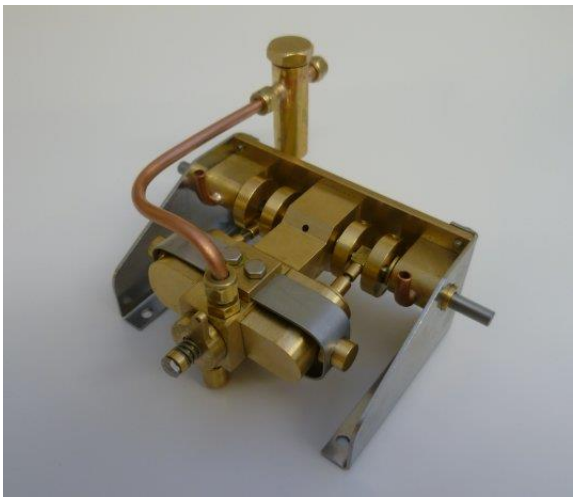
CLEVEDON STEAM

The Virgo/Libra Paddle Engine



Congratulations on becoming the owner of a Virgo or Libra Paddle Engine. With careful use and maintenance it will give many years of satisfying performance.

Contents

Engine Assembly Instructions

Notes:

1. Please read the instructions fully to familiarise yourself with the parts, the assembly and safe running of your engine. Once you have assembled your engine please retain these instructions for future reference

2. On receipt of your engine, please check that all parts are present. If any parts are found to be missing or damaged, please contact Clevedon Steam for a replacement.

3. As you progress through these instructions please assemble the parts 'dry' to ensure correct fit and operation before dismantling for final assembly using oil, and thread lock.

4. Every effort has been made to supply clean parts, free of burrs and sharp edges. However, if you do find a part that is burred, please use a fine metal file to remove the burr, finishing up with wet and dry paper if necessary.

5. When assembling the engine, all mating surfaces and bearings should have a drop of oil applied

6. Only genuine steam oil should be used in the lubricator. Steam oil can also be used for lubricating the moving parts of the engine

7. If you require any assistance or advice concerning your engine please contact Clevedon Steam.

Tools and equipment required to assemble your engine

1) Set of BA spanners

2) Cocktail stick

3) Small bench mounted vice

4) Bottle of steam oil

5) Fine needle file

6) Masking tape, wet and dry paper, paint

Painting your engine

As the engine is supplied in bare metal, before you start assembly, you may wish to paint it a colour of your choice. This is best achieved by roughing the surfaces to be painted with either wet and dry paper or an abrasive wheel, being very careful not to damage the port faces. Neatly mask the cylinder mating faces and reversing valve face of the standard with masking tape, trimming excess with a blade. The standard and spring yokes can then be sprayed with a few light coats to build up the paint finish, as thick coats should be avoided. Any heat resistant paint is best, but not essential. Hand brushing or aerosol enamel type paints should be avoided as they become waxy when hot. When the paint has thoroughly dried and hardened, remove the masking tape and clean off any rough edges.

Assembling the engine

With all the engine parts to hand, note their relative positions and part numbers as per the enclosed exploded diagram.

The pre-assembled cylinders (2) will need their big ends (7) and trunnion pins (4) fitting. Pull the piston rod out slightly and with a drop of sealant on the thread, screw the big end on completely and turn back half a turn. Repeat for the other cylinder. Next to fit are the trunnion pins. Using a cocktail stick, apply a drop of sealant into the threaded hole in the cylinder port face. Screw in the trunnion pin, grip lightly in vice jaws, which should be protected with masking tape, and turn the cylinder to ensure the thread is screwed in fully. Do not over tighten or there is a risk of deforming the cylinder bore. Repeat for the other cylinder and leave for the sealant to harden.

While waiting, take the crankshaft (14) and output shafts (17) and check they enter the bearings of the standard (1) without resistance. If there are any burrs on the machined flats of the shafts, carefully remove them with a fine flat file. Put the shafts to one side and take a cylinder assembly to check for smooth operation of the piston rod in and out. You may find it smoother one way round than the other. If so, choose the smoother position for when you assemble the engine. Take a cylinder assembly and with the piston rod fully in, insert the trunnion pin in its hole in the standard and hold the cylinder against the mating face of the standard in front of a strong light. While tipping the cylinder side to side in both vertical and horizontal planes, check to see if there is an equal gap top and bottom and side to side where the edges make contact with the standard. Note where it is not the same and grip the trunnion pin lightly in the vice jaws. Very carefully apply finger and thumb pressure to the cylinder to adjust the trunnion pin. Only apply enough force to move the pin a small amount. Too much will snap the pin. Regularly check the seating to the standard face and when satisfied that the cylinder sits equally against the port face, remove it and put a small scratch on the bottom cover flange and one on the standard below the mating face. This will ensure that the correct cylinder is assembled to its side of the standard Repeat for the other cylinder. Do not scratch mark the second cylinder. It is vital to the smooth running of the engine that the above is carried out.

To start assembling the engine, insert the grub screws (16) into the crank disc (12) and follower discs (11). Take the cylinder assembly for its correct side and insert the trunnion pin in its hole in the standard. Swing the bottom of the cylinder out and insert a crank disc pin through the big end hole and put on a follower disc. Slide the crankshaft through the opposite output bearing, centre bearing and just far enough through to put on a thrust washer (9) for a Virgo engine or a spacer (10) for a Libra engine. Take the other cylinder assembly and mount it in the trunnion pin hole as before. Repeat the fitting of crank disc and follower disc for this cylinder and swing it to a vertical position to enable the crankshaft to be inserted through the crank disc hole. This is best done by using the long end of the Allen key, to push the crankshaft through from the output bearing. Line up the first

cylinder's crank disc with the crankshaft and from the other output bearing end, push the crankshaft so enough enters the crank disc hole to be flush with the disc's outer face. The grub screws of the two crank discs can now be tightened onto the crankshaft flats. There should be slight end to end movement to prevent seizing when hot. With the engine held vertically, slide onto the outer face of one of the follower discs, either a thrust washer (18) for a Libra engine or a spacer (10) for a Virgo. Centre this over the disc's crankshaft hole and insert an output shaft until the inner end is flush with the inside face, tightening the grub screw onto the shaft's flat. Repeat this for the other end of the engine. Check that the engine turns smoothly, by holding a thumb and finger of one hand to keep the cylinders against the standard, whilst turning a crank disc with the other hand. There should be no resistance or tightness. Next to fit are the spring yokes (20), cups (5) , springs (21) and clamps (8). Insert the spring cups into both yokes and place a spring into each. Start by passing an M3 x 6 hex head bolt (22) through a clamp hole and with the free end of the spring held into the cylinder recess, screw the bolt of one side of the yoke into the relevant tapped hole in the standard. Keep pressure on the spring cup and repeat for the yoke's other side. Do not tighten the bolts yet. Take the yoke assembly for the other cylinder and ensuring the yoke ends locate behind the clamps, screw the remaining two bolts into the standard. Tighten all four and then remove them one at a time. Apply thread sealant and screw firmly back in place.

The reversing valve (3) can now be fitted. Apply a drop of sealant into the threaded hole into the end of the standard and after wiping away any excess, put the bolt assembly (23/25) and spring (21) over the reversing valve hole. Making sure the valve is centred over the standard's threaded hole, screw the bolt assembly in, checking that the tube enters the valve before tightening. The double ended male union (13) is fitted into the tapping on the crankshaft oil tube side of the standard, with the short extension (27) fitting in the opposite side. Into this fitting is screwed the exhaust elbow (26). It is recommended that it faces in a direction that allows the the exhaust pipe nut to be easily tightened. The lubricator to engine steam pipe (19) is supplied straight, so that it can be bent to the desired shape depending on engine installation. It is best bent carefully over a round object to give a gentle, neat curve avoiding tight bends. Do not bend too tightly at first, as the copper will harden and become misshapen. Screw the engine end onto the double ended male union and the in line lubricator (15) is then fitted to the nut at the other end of this pipe. A nut and union ring (24 & 6) are supplied for silver soldering to a 4mm steam pipe from the boiler.

The final parts to fit are the side plates (28 & 29). These are fixed with the four M3 x 6 pan head screws (30). Lightly tighten all four screws into the tapped holes in the bottom of the engine standard with the plate feet flat on a surface and tighten securely. This completes the engine assembly. A spacer (10) is supplied to slide onto the output shaft that will power the paddle shaft of the boat.

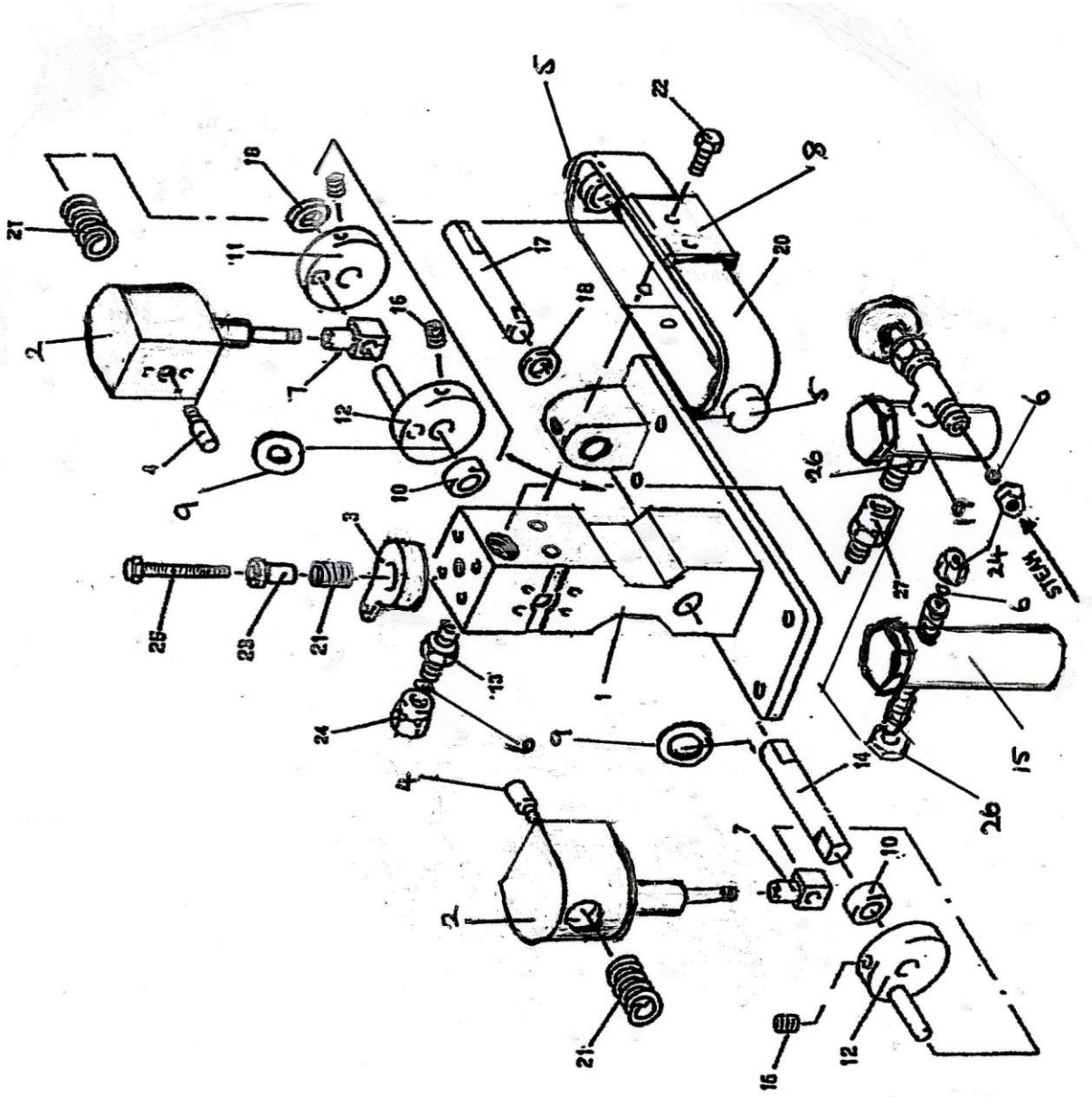
Steaming the engine

Once assembled, your engine is ready for steam testing. Ensure that all mating surfaces and bearings are lubricated with steam oil.

Unscrew the cap and fill the lubricator with steam oil to just level with the cross tube. Refit the cap finger tight only or the O ring will become damaged. Under no circumstance should the cap be loosened or removed whilst there is pressure in the boiler. Unless the steam supply pipe to the engine has a stop valve, the lubricator cap should not be removed until the boiler is cool. The waste oil residue can be removed from the lubricator with a suitable length needle and syringe. This is best done with a rag or tissue held over the open lubricator to prevent ejection of hot liquid. Always empty the lubricator after running and refill before steaming as this ensures free running of the engine.

VIRGO AND LIBRA ENGINE PARTS LIST

		QTY
1)	STANDARD ASSEMBLY	1
2)	CYLINDER ASSEMBLY	2
3)	REVERSING VALVE	1
4)	TRUNNION PIN	2
5)	SPRING CUP	2
6)	UNION RING	2
7)	BIG END	2
8)	SPRING YOKE CLAMP	2
9)	THRUST WASHER	2
10)	SPACER	3
11)	FOLLOWER DISC	2
12)	CRANK DISC ASSEMBLY	2
13)	DOUBLE ENDED MALE UNION	1
14)	CRANKSHAFT	1
15)	LUBRICATOR	1
16)	GRUB SCREW M4	4
17)	OUTPUT SHAFT	2
18)	THRUST WASHER	2
19)	STEAM PIPE	1
20)	SPRING YOKE	2
21)	SPRING	3
22)	M3X6 HEX HEAD SCREW	4
23)	SPRING RETAINER	1
24)	UNION NUT	2
25)	M3X16 HEX HEAD SCREW	1
26)	ELBOW	1
27)	SHORT EXTENSION	1
28)	PADDLE PLATE – LEFT	1
29)	PADDLE PLATE – RIGHT	1
30)	M3X6 PAN HEAD SCREW	4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