

HEAT CONDUCTION STUDY BENCH

MODEL:HE 105



T HE Heat Conduction Study Bench (Model: HE 105) has been designed for students experiments on heat conduction. The unit consists of two electrically-heated modules mounted on a bench support frame. One module contains a cylindrical metal bar arrangement for a variety of linear conduction experiments, while the other consists of a disc for radial profile studies.

DESCRIPTION

Both test sections are equipped with an array of fast response high accuracy (0.1°C) temperature sensors. Cooling water provides a heat sink to maintain steady temperature gradient. A power control circuit provides a continuously variable electrical output up to 100W.

A temperature gradient in a solid material causes heat to flow. A solid is chosen for the demonstration of pure conduction since both liquids and gases exhibit excessive convective heat transfer. Heat conduction occurs in three dimensions, a complexity which often

requires extensive computation to analyse. A one-dimensional approach is required in the laboratory to demonstrate the basic law that relates rate of heat flow to temperature gradient and area.

The test modules are designed to minimise errors due to true three-dimensional transfer. The basic principles of conduction can be taught without knowledge of radiation or convection heat transfer. The linear test section is supplied with interchangeable samples of conductors and insulators to demonstrate the effects of area, conductivity and series combinations. Contact

resistance may also be investigated and the important features of unsteady state conduction may be demonstrated.

Computer Data Acquisition System (optional) provided with the unit allows students to perform on-line temperatures trending, data logging as well as comparison of various temperature readings and calculations of heat transfer coefficients.

The unit may be used to measure the thermal conductivity of various solid materials such as cork and paper by clamping sample of specific dimensions between the hot and cold elements.

EXPERIMENTAL CAPABILITIES

- ◆ Accurate demonstration of conduction laws
- ◆ Linear and radial temperature profiles
- ◆ Conduction through composite materials
- ◆ Effect of surface contact
- ◆ Insulation effects
- ◆ Thermal conductivity determination
- ◆ Area effects
- ◆ Unsteady state profiles

SPECIFICATIONS

a) **Bench**

Type : Table Top

Material : Mild Steel c/w epoxy paint

b) **Linear Module**

Consists of:

Heater Section (Brass):

Diameter : 25 mm

Cooler Section (Brass):

Diameter : 25 mm

Interchangeable Center Section of length 30 mm:

- i) Brass of diameter 25 mm
- ii) Stainless steel of diameter 25 mm
- iii) Brass of diameter 13 mm

c) **Radial Module**

Material : Brass

Diameter : 110 mm

Thickness : 3 mm

d) **Instrumentations**

Linear module consists of a maximum of 9 temperature sensors at 10 mm interval. For radial module, 6 temperature sensors at 10 mm interval along a radius are fitted.

e) **Control Panel**

Allows the heater input power to be set and the temperature at any of the sensors to be shown in °C on the indicator.

OPTIONAL ITEMS

- EI

DIGITAL INSTRUMENTATIONS

- i) 2 units of digital indicator
- ii) 15 units of thermistor
- iii) 1 unit of power transducer

-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

Electricity : 240VAC, 1-phase, 50 Hz, 13 Amps
 Water Supply : Laboratory tap water

OVERALL DIMENSIONS

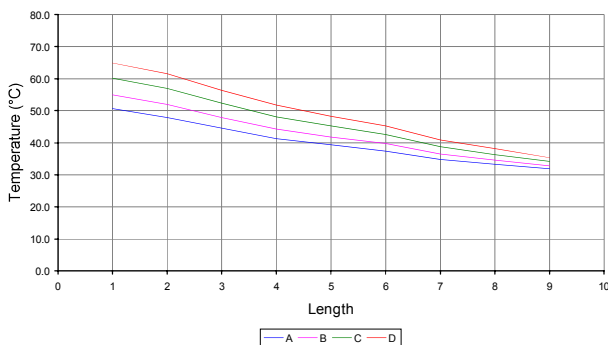
Height : 0.20 m
 Width : 0.60 m
 Depth : 0.30 m

MANUAL

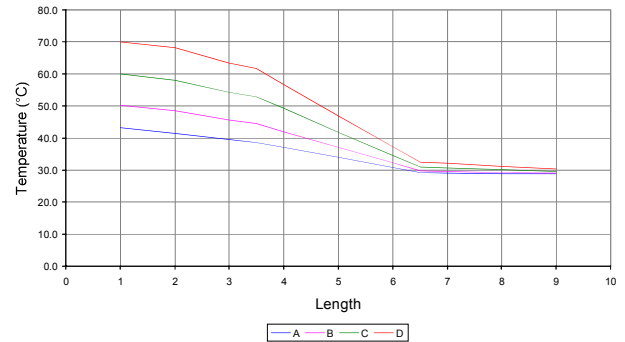
The unit is supplied with Operating and Experiment Manuals in English giving full descriptions of the unit, summary of theory, experimental procedures and typical experimental results.

TYPICAL EXPERIMENT RESULTS:

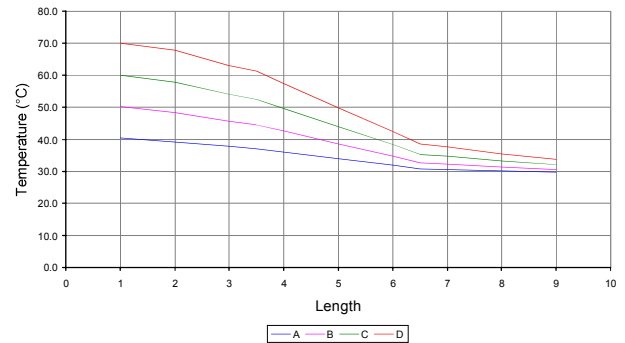
i) Heat Conduction along Homogeneous Bar



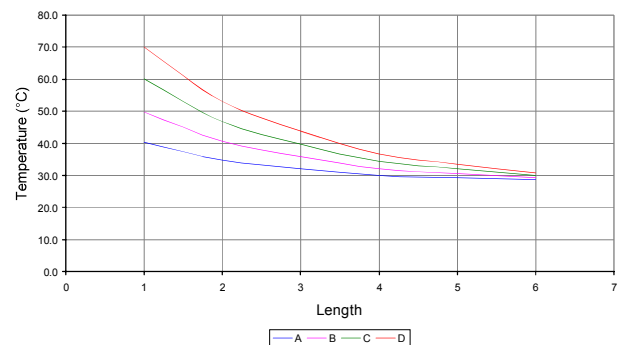
ii) Heat Conduction along Composite Bar



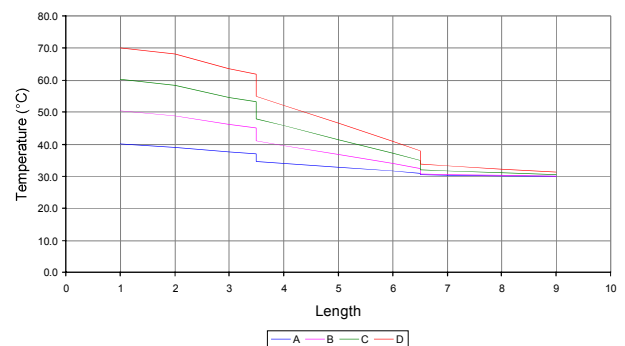
iii) Effect of Cross-sectional Area on Heat Conduction



iv) Radial Conduction



v) Effect of Surface Contact on Heat Conduction

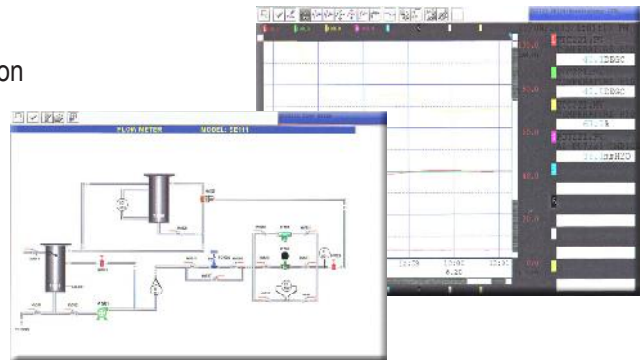


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- Data Logging
- Signal Analysis
- Process Control
- Real-Time Display
- Tabulated Results
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- Multimedia Features
- Interactive
- Graphic Simulation
- Experiment Result Samples
- Full Experiment Manuals



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