

# Stirling Engine Kit HB13-A02

## Tools and Supplies

For assembling this kit, you need the following tools and supplies, which are not included:

Hex screwdriver Size 1.5, tweezers, pointed pliers, hex key Size 2.5, Torx screwdrivers Size 8, 10 and 20.

Included are: 1 syringe of ceramic paste, 1 syringe of Aeroshell Fluid 12 oil, 1 syringe of ball bearing adhesive Loctite 601 (contains at least 60 % air to prevent premature hardening).

## Assembly

- 1 – Carefully push one bearing (2) each into the sides of rocker arm (1).
- 2 – Using Loctite, glue one bearing (3) each into the side frames (9 + 10) – flush with the outside frame surface (countersunk). Apply just a small quantity of Loctite to the bores of the side frames.
- 3 – Press the piston cover (20) into the displacer piston (19), then screw the piston (19) onto the displacer shaft (18). Apply a small amount of Loctite to the thread and carefully wipe off any excess adhesive with a cloth (drying time approx. 2 hours).
- 4 – Guide the displacer piston assembly (19/20) into the cooling cylinder (22). If the cylinder is held in a vertical position, the displacer piston must glide in by itself and must not bind.
- 5 – Center the heating cylinder (23) over the cooling cylinder (22) and secure it with screws (24).
- 6 – On the inside of the rear side frame (10), guide the crankshaft (13) with its longer end into its bearing.
- 7 – Position the cooling cylinder (22) on the inside of the rear side frame (10) and secure it with two Torx screws (29).
- 8 – Using a pin (16), connect the connecting rod (21) to the displacer shaft (18) of cooling cylinder (22). **CAUTION:** Do not cause damage to the surface of the shaft!
- 9 – Using Torx screw (29), attach the rocker arm shafts (14) to the inside of the rear side frame (10).
- 10 – Slide on the rocker arms (1) with the aluminum part toward the front side frame (9).
- 11 – Using a Torx screw (8), attach the hex distance piece (4) to the rear side frame (10). The threaded holes of the hex distance piece (4) must be vertically aligned.
- 12 – Fit the front side frame (9) to the crankshaft (13), the rocker arm shaft (14), and the hex distance piece (4). Secure the assembly with Torx screws (8 + 29). When placed on an even surface, the assembled engine must not rock or tilt – the two side frames (9 + 10) must be in alignment.
- 13 – Attach connecting rod (27) of crankshaft (13) to rocker arm (1). Fit the black plastic bushing (11) into the connecting rod (27) and secure it from up front with screw (6). Tighten lightly with a torque of just 3 cNm to avoid squeezing the plastic bushing (2X)!
- 14 – Connect connecting rod (15) to working piston (17) using a pin (16).  
**CAUTION:** The wall of the piston is very thin, do not use pliers! One bore may be an easier fit than the other!
- 15 – Apply a touch of ceramic paste to your index finger and rub it against your thumb until the paste is virtually invisible. Now apply a thin coating to the working piston (17). Guide the piston (17) into the cooling cylinder (22) and move it back and forth. The piston (17) must glide without scratching or binding! Make sure that no oil touches working piston (17), Ø 9 mm. Using the syringe, apply a small drop of oil to the displacer shaft (18).
- 16 – Attach the connecting rod (15) and rocker arm (1). Fit the black plastic bushing (11) into the connecting rod (27) and secure it from up front with screw (6). Tighten lightly with a torque of just 3 cNm to avoid squeezing the plastic bushing!
- 17 – Turn the two grub screws (26) into the flywheels (25) – see assembly drawing.
- 18 – Fit a flywheel (25) to the front side frame (9) so that the crankshaft (13) is flush on the outside. Lightly tighten the grub screw (26).

19 – Fit the second flywheel (25) to the other side of the crankshaft (13) so that it butts against the bearing. Lightly tighten the grub screw (26).

20 – Fit the black drive wheel (30).

21 – Glue three rubber feet (31) to the underside of the beech base (12) – two to the outer corners of the rear edge and one centered along the front edge.

22 – Using screws (5) and washers (7), attach the engine to the beech base (12).

23 – Pull off the cover of burner (28), moisten the wick and thread it through, then press the cover back on.

24 – Apply the self-adhesive Boehm logo.

25 – **PLEASE NOTE:** A slight unbalance of the flywheels (25) is normal and cannot be avoided. It is not covered by the warranty.

26 – Never loosen the grub screws of the crankshaft (13)! The crankshaft can only be aligned with special manufacturer's tools!

## Starting the Engine

**CAUTION:** The engine must be operated by or under the supervision of persons over 18 years of age.

Flammable objects must be kept from the vicinity of the engine. Do not touch the engine since this could lead to serious burns.

Take great care when handling alcoholic spirits. Never leave spirits bottles open.

Inappropriate handling of the engine can cause fires!

## The Working Principles of a Stirling Engine

The burner heats the air, which is in a closed system. Due to the heat expansion of the air, the piston and the flywheels are put in motion. While the piston moves toward the flywheels, the displacer piston in the displacer cylinder is pushed into the cylinder head. Since the displacer piston does not have a seal, the hot air moves past it into the fin-cooled displacer cylinder. Here, the temperature is approx. 300 °C lower, the cooled air causes a vacuum, which pulls in the piston and keeps the flywheels turning. This rotary motion causes the displacer piston to be drawn back into the displacer cylinder, the cooled air rushes into the cylinder head. It heats up again, expands and thus provides power.

## Instructions for Use

1 – Set up the engine in a draft-free area.

2 – Fill the aluminum burner cup to the lower marking with 94% alcoholic spirits.

**CAUTION:** Alcoholic spirits may damage paints and lacquers. Close the spirits bottle tightly and store it in a secure place.

3 – Light the wick.

4 – Wait for approx. 10 seconds.

5 – Rotate the flywheels until the engine begins to run by itself.

- Never leave the running engine without supervision.
- With the burner positioned over to the far right, the engine will run more slowly.
- The black drive wheel can be used to power accessories.

## Care

The engine should be protected from dust. Even small particles can cause the engine to stop. All mechanical moving parts must be free and have play or the engine will not run!

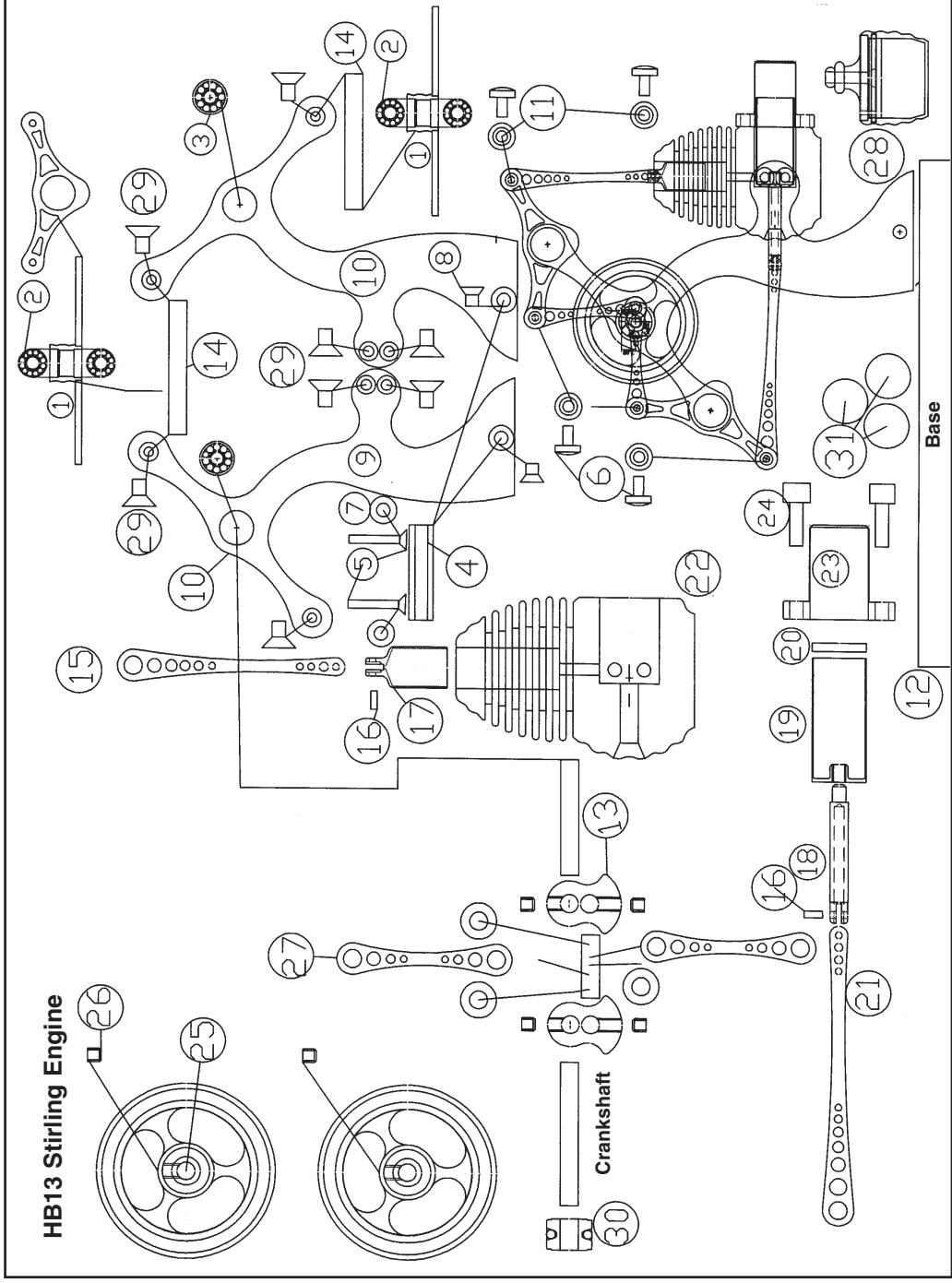
**Caution during dismantling:** Many parts have a wall thickness of less 0.25 mm.

## What if the engine will not start up?

- Check all mechanical components for free play.
- Have the black bushings been properly tightened? Does any oil cover working piston (17)?
- Has too much ceramic paste been applied?

For technical advice, please contact:

boehmstirling@t-online.de – www.stirling-technik.de.



**Parts List**

Part No.	Description	Pcs.
1	Rocker arm	2
2	Ball bearing Ø 9 mm x 2.5 mm	4
3	Ball bearing Ø 11mm x 4 mm	2
4	Hex distance piece	1
5	Torx counter-sunk screw M4 x 20 mm, TX20	2
6	Torx oval-head screw M2.5 x 4 mm, TX8	4
7	Washer Ø 11.7 x 1.5 mm	2
8	Torx counter-sunk screw M4 x 6 mm, TX20	2
9	Side frame (front)	1
10	Side frame (rear)	1
11	Plastic bushing, black	4
12	Beech base	1
13	Crank shaft, assembled	1
14	Rocker arm shaft	1
15	Connecting rod 45 mm	1
16	Pin Ø 1.5 mm x 4 mm	2
17	Working piston	1
18	Displacer shaft Ø 4 x 31 mm	1
19	Displacer piston Ø 12 x 27.6 mm	1
20	Piston cover Ø 11.6 x 1.5 mm	1
21	Connecting rod, 62 mm,	1
22	Cooling cylinder, brass	1
23	Heating cylinder Ø 25 x 21mm	1
24	Hex screw M3 x 8, SW2.5	4
25	Flywheel, brass	2
26	Grub screw M3 x 3 mm, SW1.5	2
27	Connecting rod 32 mm	1
28	Burner with wick	1
29	Torx counter-sunk screw M3 x 6 mm, TX10	8
30	Drive wheel, black plastic	1
31	Rubber feet	3