

THERMAL CONDUCTIVITY OF LIQUIDS AND GASES UNIT

MODEL: HE 156



THE Thermal Conductivity of Liquids and Gases Unit (Model: HE 156) has been designed for students to determine the thermal conductivities of various liquids and gases. The unit comes complete with a control panel and a test module which is basically a plug and jacket assembly. With an optional data acquisition system, students shall be able to automatically collect experimental data and perform all the necessary calculations to determine the thermal conductivity of the test liquid or gas.

DESCRIPTION

During the experiment, the fluid (liquid or gas) whose thermal conductivity is to be determined flows in the small radial clearance between a heated plug and a water cooled jacket. In order to prevent natural convection in the fluid, the clearance is made small in size.

The plug is made of aluminium and contains a cylindrical heating element. The plug also has ports for introducing

and venting the test fluid. A thermocouple is inserted into the plug near the external surface. The plug is placed in the middle of the water jacket. The jacket is machined from brass and has water inlet and drain connections. A thermocouple is also fitted to the inner sleeve of the jacket. The positioning of the thermocouples and the high thermal conductivities of the materials involved shall allow us to assume that the temperatures measured are effectively the temperatures of the hot and cold faces of the fluid lamina.

The test module is connected to the control panel for the voltage supply. Power input and temperature readings are digitally displayed on the control panel. A control knob on the control panel allows students to vary the power input to the heating elements.

EXPERIMENTAL CAPABILITIES

- ◆ Determination of the thermal conductivity of various liquids and gases.
- ◆ Calibration of the unit to establish the effect of incidental heat transfers.

SPECIFICATIONS

The complete unit includes the followings:

a) Test Modules:

Plug and jacket assembly consists of a cylindrical plug and a cylindrical water jacket.

Cylindrical plug:

Made of aluminium with built-in heater and temperature sensor.

Mean diameter	: 0.04 m
Length	: 0.12 m
Clearance	: approx. 0.3 mm
Heater power	: 200 W, with built-in temperature sensor
Heater control	: 0 to 200 W by means of a variable transformer.
Safety	: High temperature cut-out by means of a temperature controller.

Cylindrical water jacket:

Made of stainless steel and fitted with a temperature sensor for measuring inner surface temperature.

b) Control Panel:

The control panel includes all necessary electrical wiring with variable transformer, power transducer,

temperature controller/indicator, digital indicators for temperatures and heater power, and thermocouple selector switch.

OPTIONAL ITEMS

-DAS

SOLDAS DATA ACQUISITION SYSTEM

- i) A PC with latest Pentium Processor
- ii) An electronic signal conditioning system
- iii) Stand alone data acquisition modules
- iv) Windows based software
 - ◆ Data Logging
 - ◆ Signal Analysis
 - ◆ Process Control
 - ◆ Real-Time Display
 - ◆ Tabulated Results
 - ◆ Graph of Experimental Results

- CAL

SOLCAL COMPUTER AIDED LEARNING SOFTWARE

- i) Interactive multimedia features
- ii) Graphical simulation
- iii) Experiment results samples
- iv) Full experiment manuals

REQUIREMENTS

Electrical	: 240 VAC/1-phase/50 Hz
Water	: Laboratory mains supply

OVERALL DIMENSIONS

Height	: 0.91 m
Width	: 1.22 m
Depth	: 0.61 m

MANUAL

The unit is supplied with Operating and Experiment Manuals in English giving full descriptions of the unit, summary of theory, experimental procedures and typical experimental results.

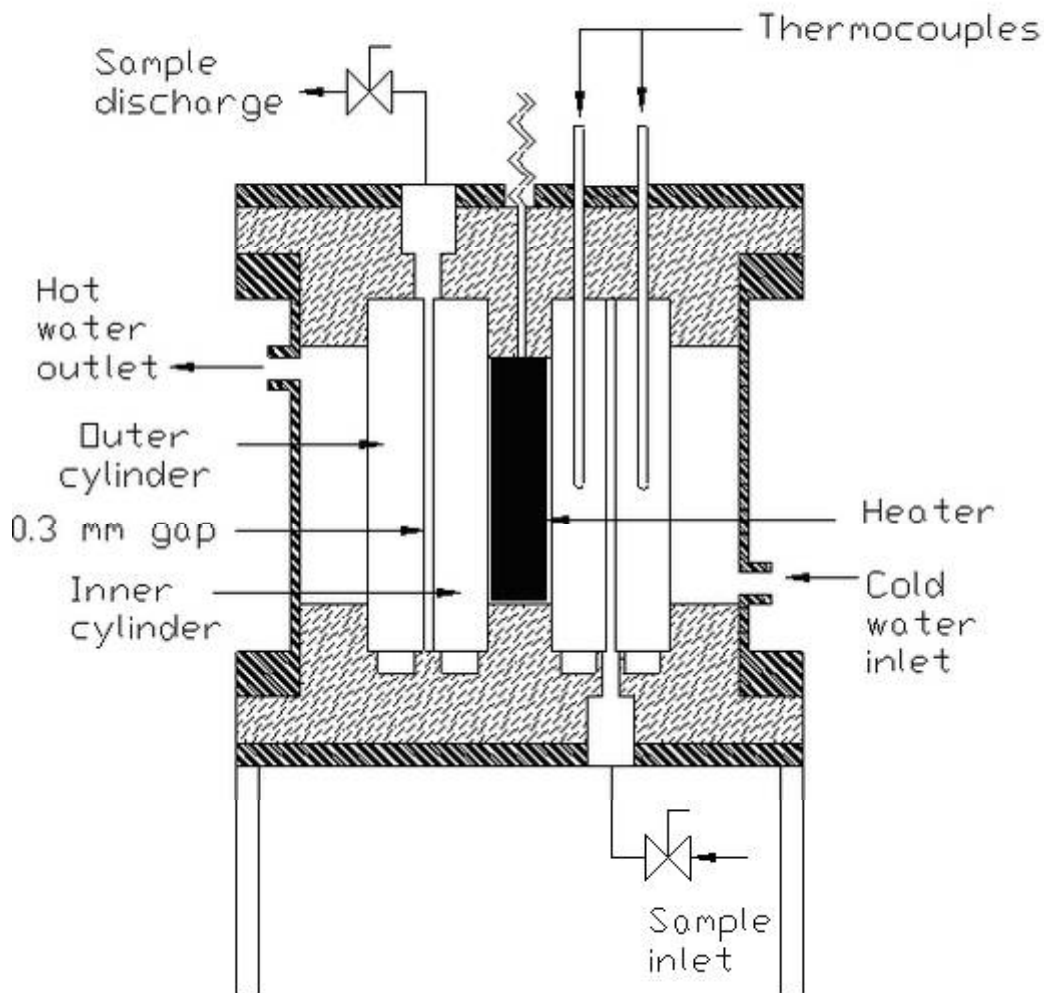
TYPICAL EXPERIMENT RESULTS

Result of the experiment

Outer radius of the inner cylinder, R_1 (m)	0.01665
Inner radius of the outer cylinder, R_2 (m)	0.01695
Length of the cylinder, L (m)	0.1

Sample	Power supply to heater, Q (W)	ΔT_1 , (°C)	ΔT_2 , (°C)	ΔT_3 , (°C)	ΔT_m , (°C)	Conductivity, k (W/m.°C) (Experimental)	Conductivity, k (W/m.°C) (Literature)
Air	24.9	17.8	17.4	17.0	17.40	0.041	0.029
Acetone	99.5	19.6	20.0	18.5	19.37	0.146	0.16

SCHEMATIC DIAGRAM

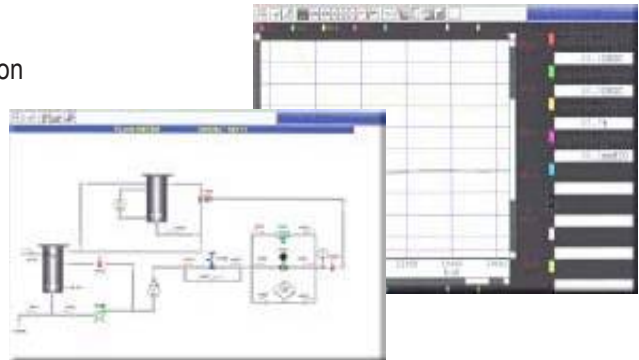


SOFTWARE & E - LEARNING

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SOLDAS™ - Supervisory Control & Data Acquisition

- Data Logging
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