

Heat Transfer Training Systems

Educational Training Equipment for the 21st Century

Bulletin 686E

H-6860 Conduction Heat Transfer Demonstrator

Purpose

The Hampden **Model H-6860** Conduction Heat Transfer Demonstrator is designed to allow students to investigate the fundamental aspects of conduction heat transfer. Heat is conducted through test sections to a heat sink. The temperature profile of the test section is monitored with thermocouples and displayed on a digital panel meter.

Description

With the unit, students are able to verify Fourier's law of heat conduction. Students shall also be able to determine experimentally the variables of interest in conduction heat transfer, which are:

- thermal diffusivity of a material
- thermal conductivity of a material and its temperature dependence
- thermal contact resistance of a metal-to-metal, pressure contact
- thermal characteristics of insulators
- thermal resistance networks
- overall heat transfer coefficient
- heat transfer coefficient of metal-to-liquid
- effectiveness of heat sinks
- heat losses in insulated flasks
- unsteady state heat transfer

The major system components supplied with the unit are an electric tube furnace heatable to 316°C with a regulation of 1°C. The temperature is controlled by a manual stepless input and is indicated on a dual-scale pyrometer. Connected to this furnace on either side are metal bars of different types in a pressure contact. The heat is removed by an immersed fluid cooled heat sink of which both the fluid flow rate and temperature are monitored. The student has control



MODEL H-6860 Conduction Heat Transfer Demonstrator
Dimensions: 52"H x 72"W x 33"D
Weight: 800 lbs.

over the fluid flow rate and thus can control the rate at which the heat is removed from the system. All conductors and hot components are insulated with non-asbestos insulation. In addition to the tube furnace, two hot plates are provided which can be heated to 370°C, accurate to within 3°C. Mounted on top of each unit is an insulating jacket, one with a constant cross-sectional area metal bar and one with a variable cross-sectional area metal bar. These bars end in a fluid-cooled heat sink used in a similar fashion as the ones mentioned previously. The above two conductors each have 10 thermocouples. The unit is also supplied with 4 insulated flasks to study the heat transfer through glass walls.

The flasks are arranged into two pairs, one pair with an evacuated layer and the other with an air-filled layer. In each set, one flask has a reflective surface and the other a plain surface. Thus, in one pair of flasks, which acts as a control group, conduction losses come into

play. There is also a conductometer supplied with the bench to study the speed at which a conductor will transmit heat. The conductometer is composed of 6 conductors, each of different materials.

This unit utilizes a digital temperature display accurate to within 0.4°C and is calibrated for use with type T thermocouples. All of the experimental fixtures mentioned above are adequately thermocoupled with Chromel/Alumel (type T) thermocouples, along the length of the fixture. A thermocouple selector switch lets the student display the readout of any of these thermocouples on the digital temperature display. Also included are two laboratory grade thermometers with a range of -30 to 110°C and are used with the flasks.

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

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A self-contained, water-based coolant system is supplied with the unit. It includes a water pump with a maximum flow rate of 10 gpm, a 5 gallon reservoir, two flowmeters (0.2 to 2 gpm), two needle valves and all of the necessary piping and accessories needed to complete the system.

A complete Experiment manual, Bulletin 686-EX, and Teacher's Manual, Bulletin 686-TM, are provided.

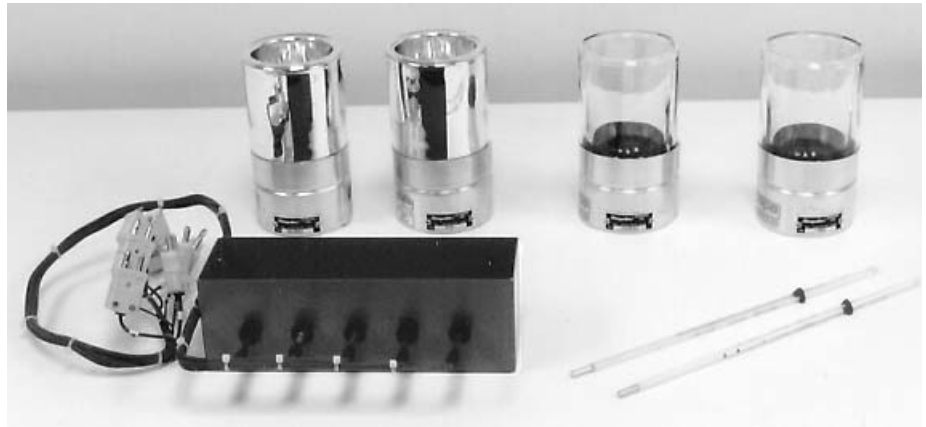
Services Required

Input Voltage: 120V AC–30A–1 ϕ –60Hz

Water Drain: Floor

Physical Specification

All of the above equipment is mounted on a Hampden HMT-5 mobile table constructed of code-gauge furniture stock steel. The table comes with an integral drawer to store items that are not permanently attached. This table is mounted on 2 swivel and 2 locking swivel casters. The table top is constructed of burn resistant material. The unit comes complete with a teacher's manual and a student manual which explains the basic background theory and provides a list of suggested experiments.



Accessories included with **MODEL H-6860** Conduction Heat Transfer Demonstrator Bench

Optional Coolant System

The self-contained water coolant system can be replaced by a coolant system of the customers choosing. The heat sinks, valves and lines are compatible with water, glycol, or oil. The system is pressure tested at 60 psi without leakage.

CDL Option

The Hampden **Model H-6860** is also available with additional instrumentation and dual thermocouples to allow remote data acquisition by National Instruments I/O modules interfaced into a PC computer through the USB port. Computer and National Instruments LabVIEW® are not included. Templates for LabVIEW® control software are included.

Specify **Model H-6860-CDL**.

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