

# Heat Transfer Training Systems

Educational Training Equipment for the 21st Century

Bulletin 685-21B

## Purpose

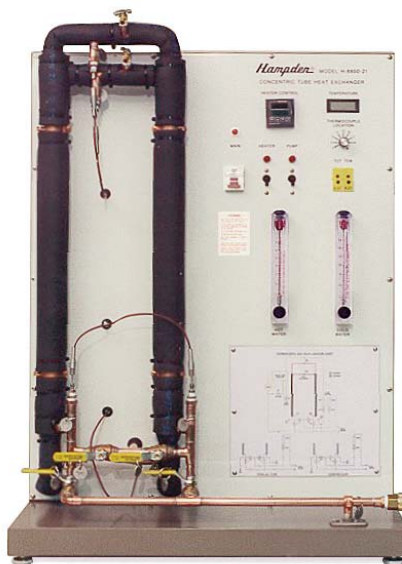
The Hampden **Model H-6850-21** Concentric Tube Heat Exchanger has been developed to investigate the fundamental principles of heat transfer as applied to a tube-in-tube heat exchanger. The apparatus permits the student to move from classroom theory to a hands-on application with all of the practical training. The student shall measure the variables that affect the overall heat transfer coefficient. The "cold" and "hot" fluid temperatures and flow rates are monitored at strategic locations. The unit can be configured to operate as either a parallel flow or counterflow heat exchanger. By varying the fluid flow rates, laminar, transitional or turbulent flow conditions can be created.

## Description

Thermocouples are located in the fluid streams for accurate measurement of the fluid temperatures. Both the shell and tube side temperatures are monitored. Furthermore, the surface temperature of the shell side tube is provided for in both passes.

This unit is equipped with a hot water supply controlled by a microprocessor-based single input, dual output temperature controller. This allows the temperature gradient between the two fluids to be varied over a wide range. The Reynolds number can be varied from laminar regime, through the transition region (2,300 to 10,000), and into the turbulent regime (40,000/50,000).

The **Model H-6850-21** is designed to be mounted on a steel panel with case mounted on a steel base. The fluid inlets and outlets for this unit are conveniently located at the bottom of the U-column. The cold and hot water fluid rates are controlled by needle valves. There are four ball valves used to configure flow or counterflow in the cooling circuit. The trainer requires only water at normal mains pressure.



**Model H-6850-21** Concentric Tube Heat Exchanger  
Dimensions: 40"H x 27"W x 29"D, Weight: 400 lbs.

The trainer is constructed out of copper tubing with copper fittings and brass valves. They are mounted securely to the panel with insulated supports. External fluid connections to the trainer are made with quick connect fittings. The fluid lines on the unit are tested to withstand 150 psig. The unit comes equipped with the following instruments and components:

- Instrument Control Panel
- Circulating pump
- Thermocouples type T, (6), w/thermowells  
Thermocouple probe sets (2)
- Ten gallon tank with 3.0KW heater
- System vents (2)
- Ball valves, (6)
- U-type heat exchanger
- Operating Instructions manual, Teacher's manual, and Experiment manual

## Services Required

- Cold water supply
- Drain

## H-6850-21 Concentric Tube Heat Exchanger

### Experiment Capabilities

- A. Heat Exchanger Configuration:
  1. Parallel flow tube-in-tube heat exchangers
  2. Counterflow tube-in-tube heat exchangers
- B. Flow Regimes:
  1. Laminar
  2. Transitional
  3. Turbulent
- C. Experimental Fluid - water to water
- D. Experimental Results:
  1. Overall heat balance
  2. Heat transfer coefficient for liquid-to-liquid
  3. Film coefficient for liquids
  4. Heat exchanger efficiency for:
    - a) parallel flow
    - b) counter flow
  5. Tube wall effects
  6. Tube-entrance effects
  7. Analytical techniques:
    - a) logarithmic mean temperature difference method
    - b) heat exchanger effectiveness method
  8. Temperature diagrams
- E. Advanced Capabilities
  1. Unsteady state heat transfer
  2. Tube entrance effects
  3. Effects of viscosity on film coefficients

### Computer Data Logging

This feature adds two flow transducers and six thermocouples into the system. One interface package consisting of National Instruments I/O modules and LabVIEW® software and templates are provided for interfacing into a PC computer through the USB port.

Computer is included.

Specify **Model H-6850-21-CDL**



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

**Hampden**  
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