

Stirling Engine

Manual and Quick Start Guide

IMPORTANT NOTICE !

These low temperature differential Stirling engines require only a small difference in the bottom and top plates to operate. **DO NOT** place them on a high temperature heat source (e.g. oil/wood burning stove, candle, Argas stove). If you do, it will melt a number of parts on the Stirling engine. It can be placed on top of a recently boiled cup of water/tea/coffee but nothing hotter.

Starting the Stirling engine

These Stirling engines do not automatically start by themselves. Put your engine on a heat source (e.g. cup of tea). Wait approximately 1 minute and then spin the flywheel gently in the direction of the arrow (see figure A). If you have enough temperature difference between the top and bottom plates your engine will continue to run. The warmer the heat source the shorter the length of time you will need to wait before spinning the flywheel.

Typical heat sources include a warm hand, top of CRT monitor, a table lamp, cup of hot water, digital TV power transformer. Anything that can give you a temperature difference between the bottom and top plates should work.

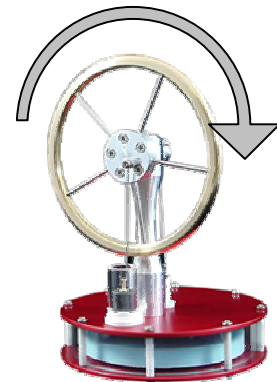


Figure A

Running the Stirling engine from the heat of your hand

Firstly, you need to be in a reasonably cool environment, and your hand needs to be warm. Hold your hand out flat, palm upwards, and place the engine on it. After a minute or two you should feel the bottom plate has warmed up. Give the engine a spin as described above and away it should go. Try not to cup your hand or let your fingers touch the top plate; both of these will retard performance.

Running your engine in reverse

Place the engine on a bowl of ice. Gently spin the flywheels opposite of that that shown in *figure A* and it will run backwards. This is because the ambient room temperature is now the heat source, effectively being applied on the top plate.



How the Stirling engine works

The Stirling engine you have purchased is a “Displacer Type” engine. This means they have a large displacer piston and a smaller power piston. They operate on a 4 stroke cycle (shown below). The diagrams below assume the heat source is at the bottom.

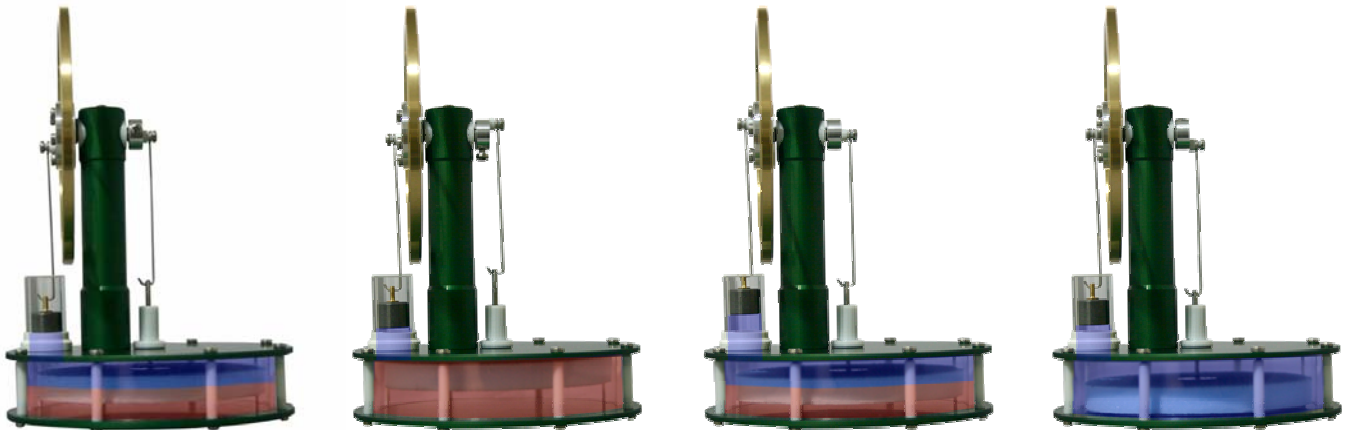


Figure 1
Contraction

Figure 2
Heating

Figure 3
Expansion

Figure 4
Cooling

Contraction Phase – The Cooling phase has just finished. The overall temperature of the air inside the Stirling engine has dropped and hence the internal air pressure is dropping. The power piston (small piston) is being pulled down by this pressure drop. At the same time the displacer piston (large piston) is at the half way point, the air underneath it is beginning to heat up.

Heating Phase – The displacer piston (large piston) is now close to the top plate. Most of the air within the Stirling engine is now being heated ready for the expansion phase.

Expansion Phase – The overall temperature of the air inside the Stirling engine has increased and so has the air pressure. The air is expanding and the power piston is being pushed up. At the same time the displacer piston (large piston) is being to fall, which starts to cool the air above it.

Cooling Phase – The displacer piston (large piston) is now at its lowest point. The air in the Stirling engine is cooling ready for the contraction phase. The cycle will repeat until the difference in temperature between the top and bottom plates are too small.



My engine is running slow, what can I do?

By far the main cause of slow running is foreign matter in the power cylinder. This is fairly easy to fix, and can be done in minutes using a small cross-point ("philips") screwdriver.

1. Undo the screw (shown in green in *picture 1*) and remove the piston and connecting rod. The whole item should come free from the engine, as in *picture 2* (take care not to drop the screw and white ring at the top of the rod).
2. Gently wipe clean the black graphite piston shown in *picture 3*. Ordinary kitchen paper towel or an old t-shirt works well for cleaning the piston. Be aware that because the piston is graphite it will leave a grey mark on whatever is used to clean it, so don't wipe it on your favourite white shirt!
3. Clean the inside of the borosilicate glass cylinder shown in *picture 4*. A cotton bud works well for this operation.
4. Reassemble. The screw at the top (shown in green in *picture 1*) should only be 'nipped' tight, with just enough torque to hold and no more.

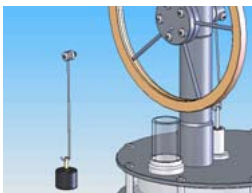
for reference, the parts that make up the power piston/conrod assembly are:

1 x M2 cross-point screw, 1 x white collar, 1 x wire rod, 1 x brass joint and 1 x graphite piston

For additional reference, the hook in the wire connecting rod points away from the main pillar (see bottom picture).



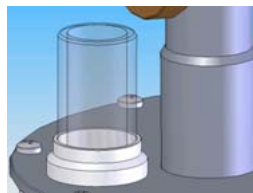
Picture 1



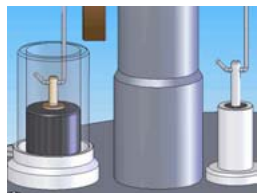
Picture 2



Picture 3



Picture 4



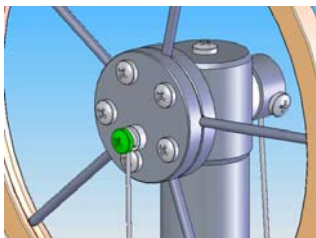
Picture 5



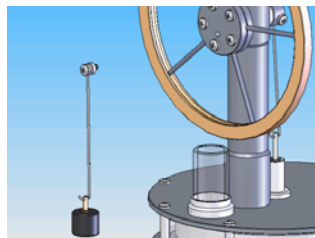
My engine still runs slow, what else can I do?

If you have cleaned the piston and cylinder and your engine still runs slow then the bearings may need cleaning.

1. Undo the screw (shown in green in picture 1) and remove the piston and connecting rod. The whole item should come free from the engine, as in picture 2 (take care not to drop the screw and white ring at the top of the rod).
2. Undo the crank screw (shown in green in picture 3) and slide the crank off the axle. You should be able to lie the whole crank/rod down, leaving the wire connecting rod attached at the bottom. The engine should look like picture 4.
3. Gently slide the flywheel out of the bearing cartridge, the top of the engine should look like picture 5.
4. Undo the top screw, highlighted green in picture 5, and slide the white cartridge out of the pillar (picture 6).
5. Thoroughly rinse the whole cartridge in methylated spirits (sometimes know as denatured alcohol or ethyl alcohol) or similar. Dry with compressed air if available. If you do not have compressed air, shake the excess methylated spirits off the cartridge and allow to dry naturally.
6. Reassemble. The crank screw should locate on the flat section of the axle (shown in green in picture 4) should only be 'nipped' tight



Picture 1



Picture 2



Picture 3



Picture 4



Picture 5



Picture 6

