Safety Notes

1. Only add more alcohol to the lamp when the alcohol lamp is extinguished. To add alcohol: first blow out the lamp, open the lamp container, add the alcohol, replace the wick, and then light the lamp again.

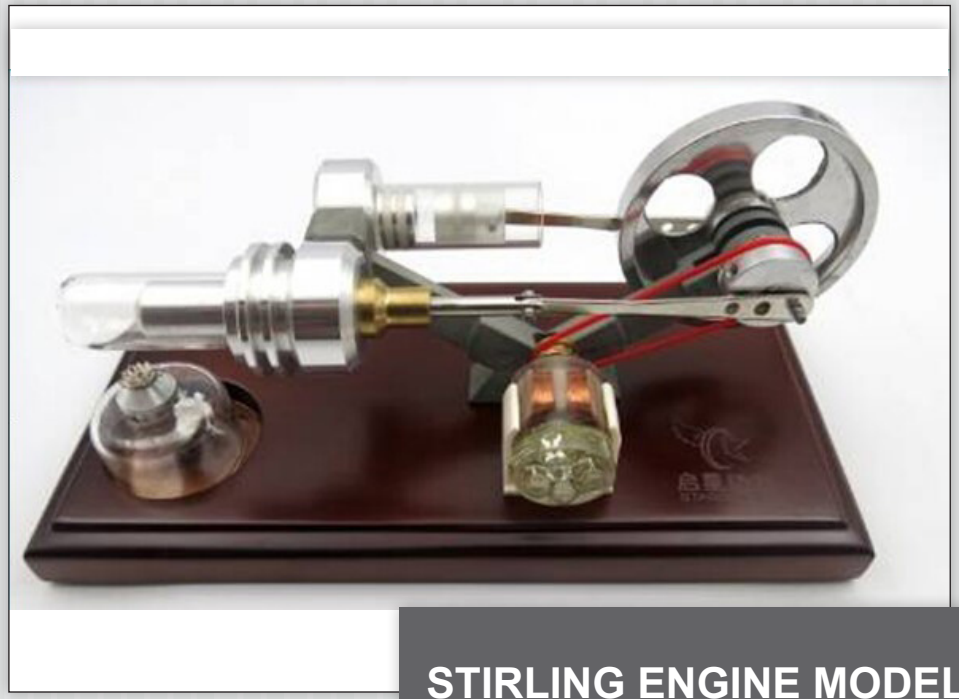
2. If any alcohol accidentally spills into the model base or on any other parts or surfaces, wait for the alcohol to volatilize or wipe away the alcohol before lighting the alcohol lamp.

3. Do not let the alcohol lamp wick touch the glass tube as the wick produces vapor when burning; if the wick and glass tube touch, the vapor will make the tube burst.

4. The engine model can rotate at high speeds, which can cause the model to vibrate. Ensure that the engine model is placed far enough from the surface edge to prevent the model from falling.

5. When in use, the engine model will get hot! Handle with care to prevent burns.

MANUAL



STIRLING ENGINE MODEL
ITEM # 1000-14

ENERGY - HEAT

Invented in 1816 by Robert Stirling, the Stirling Engine Model is a unique heat engine. It is a great product to show students how thermal expansion and cold shrinkage can create energy, enough to power an engine.

The engine model uses a closed-cycle thermodynamic system in which air is being compressed and expanded at different temperatures to create heat energy.

Specifications

Product Specifications and Parts

- Product includes: Stirling Engine Model, alcohol lamp
- Spare Parts: hot gas container, power cylinder and piston, sealing ring, needle roller and silicone tube
- Also includes: 3 Allen wrenches

History

The engine model was invented in 1816 in London by a pastor called Robert Stirling, through whom the engine model got its name Stirling Engine.

How it works:

The Stirling Engine is a unique heat engine because its theoretical efficiency is nearly equal to the theoretical maximum efficiency, called Carnot Cycle Efficiency. Stirling Engines generate power through gas thermal expansion and cold shrinkage. It is an external combustion engine, making fuel burn continuously. The piston moves because of a continuous cycle of air expansion in the main cylinder and cooling in the cold chamber.

Note

It is always best to DO an experiment ahead of time to be able to best present it to the class.

Setup

1. Place the engine model in front of you on a flat, sturdy surface.
2. Gently test the connection rods and the flywheel. Check if the wheel is rotating smoothly by slowly turning it with your hands.

   If there is friction, check if the connection rods are connected properly and if there is oil on the piston of the cold cylinder or spindle of copper sets. If there is oil on these parts, use a clean cloth to wipe the piston and the outer wall of the spindle to ensure that there is no oil or foreign matter on them that could cause friction.

   Also check the main cylinder for foreign objects and wipe clean if necessary.
3. Keep turning the flywheel until it is rotating effortlessly.
4. Ensure that the two connection rods are connected properly and linked to the crank at 90 degree angles. If not, adjust the connection rods.
5. Fill the small alcohol lamp container with alcohol.
6. Slowly place the alcohol lamp in the mold under the head of the main cylinder of the engine model.
7. Carefully light the alcohol lamp.
8. Let the flame of the alcohol lamp heat the cylinder for about 20 seconds, then gently turn the flywheel until it starts rotating independently.
9. During the heating process, keep hands away from the cylinder at all times to prevent burns.
   Cylinder will be hot!

Cool Down

1. After use, let the alcohol lamp and the engine model cool naturally.
2. If you need to stop the process manually, blow out the alcohol lamp first, then let the model and lamp cool naturally.
3. Children should only use the engine model under close adult supervision to avoid burns or cuts from broken glass pieces.
4. Keep the engine model out of reach of children during the cool down period and when the engine model is not in use.