H-6862A
Thermal Conduction Demonstrator

Purpose

The Hampden **Model H-6862A** Thermal Conduction Demonstrator allows students to investigate in detail the principles of conduction heat transfer. The student is able to determine the relationship governing conduction heat transfer and show that it is dependent on the thermal conductivity of the material, the length of the conducting path, the cross-sectional area of the conduction path, and the temperature gradient. The student is able to determine linear and radial temperature surface contact resistance, conduction through materials with different cross-sectional areas, conduction through insulation, and conduction through composite materials.

Description

The **Model H-6862A** consists of an instrument console, linear and radial conduction module and cooling water flowmeter module designed for bench-top use.

The linear and radial conduction module consists of:

- an insulated radial conduction device with heater
- cooling circuit
- six temperature sensor sockets
- insulated linear conduction device with heater and three temperature sensor sockets
- insulated linear conduction heat sink water cooled device with three temperature sensor sockets
- insulated 1" brass center insert with three temperature sensor sockets
- insulated 1" stainless steel center insert
- insulated ½" brass center insert
- associated receptacles for interface with the instrument console and cooling water flowmeter module.
- four water temperature sensors
- two heater temperature sensors

MODEL H-6862A-CDL Thermal Conduction Demonstrator with CDL Option
Shipping Weight: 200 lbs
Cubic Feet: 13

The instrument console consists of:

- ground fault circuit interrupter
- digital indicating temperature control with PID control mode
- digital wattmeter with analog output
- digital temperature indicator with analog output
- multi-position selector switch and associated receptacles for interface with the linear and radial conduction module.

The flowmeter module interfaces with either the linear or radial conduction modules providing controlled cooling water flow.

Experiment Capabilities

1. Verify Fourier's Law of Heat Conduction
2. Measure linear and radial temperature profiles.
3. Calculate thermal conductivities of materials.
4. Determine effect of cross-sectional area on conduction
5. Demonstrate surface contact resistance.
6. Determine heat transfer through insulation.
7. Demonstrate conduction through composite materials.

Accessories

- Six-point temperature thermocouples assembled with thermocouple jacks
- Three-point temperature thermocouples assembled with thermocouple jacks
- Temperature interface cables with thermocouple jacks, 3 ft. (2 provided)
- Plug – water
- Tube, heat conducting compound
- Manuals – Experiments, Operating and Maintenance

Requirements

Electrical:
120V AC single-phase 60Hz
Water:
20 gallons per hour at 15 psi

All Hampden units are available for operation at any voltage or frequency

Hampden® ENGINEERING CORPORATION

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Specifications

Instrument Console

Enclosure:
12-gauge furniture stock steel finished in 443 tan enamel.

Panel:
11-gauge furniture stock steel finished in 443 tan enamel.

Nomenclature:
Black KEM silkscreened enamel.

Electrical Main:
Ground Fault Circuit Interrupter with associated omniglow pilot light and related 6 ft. power cord with plug.

Temperature Control:
Digital indicating temperature control with PID control mode. Unit utilizes a Type T thermocouple input and a 4–20mA output controlling a variable voltage power controller. ½" indicator LEDs display process input value or primary set point value. LED light indicates when output is energized.

Accuracy of Temperature Control:

- Calibration Accuracy and Sensor Conformity: ±0.25% of span, ±1 digit at 77°F ±5° (25° ±3°) ambient and rated line voltage ±1%.
- Millivolt Signal I/O: ±0.25% of span.
- Accuracy Span: 1000°F or 540°C minimum.
- Temperature Stability: ±2mV/°F (3.6mV/°C) ambient
- Voltage Stability: ±0.01% of span/% of rated line voltage.

Wattmeter:
Digital 3½ digit LED indicating wattmeter with 4–20mA DC analog output. Wattmeter monitors the output of the variable voltage power controller.

Temperature:
Digital 3½ digit LED indicating temperature meter with a 1mV/degree analog DC output.

Selector Switch:
Multi-position for thermocouples.

Linear and Radial Conduction Module

Base:
11-gauge furniture stock steel finished in 443 tan enamel.

Linear Conduction Device:
Insulated 1" brass bar with a 100 watt cartridge heater and three temperature sensor sockets.

Linear Conduction Heat Sink Device:
Insulated water cooled 1" brass bar with three temperature sensor sockets.

Coupling Device:
Spring loaded quick connect.

Insulated inserts:

- 1" dia. insulated brass center insert with three temperature sensor sockets.
- ½" dia. insulated brass center insert.
- 1" dia. insulated #304 stainless steel center insert
- 3" x 3" square cork insert
- 3" x 3" square paper insert

Radial Conduction Device:
Insulated 11" dia. x ⅛" copper plate with water cooled copper tube peripheral heat sink. The 100 watt cartridge heater is located in the center base section and six temperature sensor sockets are located from direct center outward in equal increments.

Flowmeter Module

Base:
11-gauge furniture stock steel finished in 443 tan enamel.

Flowmeter:
0–1 gallon per minute.

Flow Control:
Needle valve.

Connections:
Quick coupling.

Hoses:

- 6 ft. drain tube.
- 6 ft. supply tube with hose connector.
- 2 ft. interface tube with connectors each end.

Temperature Sensor:
The flow input and output of both radial and linear heat sink devices are monitored with thermocouples. The heater elements are monitored with thermocouples.

Computer Data Logging

The Hampden **Model H-6862A** Thermal Conduction Demonstrator can be outfitted with a computer data logging option.

The analog outputs are factory wired to National Instruments I/O modules where the signals are converted and terminate to an USB receptacle. Software and templates for LabVIEW® control software are included. Computer is included.

Specify **Model H-6862A-CDL**

All Hampden units are available for operation at any voltage or frequency

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