5.4.1 The Sink

The sink is supplied with water from the lake by a steam ejector. Opening the Cold tap supplies the steam, and lake water heated by the condensing steam is supplied to the sink. This water can be quite hot.

If the hot tap is also opened, the lake water passes through a heat exchanger and very hot water is delivered. Note that opening the hot tap alone has no effect, and that really cold water cannot be supplied.

The sink drains by gravity back into the lake.

5.4.2 The Windermere Kettle

The kettle boils extremely quickly (it has been estimated to be the equivalent of about 15 kW). The lid should be removed before turning it on, otherwise it will be blown off when the kettle boils, and the kettle should be monitored throughout.

The tap should be completely back when closed – if left in the vertical position it drips.

The kettle steam supply pipe becomes very hot.

Figure 5-4: The Windermere Kettle

6 Emergency procedures

6.1 Plant: loss of steam, loss of water, mechanical breakdown

(a) Loss of steam pressure is normally due to an inadequate fire – either not enough fuel is present or there are holes in the fire where air can flow straight through from the ashpan without going through the fuel. The fire may also be choked with ash or clinker so that air will not flow through.

The solution is to rake the fire to let the ash fall through and close all holes in the fire with fresh coal. It may be useful to put some wood on top of the fire to help it ignite, and to use the stack blower. In extreme cases, the engine may be stopped for a few minutes (if it is safe to do so).

(b) Low water level is usually due to inattention on the part of the driver. More water should be added using the injector. If one injector fails to operate, the other one should be tried. This will usually cause a drop in steam pressure, and it may be necessary to wait a few minutes until the pressure recovers.

(c) Perforation of a boiler tube will result in loss of pressure and water and a noise similar to the stack blower. One or both injectors should be used to try to maintain water level while returning to a safe base.

(d) If neither injector works or there is a sudden loss of water, the fire must be drawn: raked down as far as possible, and burning fuel removed and thrown overboard (if it is safe to do so). The boat should be anchored or secured to a buoy or jetty, and help summoned.

(e) In the event of mechanical breakdown, the fire should be banked (raked to the front of the firebox, with the air completely shut off and the fire door slightly open). If possible and appropriate, the boat should be moored or anchored. The skipper and crew will review whether repairs are possible *in situ*. If not, help should be summoned.

6.2 Medical emergency on board

A first aid kit is carried on board and minor injuries may be treated by anyone confident and competent to do so. Burns should be treated with large quantities of cold water, for an extended period of time.

In the event of serious injury or illness, beyond the scope of the on-board resources, emergency services should be called by phoning 999 and ask for Coastguard. They will coordinate other services (including the Lake Wardens) and give instructions as to where the boat should head.

6.3 Operations: grounding, collision, problems caused by inappropriate behaviour of other vessels, extreme weather, etc.;

Anchor if possible. Call for assistance. Ensure everyone has adequate personal buoyancy. Get as close to land as possible. In less severe situations, call the Lake Wardens. In more severe, call 999 and ask for Coastguard.

7 Putting the boat to bed

7.1 Shutting Down

There is an aide-memoire check list on board covering the outline of the following procedures.

When approaching the end of a day's steaming:

(i) allow the fire to die down until there is judged to be just enough to complete the journey (plus a few minutes spare);

(ii) Fill the boiler right up using the injectors;

(ii) In a safe position a little way off-shore, stop the engine. With the injector running, blow down about half the water in the gauge.

There are two blow down valves: each should be opened in turn for 3 bursts of about 2 seconds. The firebox blow-down valve is situated under the boiler, and is reached by removing the panel below the steering wheel at the front of the boiler and using the extension rod to operate the valve. The barrel blow down valve is above the handle for the other, on the front of the barrel (Figure 7-1). The blow-down sea cock, which is on the starboard side just aft of the starboard injector sea cock, is normally left open.

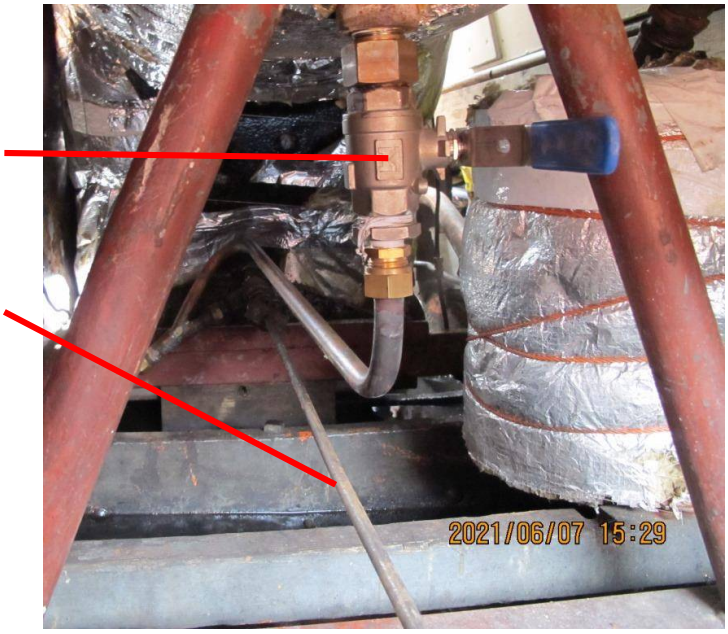


Figure 7-1: Blow down valves (photo taken before the boiler casing was fitted)

(iii) Close the blow-downs and fill the boiler again.

At this point, it will often be appropriate to remove as much ash as possible from the ashpan and dispose of it. It is not considered acceptable on environmental grounds for ash to be dropped in the lake; it should be carefully disposed of ashore.

(Iv) Using the last of the fire, steam slowly into the berth and moor.

This procedure ensures that there is sufficient water in the boiler for the next steaming, and that any oxygen in it has been boiled out before it is left.

After steaming, oil the cylinders:

(I) open all drain cocks fully;

(ii) unscrew the upper cylinder cocks from the cylinder block;

(iii) pump about six strokes from the oil can into each cylinder;

(iv) replace the cocks.

While there is still steam available, eject any water in the injector drip container and in the bilges both sides of the boat: see section 4.2.1 .

Before leaving the boat, the injector water control valves, water delivery and steam valves should be closed.

7.2 Cleaning out

The fire should be raked through and ash and clinker removed from the ashpan before the next steaming. This is most easily done when the boiler is cold. If done hot, extreme care must be taken that hot ash does not fly and damage people or the boat. The funnel cap (Figure 7-2) may be used to avoid this, particularly in the boathouse.

Figure 7-2: The Funnel Cap

Ash tends to cake (harden) at the back of the fire box and the ashpan, and can build up. Care should be taken to remove this to lessen the chance of the fire bars overheating.

Ash must be disposed of in a sensible and legal manner.

7.3 Mooring in a boathouse or dock

Remove the burgee staff before entering the dock – it tends to catch in the ropes and get broken.

Fenders should be placed as appropriate – see in 5.1.1 above.

The aim is to keep the boat in the centre of the dock, and prevent surging forward and backwards due to waves. Exact details will depend on what is permanently fixed, but all have common features:

(a) Four mooring ropes to the cleats on the fore and after decks. These may be weighted lines from overhead or may be short ropes to bollards/cleats/posts on each side and slightly ahead/astern of the deck cleats. These ropes should be reasonably slack to take account of possible changes in lake level, and may have weights on them. Their purpose is to keep the boat in the centre of the dock.

(b) Four springs – long weighted lines from the midships cleats to well ahead and astern of the boat. These prevent the boat surging fore and aft due to waves. The weights should be substantial – motor tyres with a hole for a fixing loop of rope work well. A drain hole at the bottom is useful for lifting them out of the water. They may be filled with gravel to increase their weight.

The ensign staff should be removed when the boat is moored.

7.4 Boiler Covering

The boiler will remain warm for a day or so. If it is to be left longer than this, the small electric bar heater should be placed in the firebox and the boiler covers (quilts/blankets) draped over the boiler to minimise the possibility of condensation.

7.5 Cleaning round

Fly ash should be gently removed form the cabin roof. If the boat is wet (above the waterline!), all surfaces should be dried using clean towels to lessen staining

The brass edge at the funnel top (Figure 7-2) should be thoroughly cleaned with metal polish whilst warm to prevent the soot from etching the surface of the brass. It will be much more difficult to polish the next morning if this is not done.

8 Storage of Equipment

8.1 Fenders

Fenders normally used forward or amidships are stored under the seats in the forward well.

Fenders normally used aft are stored under the seats in the after well.

Spare fenders are stored in the forepeak or afterpeak.

8.2 Mooring Ropes

The white coiled ropes on the decks are purely decorative – they are never used for mooring.

There are four long (blue) ropes, stored one in each ‘corner’, on each side under the seats forward and aft.

Short ropes for midships mooring are kept near their respective cleats.

Some spare ropes are kept under the seats forward and aft.

8.3 Anchor

The anchor with its chain and warp is stored under the step on the port side. Note that the end of the warp is not attached to anything while stored.

8.4 Oil

Bearing and cylinder (‘black’) oils are in the port side locker next to the engine. This locker also contains lamp oil and the battery and bilge pump. There is also a container to receive oil/water mixture pumped out of the engine sump. This must be disposed of through an authorised hazardous waste organisation.

8.5 Coal

Spare coal is in the locker on the port side beside the boiler. This coal should be ‘rotated’ into the bunker and replaced periodically.

8.6 Navigation lights

The headlight is kept in the forepeak on the starboard side. The port and starboard lamps, and their mounting boards, are behind the cabin doors. The stern light is beside the sink.

8.7 Miscellaneous

The rope ladder is under the step on the starboard side.

The fire extinguisher is behind the cabin door on the starboard side. The fire bucket is under the seat forward on the starboard side.

Oars for emergency use are under the seat on the port side aft.

Cleaning and polishing materials are under the seat on the starboard side aft.

9 Maintenance

9.1 Sweeping Boiler Tubes

The boiler tubes should be swept every 50 hours steaming, or whenever there seems to be a lack of steam.

1. Remove the steering wheel, the panel behind it and the panel below it.

2. Lay a canvas sheet under the front of the barrel, as far back as possible, to catch any fall of soot.

3. Remove the smoke box door. This is heavy, and is easier with two people. Note how the catches turn to open and lock the door.

4. Brush/vacuum out the loose soot in the smoke box. Using the tube brush (which should be under the seat forward), clean through each tube right through to the firebox, at least twice.

5. Clean out the smoke box, brushing the tube plate, sides, top and bottom and as far up the flue as is practicable.

6. Remove the sheet, taking care that soot does not fall into the bilge.

7. Replace the smoke box door, making sure it is securely locked. The top of the door goes in first.

8. Replace the panels and wheel.

Figure 9-1: The Smoke Box

10 Laying-up – winter procedures

10.1 Removing the Funnel

In the Wray boathouse, the funnel should be removed when there is a risk of the lake level rising significantly. This is not necessary in the Ferry Nab boathouse.

Remove the safety valve vent pipe by undoing the screws on the flange on the steam dome and the clamp near the top of the funnel.

Remove the front steering wheel and the panel behind it. Remove the brass screws holding down the trim (they have captive nuts under the board). The trim can then be lifted off. Remove the outer funnel and inner flue.

All screws removed should be put in a suitable container and stored where they are safe but readily accessible. They should not be left loose or mixed with other items.

10.2 Draining the wash basin system

The steam and water pipes to the wash basin must be emptied to avoid freezing.

a) Turn off the valve on the boiler face which supplies the steam (Figure 10-1), and disconnect the pipe;

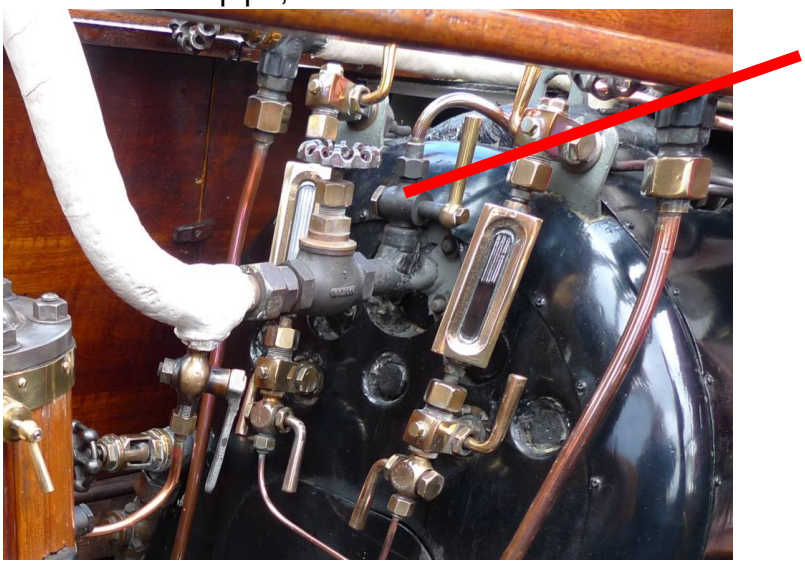


Figure 10-1: Auxiliary Steam Valve

Figure 10-2: Basin Sea Cock

b) Under the cabin floor, turn off the sea cock supplying the basin water, and disconnect the pipe to it. Some water will run out into the bilge.

Figure 10-3: Basin Plumbing

c) There is a bit of plastic pipe with a union on the end under the floor. Attach this to the sea cock, and blow, while opening the valve, waiting for appropriate bubbling noises, and closing the valve. This ejects any water in the valve body.

d) Further aft, there is a tee on the basin waste pipe. On the end of the branch is a plug. Remove this – quite a quantity of water will come out – about 2 mugs full;

catch it if possible and dispose. Leave the plug nearby in the bilge.

e) While in the bilge, check that the limber holes on the starboard side are clear.

f) in the lower right-hand cupboard under the sink, at the back on the left, there is a vertical cylindrical copper pipe – the heat exchanger. Disconnect the ¼ inch fitting at the bottom of this.

g) Turn both basin taps on.

h) Inform anyone appropriate that this has been done (e.g. by leaving a note in the basin), and that no water should be poured into the basin.

In the spring, re-connect all these pipes and turn the supply valve on again.

10.3 Pressure gauges and kettle

(a) Disconnect the pipe to the main pressure gauge, remove the gauge and shake it to remove any water. Preferably take it away to a warm place for the winter.

(b) Disconnect the pipe to the valve chest pressure gauge, remove the gauge and shake it. Either re-mount it (leaving it disconnected) or take it away.

(c) Disconnect both pipes to the kettle. Empty the kettle and blow any water out of the coil. Disconnect the other end of the steam pipe and drain any water out. Leave the kettle disconnected.

(d) Disconnect the water level gauge drains and drain any water out of them.

In the spring reconnect all these items.

Appendix A Boiler Water Treatment

Treatment chemicals must be added to the boiler water to inhibit corrosion. *Feedwater Treatments* have recommended Polytan 4C, which will improve the Alkalinity, pH, and the hardness. The suggestion is run the boiler's Total Dissolved Solids (TDS) at 2500ppm max, rather than 3500ppm as previously

Short swift blowdowns will allow the sludge build up to be removed as well as controlling the TDS levels, a long blowdown will generally remove water from the centre of the boiler after a few seconds.

POLYTAN 4C is a blended liquid treatment based on organic tannins, polymer sludge, conditioners and alkali. POLYTAN 4C can be used with softened or moderately hard make-up, and in many instances provides a complete balanced treatment by itself. However POLYTAN 4C can be used with other widely used conjunctional treatments to provide phosphate control and condensate system protection. POLYTAN 4C controls corrosion by the dual mechanism of oxygen scavenging and the formation of a corrosion resistant tannate film. It prevents scale formation by converting residual hardness salts to a mobile non-adherent sludge that can be removed by blowdown. The manufacturer's data sheet is included below.

Usage

POLYTAN 4C should be dosed initially at 1:1000, based on the system volume. The ongoing dosages should be made to maintain a tannin reserve of 12-20, and the appropriate pH and alkalinity residuals.

Volume of water in boiler at normal working level: xxx litres (yyy gallons)
Amount of treatment to be added to newly filled boiler: aaa litres (bbb pints)

Amount of water lost in typical blowdown: ppp litres (qqq pints)
Amount of treatment to be added after nnn blowdowns: zzz litres (ddd pints)

(*This section to be completed when numerical values of the boiler volume are available).*

The actual dosage required depends on such variables as make-up water temperature, hardness and TDS and can be advised by our FEEDWATER CONSULTANT.

Analysis of our Tannin levels can be performed using the test kit

Monitoring

It is necessary to monitor the amount of boiler treatment in the boiler water. After a few blowdowns it will be diluted and not provide effective protection against erosion of fire tubes and stays. When it is necessary to do a test on the water in the boiler, with the boiler cold and before adding water, draw a sample by removing a drain pipe from one of the sight glasses. Discard the first 100 ml of water and draw off a sample using the measuring cylinder; follow the instructions included with the test kit.

First Aid Measures

Inhalation: Remove affected person from source of contamination. Keep affected person warm and at rest. Get medical attention immediately.

Ingestion: Never give anything by mouth to an unconscious person. Do not induce vomiting. Rinse mouth thoroughly with water. Get medical attention immediately.

Skin contact: Remove affected person from source of contamination. Remove

contaminated clothing. Wash skin thoroughly with soap and water. Get medical attention promptly if symptoms occur after washing.

Eye contact: Remove affected person from source of contamination. Remove any contact lenses and open eyelids wide apart. Continue to rinse for at least 15 minutes. Get medical attention immediately. Continue to rinse.

feedwater
the water treatment specialists

Tarran Way West, Moreton,
Wirral, CH46 4TU,
United Kingdom
Tel: +44 (0) 151 606 0808
Email: info@feedwater.co.uk
Web: www.feedwater.co.uk

PRODUCT DATA

POLYTAN 4C

Treatment for Steam Boilers and LPHW systems

Description and Use

POLYTAN 4C is a blended liquid treatment based on organic tannins, polymer sludge conditioners and alkali. POLYTAN 4C can be used with softened or moderately hard make-up, and in many instances provides a complete balanced treatment by itself. POLYTAN 4C can also be applied with other widely used conjunctional treatments to provide phosphate control and condensate system protection.

POLYTAN 4C controls corrosion by the dual mechanism of oxygen scavenging and the formation of a corrosion resistant tannate film. It prevents scale formation by converting residual hardness salts to a mobile, non-adherent sludge that can be removed by blow-down.

Dosage Rates

As a starting point POLYTAN 4C should be dosed initially at 1:1000 (1 litre per m^3), based on the system volume. The ongoing dosage should be set up to maintain a tannin reserve of 12-20 as 'tannin index', or 120-200mg/l of active tannin. The appropriate pH and alkalinity residuals should also be maintained. Your dose rate should be adjusted as required based on feedback results from sample testing.

The dosage rate of POLYTAN 4C may be advised by your FEEDWATER Consultant, who will consider several factors to optimise the set-up including the feedwater temperature, boiler blow-down rate and workload.

Typical Properties

Appearance..... Dark brown liquid
pH..... >13
Specific Gravity..... 1.3 – 1.4
Non-flammable
Non-volatile

Always read the label and product information before use. See safety data sheet for safety and handling precautions

For safety data sheets email msds@feedwater.co.uk

Appendix B Materials and Supplies

Item	Specification	Source
Coal	Welsh Steam Coal, 4 inch size	Frank Burston, Station Rd, Chepstow NP16 5PB, 01291 623976, https://www.frankburston.co.uk/
		Alex Sharphouse, Old Hall Farm, Bouth, Ulverston LA12 8JA, 01229 861993, https://oldhallfarmbouth.com
Cylinder Oil (“Black Oil”)	Steam Cylinder Oil 68OCT	Heritage Steam Supplies Unit 34, Brunel Way Segensworth East Fareham. Hampshire PO15 5SF, https://www.heritagesteamsupplies.co.uk
Engine Oil	Straight Bearing oil LBO460C	Heritage Steam Supplies
Grease		
Boiler Water Treatment	Polytan 4C	Feedwater – see Appendix A
Boiler Lime/Soda		
Metal Polish	Peak	Heritage Steam Supplies
Varnish	Epifanes	

Appendix C Boiler Inspection

Preparation

1. Ensure there is sufficient water in the boiler, and light the fire.
2. Remove the forward steering wheel and the upper and lower front boiler casing panels
3. Disconnect the kettle inlet tube and the whistle cord. Remove the safety valve vent pipe.
4. Remove the brass screws retaining the steam dome trim. Some of these may have nuts underneath, which can be reached from the front of the casing. Others have a captive nut.
5. Lift off the trim, manipulating it past the whistle, safety valves and kettle cock
6. Wait until the steam pressure is around 30 lb/sq in, avoiding building up the fire too much. When this pressure has been reached, suppress the fire (raking through, perhaps removing large pieces of partially burnt fuel).
7. Open the blowdown valves fully, and wait until all the water has been ejected. It is helpful to rock the boat a bit during this operation, to make sure any sediment remains in suspension and is ejected.
8. When the blowdown becomes silent, there is still some pressure, but not enough to overcome the hydrostatic pressure at the sea cock. Close the blowdown valves (to avoid water being drawn back in) and carefully open the kettle valve to release the remaining pressure.
9. Once the fire has been extinguished, the smoke box door may removed (it will be hot!).
10. When all the pressure has gone, remove the nuts retaining the steam dome (this will also be hot), and lift it off onto a nearby wad of newspaper. If the dome is reluctant to come off, use two ½" Whitworth screws in the jacking holes. Do not attempt to prise it off with a screwdriver.

Figure C-1: Steam Dome Removed

11. Remove the four washout plugs at the four bottom corners of the firebox. These are very awkward to get at; it may be necessary to remove the inlet pipe of the port injector to get at the after port plug and the pipe from the silencer to the ashpan for the forward port plug. There are three special spanners for these plugs.

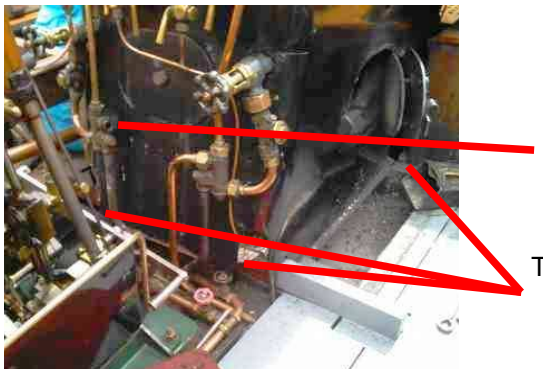


Figure C-2: Washout Plugs

Figure C-3: Spanners for Washout Plugs

12. Clean out the accumulated ash and soot from the smokebox, taking care that it does not fall into the bilge. Using the tube cleaning brush, clean through all the boiler tubes, pushing all material into the firebox.
13. Remove the blanking panel from the rear of the firebox by removing the centre nut (visible just below the gauge glass drain tubes on Figure 4-6). There is a second nut behind the outer panel. When this is removed, the clamp can be withdrawn from inside the firebox.
14. Remove all the firebars (which may still be hot). All the accumulated ash, soot, etc. will now fall into the ashpan, which should be cleaned out completely.
15. To clean the uptake, blast pipe and blower nozzle, it may be convenient to remove the funnel. Remove the trim screws, in a similar manner to those for the steam dome trim, and lift off the trim. The outer and inner funnels can then be lifted off.

Figure C-4: Cleaning the Uptake

Cold Inspection

The inspector will look at all safety critical elements of the boiler.

Hydraulic Test

After the cold inspection, the inspector may require a hydraulic test to working pressure or above working pressure. Both these require the boiler to be filled to the brim. This may be done using a submersible bilge pump powered from a battery charger.

1. Replace the washout plugs, using ptfe tape.
2. Fill with water to the brim.
3. In place of the steam dome, put on the blanking flange which has an air bleed valve. Since this is thinner than the dome, a number of washers may be needed on the screws. Close all boiler inlet and outlet valves.
4. The inspector will attach a hand pump to an appropriate connection, and carry out the hydraulic test.

Figure C-5: Steam Dome Blanking Flange

Steam Test:

The steam test is primarily to check the correct operation of the safety valves, pressure gauge, water level gauges, injectors and blow-down.

1. Replace the washout plugs (if not already done).
2. Remove the dome blanking plate (if fitted) and refit the steam dome. Refit the funnel (if removed) and the safety valve vent pipe.
3. Fill/drain water to the normal operating level.
4. Add the appropriate amount of boiler water treatment and lime.
5. Replace the fire bars, the firebox blanking panel, the injector inlet tube (if removed) and the smoke door.
6. Light the fire and raise steam.

After the live steam inspection, if all is well, all trim and panels and the kettle can be re-fitted (to fit the trim, it will be necessary to remove the safety valve vent pipe again). After a good clean round, the boat is ready for service.

Appendix D The Launch Boiler

The Launch Boiler

The boiler uses heat from burning fuel (e.g. coal or wood) to boil water to make steam. For good efficiency, a large surface area between the fire and water sides is needed. The boiler must withstand high temperatures around the fire and high pressures in the steam container.

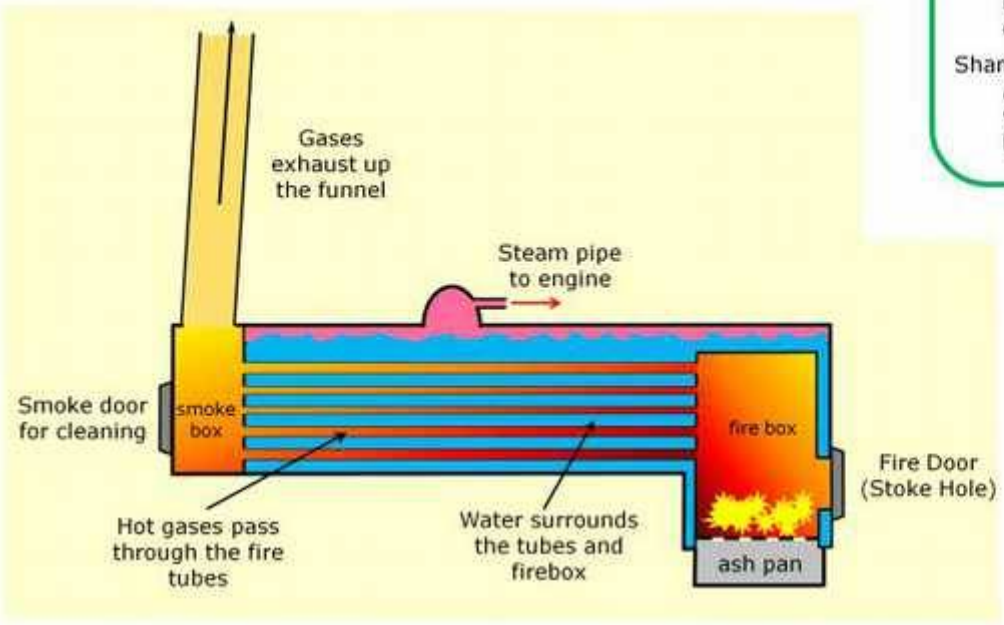
In the early nineteenth century, the design principles for boilers were not well understood, and there were many accidents.

From the middle of the century, experience and better engineering understanding (and new regulations) led to boiler designs which were safe and economical. These are essentially the same as those used today

Boiler types have names which indicate where or for what they were developed:

- *Cornish* boilers for mine pumping;
- *Lancashire* for cotton milling;
- *Scotch* for steamships;
- *Locomotive* for railways and traction engines.

Shamrock's boiler is a *Launch* boiler, a variant on the Locomotive boiler.



The Stoke Hole is at the back for a Locomotive boiler, or at one side for a Launch boiler.

Launch and Locomotive boilers have a large cylindrical drum containing water, with a number of fire tubes running through it from end to end.

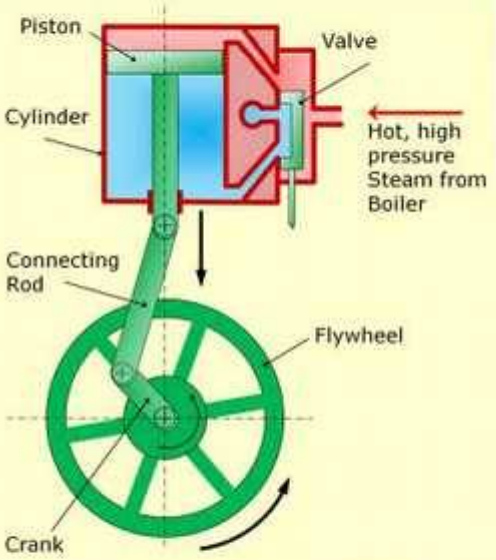
At one end is the firebox, which is double-walled with water in between. The hot gases pass from the fire box through the fire tubes to the smoke box and thence up the funnel. Heat is transferred to the water through the walls of the firebox and the fire tubes.

Shamrock's boiler has 32 fire tubes each 32 mm (1¼ inches) in diameter. The drum is 560 mm (1 ft 10 in) diameter and 1470 mm (5 ft 8 in) long.

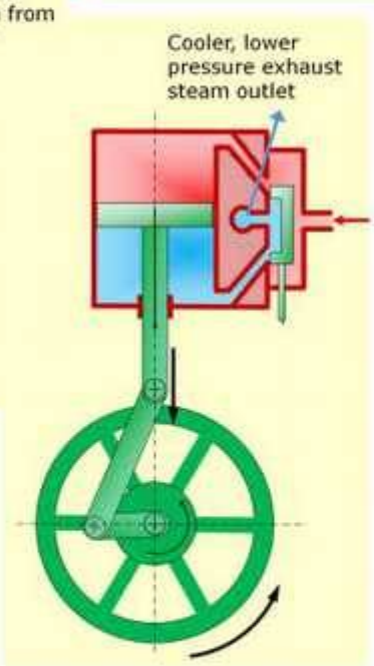
Appendix E The Steam Engine

The Steam Engine

Steam engines take energy from steam at high pressure and temperature and convert it to mechanical power. Traditional reciprocating engines do this with a piston and crank similar to those in a petrol or diesel engine

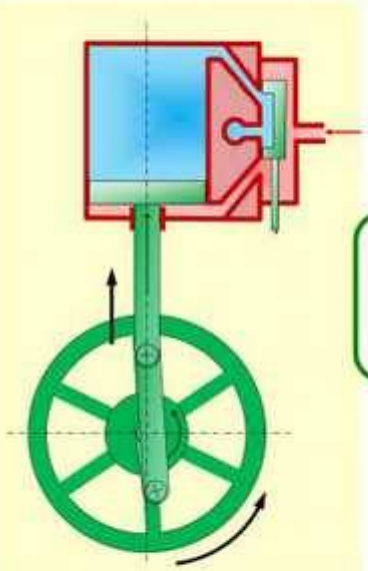


1 Hot, high pressure steam from the boiler comes through a valve into the space above the piston.



2 The steam forces the piston down, turning the crankshaft by means of the connecting rod.

Colder, lower pressure steam from the previous stroke is let out from below the piston.



3 When the piston gets near the bottom, the valve changes the steam supply from the top to the space below the piston, forcing it up again. The crank keeps turning the same way.

The lower pressure steam above the piston is allowed to escape.

4 When the piston gets near the top, the valve changes over again, and the process repeats.

The energy of the flywheel helps to keep the engine rotating at the ends of the stroke. The valve is driven from the crankshaft, so the whole thing is automatic.

Shamrock's engine has two sets of pistons and cylinders working on the same shaft – a *twin high pressure* engine. Between them, they keep the shaft turning continuously, so a flywheel is not needed (though the propeller and its shaft act rather like one).

Appendix F Other Appendices to be written

Pulling out vessel using railway at black boathouse

The enclosed area is 48' from wall to doors, (the positioning of the vessel on trolleys is thus critical)

Setting up trolleys: the chains joining the trolleys should be singled and at their longest. They may have been altered for another boat.

The post on the front (top) trolley must be in line with the second white rope stanchion on the port side, and should be loosely tied as she is positioned on the trolley.

Draw up trolley until 6" back from edge of plinth (check because of the new trolley)

Special cradles to fit her have to be put in as she is drawn from the water but the weight of the vessel must be taken by the keel, not on the cradles which are to prevent tipping

The above a guide only and we need to do it and observe.

Boat house door mechanism