Heat Transfer Training Systems

Educational Training Equipment for the 21st Century

Bulletin 685-30

Model H-6850-30 Double-Pipe Heat Exchanger
Dimensions: 30"H x 144"W x 12"D Weight: 120 lbs.

H-6850-30

Double-Pipe Heat Exchanger (Air to Water)

Purpose

The Hampden **Model H-6850-30** Double-Pipe Heat Exchanger has been developed to permit the experimental determination of the different heat transfer coefficients. Heated air is passed through a tube around which cooling water flows. The air, water and tube temperatures are monitored at the inlet and outlet ports along with the air and water flow rates. In addition, the velocity and temperature profiles within the air tube can also be measured.

Description

The apparatus is designed to be operated with turbulent air flow and either laminar, transitional or turbulent water flow. The student will be able to determine experimentally for both parallel and counterflow cases:

1. Overall Heat Transfer Coefficient (Air-to-Water)
2. Film Coefficients for:
   a) Air-to-tube
   b) Tube-to-water
3. Total Heat Balance using:
   a) Logarithmic Mean Temperature Difference Method
   b) Heat Exchanger Effectiveness Method
4. Pipe Friction Pressure Losses
5. Velocity and Temperature Profiles of the air tube
6. Empirical Relationship of Reynolds, Nusselt, and Prandtl Numbers

Instrumentation Provided

This unit comes equipped with the following instrumentation:

1. Analog Temperature Meter - 0-500°F range and a scale accuracy of ±1%.
2. Thermocouples and Probes - two (2) probes for water immersion, one (1) probe for air temperature profile survey and two (2) thermocouples cemented onto the 3/4" ID tube. All thermocouples are type T, Chromel/Alumel.
3. Manometers - one (1) inclined manometer to indicate the air velocity which has a range of 0-4" WC. (1000-8000 fpm) and one (1) inclined manometer to indicate the frictional pressure drop which has a range of 0-2" WC with 0.01" minor divisions. Both units have a ±2% full scale.
4. Pitot Tube - one (1) pitot-static tube to measure the air velocity profile.
5. Pitot Tube Traverse - a manual traverse unit capable of positioning the pitot tube or thermocouple probe to within 0.01" of the linear position and 0.2° of its angular position.
6. Thermometer - two (2) mercury-in-glass calorimeter grade thermometers with an adjustable range of 6°C over an operating range of -20 to 120°C. Scale subdivided into 0.01°C intervals.
7. Volumetric Flow Tank and Timer - one (1) 5.5 liter capacity tank calibrated to within 1% of its actual volume and one (1) digital stopwatch which indicates the time to the nearest 1/100th of a sec.
8. Ring Compressor - one (1) Fuji ring compressor which will deliver a variable amount of filtered air without pulsation.
9. Air Heater - one (1) 2 kw air heating element which will heat air from ambient conditions to any desired temperature from 100 to 482°F. The air temperature is thermostatically controlled.
10. Heat Transfer Section - one (1) concentric tube arrangement featuring the following:
    a) copper inner tube with a 0.75" id and a 0.814" od;
    b) copper outer tube with a 1.00" id;
    c) fully insulated;
    d) constant temperature inlet and outlet sections achieve fully developed flow with uniform velocity and temperature profiles;
    e) positive sealing quick-connect/ disconnect fittings on the water lines;
    f) needle valve to control the water flow rate;
    g) quick changeover from parallel-flow to counter-flow;
    h) working surface areas of 1.288 sqft inner and 1.398 sqft outer;
    i) working length - 78.74", (the distance between manometer points).

Services Required

Electrical - 120V AC-1ϕ-60Hz, 26A
Water - 4 gpm @ 60 psi (4 bars)

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

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