

Miniature Steam Pty Ltd.

Bringing the Highest Quality Standards to Model Engineering

“Miniature Steam” “Avon”

Twin Cylinder Vertical Oscillating Steam Engine

8mm Bore/11mm Stroke

Assembly Instructions

P/N 5028



Manufacturer:

Miniature Steam Pty Ltd
PO Box 16
Montrose Victoria 3765
Australia
Phone +61 3 9728 6281
Fax +61 3 9728 6285
Email: info@miniaturesteammodels.com
Web: www.miniaturesteammodels.com



“Avon” Twin Cylinder Steam Engine Assembly Instructions.

General Instructions

On receipt of your product set, check that you have received; at least, 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 item numbers associated with the items, that in turn are mentioned in the descriptive material. Note that some small items that are easily lost have been OVER supplied

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.

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.

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:

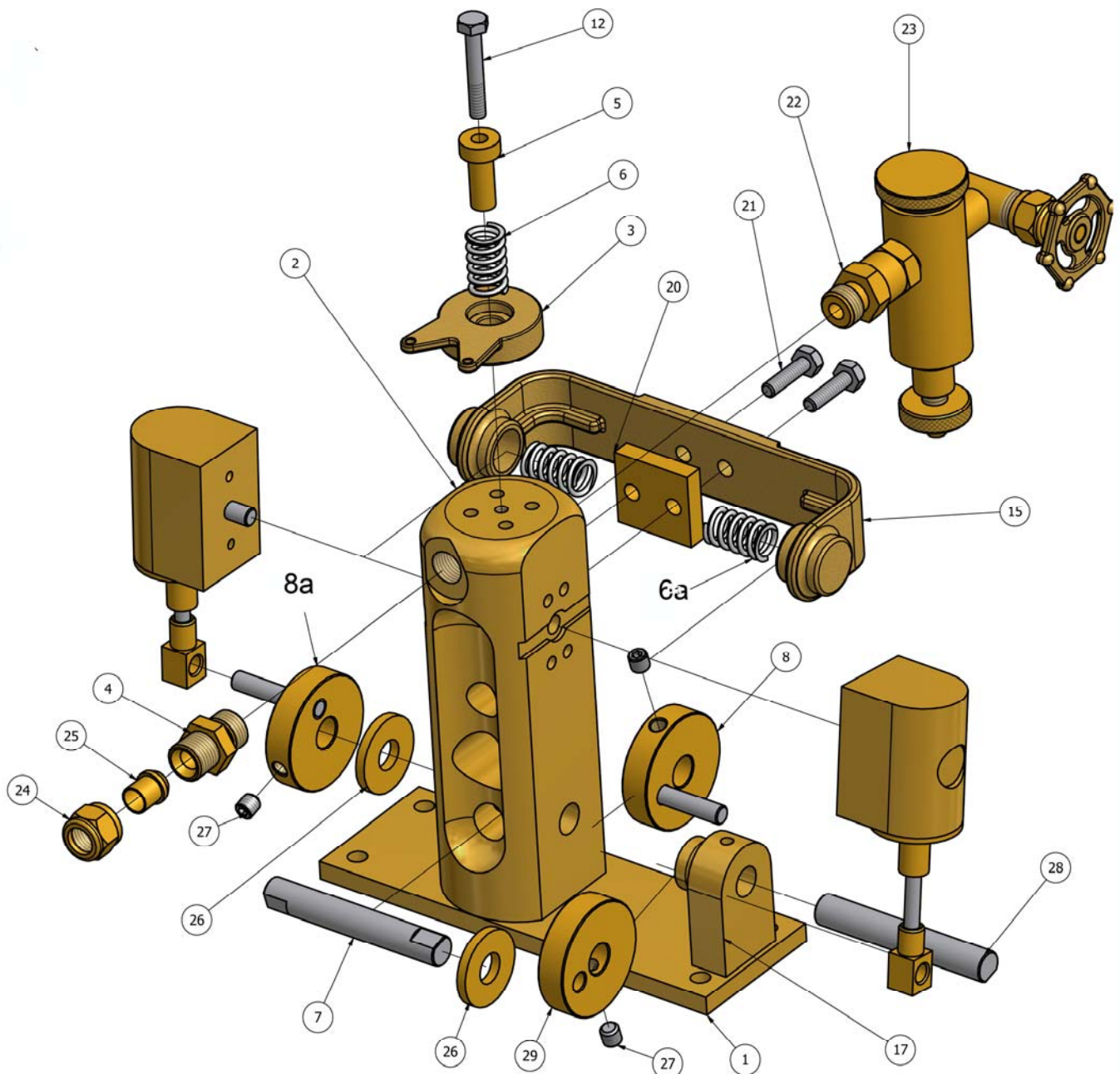
If you plan to paint the components of the engine, please be aware that commonly available paints do not consistently adhere to high quality brass. To obtain a durable finish for your engine please use an “etch primer” as available in your locality to prepare the engine surfaces before applying the paint of your choice. We recommend that you paint the components before starting the assembly process. Remove all grease and oil before painting.

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General Assembly Drawing

Please note: This drawing is a schematic only and does not show all components. The Cylinder Assembly (Item 13) is sold as a precise factory assembled item. If problems are encountered it is recommended that it should be replaced in total.

The “Packing Quantity” column of the Components List tables should be used to check the initial delivery.



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Assembly Components List

Item	Packing Qty	P/N	Description
1	1	2118	Base Plate
2	1	2119	Centre Column
3	1	1104	Fwd/Rev Controller
4	1	2707	Nipple
5	1	2112	Pivot Spacer
6	1	2115	Spring Heavy
6a	2	2117	Spring Light
7	1	2110	Crankshaft
8	1	2109	Crankshaft Flywheel (Long Pin)
8a	1	2109	Crankshaft Flywheel (Short Pin)
9	2	2105	Big End Clevis
10	2	2106	Piston Rod
11	2	2107	Crank Pin
12	1	9637-1	7 BA x 5/8" Hex Bolt
13	2	2121	Cylinder Assembly
15	1	1105	Holding Bracket
17	1	2120	Support Bearing
20	1	2124	Holding Bracket Spacer
21	2	9667-1	7 BA x 3/8" Hex Bolt
22	1	2826	Lubricator Nipple
23	1	5273	Displacement Lubricator
24	1	2598	1/4 x 40 Nut
25	1	2608	5/32" Pipe Tail
26	2	2125	End Float Washer
27	3	9200	M3 x 3 Grub Screw
28	1	2111	Output Shaft
29	1	2108	Crankshaft Flywheel (slip pin)
30	1	2102	Bearing Alignment Shaft (Not shown)

Cylinder Sub-assembly



As noted above the cylinder assembly is factory lubricated and assembled to exacting standards and it is recommended that local inspection should not be undertaken. Please note that a stuffing gland has been added to reduce steam leakage past the connecting rod. This can be seen in the image on the cover page.

This is an exploded view of the Cylinder Assembly.

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Assembly Sequence

Base Assembly:

The following instructions are based on using the orientation of components as set out in the General Assembly Drawing. If there is reason to want a different orientation (i.e. the Holding Bracket needs to be on the other side of the engine) simply rotate the Centre Column 180°. As explained below the steam supply/exhaust ports are interchangeable.

Lightly screw the Centre Column (2) to the Base Plate (1) using the countersunk screws supplied (not shown).



Repeat this procedure for the Support Bearing (17) making sure the machined boss points toward the Centre Column. Having first nipped up the countersunk screws loosen them slightly, insert the alignment rod P/N 2113 (not shown) through the support bearing and the centre column (see image), progressively “wiggle” each item and then tighten the screws until they are tight and the alignment shaft rotates freely against your fingers. This ensures that accurate alignment of the two main bearings for the procedures that follow.

Remove the alignment shaft and store it in case it is needed at a later time.

Crankshaft & Cylinder Assembly

1. Screw the three grub screws (27) into each of the Crankshaft Flywheels (8, 8a and 29) using the 3mm Allen key supplied. Run the grub screws down until you can just see them slightly protruding into the shaft hole. This is to ensure that you can accurately align the position of the grub screw and the face of the shaft flats into which they are to be set.
2. The two Crankshaft Flywheels have a crankshaft flywheel pin pressed in. One (8) has a longer pin than the other (8a). The third (29) has a clearance hole to accommodate the matching pin (on the flywheel with the longer pin).
3. In the following instructions, 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; (see 1. above.). When tightening the grub screws “wiggle” the shaft to ensure accurate centering of the grubscrew in the centre of the shaft flat. The Crankshaft/s should not protrude beyond the face of the Flywheel/s
4. Take the Flywheel (8a) with the shorter pin and fit it to one end of the Crankshaft (7) and tighten the grub screw as instructed in 3 above. Thread an End Float Washer (26) onto the Crankshaft and insert the assembly into the Centre Column left hand side. The Crankshaft should protrude past the other side of the Centre Column. Thread the other End Float Washer (26) onto the protruding shaft and withdraw the shaft to a position where the shaft end is flush with the outer face of the washer
5. Secure the Flywheel (8) that has the longer pin onto the Crankshaft and tighten the grub screw onto the Crankshaft's machined flat as described in 3 above.. At this stage lightly oil the Crankshaft and ensure that it is turning freely. If there is any binding, identify the cause and make corrections.(if you have properly used the alignment tool do not be tempted to adjust the centre column & outrigger bearing settings: the most likely cause will be machining burrs that have eluded our inspectors.) The crankshaft assembly should turn firmly but freely.
6. Take one Cylinder Assembly (13) and locate its big end onto the pin of Flywheel (8). Slide it along the pin while guiding the cylinder pivot pin into its matching hole in the top part of the Centre Column. Repeat this for the other Cylinder Assembly. The cylinders should be firmly seated against the Centre Column
7. Take the third Flywheel (29) and thread the clearance hole onto the projecting long pin of Flywheel (8)
8. Take Output Shaft (28) and slide the end with the shortest flat into the Support Bearing and thread it onto the centre hole of the Crankshaft Flywheel (29). Tighten the grub screw as instructed in 3 above while making sure that the end of the shaft does not protrude past the inside face of the Crankshaft Flywheel.
9. Lightly oil one face of the Spacer (20) and slide it into the slot machined for it in the Centre Column. The oil will help keep the Spacer in place while performing step 10, 11 & 12 following.
10. Take the cylinder Holding Bracket (15) and insert the two Springs (6a) into the recesses inside the ends of the Holding Bracket. The bracket should be oriented so that it will cover the Spacer (20) when assembled to the engine.
11. Firmly grip the Holding Bracket and locate one Spring (6a) on the prepared recess of one Cylinder.

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12. 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.
13. Secure the Cylinder Holding Bracket to the Trunk with the two bolts supplied (21).
14. Lightly oil all bearings and working surfaces except the Reversing Control (3). This should be kept dry for best sealing
15. Manually rotate the engine to ensure it moves freely.

Reversing Control

Assemble the Reversing Control components (12), (5), (6), (3) as shown in the General Assembly Drawing and screw the assembly to the top of the Centre Column. Gently but firmly tighten the bolt (12)

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.

The Lubricator Nipple (22) is required if the Displacement Lubricator (23) is to be positioned over the Holding Bracket. Attach the Displacement Lubricator (23) by screwing it in as far as practical up to where the barrel is vertical with the discharge valve pointing down and then tightening the locking nut to hold it in that position. Attach the Exhaust Nipple (4) to the other port.

Connect the supply/exhaust piping using the 1/4" 40 Nuts (24) and 5/32" Tails (25) supplied. The supply pipe is set for 5/32" OD pipe. The exhaust tail has a short length of copper pipe soldered into the tail to enable easy connection of rubber tubing used to connect to the exhaust steam oil trap.

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 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.

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Running In Guidelines:

Because of the close tolerances used in its manufacture, the engine may be a little “stiff” after you have assembled 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 Centre Column for the inner and outer crankshaft bearings.
- Crankshaft big end bearings and the piston rods 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.

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 components are machined from brass and stainless steel. 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.