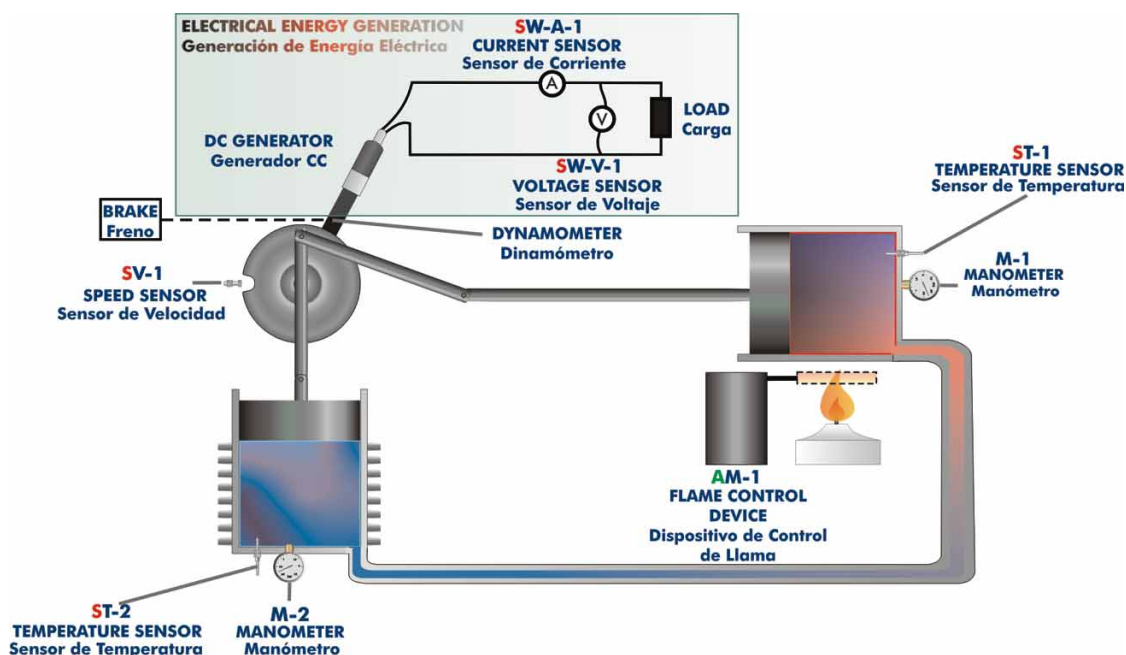


Electronic console

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



INTRODUCTION

A Stirling motor is a heat engine that operates by cyclic compression and expansion of air or other gas, the working fluid, at different temperature levels such that there is a net conversion of heat energy to mechanical work.

The motor is an external combustion unit like a steam engine in that all heat transfer takes place through the engine wall and the heat source is outside the engine. But unlike the steam engine, the working fluid used by the Stirling motor is a fixed quantity of gas either air or other type.

Similarly to other heat engines, the general cycle consists of compressing cool gas, heating the gas, expanding the hot gas, and finally cooling the gas again before repeating the cycle.

The Stirling motor is noted for its high efficiency, quiet operation, and can be used with any type of heat source as the renewable ones.

GENERAL DESCRIPTION

The Stirling Motor is used to demonstrate the operation of a thermodynamic machine for the conversion of energy. It converts thermal energy into mechanical energy and operates as a motor (heat engine). Additionally it can operate an electrical generator and load.

The Stirling Motor unit designed by EDIBON is an alfa type engine. It consists of two power pistons located in separate cylinders (one for the cold source and another for the hot one). They are connected to a tube where the regenerator is located, which stores and transfers the heat, that enables to reach a higher efficiency. There is a piston in each cylinder, they move with a phase difference of 90° between them. Cylinders are connected by a crankshaft, which makes the power/volume ratio be quite high, since the power transfer mechanism is very simple.

Gas moves between the both cylinders in a close circuit. The external heat source provides energy to the hot cylinder and the expansion of the gas moves its piston, which is fixed to the other piston of the cold cylinder by means of a crankshaft.

The hot gas passes to the cold cylinder. During this time the cold cylinder piston compresses the cooled gas and forces it to move to the hot cylinder, where it receives the heat from the hot source and the cycle starts again.

An ideal stirling cycle has four phases:

Phase 1 - Constant volume heating of the gas in the hot cylinder.

Phase 2- Isothermal expansion at constant temperature in the hot cylinder.

Phase 3- Constant volume working in the cold cylinder.

Phase 4- Isothermal compression of the gas in the cold cylinder.

The TMSB unit is mainly formed by: an alfa type stirling engine with a heating element, a braking system, an electrical generator with pulley to convert the mechanical energy to electrical energy, equipped with an electrical load and current and voltage measurement system.

This unit is supplied with the suitable sensors and instrumentation for the control and measurement of the most representative parameters, as: flame control, temperatures measurement in the cylinders, pressures measurement in the cylinders, speed measurement (rpm), torque measurement (force) and power measurement, mechanical and electrical.

SPECIFICATIONS

Bench-top unit.

Anodized aluminium structure and panels in painted steel.

Diagram in the front panel with similar distribution to the elements in the real unit.

Alfa type Stirling motor: hot and cold cylinders made of stainless steel and pistons made of bronze.

Lubrication valves and white lithium grease suitable for the correct operation of the unit.

Device to control the flame of the heating element, to cover it and to release it.

Alcohol lamp as heating element.

Braking system.

Electrical generator with a pulley for converting the generated mechanical energy into electrical energy. Equipped with an electrical load and current and voltage measurement system.

2 Temperature sensors, one in the hot cylinder and the other in the cold cylinder.

2 Pressure meters (manometers), one in the hot cylinder and the other in the cold cylinder, range: from -1 to 0.6 bar

Speed sensor (rpm).

Dynamometer to measure the force, range: from 0 to 1N.

Current and voltage sensors.

Electronic console:

Metallic box.

Temperature sensors connectors. Digital display for the temperature sensors. Selector for the temperature sensors.

Voltage sensor connector. Digital display for the voltage sensor.

Current sensor connector. Digital display for the current sensor.

Speed sensor connector. Digital display for the speed sensor.

Switches to open and close the flame device.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Study of the conversion of thermal-mechanical-electrical energy.
- 2.- Study of the relation between the temperatures difference of the thermal machine and the speed generated.
- 3.- Calculation of the "threshold" temperatures difference which generates motion.
- 4.- Study of the mechanical power in relation to speed.
- 5.- Study of the electrical power in relation to speed.
- 6.- Mechanical efficiency calculation.
- 7.- Electrical efficiency calculation.
- 8.- Speed measurement (rpm).
- 9.- Torque measurement.
- 10.- Measurement of the generated electrical power.
- 11.- Temperature measurements.
- 12.- Pressure measurements.

REQUIRED SERVICES

- Electrical supply: single-phase, 220 V/50 Hz. or 110 V/60 Hz.
- Alcohol or paraffin.

DIMENSIONS & WEIGHTS

TMSB:

Unit: -Dimensions: 450 x 450 x 600 mm. approx.
(17.71 x 17.71 x 23.62 inches approx.)

-Weight: 35 Kg. approx.
(77.16 pounds approx.)

Electronic console: -Dimensions: 490 x 330 x 310 mm. approx.
(19.29 x 13 x 12.2 inches approx.)

-Weight: 10 Kg. approx.
(22 pounds approx.)

AVAILABLE VERSIONS

Offered in this catalogue:

-TMSB. Stirling Motor.

Offered in other catalogue:

-TMSC. Computer Controlled Stirling Motor.

* Specifications subject to change without previous notice, due to the convenience of improvements of the product.



C/ Del Agua, 14. Polígono San José de Valderas.
28918 LEGANES (Madrid) SPAIN.

Phone: 34-91-6199363 FAX: 34-91-6198647

E-mail: edibon@edibon.com WEB site: www.edibon.com

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