

Miniature Steam Pty Ltd.

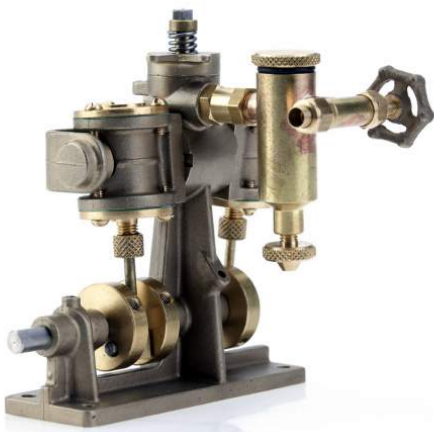
Bringing the Highest Quality Standards to Model Engineering

“Miniature Steam” “Clyde”

Twin Cylinder Vertical Oscillating Steam Engine

11mm Bore/Stroke

Assembly Instructions



Manufacturer:

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"Clyde" Twin Cylinder Steam Engine Assembly Instructions.

General Instructions

On receipt of your product set, check that you have received the correct quantity of components as listed in the "Assembly Components List" for the product ordered and relate them to the "exploded" drawing of the engine as supplied. This is also an excellent way to familiarise yourself with the part numbers associated with the items, that in turn are mentioned in the descriptive material.

Make a preliminary inspection of all components to check for machining burrs that may have been missed by our inspectors and eliminate them with fine abrasive paper or needle files before assembly.

It is important to understand the way in which component part numbers are used within this document.

- Part numbers generally fall into the following categories:

#1000 series are castings that have been machined to our specifications.

#2000 series are components that have been machined from bar stock to our specifications.

#5000 series are assemblies of #1000/2000 series components

#9000 series are nuts, bolts screws and like items that are supplied with the kit

All items can be purchased separately.

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When assembling an engine everything should come together easily. If you encounter stiffness in the assembly then backtrack and trace its origin. NEVER try to force a smooth result. With pre-machined components it is most likely to be caused by a machining burr.

If you are concerned that "finger pressure" tightening in the following instructions is insufficient by all means use a tool but remember that the components involved should not be damaged in any way.

When tightening connections with grubscrews "wiggle" the shaft as you screw down the grub screw to make sure the secure point of contact is centred on the middle of the flat.

Tools Required

- 3 mm hex set key (supplied)

- Small flat blade screwdriver (not supplied)

- Small adjustable spanner for attaching reversing valve assembly and connecting pressure inlet and exhaust fittings (not supplied)

Other Items Not Supplied

- General Lubricant – suggest a locally available light machine oil (see **Oils** below)

- Steam Oil For Displacement Lubricator – a light grade of special steam oil (Steam Engine Compound Cylinder Oil – sometimes called "Cylinder Oil") suitable for lubricating at steam temperatures. (see **Oils** below)

Note: The displacement lubricator is **only** for use in a steam driven system. If compressed air is used a different type of lubricator is required. Please contact us for further information

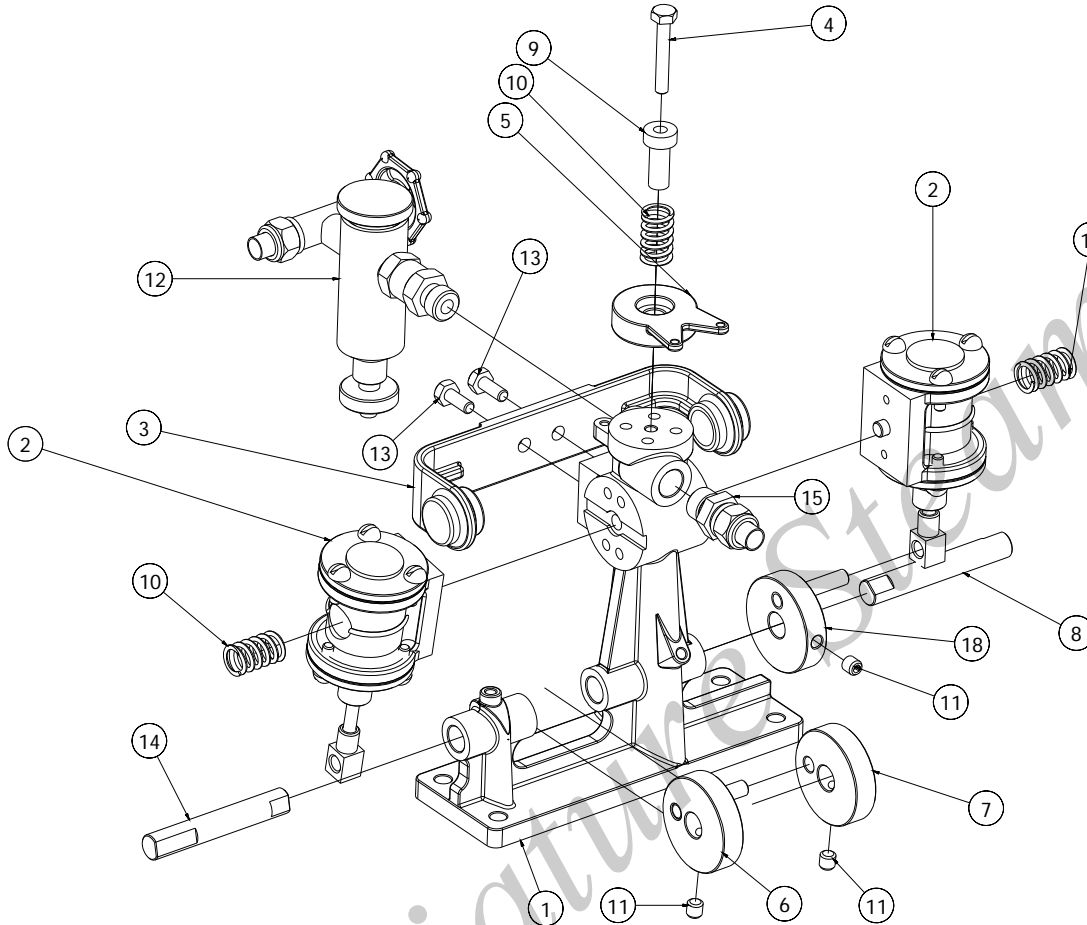
Painting:

If you plan to paint the components of the engine, please be aware that commonly available paints do not consistently adhere to the high quality bronze materials used in the casting sets we supply. To obtain a durable finish for your engine please use an "etch primer" as available in your locality to prepare the engine surfaces before applying the paint of your choice. We recommend that you paint the components before starting the assembly process.

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General Assembly Drawing

Please note: This drawing is a schematic only and does not show all components. It should be read in conjunction with the Cylinder Sub-assembly Drawing to explore all details of the engine. The “Packing Quantity” column of the Components List tables should be used to check the initial delivery.

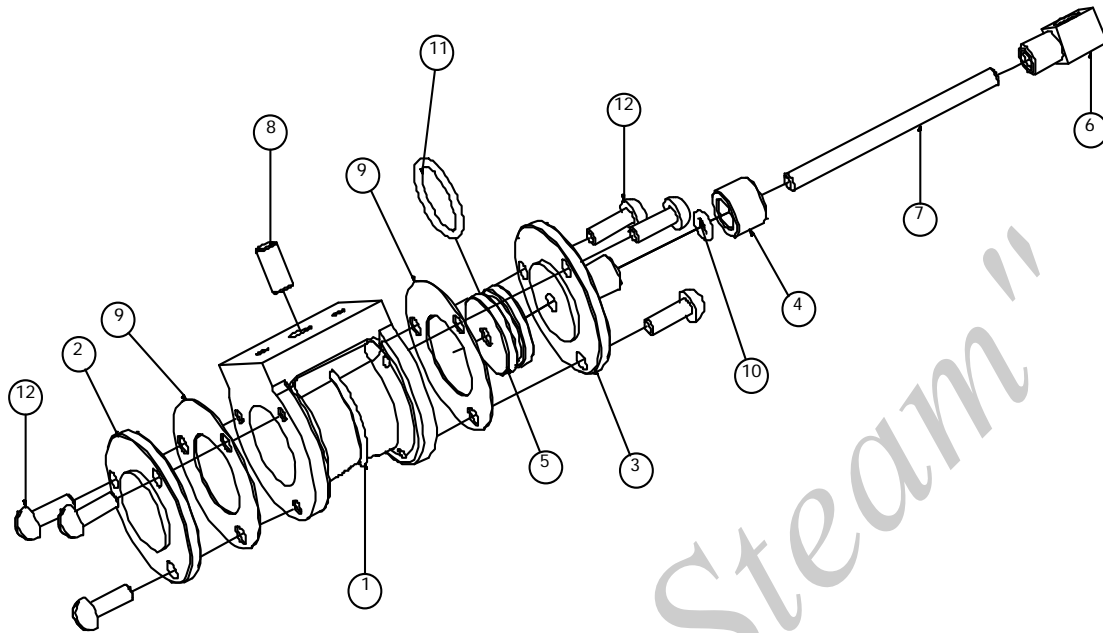


GENERAL ASSEMBLY COMPONENTS LIST

| ITEM | PACKING QUANTITY | ASSEMBLY QUANTITY | PART NUMBER | DESCRIPTION |
|------|------------------|-------------------|-------------|------------------------------------|
| 1 | 1 | 1 | 1101M | Trunk |
| 2 | 0 | 2 | 5214 | Cylinder Sub-assembly |
| 3 | 1 | 1 | 1105M | Cylinder Holding Bracket |
| 4 | 1 | 1 | 9438 | 7BA x 5/8" Hex Bolt |
| 5 | 1 | 1 | 1104M | Reversing Control |
| 6 | 1 | 1 | 5102-B | Flywheel With Long Pin |
| 7 | 1 | 1 | 2108 | Flywheel With Clearance Hole |
| 8 | 1 | 1 | 2110 | Crankshaft A (Flats @ 90 Degrees) |
| 9 | 1 | 1 | 2112 | Reversing Control Collar |
| 10 | 3 | 3 | 2115 | Spring |
| 11 | 3 | 3 | 9200 | Grub Screw - M3 x 3 |
| 12 | 1 | 1 | 5034 | Lubricator Sub-assembly |
| 13 | 2 | 2 | 9667 | 7BA x 1/4" Hex Head Screw |
| 14 | 1 | 1 | 2111 | Crankshaft B (Flats in same plane) |
| 15 | 2 | 2 | 2595 | Nut 1/4" x 40 |
| 15 | 2 | 2 | 2582 | Tail 5/32" Pipe |
| 15 | 1 | 1 | 2375 | 1/4" x 40 Spigot |
| 18 | 1 | 1 | 5102-A | Flywheel With Short Pin |

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Cylinder Sub-assembly Drawing



| CYLINDER SUB-ASSEMBLY | | | | |
|-----------------------|------------------|--------------|-------------|-------------------------|
| ITEM | PACKING QUANTITY | Per ITEM QTY | PART NUMBER | DESCRIPTION |
| 1 | 2 | 1 | 5104 | Cylinder With Pivot Pin |
| 2 | 2 | 1 | 2101 | Top Cylinder Cover |
| 3 | 2 | 1 | 2102 | Bottom Cylinder Cover |
| 4 | 2 | 1 | 2103 | Gland Nut |
| 5 | 2 | 1 | 2104 | Piston |
| 6 | 2 | 1 | 2105 | Piston Big End |
| 7 | 2 | 1 | 2106 | Piston Rod |
| 8 | 0 | 0 | 2114 | Pivot Pin |
| 9 | 4 | 2 | 2116 | Gasket |
| 10 | 2 | 1 | 9130 | Gland Packing |
| 11 | 2 | 1 | 9103 | O-Ring |
| 12 | 12 | 6 | 2113 | Round Head Screws |

Assembly Sequence

Cylinder Sub-assemblies

1. The Piston Rod (2106) is delivered pre-assembled with the Piston Big End (2105). Slide the Gland Nut (2103) followed by the Bottom Cylinder Cover (2102) onto the assembly with the long spigot pointing toward the Piston Big End. Wrap a little Gland Packing material (9130) around the shaft and lightly tighten the Gland Nut onto the spigot.

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Check that the shaft slides cleanly before nipping it up firmly. Reduce the amount of packing material if the shaft movement becomes noticeably stiff. It may free up with time but may require adjustment if the engine becomes sluggish

2. Screw the free end of the Piston Rod into Piston, and, gripping the Piston firmly, twist the Piston Big End to tighten the assembly. Finger pressure alone should be sufficient to secure the threads.

3 Place the Piston “O” Ring (2116) on the Piston after lubricating it lightly.

4. Place a Gasket (2116) over the Piston and insert the Piston in one end of the Cylinder Sub-assembly (5104) (the Cylinder is symmetrical so it does not matter which end). Secure the Bottom Cylinder Cover with the screws supplied (2113)

5. Lightly lubricate the Piston in the Cylinder and the Piston Rod outside the assembly and check for smooth operation of the assembly. It may feel a little rough but the piston should move freely through the entire stroke of the Piston Rod. Adjust the Gland Nut as appropriate.

6. Take the Top Cylinder Cover (2101), add a Gasket (2116) to the flat side of the Top Cylinder Cover and secure it to the Cylinder with the brass screws supplied (2113)

7. Repeat steps 1-7 for the second Cylinder Sub-assembly.

Crankshaft Assembly

1. Place the Trunk (1101M) in front of you with the “tower” on your right. Identify the two crankshafts (2110 & 2111). Crankshaft (2110) has the flats on each end machined at 90 degrees and is fitted on the right side of the Trunk. Crankshaft (2111) has the flats machined in the same plane and is used on the left side of the Trunk (output side).

2. Two of the three Crankshaft Flywheels (5102 A & B) supplied, has a crankshaft flywheel pin pressed in. Flywheel (5102 A) has a shorter pin while Flywheel (5102 B) has a longer pin. The third (2108) has a clearance hole to accommodate the matching pin. The Crankshaft Flywheels are secured to the Crankshafts with a 3mm grub screw. An Allen key is supplied to enable this.

3. When fitting the Flywheels to the Crankshafts, position the grub screws so that the shaft can only enter the Crankshaft Flywheel when a flat is underneath the grub screw. This will ensure correct timing of the crankshaft, flywheel and piston sub-assembly.

4. Take Flywheel (5102 A) and insert one end of Crankshaft (2110) in the centre hole and tighten the grub screw onto the Crankshaft's machined flat. Insert the Crankshaft into the main bearing from the right hand side of the trunk. The Crankshaft should protrude past the main bearing. Secure Flywheel (2108) to the protruding Crankshaft and tighten the grub screw onto the Crankshaft's machined flat. At this stage lightly oil the Crankshaft and ensure that it is turning freely in the main bearing. The Flywheels should not bind against the face of the main bearings.

5. Take one Cylinder Sub-assembly (5104) and locate its big end into the pin of Flywheel (5102 B). Insert the cylinder Pivot Pin (2114) into the top bearing of the “Trunk Tower” at the same time inserting the pin of Flywheel (5102 B) -with the big end fitted - into the clearance hole of Flywheel (2108). Insert Crankshaft (2111) into the left main bearing and secure it to Flywheel (5102 B).

6. Take the second Cylinder Sub-assembly, insert the cylinder Pivot Pin (2114) into the top right hand bearing of the “Trunk Tower” at the same time inserting the Pin of Flywheel (5102 A) into the Piston Big End (2105).

7. Take the Cylinder Holding Bracket (1105M) and insert the Springs (2115) into the recesses inside the ends of the Holding Bracket.

8. Firmly grip the Holding Bracket and locate one Spring on the prepared surface of one Cylinder.

9. Fully compress the selected Spring and ease the Holding Bracket and the Spring at the other end onto the second Cylinder. It should happen without tools but you may need a flat screwdriver to ease the second spring into position.

10. Secure the Cylinder Holding Bracket to the Trunk with the two screws supplied (9667).

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11. Lightly oil all bearings and machined surfaces except the Reversing Control. This should be kept dry for best sealing
12. Manually rotate the engine to ensure it moves freely.

Reversing Valve

Take the Reversing Control (1104M) and insert the Reversing Control Collar (2111) in so that the head fits snugly into the recess machined in the Reversing Control, then place the spring (2115) on the projecting spigot on the other side of the control. Insert the control bush bolt (9438) and fit the assembly to the top of the Trunk tower. Tighten the bolt to provide gentle spring pressure on the Reversing Control.

Final Assembly

The 1/4" 40 ME threaded steam inlet and exhaust ports are fully interchangeable in that the Reversing Control is used to control rotation direction. Attach the Displacement Lubricator (5034) to the most convenient port and the Spigot (2375) to the other port. Connect the supply/exhaust piping using the 1/4" 40 Nuts (2595) and 5/32" Tails (2582) supplied.

Installation & Running In

1. It is very important that the engine be installed on a firm flat surface. The engine components are built to very fine tolerances to ensure maximum performance. Any uneven pressure on the Trunk base can cause binding and reduced performance.
2. Please run the engine for at least three “standard fill” boiler sessions to run in the engine before expecting maximum performance. It is designed to run on steam pressures in the region of 30-40psi.
3. At the recommended pressures there should be no steam leakage. All steam interfaces are lapped before delivery. If leakage occurs after step 2 is complete, it may be necessary to dismantle the cylinders and clean and/or re-lap the offending surfaces. Ask us for advice if you encounter this problem.
4. The reversing valve surfaces should not be lubricated. They are lapped before delivery and will provide a better seal if left “dry”.
5. Although it will work with compressed air, the engine is **NOT** designed to use this power supply for prolonged periods. The Displacement Lubricator only works with steam.

Running In Guidelines for Factory Assembled Engine:

Your assembled engine has been carefully tested before delivery, but because of the close tolerances used in its manufacture, it may be a little “stiff” when you receive it. Before dispatch we have lubricated the piston/cylinder with a “rubber lubricant” to minimise initial stiffness. This lubricant will dissolve during early running and the special steam oil used in the displacement lubricator will take over to minimise your possible frustration during the “running in” phase of your ownership. Some stiffness will remain for the first few “boiler loads” of running.

Important Note

- Steam Oil (see below) should only be used in the displacement lubricator. Do not recycle oil collected in an Exhaust Oil Separator.
- Bearings require oiling with the General Lubricant (see below) For trouble free service, ensure that all bearings are lubricated after every boiler fill. Oil holes are present in the Trunk (1011M) for the inner and outer crankshaft bearings.
- Crankshaft big end bearings (2105), and the Piston Rod (2016), should be lubricated by dripping a little oil alongside them while turning the engine over by hand.
- At the end of a days running remove all residual water and oils and lubricate all bearings as above.

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Oils

We recommend the following: Steam Oil:

250ml P/N 8321
500ml P/N 8322
1000ml P/N 8323

General Lubricant:

250ml P/N 8324
500ml P/N 8325
1000ml P/N 8326

See our website <http://www.miniaturesteammodels.com> for details

Long Term Storage:

The engine's cast components are made from a marine grade non-corrosive alloy; the crankshaft is made from stainless steel and the remainder of the machined components from brass. This combination provides maximum protection from corrosion during service if the engine is run regularly. However if you are planning to not run it for a prolonged period – say 3 months or more, the residual condensate that will remain in the cylinder after a run may cause some tarnishing of the cylinder bore. This could cause accelerated wear of the "O" rings and increase the internal friction of the engine during initial startup. In these circumstances we recommend that you remove the top and bottom cylinder covers, soak up the condensate, directly lubricate the cylinder bore (preferably with a benign rubber grease) and replace the cylinder covers before storing the engine.