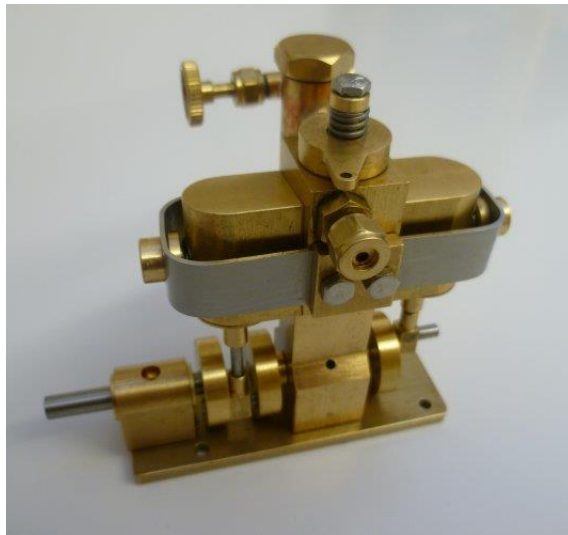




The Virgo/Libra Steam Engine



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

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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 shaft (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 and follower discs. Take the crankshaft (14) and tighten the grub screw of one of the crank discs onto the flat of the crankshaft, with the Allen key supplied. The end of the crankshaft should just be below the face of the crank disc. Put a crankshaft spacer (10, Libra engine) or a thrust washer (9, Virgo engine) onto the crankshaft and insert the end into the bearing of the standard, but only until the end is just protruding enough to slide on the other spacer/thrust washer.

Next, take the cylinder for the output side of the engine and insert the trunnion pin in its hole in the

standard. With the piston rod fully extended, put the pin of the other crank disc through the big end hole and slide on the follower disc (11) with its grub screw lining up with the crank disc one. Swing the crank disc assembly down until the crankshaft can be inserted into the crank disc. Make sure the grub screw is on the flat of the shaft and tighten it. There should be slight end float to prevent the shaft seizing when hot. Whilst holding the engine with the output bearing upwards, slide the thrust washer (18) into place between the follower disc face and the output bearing inner surface. Slide the output shaft (17) into its bearing so that the smaller flatted end enters the follower disc, again checking that the grub screw seats on the flat before tightening. As a check for freeness of rotation, hold the cylinder against the standard with your thumb and finger whilst revolving the crank disc. There should be no resistance or stiffness. If all is well, slide the other cylinder into place then recheck.

The spring yokes (20) need the brass spring cups (5) fitting into their holes. Hold a spring (21) into one of the spring cups and place the other end of it into the recess in the cylinder outer face. Take one of the M3X6 hex head bolts (22) and after putting it through one of the yoke clamp (8) holes, lightly bolt one side of the yoke to the standard. Repeat for the other side of the engine, whilst maintaining pressure against the spring, ensuring the yoke ends are located in the machined slots of the clamps. Repeat for the other spring yoke and nip all four bolts until firm. Take them out one at a time and apply a drop of sealant to the bolt thread and tighten firmly. Do the same for the other three bolts.

The reversing valve (3) can be fitted with a drop of sealant in the tapped hole in the centre of the top of the standard. Wipe any sealant from the port face and take the M3X16 hex head bolt (25) and retainer (23) and spring (21). With the reversing valve sitting centrally over the hole, screw the bolt in, making sure the spacer enters the valve as you screw it home.

The lubricator coupling (27) and exhaust double ended male union (13) are next fitted to the tapped holes either side of the standard, with a drop of sealant on the threads. Note the correct sides for their attachment.

The last part to be fitted is the lubricator (19, Libra engine, 15, Virgo engine). This is screwed in, again with sealant, making sure it is vertically in line with the standard. Tighten the locknut (26) for security. The steam inlet of the lubricator and the exhaust fitting are supplied with a nut and union ring each, for silver soldering to 4mm copper pipe. An output thrust washer (18) is included to fit on the output shaft where a universal coupling is fitted.

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. The Libra engine lubricator has a stop tap and this should be shut fully before the cap is slowly removed in case of residual pressure. Unless the steam supply pipe to the Virgo 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 – VIRGO	2
10)	SPACER – LIBRA	2
11)	FOLLOWER DISC	1
12)	CRANK DISC ASSEMBLY	2
13)	DOUBLE ENDED MALE UNION	1
14)	CRANKSHAFT	1
15)	LUBRICATOR – VIRGO	1
16)	GRUB SCREW M4	3
17)	OUTPUT SHAFT	1
18)	THRUST WASHER	1
19)	LUBRICATOR – LIBRA	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)	LOCKNUT	1
27)	LUBRICATOR COUPLING	1

