SOLAR / HEAT SOURCE VAPOUR TURBINE

F823

Year 1
study

Features

- Safe and Suitable For Unsupervised Student Operation.
- Optional (Renewable Energy) Solar Option Available.
- Responds Rapidly to Control Changes.
- Negligible Operating and Maintenance Costs.

Description

The vapour generator (or boiler) consists of a coiled copper tube through which a pressurised working fluid runs. The coil is immersed in an insulated tank containing hot water provided by either an electric resistance heater which is housed within the tank, or by the optional solar energy collector mounted in a suitable position outside. The vapour produced then flows through a convergent- divergent nozzle and impinges on the blades of a single stage impulse turbine. The turbine is mounted on the condenser and the exhaust vapour from it passes directly over the water-cooled coil. The condenser, which has a high strength glass shell, is partly flooded to provide the working fluid with a few degrees of sub-cooling. The working fluid is chosen for its low pressure-temperature characteristics allowing safe operation in glass. An internal fixed speed positive displacement pump draws condensed solvent from the bottom of the condenser and delivers it, via a control valve and flow meter, to the vapour generator for re-evaporation. A small quantity of lubricating oil mixed with the working fluid and is separated from the high-pressure vapour line and fed to the turbine bearings. Maximum power is obtained at about 15,000 rev.min-1. A simple band brake dynamometer applies and measures the resisting torque to the turbine shaft. An optical sensor senses the rotational speed of the turbine, and this is displayed on a digital meter.

Related Laws/Applications

- Chemical Engineering
- Marine Engineering
- Mechanical Engineering
- Plant and Process Engineering
- Environmental Engineering

Learning capabilities

- Clear and easily observed demonstration of a classic Rankine Cycle (Boiler, Turbine, Sub-atmospheric Condenser and Feed pump).
- Production of Torque/Speed and Power/Speed curves for a single stage impulse turbine.
- Use of property charts or tables and the application of the First Law of Thermodynamics to produce energy balances
- Determination of thermal efficiency at a range of turbine inlet and exhaust pressures.
- Comparison of performance with the Rankine Cycle, (including the external isentropic efficiency of turbines).
- Estimation of total frictional losses in turbines.

Technical Specification

- Vapour Generator: Copper generating coil in water filled stainless steel tank fitted with thermostatically controlled *1.5kW heater.
- Turbine: Single stage impulse turbine typical output approximately *20W at 15,000 rev. min-1.
- Condenser: Water cooled coil housed in glass walled cylindrical chamber.
- Feed Pump: Positive displacement pump.
- Circulating Pump: To circulate water through vapour generator tank and solar panels (if fitted).
- Noise level (*Typical values. Results will vary from individual machines due to local voltage and operating conditions):
- 1m distance approx. with the unit running at circa 25000rpm:
- Front of unit = 79.8dB to 86.6dB
- Rear of unit = 79.5dB to 86.0dB
- Left side = 76dB to 87.0dB
- Right side = 76.5dB to 87.5dB
- Instruments:
- 15 point digital temperature indicator with spare stations for solar system if fitted
- Two pressure gauges ranges 0 to 800kN m-2 and -100 to +100kN m-2 respectively
- Working fluid flowmeter 1 to 10 g s-1
- Water flowmeter 4 to 50 g s-1
- Digital Tachometer with optical sensor 0 to 99999 rev.min-1.
- Band brake dynamometer for 0-5N net force at pulley.

Recommended Ancillaries

- F823S

What's in the Box?

- 1 x F823
- 1 x External Transformer (115V version only)
- 3m Reinforced PVC tube
- 3m Clear PVC tube
- 1 x Charging Adaptor
- 1 x Ear Defenders
- 1 x Power Lead
- 2 x Hose Clip
- 4 x 'O' ring
- 2 x Brake Band
- Instruction manual
- Packing List
- Test Sheet

You might also like

- F823S

Weights & Dimensions

- Weight: 67 kg
- Length: 1060mm
- Width: 430mm
- Height: 925mm

Essential Services

- 1.7kW 220/240 Volts, Single Phase, 50Hz. (With earth/ground).
- 1.7kW 110/120 Volts, Single Phase, 60Hz. (With earth/ground).
- Water: 3 litres/minute in cooling water at 15m head (minimum).

Ordering information

To order this product, please call PA Hilton quoting the following codes:
F823/230
F823/115

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