



# Chiltern Model Steam Engines

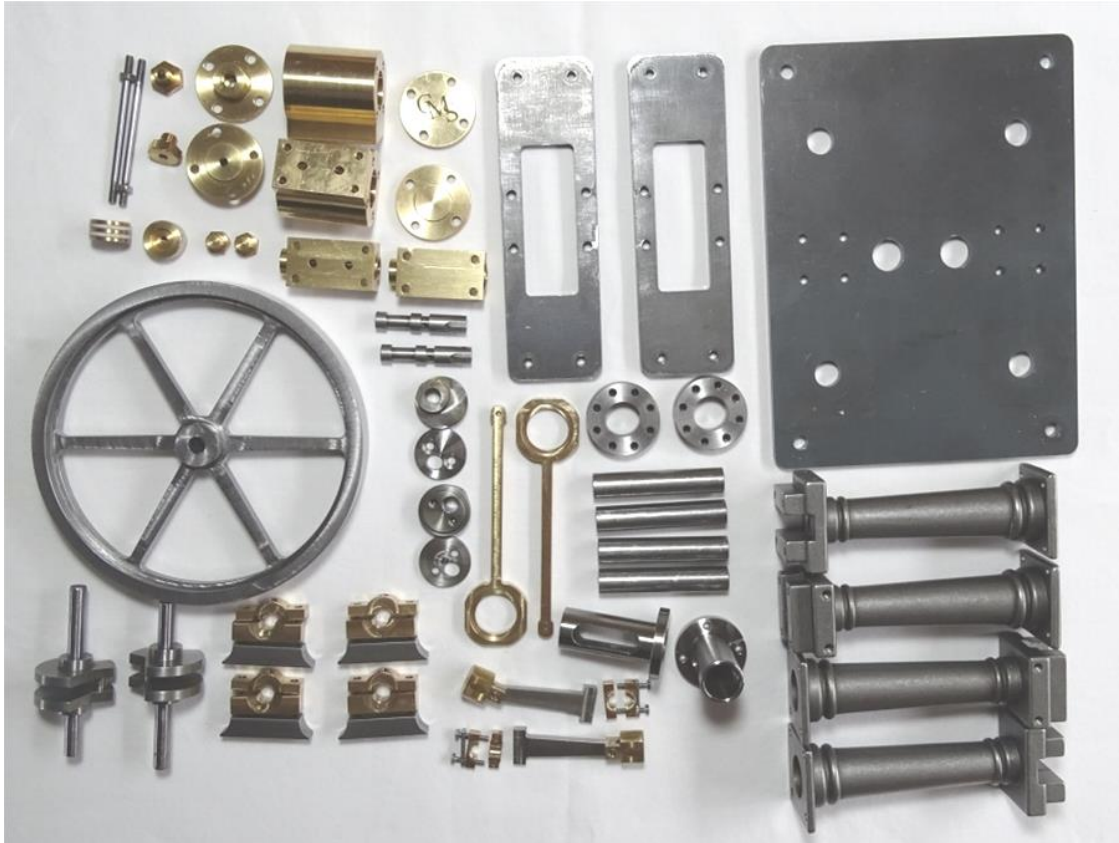
## Bitsa 2 Model Steam Engine Assembly Instructions v1.1

### Notes:

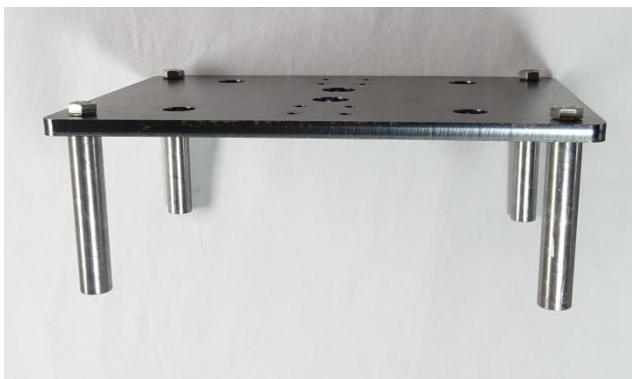
1. Model steam engines and boilers are NOT children's toys and should not be assembled or operated by children unless under close supervision of an adult.
2. If there are any questions or problems arising during assembly or operation of the engine please contact Chiltern Model Steam.
3. In overview the engine should first be assembled "dry" with no oil/lubricants, thread lock or gasket sealant applied, then disassembled, polished, painted as required, and finally re-assembled lubricating and applying thread lock and gasket sealant as applicable.
4. The engine will work properly without thread lock or gasket sealant but if it is to be run under load, it is recommended that thread lock, such as Loctite 222 Screwlock (or equivalent low strength locking compound) be used to stop the fasteners from coming loose. Also that a gasket sealant, such as Loctite Instant Gasket (or equivalent), is used on the cylinder's mating surfaces with the end plates and Chest. Both thread lock and gasket sealant can be purchased for a small sum from automotive shops or on the internet.
5. Although sharp edges and burrs should have been removed during manufacturing, check all parts and if any sharp edges or burrs exist carefully remove them with a metal file.
6. It is recommended that the base castings are painted. Hammerite's range of metal paint sprays work well for this application although does take a long time to fully harden; up to a week, before the engine can finally be assembled. Use masking tape to cover areas on which other parts are located, or scrape off the paint as needed afterwards.
7. For polishing the brass components, wet and dry paper can be used - start with coarse e.g. 280 grade to get the worst marks out of the brass work and end with very fine paper, e.g. 1500 grade and finally Brasso and a rag.
8. Be careful not to over tighten or cross thread the set screws. If more than a slight force is being used there is probably something out of alignment.
9. Always check [www.chilternmodelsteam.co.uk](http://www.chilternmodelsteam.co.uk) for the latest assembly drawing, instructions and tips. Any questions or comments, good or bad, please don't hesitate to contact us via email: [sales@chilternmodelsteam.co.uk](mailto:sales@chilternmodelsteam.co.uk).
10. We would be grateful if you would take some pictures of your completed model and email them to us for inclusion on our WEB site.
11. Typical tools required for assembly; M3 (5.5mm) and M2 (4mm) socket spanners, Hex/Allen Key (1.6mm key included in kit) and potentially a metal file.

**Step by step instructions:**

1. Locate the parts as show in the following picture and as listed on the A3 Assembly Drawing (a copy of which will have been included with the kit but also available for download from [www.chilternmodesteam.co.uk](http://www.chilternmodesteam.co.uk)). NOTE: for shipping purposes many parts will be packed semi-assembled or in place, e.g. piston rings, grub screws, bearings and eccentric rod.



2. Fix the Legs onto the Base Plate using 4 M5 setscrews. The Base Plate surface may be cosmetically better on one side than the other.  
The Legs have M5 threads in both ends to facilitate the fixing of the finished engine to a base board.



3. Fix the 2 Slider Tubes to the 2 Mid Plates using 4 M3 12mm setscrews.



4. Remove the setscrews and the Main Bearing Uppers off the Base Plate. Ensure these are later replaced in the same place and orientation as they are machined in pairs.

5. Screw each Packing Nut into the Cylinder Plate Inners.



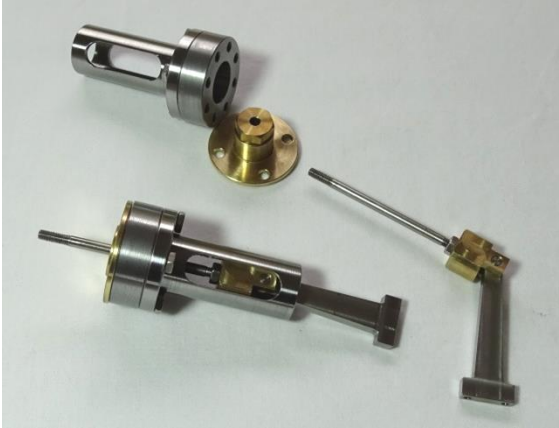
6. If it is planned to use high pressure steam - during final assembly, to improve the seal around the Piston Shaft, PTFE tape can be wrapped around the Shafts and Packing Nut thread. When tightening the Packing Nut into the plate ensure the Shaft can still move freely, that is, do not over tighten the Packing Nut.

7. Screw an M3 nut onto the longer threaded end of the Piston Shafts. Then screw that end into the Tube Sliders (which should already be fitted to the Connecting Rod) and lock using the nut. The end of the shaft with the shorter thread is for the Piston.



8. NOTE: Usually it is not necessary but the Piston Shaft can be screwed in and out of the Slider to more accurately centralise the “throw” of the piston in the Cylinder.

9. Place the Piston Shaft/Sider Tube/Connecting Rod sub-assemblies into the Slide Tubes and place the Packing Nut/Cylinder Plate Inners on the opposite side of the Mid Plate as shown in the picture.



10. Screw the Pistons onto the Piston Shafts. NOTE from the picture the orientation of the Piston.  
Lock the shafts to the pistons using an M3 nut tightened with a small pair of pliers - carefully grip the shaft with some pliers to make sure it is reasonably tight (the shaft is stainless steel but can be damaged if excessive force is used).



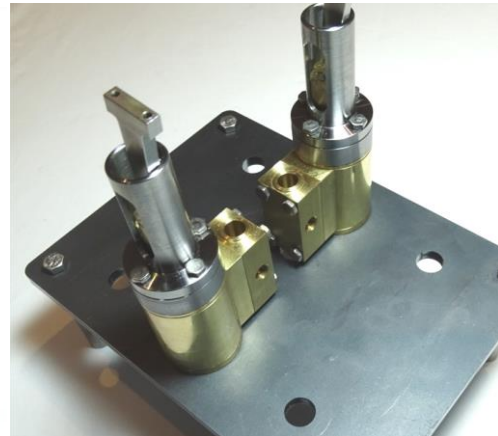
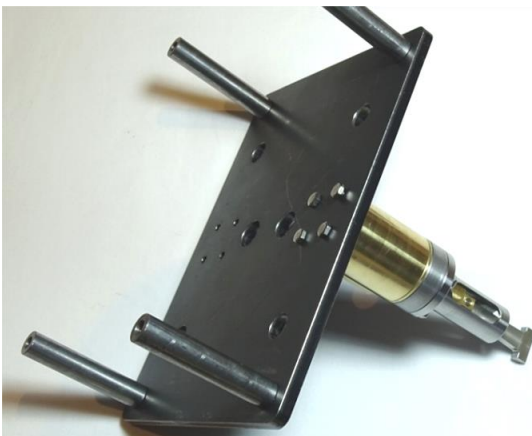
11. Place the Cylinders over the Pistons in the orientation shown in the picture and put the Cylinder End Plate on the end of the Cylinder. Align the holes of in the Mid Plate, Cylinder Plate Inner, Cylinder and Cylinder End Plate.



12. Fix the Chests onto the Cylinders using 4 M3 16mm setscrews. NOTE the orientation of the Chest.



13. Fix the Cylinder sub-assemblies onto the Base Plate from underneath using 4 M3 50mm setscrews. Do not at the stage tighten the setscrews.

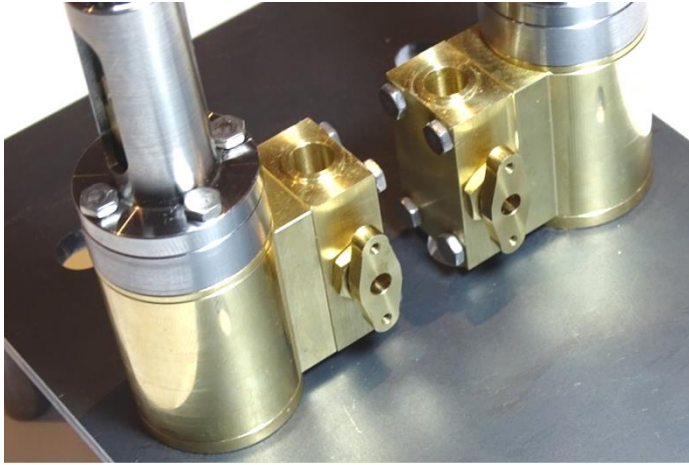


14. If the optional Manifold Set is to be fitted, use the next steps. PTFE (plumbers) tape can be wrapped around the threads to provide additional sealing.
15. Screw the 1/4" brass nuts on to the Manifold halves as far as they will turn.





16. Two of the Manifold halves have threaded holes (M2 threads) and the other two have plain holes (2mm). Screw the Manifolds halves that have the threaded holes into the Chests as far as they will go. The Manifolds are locked in place using the ¼" brass nuts.



17. Place the 2 M2 setscrews in each of the 2 Manifolds with the plain holes, as shown in the picture.

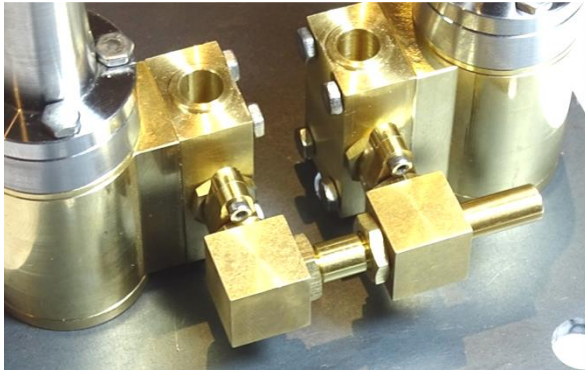


18. Assemble the Elbow and Tee blocks together with the Manifolds with the plain holes and the Link Pipe. Do not tighten the ¼" brass nuts.

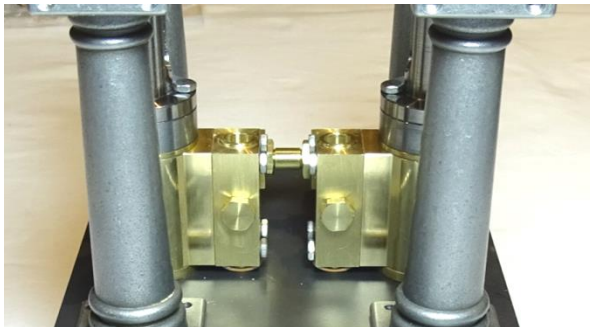


19. Screw the Tee/Elbow in and out of the Link Pipe so that the 4 M2 setscrews line up with the threaded holes in the Manifolds in the Chests. Use an Allen key to then carefully screw in the 4 M2 capscrews – if any force is needed to screw in the capscrews the Manifolds are misaligned so realign and start again.

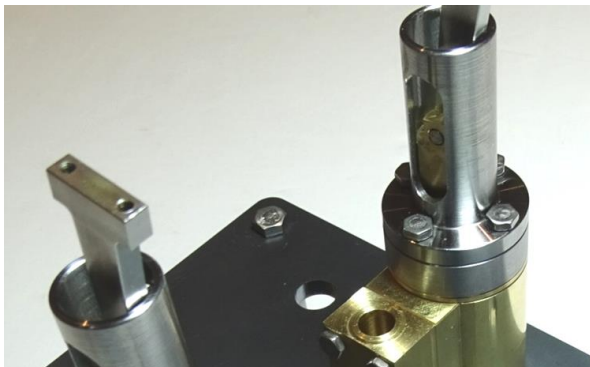
Screw in the Inlet Stub Pipe as required for later testing with a compressed air source. The threaded holes in the Chests and Manifolds are ¼" x 40 tpi ME which will accommodate the most common connection to a model steam boiler.



20. Screw in the Chest Plugs on the other side of the Chests.



21. Gradually tighten the 8 M3 50mm setscrews from under the Base Plate whilst moving the Connecting Rods in and out. When the M3 setscrews are fully tightened the Connecting Rods should still move up and down freely and be aligned side-to-side as per the picture.



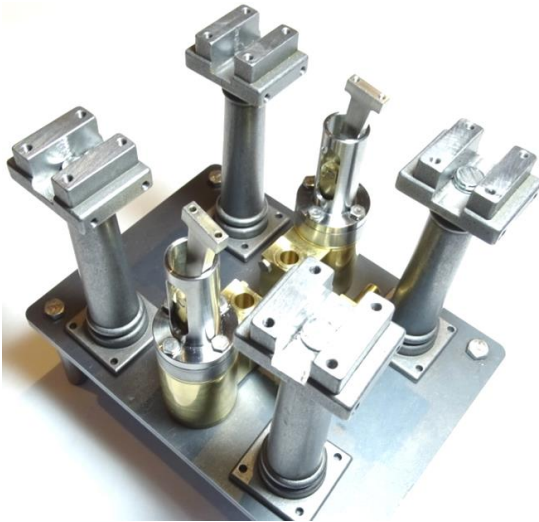
22. Screw the M10 Threaded Rods into the 4 Columns leaving approximately 15mm exposed at the bottom.



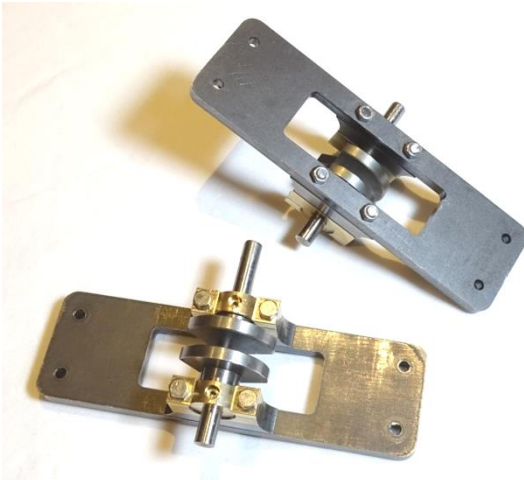
23. Fix the 4 Columns to the Base Plate using the 4 M10 nuts and washers.



24. Orientate the tops of the Columns as shown in the picture. Do not tighten the nuts at this stage.



25. Assemble the 2 Top Plates with the Bearing Upper and Lower halves, Main Bearing Support blocks and Single Cylinder Cranks using the M3 30mm setscrews and nuts as shown in the picture. Do not tighten the nuts at this stage.





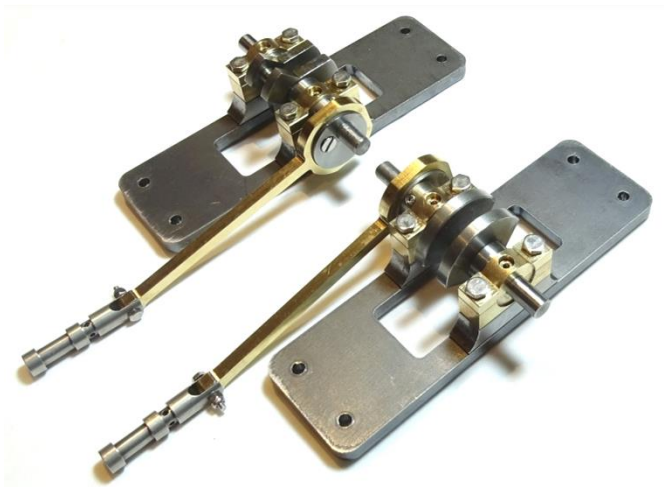
26. Connect the Valves with the Eccentric Rods using M2 10mm setscrews and lock each with a nyloc nut as shown in the following picture. The nut should be left slightly loose to allow free movement of the Valve in operation.



27. Put the Eccentric Wheels and Eccentric Wheel Plates together with the Eccentric Rods using the counter sunk M3 screws, as shown in the following pictures. Then, if not already installed, screw a 3mm grub/set screw into the Eccentric Wheels which will be used to lock the wheels onto the Crank Shaft.

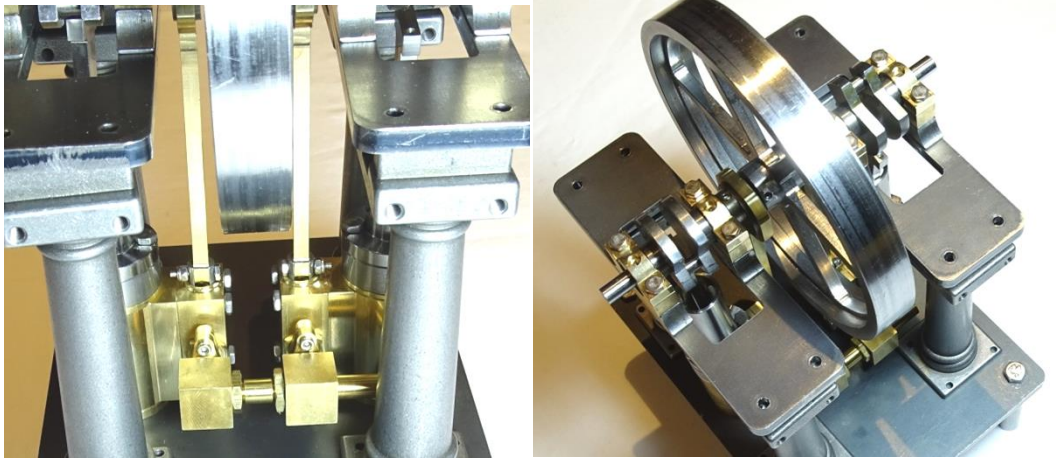


28. Push the Eccentric Wheel/Rod sub-assemblies onto the longer ends of the Cranks as shown in the picture. Do not tighten the grub screws at this stage.

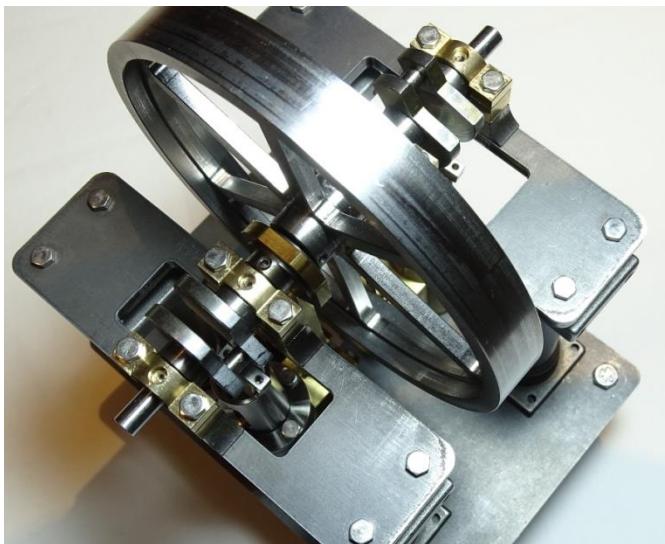


29. If not already installed screw in the 4 M3 grub screws into the Flywheel boss (2 each side).

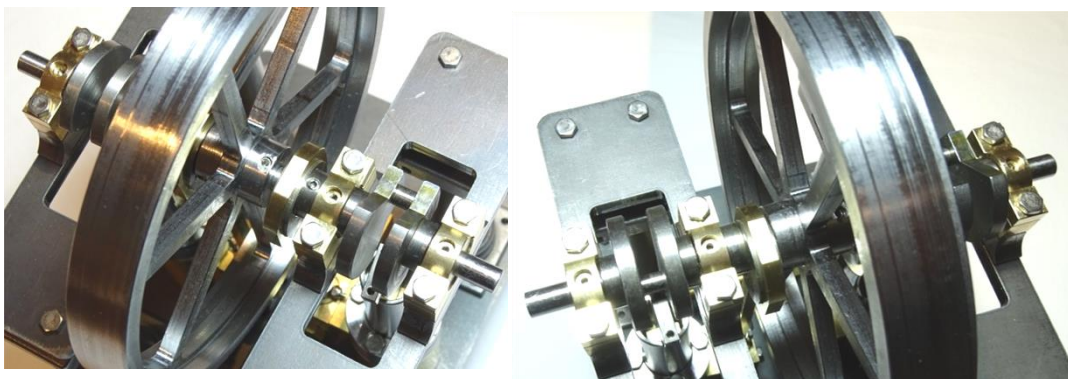
30. Slide each of the longer ends of the Crank shafts into opposite sides of the Flywheel, do not tighten the grub screws. Then lift this sub-assembly onto the Columns while inserting the Valves into the Chests as shown in the pictures.



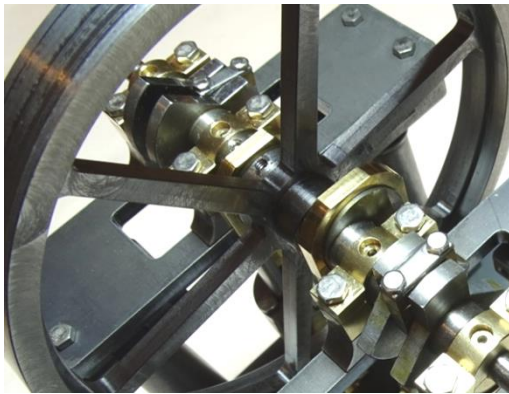
31. Fix the Top Plates to the Columns using the 8 M3 10mm setscrews. Do not tighten at this stage.



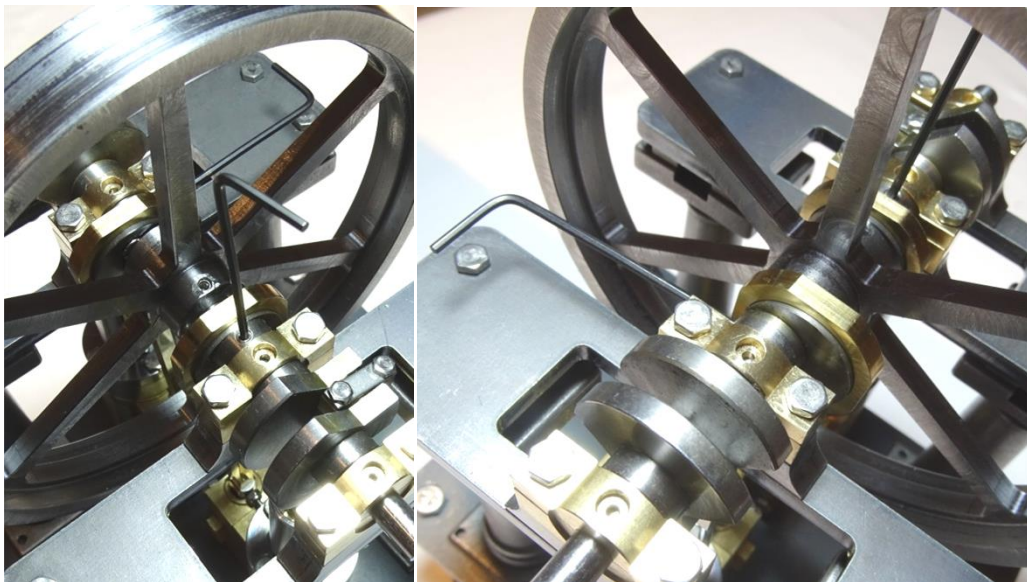
32. The arms of the 2 Cranks need to be set 90 degrees to each other, see pictures. Slightly tighten the 4 grub screws in the Flywheel with the Cranks in this orientation.



33. Gradually tighten all of the setscrews left loose earlier and the grub screws in the Flywheel. Spin the Flywheel as the setscrews are tightened to ensure that all the respective parts are aligned and the Flywheel/Cranks can still rotate freely. This will ensure the bearings centre themselves properly on the shaft. Lubricate via the hole in the Upper bearings.
- NOTE: Any wobble in the Flywheel can be taken out by screwing the 4 grub screws in/out. This process may have to repeated realigning the Bearings and Top Plates in particular to get everything tight and running as required.
34. Place the Con Rod Bearing Halves on either side of the Crank Arm Pin with the Bearing Keep and screw in the M2 10mm setscrews. Rotate the Crank and tighten the setscrews gradually. Repeat for the other side.

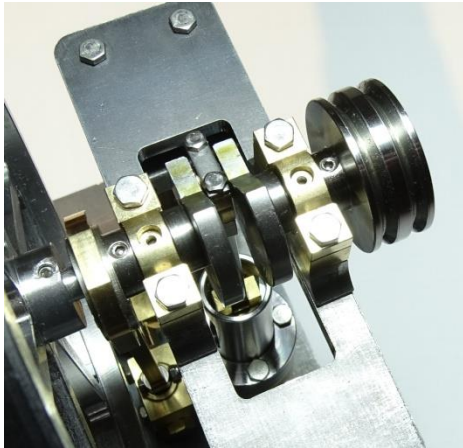


35. The Valve timing is set by fixing the Eccentric Wheels at the angle shown in the following pictures – also show on the Assembly Drawing. The Allen keys show the position of the Eccentric Wheels.



36. The optional Pulley wheel can be place on either side of the engine Crank Shaft and is secured with an M3 grub screw.





37. Lubricate the engine with a general light oil to ensure it operates freely.
38. To test the model a compressed air source such as a bicycle stirrup pump can be used to turn the engine over.
39. Disassembly is a reverse of the above instructions. Once disassembled each component can be cleaned, painted or polished as mentioned in the notes above. See [www.chilternmodelsteam.co.uk](http://www.chilternmodelsteam.co.uk) for examples of completed models.
40. Please send some pictures of the completed engine to email: [sales@chilternmodelsteam.co.uk](mailto:sales@chilternmodelsteam.co.uk).



