The HB6 Ice-Dwarf instructions



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This document covers the following:

- Tools required
- Parts list
- Assembly instructions
- Operating instructions
- Maintenance











Main pillar x1	Transfe	er tube x1	Transfer port x1	Gland x1
Cylinder cover x1	Cylinder x1	Piston x1		Axle x1
Bracket x1	Chamber pillar x7	Gland stem x1	Conroc	d assembly x1





Fit a 7mm O ring into the groove in the bottom of the gland.

If you have acrylic plates you will need to remove the protective film from both sides of the top **bö** plate now. Once you have removed the film try to handle the plate by its edges, this will stirling minimise fingerprints. Aluminium plates do not have protective film.



Identify the underside of the top plate.

The underside is the side with the countersinks on the two holes as shown.



Screw the gland into the hole in the middle of the top side of the top plate and fully tighten, you might need to wrap an elastic band around it for grip. Make sure that the O ring does not become pinched or fall out of its groove. If you have trouble with the O ring falling out you can turn the plate upside down and screw the gland in from underneath.



Align the hole in the main pillar as shown and push the pillar into the hole in the packing tray.



This will hold it still and upright while you perform the next few assembly stages.





Position the top plate over the main pillar, with the underside of the plate facing upwards. Align the two countersunk holes in the plate with the two threaded holes in the main pillar and insert two M3x6mm countersunk screws a couple of turns each. Note the alignment of the plate.

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Screw the screws in until they both lightly touch the top plate, then fully tighten. Make sure that the O ring stays in its groove and does not become pinched while tightening the screws.





Remove from the packing tray and place over the top of a mug.

Insert seven chamber pillars into the seven small holes in the plate.

If you have acrylic plates the heads of the pillars will sit slightly below the surface, if you have aluminium plates the heads will sit on the surface.



Position the packing tray over the partially assembled engine and align the hole in the bottom of the stirling-Technik tray with the main pillar and gland as shown on the left.

lower the tray down until it sits on top of the brass chamber pillars as shown on the right.





Hold the packing tray and engine firmly together so that the chamber pillars do not fall out of the top plate. Remove from the mug, carefully turn upside down and place back on top of two mugs with the main pillar positioned between them as shown.

The packing tray will hold the chamber pillars in a vertical position while you perform the next few assembly stages.



Wipe the chamber wall with a dry cloth to remove any fingerprints. Stretch a 75mm O ring over the rebate on one end.



Stretch another 75mm O ring over the rebate on the other end.



Carefully lower the chamber wall and O rings onto the upturned top plate. Make sure the O rings stay seated in their rebates, and that you do not dislodge any of the chamber pillars.





Identify the tops of the displacer and gland stem.

The top of the displacer has been marked with a dot near the centre and the top of the gland stem has a hole through it.

Insert the bottom end of the gland stem into the top face of the displacer, it will be a reasonably tight fit. You only need to push the stem in a quarter of the way for now, final positioning will be done at a later stage.

If you have acrylic plates you will need to remove the protective film from both sides of the bottom plate now. Once you have removed the film try to handle the plate by its edges, this will minimise fingerprints. Aluminium plates do not have protective film.

Identify the underside of the bottom plate. The underside is the side with the countersinks on the seven holes as shown .

With the underside facing upwards, lower the bottom plate onto the chamber wall and pillars. Align the holes in the base plate with the chamber pillars and start inserting seven M2x6mm white plastic screws. Screw each screw nearly all the way in.

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When all the screws are in start to tighten them, you might need to pinch each chamber pillar with your thumb and finger to stop it spinning while you tighten the screws. Work around the screws in the sequence 1, 3, 5, 7, 2, 4, and 6, screwing each screw down until it touches the countersinks in the plate. Go round again in the same order tightening su fficient to hold the plate in place without any sideways movement, any tighter is unnecessary and could damage the screws.

The chamber pillars are deliberately short and will not touch the bottom plate. This is so that they cannot conduct heat directly between the two plates and retard engine performance.

Fit a 5mm O ring into the groove in the top of the transfer tube .

Fit a 7mm O ring into the groove in the bottom of the transfer tube .

Screw the transfer tube into the top plate and fully tighten, you might need to wrap an elastic band around it for grip.

Make sure that the 7mm O ring does not become pinched or fall out of its groove.

If you have trouble with the O ring falling out you can turn the engine upside down and screw the tube in from underneath.

Fit the bracket into the slot on the side of the main pillar and secure with two M2x6mm roundhead screws. Screw the screws in until they both lightly hold the bracket and then fully tighten.

Fit a 7mm O ring into the first groove in the end of the transfer port .

Fit a 7mm O ring into the second groove in the end of the transfer port .

Moisten the inside end of the glass cylinder sparingly with slightly soapy tap water for lubrication and fit it over the 7mm O rings on the end of the transfer port.

A gentle pushing and twisting motion works best. Try not to allow the glass to tilt at an angle during this process.

Wipe all excess water off the transfer port afterwards.

Moisten the O ring on the top end of the transfer tube sparingly with slightly soapy tap water for lubrication.

Gently push the transfer port down over the transfer tube O ring. Make sure to push straight, if you push at an angle you risk scraping some rubber o ff the O ring.

Push it down until the two holes in the bracket align with the two holes in the transfer port.

Wipe all excess water off the transfer port and tube afterwards.

Insert two M2x6mm roundhead screws through the bracket into the transfer port.

Screw the screws in until they both lightly hold the bracket and then fully tighten.

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The bearings have a dust shield on one side and are open on the other.

The shielded sides should face outwards on the next stage

Shielded side.

Open side.

Fit the two bearings into the recesses in the top of the main pillar. Make sure the shielded sides are facing outwards.

Fit the hook on the long conrod through the hole in the top of the gland stem

Rotate the conrods up until the piston is level with the glass cylinder.

Make sure the crank stays facing the main pillar as shown.

Slide the piston into the glass cylinder.

Some slight air resistance should be felt.

Identify the top side of the flywheel. The top side is the side with the the countersinks on the three holes as shown.

The top side should be upwards in the next stage.

Fit the axle to the flywheel. The three holes in the flywheel and axle are spaced so that there is only one way that they will all line up together, t his ensures the flywheel counterweight is in the correct position.

Identify the flat section on the axle (highlighted in green).

This must align with the hole in the crank in the next stage.

Position the crank (cut-away in red) in front of the bearing, and with the crank screw aligned approximately opposite the glass cylinder as shown.

Fit the axle through the bearings and fully into the crank.

Keeping the crank screw approximately opposite the glass cylinder, carefully rotate the flywheel inside the crank until the flat (highlighted in green) aligns with the crank screw. Screw the screw the screw gently onto flat and carefully tighten.

The instructions on the following four pages outline the positioning of the displacer within the main chamber and should be read and understood fully before carrying out the procedure.

Gently press downwards on the top of the gland stem with the side of a flat screwdriver until the crank and conrod are at their lowest position.

This will press the stem into the displacer and begin the process of setting the displacer to its correct position in the chamber.

The flywheel and crank will rotate clockwise as you press downwards, this is expected.

At this stage the bottom of the displacer should be touching the bottom plate. There is a small amount of flex in the conrod, you will be able to take advantage of this and over-press the top of the stem very slightly and carefully so that when you release the pressure on the screwdriver the displacer lifts o ff the bottom plate slightly.

It is best to press tiny amounts several times and check often rather than try to press all in one go.

Slowly rotate the flywheel to move the displacer up and down in the chamber.

Check that the displacer does not touch the top plate. If it does then you have pressed the stem too far into the displacer. You will have to disassemble your engine until you gain access to the displacer and stem, remove the stem from the displacer and then re-assemble.

Re-press and check again.

Note, the chamber wall and 75mm O rings are shown cut away for clarity.

Slowly rotate the flywheel to move the displacer up and down in the chamber.

Check that the displacer does not touch the bottom plate. If it does you can go back and press the top of the gland stem some more.

Re-press and check again until the displacer does not touch the bottom plate.

Ideally the displacer should have an even gap at the top and bottom of its stroke.

Note, the chamber wall and 75mm O rings are shown cut away for clarity.

Your engine is now fully assembled. Check that the flywheel rotates fully, a small amount of resistance will be felt due to the air pressure inside the chamber. Check the displacer does not bump into either plate. Once you have made these final checks you are ready to operate your engine.

The engine is not self - starting, you will need to give the flywheel a little spin to get it going.

After the engine has been on your heat source for half a minute to a minute gently spin the wheel and it should carry on running.

The engine has been designed to run on hand heat, but will run equally as well from a wide variety of heat sources including Digital TV box, router, table lamp, hot water, tea or coffee, warm sunlight.

The engine will operate in reverse if you place it on a bowl of ice, this is because Stirling engines operate on a temperature difference, and it doesn't matter if the bottom plate is warm and the top plate is cool, as in conventional running, or the bottom plate is cool and the top plate is warm, as in ice running.

The engine only requires a very small temperature difference between the top and bottom plates to operate, anything hotter than hot water WILL damage it. DO NOT place it on any high temperature heat source (cooker, wood burning stove, candle etc.), this could melt a number of parts on the engine.

If you wish to operate your engine on hot liquid you must allow it to cool for a couple of minutes first. The hottest heat source that you should use for your engine must not be hotter than 75°C (167°F).

If your engine is running slower than usual you might need to clean the bearings.

Disassemble your engine by following the assembly instructions in reverse until you gain access to the bearings.

Remove them and rinse in Methylated spirits or Denatured alcohol.

Then either blow dry with compressed air or allow to dry naturally on an absorbent cloth or paper towel.

Follow the assembly instructions to reassemble your engine.

If your engine is running slower than usual you might need to clean the piston and cylinder.

Disassemble your engine by following the assembly instructions in reverse until you gain access to the piston.

Wipe the piston with a paper towel and clean the inside of the cylinder with a rolled up paper towel or cotton bud.

Follow the assembly instructions to reassemble your engine.

If your engine is running slower than usual you might need to clean the gland stem.

Rotate the flywheel until the displacer stem is at its highest point, and then wipe the gland stem with a cloth.

