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Heat Transfer in an Aluminum Heat Exchanger Using Normal Hydrogen Gas: Final Report

Douglas A. Olson

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HEAT TRANSFER IN AN ALUMINUM HEAT EXCHANGER USING NORMAL HYDROGEN GAS: FINAL REPORT

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Nomenclature

A_f = flow normal area = $n \cdot h_c \cdot w_c$
A_n = heat exchanger normal area = $L \cdot W$
A_w = wetted wall area (total wall area exposed to fluid)
= $2 \cdot n \cdot (w_c + h_c) \cdot L$
c_p = specific heat at constant pressure
Bi = Biot number = $h_w \cdot D_h / k_{al}$
D_h = heat exchanger hydraulic diameter
= $4 \cdot A_f \cdot L / A_w = (2 \cdot h_c \cdot w_c) / (h_c + w_c)$
f_q = heat flux distribution function
h = heat transfer coefficient
h = enthalpy
h_c = height of channel
h_w = heat transfer coefficient based on temperature of wall-fluid interface
k = thermal conductivity
k_{al} = thermal conductivity of aluminum
L = length of heat exchanger
n = number of channels
$\dot{m}$ = mass flow rate
Nu = Nusselt number = $h \cdot D_h / k$
Nu_w = wall Nusselt number = $h_w \cdot D_h / k$
P = pressure
Pr = Prandtl number = $\mu \cdot c_p / k$
Q_{px} = fraction of total heat flow on heat exchanger added up to position x
= integration of furnace calibration function f_q, 0 to x
Q_T = total heat transfer to heat exchanger
q_w = local heat flux into the cooling fluid based on total wetted-wall area of the heat exchanger
Re = Reynolds number = $\rho \cdot V \cdot D_h / \mu$
T = temperature
T_f = local bulk fluid temperature
T_w = heat exchanger wall temperature
$T_{w,hot}$ = wall temperature on hot side
$T_{w,ins}$ = wall temperature on insulated side
V = velocity
W = width of heat exchanger
w_c = width of channel
W_{dp} = uncertainty in pressure drop
W_h = uncertainty in heat transfer coefficient
W_{nu} = uncertainty in Nusselt number
W_{qt} = uncertainty in total heat transfer
W_{re} = uncertainty in Reynolds number
W_{tf} = uncertainty in fluid temperature
W_{tw} = uncertainty in wall temperature

x = position coordinate parallel to flow direction
y = position coordinate perpendicular to flow direction

ζ = temperature ratio, eq (13)

η = fin efficiency
μ = dynamic viscosity
ρ = density

0 = location of upstream pressure and temperature measurement
1 = location of downstream pressure and temperature measurement

Heat Transfer in an Aluminum Heat Exchanger Using Normal Hydrogen Gas: Final Report

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I have measured heat transfer and pressure drop in a flat aluminum heat exchanger in normal hydrogen gas at 10.3 MPa and Reynolds numbers of 6600 to 24 600. The heat exchanger was 3.7 mm thick and contained 13 parallel flow channels of rectangular cross section, 1.32 mm wide and 2.64 mm high. The heat exchanger was insulated on the back and radiatively heated on the top with heat fluxes up to 88 W/cm^2. The measured Nusselt number was independent of heating rate and was a function of Reynolds number only. Comparison of my data to correlations from past studies, along with a numerical analysis, indicated large temperature variations from the heated side to the insulated side. Because the heat exchanger was brazed to a thick base, heat conduction along the flow direction appeared to be significant.

Key words: compact heat exchanger; heat transfer; normal hydrogen gas; National Aerospace Plane; pressure drop; radiative furnace; turbulent flow.

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1. Introduction

This report presents the results of an experimental test of the heat transfer in an aluminum heat exchanger which uses normal hydrogen gas as the coolant. The heat exchanger is a candidate cooling panel for components of the National Aerospace Plane (NASP) which receive high heat flux. The heat exchanger was provided by a commercial manufacturer. As used in NASP, the heat exchanger would be bonded to a component that needs protection from the incident heat flux. One side of the heat exchanger will receive a heat flux of 180 W/cm^2 (160 $Btu/(s \cdot ft^2)$) or greater, and hydrogen gas will flow through internal passages at 28 MPa (4000 psi) to absorb the heat. A complete experimental evaluation of the heat transfer performance of the heat exchanger will be conducted by Wright Patterson Air Force Base. Their test facility was not operational in January, 1992, when I tested the heat exchanger. I tested the heat exchanger in a hydrogen flow apparatus which can generate 90 W/cm^2 (80 $Btu/(s \cdot ft^2)$) of heat flux and supply hydrogen gas at 10.3 MPa (1500 psi). My data will be used for preliminary analysis of the performance of the heat exchanger.

The heat exchanger was a flat aluminum panel, 3.7 mm (0.14 in) thick, formed by extrusion to provide internal rectangular channels. There were 13 parallel channels which provided a single pass for the hydrogen gas. As used in NASP, the number of parallel channels would be chosen to provide the necessary total width of the panel; the length also would depend on the size of the component to cool. The rectangular channel geometry is one for which there have been numerous heat transfer investigations and correlation equations [Rohsenow and Hartnett, 1973; Olson, 1990], especially for a single channel with either isothermal or constant heat flux boundary conditions. The performance of this heat exchanger could be different from that of a single channel for a number of reasons. The distribution of flow from channel to channel may not be uniform, causing hot spots where the flow is lower than average. Heat conduction from the heated side to the insulated side could cause temperature gradients in the aluminum which could be significant. For conditions of extremely high heat flux, temperature differences between the wall and the gas could cause large variations in thermophysical properties.

In this report I will describe the apparatus used to perform the heat transfer tests, details of the heat exchanger, and the instrumentation and data analysis. The main purpose of the report is to provide a repository of the data gathered during the testing, and the data tables form the bulk of the report. I will present some of the data in graphs to indicate the heat transfer performance.

2. Description of the experiment

2.1. Hydrogen flow apparatus

The hydrogen flow apparatus is shown in figure 1, with the details of the furnace section given in figure 2. The hydrogen apparatus is similar to a helium flow apparatus I described earlier (Olson [1989]), which was used to test compact, flat heat exchangers. Because of the explosive hazard of hydrogen, I took precautions to ensure that the test was conducted safely. All components of the apparatus containing hydrogen were situated behind a concrete blast wall, 30 cm thick. The experimental controls and data acquisition system were located in a trailer on the opposite side of the blast wall from the apparatus. All valves were operated remotely with air pressure.

Hydrogen gas was stored in a tube trailer at 17 MPa (2500 psi) or less. The tube trailer contained 1500 m^3 of gas (STP). Since the hydrogen had been stored in the tubes for several days before being used, it will be in the equilibrium form as normal hydrogen rather than para-hydrogen. With valve 1 open, gas flowed from the trailer and through the inlet piping, and was filtered before entering the dome-loaded pressure regulator (valve 3). The regulator set the flow pressure downstream of the regulator to the value of an external control pressure, which was about 10.3 MPa (1500 psi).

Within the furnace (fig. 2), the gas flowed past a platinum resistance thermometer (PRT) and into the support base made of 6061-T6 aluminum. The support base had been brazed to the heat exchanger by the manufacturer. A distribution manifold in the base directed the gas into the slots of the heat exchanger. A similar distribution manifold in the base collected the gas exiting the heat exchanger. The gas flowed past a second PRT and into the outlet tubing. I measured gas inlet pressure at the pressure tap at location 0, which was in the inlet manifold upstream of the heat exchanger channels. I measured the difference in pressure between locations 0 and 1 (outlet manifold, downstream of the heat exchanger channels). The base with the attached heat exchanger was located in the target area of the furnace (7.8 cm wide by 15.2 cm long), which delivered radiant heat to the exchanger and raised the temperature of the hydrogen as it flowed through.

The furnace consisted of a high-intensity infrared radiant heater, surrounded by highly reflective walls which reflected the heat from the heater to the exchanger [Olson, 1990]. The reflective walls were made of 6.4 mm thick aluminum plates, polished on the inner surface, with water-cooled copper tubes soldered to the outside. The heater contained six high-temperature infrared lamps mounted in an aluminum housing. The heater was cooled by water and compressed air. A phase-angle

power controller which used 480 VAC, three-phase, and 50 A at maximum voltage powered the heater. The voltage was converted to direct current in the power controller.

Because the heat exchanger was smaller than the target area of the furnace, I mounted a shading plate flush with the top of the heat exchanger to prevent the heat of the furnace from striking the base or instrumentation. The shading plate was an aluminum plate, 6.3 mm thick, 10.2 cm wide, and 30.5 cm long with a hole cut out to match the size of the heat exchanger. The plate was polished on the side facing the furnace, and was water-cooled on the underside.

Downstream of the furnace section, the gas flowed through a cooling coil immersed in a water bath. The rate of gas flow was adjusted at the bath outlet by valve 5, which also dropped the gas pressure to atmospheric pressure. Beyond the valve, I measured hydrogen flow rate with a heated-tube thermal mass flow meter. After exiting the flow meter the gas was discharged through a vent stack, about 10 m above the elevation of the apparatus.

To purge air from the system initially or to purge hydrogen at the completion of an experiment, I closed valve 1 and opened valve 2 to allow helium to flow through the apparatus. To pump air or hydrogen out of the system, valves 1 and 2 were closed and valve 4 opened to a vacuum pump. Gases from the exhaust of the vacuum pump were discharged in a vent stack about 4 m high. The vent stacks of the vacuum pump and the main apparatus were continuously purged with low-pressure nitrogen to prevent air from flowing back into the system.

2.2. Aluminum heat exchanger

The aluminum heat exchanger was constructed by the manufacturer and is shown in figure 3. Heating was from the top in the figure. The manufacturer provided the internal dimensions. The heat exchanger was 3.66 mm (0.144 in) thick and was brazed to a support base. Both were made of 6061-T6 aluminum. 13 parallel, rectangular channels were formed in the heat exchanger by extrusion. The channels were 1.32 mm wide by 2.64 mm high (0.052 in by 0.104 in). The vertical support between channels was 0.51 mm (0.020 in) wide; the skin below and above the channels was 0.51 mm (0.020 in) thick. After extrusion, the ends of the heat exchanger were welded across the width to close off the channels. The heat exchanger was 27.13 mm (1.068 in) wide and 108.13 mm (4.257 in) long.

The support base was 5.5 mm (0.22 in) thick in the center to minimize axial heat conduction and 32 mm thick at the ends to provide for distributing the gas into the channels. At either end of the support base, 13 holes were drilled through the top of

the base to line up with holes drilled into the channels of the heat exchanger. The pressure taps were aluminum tubes, 3.18 mm (0.125 in) diameter, welded into the base as shown in figure 3.

I painted the top of the heat exchanger black to establish a uniform and highly absorptive surface over the heated area. The paint was rated to 1000 K, with a total normal emissivity of 0.85 ± 0.05. As shown in figure 3, the x coordinate aligns with the flow direction and is parallel to the channels, with x = 0 at the inlet end of the heat exchanger. The y coordinate is perpendicular to the flow direction, with y = 0 at the centerline of the heat exchanger.

2.3. Instrumentation

I measured the temperatures of the gas stream at the inlet and outlet of the heat exchanger, gas pressures at the inlet and outlet of the heat exchanger, temperatures at 19 locations on the unheated side of the heat exchanger, and the gas flow rate. The measurement techniques and uncertainties, along with the gas property uncertainties, are summarized in table 1.

I determined the distribution of heat flux on the heat exchanger by calibrating the furnace prior to installing the exchanger [Olson, 1989]. I defined the heat flux distribution as the local, normal (perpendicular) heat flux as a function of position over the furnace target. Over the area of the target occupied by the heat exchanger, the heat flux was constant in the direction perpendicular to flow (y), and varied by no more than ±7 percent in the flow direction (x) [Olson, 1990].

The gas inlet and outlet temperatures were measured with platinum resistance thermometers, 4.8 mm (0.188 in) diameter, inserted in the gas stream as shown in figure 4. I measured the gas pressure at the inlet with a variable-reluctance pressure transducer which had a 13.8 MPa (2000 psi) full-scale output. Difference in pressure between the inlet and outlet was measured with a differential pressure transducer, also a variable-reluctance type with a 0.86 MPa (125 psi) full-scale output.

I measured the wall temperatures of the heat exchanger with thermocouples made from type N wire of diameter 0.25 mm. I spot-welded 19 thermocouples to the underside of the support base as shown in figure 4. Fifteen thermocouples were welded in three rows of five each on the thinnest portion base. Two thermocouples were welded to each of the thicker ends of the base. I welded a thin strip of stainless steel over each thermocouple pair, at least 5 mm from the junction, as a stress relief. The lead wires of the thermocouples extended out from the base parallel to the y direction.

All thermocouples were connected to terminals in an

isothermal reference box. I measured the temperature of the reference box with a platinum resistance thermometer. Copper conductor wire connected from the terminals in the reference box to the data scanner. The reference box introduced negligible error in the temperature measurement [Olson, 1989].

All instrument signals were multiplexed through an automated scanner and measured with a digital voltmeter. The scanner and voltmeter were controlled with a personal computer through an IEEE-488 bus. Raw signals were stored on a hard disk and copied to a floppy disk for backup. Signals were converted to SI units and the data analyzed at the completion of an experimental run. Some signal readings were converted immediately to SI units and displayed on the video terminal to assist in monitoring and operating the experiment. I have included the measurement uncertainties introduced by the data acquisition system in the stated uncertainties of each sensor.

3. Experiments and analysis of data

3.1 Experiments

Eight heat transfer experiments were conducted on the aluminum heat exchanger and the conditions for the experiments are summarized in table 2. Also listed are the values for the geometrical parameters of the heat exchanger. Table 3 lists values for all the measured and calculated parameters at each data point for each experiment. The first page of the table for each experiment is a summary of the data points taken for that experiment. Tests were conducted at a system pressure of approximately 10.3 MPa (1500 psi). In experiments 1 to 5, I set the furnace heater output to a constant power and tested a range of hydrogen flow rates. I took data with the flow rate ranging from low values to high values; next I turned off the heater, allowed the heat exchanger to cool, and turned the heater back on to the same power; I then took data from high flow rates to low flow rates. For tests 3 to 5, I also recorded data with no heating. Results of the first 5 tests indicated excellent repeatability in the data, regardless of the order in which the flow rate was varied.

In experiment 6, I kept the flow rate constant and varied the heating rate from a low value to a high value. The test was terminated when several of the lamps burned out at a heat flux above 70 W/cm^2 (62 $Btu/(s \cdot ft^2)$). For experiment 7, I set the heater to a constant power and varied the flow rate, this time over a wider range than in experiments 1 to 5. Experiment 8 was a repeat of experiment 6, but with the new lamps I was able to achieve a heat flux of 88.0 W/cm^2 (77.5 $Btu/(s \cdot ft^2)$) before the lamps burned out.

The range in normal heat flux was 0 to 88.0 W/cm^2 (0 to 77.5 Btu/(s·ft^2)). The flow rate ranged from 5.4 kg/h to 19.7 kg/h (0.0033 lbm/s to 0.0121 lbm/s), providing a range in Reynolds number of 6600 to 24 600. Inlet gas temperatures ranged from 271.9 K to 288.8 K (29.8 °F to 56.5 °F); outlet gas temperatures ranged from 280.6 K to 347.9 K (45.4 °F to 166.5 °F). The maximum temperature rise in the gas between inlet and outlet was 61.2 K (110.0 °F) and the maximum temperature I measured in the heat exchanger was 376.8 K (218.5 °F). The Prandtl number was approximately 0.70 for all tests.

Before scanning the sensors at each experimental setting, I monitored gas and heat exchanger temperatures to determine whether they were steady. A temperature difference between the heat exchanger and the gas at the geometric midpoint of the heat exchanger was the best indication of thermal steady-state. Thermal steady-state occurred 2 to 5 minutes after a change in flow rate or heating rate. Gas pressure, furnace heating, and gas flow rate remained sufficiently steady while taking data to ignore thermal transients in the data analysis. At each experimental setting, I scanned the sensors and stored the readings 3 or more times. Each scan, with the data converted to useful parameters, is recorded in table 3.

I analyzed the measured data to determine the heat transfer coefficient h. The heat transfer coefficient was non-dimensionalized as a Nusselt number Nu. I calculated a wall Nusselt number Nu_w, in which I extrapolated the measured temperature of the insulated side to the temperature of the wall-fluid interface, which I predicted through a numerical heat conduction analysis of the heat exchanger. I normalized the gas flow as the Reynolds number Re. Nu and Nu_w were correlated with Re. The parameters h, Re, Nu, and Nu_w were calculated at each location of an insulated-side thermocouple.

3.2. Calculation of heat transfer

The heat transfer coefficient h is defined through the equation

$$q_w = h \cdot (T_w - T_f), \qquad (1)$$

where

q_w = local heat flux (heat flow per unit area) into the cooling fluid based on total wetted-wall area of the heat exchanger;
h = heat transfer coefficient;
T_w = temperature of the insulated wall;
T_f = temperature of fluid (hydrogen gas).

If the kinetic energy of the gas were significant compared to enthalpy changes, the adiabatic wall temperature should be used

in eq (1) instead of the fluid temperature [Rohsenow and Choi, 1961]. However, for my tests the maximum gas velocity was 16.3 m/s (53.5 ft/s), which would cause the adiabatic wall temperature to exceed the fluid temperature by less than 0.01 K. This difference was much less than uncertainties in the fluid temperature.

The local heat flux in eq (1) is expressed in terms of the total radiant heat transfer Q_t to the heat exchanger, the total wetted wall area A_w, and the furnace calibration function f_q [Olson, 1989], which is a dimensionless expression of the local normal heat flux:

$$q_w = \frac{Q_t}{A_n} \cdot f_q \cdot \frac{A_n}{A_w}, \qquad (2)$$

with

A_w = wetted wall area = $2 \cdot n \cdot (w_c + h_c) \cdot L$;
A_n = heated normal area = $L \cdot W$;
n = number of channels;
h_c = height of a channel;
w_c = width of a channel.

The function f_q is on the order of 1; if the heat flux were constant then f_q would be 1 everywhere. The wall temperature used in eq (1) was measured with the thermocouples on the insulated side of the heat exchanger.

By equating the heat convected into the fluid with the radiant heat incident on the heat exchanger, I neglect heat conduction in the solid wall. Measured wall temperatures show that heat conduction in the wall was negligible perpendicular to the flow direction (y). However, measured wall temperatures in the flow direction (x) show curvature in the profile of temperature vs x, indicating streamwise gradients in the heat conduction. Heat conduction to the thick end pieces of the base likely caused the gradients in the heat conduction. The gradients in the heat conduction will cause errors in using eq (2) to calculate the heat convected to the fluid. To estimate the magnitude of the streamwise heat conduction, I should perform a numerical heat conduction analysis of the solid heat exchanger including the base. Such an analysis was beyond the scope of the effort I was asked to perform, but should be considered in a detailed analysis of the data. Curvature in the measured wall temperature vs x was least at x/L = 0.5 (the location furthest from the end manifolds), so errors in eq (2) caused by gradients in heat conduction will be least at x/L = 0.5.

Combining eqs (1) and (2) and rearranging, I get

$$h = \frac{\frac{Q_T}{A_w} \cdot f_q}{T_w - T_f} . \qquad (3)$$

The flow-direction energy equation was used to calculate Q_T (to follow). Gas temperature T_f was calculated using the flow-direction energy equation along with the furnace calibration (also to follow).

The total heat incident on the heat exchanger is equal to the enthalpy rise of the coolant gas, since heat losses were negligible. The enthalpy rise was calculated from the first law of thermodynamics, using the enthalpy h of the gas at the inlet and outlet of the heat exchanger, and the hydrogen gas flow rate:

$$Q_T = \dot{m} \cdot (h_1 - h_0) , \qquad (4)$$

where

h = enthalpy;
0 = location of gas inlet PRT and pressure tap;
1 = location of gas outlet PRT and pressure tap.
$\dot{m}$ = mass flow rate.

I neglected kinetic energy changes from 0 to 1 since they were insignificant compared to the uncertainties of the temperature measurement. The enthalpies at 0 and 1 were found as a function of the measured temperatures and pressures using the tables given in McCarty et al. [1981].

$$h_{0 \text{ or } 1} = h(T_{0 \text{ or } 1}, P_{0 \text{ or } 1}) . \qquad (5)$$

The fluid temperature T_f was calculated by integrating the flow energy equation from the inlet manifold up to the location of interest (designated as x) to first obtain the enthalpy at x, h_x:

$$h_x(T_{fx}, P_x) = h_0 + \frac{Q_T \cdot Q_{px}}{\dot{m}} , \qquad (6)$$

with Q_{px} = fraction of total heat flow on heat exchanger added up to position x;
= integration of furnace calibration function f_q, 0 to x.

I neglected the kinetic energy term since it was insignificant compared to the enthalpy term. To use eq (6) I again must neglect axial heat conduction. I assumed the pressure varied linearly between locations 0 and 1:

$$P_x = P_0 - (P_0 - P_1) \cdot \frac{x}{L}. \quad (7)$$

The error in T_f introduced by assuming a linear pressure variation was insignificant compared to uncertainties in the wall temperature measurement. With eq (7) used to evaluate the pressure, I solved eq (6) by initial guess and iteration to give the fluid temperature. T_f and Q_t were substituted back into eq (3) to give the heat transfer coefficient h. The Nusselt number, Prandtl number, and Reynolds number were then calculated, with the transport properties evaluated at the bulk fluid temperature T_f:

$$Nu = \frac{hD_h}{k}, \quad (8)$$

$$Pr = \frac{\mu c_p}{k}, \quad (9)$$

$$Re = \frac{\rho V D_h}{\mu}. \quad (10)$$

Transport properties were calculated from the tables given by McCarty et al. [1981].

I defined the heat transfer coefficient h in terms of the insulated wall temperature, because I measured the temperature of the insulated wall. Using a correlation developed in my experiments, I can predict the insulated wall temperature for given conditions of heat flux and gas flow rate. However, I want to compare my results to the literature, where h is defined in terms of a solid-fluid interface temperature. Because the heat exchanger was heated from one side only and the solid thermal conductivity was finite, the temperature on the heated side will be hottest, and the temperature along the solid-fluid interface will be hotter than the temperature on the insulated side which I measured.

To compare my results to those of past studies where the heat transfer coefficient was defined in terms of the solid-fluid interface temperature, I computed temperature distributions in a two-dimensional vertical cut through the heat exchanger using a finite-element heat conduction analysis. My inputs to the model were the anticipated values of the wall heat transfer coefficient h_w, anticipated normal heat fluxes, and the fluid temperature. I assumed the heat transfer coefficient was uniform around the wetted wall of the flow channel. I neglected axial heat conduction in the wall of the heat exchanger. I then calculated a "fin" efficiency η defined by

$$\eta = \frac{\frac{Q_T}{A_w}}{h_w \cdot (T_w - T_f)} . \qquad (11)$$

According to the definitions in eqs (11) and (3), $h_w \eta = h$ (with $f_q = 1$). The temperature T_w of the insulated wall was calculated in the analysis. I repeated the computation for the range of h_w expected experimentally, and η was calculated for each set of conditions. For constant wall thermal conductivity, k_{al}, and constant h_w, heat transfer theory [Rohsenow and Choi, 1961] shows that η should be a function only of h_w, k_{al}, and the geometry. I expressed these parameters as a Biot number Bi and correlated η with the Biot number as

$$\eta = 0.9698 + 15.957 \cdot Bi - 66.214 \cdot Bi^2 , \qquad (12)$$

with $\quad Bi = h_w \cdot D_h / k_{al} .$

Over the range of h_w expected experimentally, the model calculated a temperature on the heated surface which was much hotter than the temperature on the insulated surface. To quantify this difference, I define a temperature ratio ζ where:

$$\zeta = \frac{T_{w,hot} - T_f}{T_{w,ins} - T_f} , \qquad (13)$$

with

$T_{w,hot}$ = wall temperature on hot surface,
$T_{w,ins}$ = wall temperature on insulated surface.

For $h_w = 3000$ W/(m^2·K), $\zeta = 1.92$. For $h_w = 6000$ W/(m^2·K), $\zeta = 3.05$.

To calculate h_w from the experimental data, I measured Q_T/A_w and T_w, and calculated T_f from eq (6). Then I used eq (11) in conjunction with eq (12) to solve for h_w. h_w was normalized as a wall Nusselt number

$$Nu_w = \frac{h_w D_h}{k} . \qquad (14)$$

Nu_w was also correlated with Re.

3.4 Analysis of uncertainty

Uncertainties for the calculated quantities were obtained by Taylor-series error propagation as described by ASME [1986]. This technique generally produces the same confidence in a calculated result as the confidence in the measurements which

contribute to the result [Kline and McClintock, 1953]. A summary of the uncertainties in the data analysis parameters and in the calculated quantities is listed in table 4. Actual values at the experimental points are included in table 3. I defined the uncertainties in Q_t, h, and Nu as 0 if the heat exchanger was not heated ($Q_t = 0$).

The largest contributor to the uncertainties in h and Nu was the uncertainty of the temperature difference between the wall and the gas. I did not calculate the uncertainty in Nu_w, since calculating Nu_w involved assumptions that the heat transfer coefficient around the channel perimeter was constant and that axial conduction was negligible. However, the uncertainty in Nu_w will be at least as large as the uncertainty in Nu. Large uncertainties in h and Nu occur for conditions of small wall-to-gas temperature differences. The uncertainty in h and Nu can be kept under 20 percent if the wall-to-gas temperature difference is kept above 6 K, which occurs roughly when the gas temperature rise through the heat exchanger is greater than 10 K.

4. Results of the experiments

4.1 Pressure drop

The pressure drop P_0-P_1 through the heat exchanger is shown as a function of gas flow rate $\dot{m}$ in figure 5. I show the data for all experimental points where the upstream pressure was within 2 percent of 10.34 MPa; this excludes only 3 data points for experiment 8 where P_0 was 9.47 MPa. The data show an approximate quadratic dependence of pressure drop on gas flow rate. Scatter in the data is due to the inherent uncertainty in the pressure transducer (7 kPa), and variation in gas density between experiments due to differences in gas temperature and pressure. The highest pressure drop I measured was 108.9 kPa (15.8 psi), which occurred in experiment 8 at 19.7 kg/h gas flow and 9.47 MPa inlet pressure.

4.2 Temperature distributions and heat transfer

A typical plot of temperatures in the hydrogen gas and along the insulated wall of the heat exchanger is shown in figure 6. The data are for the highest flow rate (19.7 kg/h) of experiment 7. The measured wall temperatures are plotted along the y centerline (y/W = 0), and off-center (y/W = 0.34 and -0.35) in the flow direction. The calculated gas temperature (eq 6) is also plotted for the locations of the center-line thermocouples. The gas temperature increased approximately linearly from the inlet to the outlet. Wall temperatures increased from the inlet to the outlet, but with negative curvature in the slope. Wall temperatures were slightly hotter near the edges (away from the centerline). This could be due to flow nonuniformity in the

channels; reduced gas flow near the edges would cause higher gas and wall temperatures.

Figure 7 shows the data of figure 6, plus two additional flow rates from experiment 7. I now plot the temperature difference between the wall and the gas. Since the heat flux is the same for all flow rates (59.8 W/cm^2 or 52.7 $Btu/(s \cdot ft^2)$), increasing the flow rate reduces the wall-to-gas temperature difference. Plotted as a temperature difference, the negative curvature in the slope is more pronounced. The temperature difference increases for $0 < x/L < 0.5$, and decreases for $x/L > 0.6$. The negative curvature indicates the gradient in heat conduction was higher near the ends than in the middle. The massive relative size of the end manifolds can draw heat from the central portion of the heat exchanger in both directions. The reduced temperature difference for small x/L could also be due to channel entrance effects [Rohsenow and Hartnett, 1973], which produce higher heat transfer at the inlet of a channel.

In figure 8 I show the heat transfer coefficient h as a function of gas flow $\dot{m}$ for experiments 1 to 8 for all points with heating greater than 0. Shown are data at the midpoint of the heat exchanger ($x/L = 0.5$, $y/W = 0$), since heat conduction effects will be least there. This figure shows that there is no dependence of the heat transfer coefficient on the heating rate, and that the only dependence is on gas flow rate. The low data scatter indicates high repeatability.

Figure 9 shows the heat transfer normalized as the Nusselt number Nu as a function of the Reynolds number Re for data from all the experiments at the midpoint of the heat exchanger. Shown as the dashed line is the correlation in Rohsenow and Hartnett [1973] for turbulent flow in a channel with constant heat flux boundary conditions:

$$Nu = 0.022 \cdot Re^{0.8} \cdot Pr^{0.6}. \tag{15}$$

The solid line is the correlation for my data:

$$Nu = 0.0166 \cdot Re^{0.866} \cdot Pr^{0.6}. \tag{16}$$

The standard deviation between my data and correlation is 2.0 percent. The leading coefficient and exponent on Re were calculated from a least-squares fit of the data. I assumed a 0.6 power variation on Pr, to be consistent with the Rohsenow and Hartnett correlation. The uncertainty on the measured data ranged from 9.4 to 43.8 percent, with the highest uncertainty occurring at conditions of $T_w - T_f < 6$ K.

Nu from my correlation is consistently higher than Nu from the Rohsenow and Hartnett correlation (35 percent higher at Re = 6600; 47 percent higher at Re = 24 600). This is because my heat

transfer coefficient was defined using the temperature of the insulated wall, which was cooler than the temperature of the wall-fluid interface. The cooler wall temperature makes the wall-to gas temperature difference smaller, and h and Nu higher.

When I used my finite-element model on the measured data to calculate Nu_w, which accounted for temperature variations from the heated surface to the insulated side, I got the results shown in figure 10. The figure shows data from all experiments at the heat exchanger mid-point, along with the correlation from Rohsenow and Hartnett. The solid line is a correlation of my data:

$$Nu_w = 0.101 \cdot Re^{0.636} \cdot Pr^{0.6}. \qquad (17)$$

The standard deviation between the data and correlation is 1.5 percent. With this first-order correction, the agreement between the measured data and the accepted correlation is much closer: Nu from my correlation is 8.5 percent higher than the Rohsenow and Hartnett correlation at Re = 6600, and 12.5 percent lower than their correlation at Re = 25 000. I have not adjusted my data for heat conduction in the flow direction, or nonuniform flow in the channels. To within experimental uncertainty, my data agrees with the accepted correlation for turbulent flow in a channel with constant heat flux boundary conditions.

5. Summary and conclusions

I tested an aluminum heat exchanger with rectangular flow passages in hydrogen gas to measure the pressure drop and heat transfer. Experiments were performed in an apparatus which radiatively heated one side of the heat exchanger at a heat flux of up to 88 W/cm^2 (77.5 $Btu/(s \cdot ft^2)$), and cooled the heat exchanger with normal hydrogen gas at 10.3 MPa (1500 psi) and Reynolds numbers of 6600 to 24 600. Hydrogen gas temperatures ranged from 271.9 K (29.8 °F) to 347.9 K (166.5 °F); the maximum wall temperature was 378.8 K (218.5 °F). I report the heat transfer both as a Nusselt number, which should be used to predict the temperature on the insulated side of the heat exchanger, and as a wall Nusselt number, which I used to compare the performance to past work on turbulent flow in channels. My measured wall Nusselt number agrees with the correlation of Rohsenow and Hartnett [1973] to within experimental uncertainty. Over this range in heat flux, the heat transfer coefficient and Nusselt number are independent of the heating rate, and depend only on the Reynolds number. Heat conduction to the end manifolds appears to be significant. I recommend that a detailed numerical analysis be conducted of heat flow and temperature distributions in the heat exchanger, to augment interpreting the measured data. Higher wall temperatures away from the centerline indicate the center channels receive more flow than the outer

channels.

6. Acknowledgements

The heat exchanger was provided by United Technologies Pratt and Whitney, West Palm Beach, Florida. Tim S. McKey of Pratt and Whitney witnessed all testing. I thank Michael P. Glover for constructing the experimental apparatus, and Timothy G. Waldorf for assisting in operating the experiment.

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7. References

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Table 1. Uncertainties in experimental measurements and gas properties

Measurement or Property	Technique	Major Source of Uncertainty	Magnitude of Uncertainty
Gas Flow Rate	Thermal Mass Flow Meter	Meter Calibration	±1 percent
Heat Flux	Calibration of Furnace	Heat Flow Meter	±4 percent
Gas Inlet and Outlet Temperatures	Platinum Resistance Thermometer	Radiation	±0.3 K
Gas Pressure	Pressure Transducer	Calibration	±0.25 percent
Gas Pressure Difference	Pressure Transducer	Calibration	Greater of ±1 percent or ±6.9 kPa
Heat Exchanger Temperature	Type N Thermo-couple	Wire Calibra-tion	Greater of ±0.4 percent or ±1.1 K
Gas Density	Thermodynamic Function	Function Accuracy	±1 percent
Gas Enthalpy	Thermodynamic Function	Function Accuracy	±0.35 percent
Gas Specific Heat	Thermodynamic Function	Function Accuracy	±3 percent
Gas Viscosity	Thermodynamic Function	Function Accuracy	±5 percent
Gas Thermal Conductivity	Thermodynamic Function	Function Accuracy	±7 percent

Table 2. Summary of geometrical parameters and experimental conditions for the aluminum heat exchanger

Heat Exchanger Hydraulic Diameter, D_h = 1.761 mm
Heat Exchanger Heated Length, L = 10.81 cm
Heat Exchanger Width, W = 2.713 cm
Heated Normal Area, A_n = 29.332 cm^2
Wetted Wall Area, A_w = 104.671 cm^2
Flow Normal Area, A_f = 0.4536 cm^2
Channel Height, h_c = 2.64 mm
Channel Width, w_c = 1.32 mm

Expt. #	Inlet Pressure (MPa)	Normal Heat Flux (W/cm^2)	Gas Flow Rate (kg/h)	Gas Temperature Rise (K)	Reynolds Number
1	10.25	7.3	5.4-10.6	5.00-9.82	6600 - 13 000
2	10.34	14.1	7.5-16.5	6.18-13.54	9100 - 20 500
3	10.48	20.7	10.5-19.5	7.66-14.40	13 100 - 24 600
4	10.15	27.4	14.7-18.3	10.81-13.66	18 200 - 23 200
5	10.19	34.6	14.7-19.5	12.89-17.24	18 200 - 24 500
6	10.31	33.8-70.0	19.2	12.67-26.62	23 500
7	10.36	59.8	7.1-19.7	21.78-61.17	8200 - 23 600
8	9.47, 10.31	36.3-88.0	19.5	13.58-32.38	23 700

Table 3. Data tables for all experiments

Table 3.1. Data tables for experiment 1

Aluminum Heat Exchanger
Summary Data Table for Experiment 1
Date: 6 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	PO MPa	PO-P1 kPa	TO K	T1 K	T1-TO K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	14:31:34	213	7.26	5.66	10.22	6.94	286.77	296.09	9.32	6.72	4.33	6851	0.695	3084	29.19	22.85
2	14:32:00	214	7.30	5.66	10.23	6.91	286.74	296.09	9.35	6.74	4.33	6851	0.695	3085	29.21	22.87
3	14:32:25	214	7.30	5.66	10.23	6.94	286.76	296.11	9.35	6.74	4.33	6851	0.695	3083	29.18	22.85
4	14:38:25	216	7.36	10.55	10.24	29.12	283.15	288.23	5.08	4.03	7.92	12948	0.696	5224	50.18	34.70
5	14:38:50	218	7.43	10.55	10.24	29.13	283.07	288.19	5.12	4.03	7.92	12954	0.696	5260	50.54	34.89
6	14:39:16	218	7.43	10.55	10.24	29.12	283.01	288.12	5.11	4.04	7.91	12955	0.696	5240	50.36	34.80
7	14:47:05	215	7.33	10.54	10.25	29.10	281.47	286.52	5.05	4.24	7.85	12981	0.696	4924	47.51	33.37
8	14:47:35	212	7.23	10.53	10.25	29.22	281.68	286.67	4.99	4.24	7.85	12965	0.696	4869	46.96	33.08
9	14:48:01	215	7.33	10.54	10.26	29.17	281.84	286.90	5.06	4.20	7.86	12969	0.696	4985	48.05	33.64
10	14:53:06	213	7.26	5.41	10.28	6.11	283.28	293.04	9.76	7.26	4.07	6596	0.695	2861	27.31	21.70
11	14:53:31	213	7.26	5.40	10.28	6.17	283.46	293.23	9.77	7.23	4.07	6588	0.695	2870	27.38	21.75
12	14:53:57	215	7.33	5.41	10.28	6.20	283.60	293.42	9.82	7.24	4.08	6594	0.695	2885	27.51	21.83

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 1
Date: 6 January 1992
Time: 14:31:34

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
286.77	56.50	296.09	73.28	5.66	0.00346	10.225	1483.0	6.94	1.01	99.37	213	7.63	7.26	6.40

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.29	61.04
1.702	0.670	0.001	0.000	289.69	61.76
9.093	3.580	0.001	0.000	297.96	76.65
10.706	4.215	0.001	0.000	297.61	76.01

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	294.67	289.78	4.89	10.222	4.30	6877	0.695	4233	40.25	29.36	1.10	0.40	5.77	25.48	26.55
4.163	-0.025	296.26	290.36	5.90	10.222	4.31	6868	0.695	3522	33.43	25.44	1.10	0.39	5.77	21.66	22.92
5.408	-0.071	298.17	291.45	6.72	10.221	4.33	6851	0.695	3084	29.19	22.85	1.10	0.39	5.77	19.48	20.87
6.703	0.001	299.30	292.59	6.71	10.220	4.34	6834	0.695	3081	29.09	22.78	1.10	0.40	5.77	19.56	20.94
7.249	0.001	299.48	293.07	6.42	10.220	4.35	6827	0.695	3209	30.26	23.50	1.10	0.41	5.77	20.33	21.67
3.566	0.953	295.02	289.83	5.18	10.222	4.30	6876	0.695	3996	37.99	28.10	1.10	0.40	5.77	24.21	25.34
4.176	0.927	296.42	290.37	6.05	10.222	4.31	6868	0.695	3432	32.59	24.94	1.10	0.39	5.77	21.21	22.49
5.370	0.953	298.22	291.42	6.80	10.221	4.33	6852	0.695	3049	28.87	22.65	1.10	0.39	5.77	19.30	20.70
6.703	0.927	299.41	292.59	6.82	10.220	4.34	6834	0.695	3032	28.62	22.48	1.10	0.40	5.77	19.31	20.71
7.313	0.914	299.57	293.12	6.45	10.220	4.35	6826	0.695	3190	30.07	23.38	1.10	0.42	5.77	20.25	21.59
3.528	-0.953	295.28	289.80	5.48	10.222	4.30	6877	0.695	3783	35.97	26.94	1.10	0.40	5.77	23.11	24.29
4.112	-0.914	296.46	290.31	6.14	10.222	4.31	6869	0.695	3380	32.10	24.65	1.10	0.39	5.77	20.94	22.24
5.408	-0.927	298.52	291.45	7.07	10.221	4.33	6851	0.695	2934	27.78	21.97	1.10	0.39	5.77	18.73	20.17
6.678	-0.978	299.60	292.57	7.04	10.220	4.34	6834	0.695	2940	27.76	21.94	1.10	0.40	5.77	18.84	20.28
7.313	-0.978	299.78	293.12	6.66	10.220	4.35	6826	0.695	3090	29.14	22.80	1.10	0.42	5.77	19.74	21.11

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	70.72	61.91	8.81	1482.6	14.12	6877	0.695	745.9	40.25	29.36	1.98	0.71	5.77	25.48	26.55
1.639	-0.010	73.57	62.96	10.61	1482.6	14.15	6868	0.695	620.6	33.43	25.44	1.98	0.70	5.77	21.66	22.92
2.129	-0.028	77.03	64.93	12.10	1482.4	14.20	6851	0.695	543.4	29.19	22.85	1.98	0.70	5.77	19.48	20.87
2.639	0.000	79.05	66.97	12.08	1482.3	14.26	6834	0.695	542.9	29.09	22.78	1.98	0.73	5.77	19.56	20.94
2.854	0.000	79.38	67.83	11.55	1482.3	14.28	6827	0.695	565.4	30.26	23.50	1.98	0.75	5.77	20.33	21.67
1.404	0.375	71.34	62.01	9.33	1482.6	14.12	6876	0.695	704.1	37.99	28.10	1.98	0.71	5.77	24.21	25.34
1.644	0.365	73.87	62.98	10.89	1482.6	14.15	6868	0.695	604.7	32.59	24.94	1.98	0.70	5.77	21.21	22.49
2.114	0.375	77.10	64.87	12.24	1482.5	14.20	6852	0.695	537.2	28.87	22.65	1.98	0.70	5.77	19.30	20.70
2.639	0.365	79.25	66.97	12.28	1482.3	14.26	6834	0.695	534.2	28.62	22.48	1.98	0.73	5.77	19.31	20.71
2.879	0.360	79.55	67.93	11.62	1482.3	14.28	6826	0.695	562.1	30.07	23.38	1.98	0.75	5.77	20.25	21.59
1.389	-0.375	71.81	61.95	9.86	1482.6	14.12	6877	0.695	666.6	35.97	26.94	1.98	0.71	5.77	23.11	24.29
1.619	-0.360	73.93	62.88	11.06	1482.6	14.15	6869	0.695	595.6	32.10	24.65	1.98	0.70	5.77	20.94	22.24
2.129	-0.365	77.64	64.93	12.72	1482.4	14.20	6851	0.695	517.0	27.78	21.97	1.98	0.70	5.77	18.73	20.17
2.629	-0.385	79.59	66.93	12.66	1482.3	14.26	6834	0.695	518.0	27.76	21.94	1.98	0.73	5.77	18.84	20.28
2.879	-0.385	79.92	67.93	11.99	1482.3	14.28	6826	0.695	544.5	29.14	22.80	1.98	0.75	5.77	19.74	21.11

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 2
Date: 6 January 1992
Time: 14:32:00

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
286.74	56.45	296.09	73.28	5.66	0.00346	10.227	1483.3	6.91	1.00	99.80	214	7.60	7.30	6.43

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.31	61.08
1.702	0.670	0.001	0.000	289.72	61.81
9.093	3.580	0.001	0.000	297.99	76.69
10.706	4.215	0.001	0.000	297.61	76.02

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	294.68	289.76	4.92	10.225	4.30	6877	0.695	4218	40.10	29.28	1.10	0.40	5.77	25.32	26.40
4.163	-0.025	296.26	290.34	5.92	10.224	4.31	6868	0.695	3516	33.38	25.41	1.10	0.39	5.77	21.57	22.83
5.408	-0.071	298.18	291.44	6.74	10.223	4.33	6851	0.695	3085	29.21	22.87	1.10	0.39	5.77	19.43	20.82
6.703	0.001	299.30	292.58	6.72	10.222	4.34	6833	0.695	3087	29.14	22.81	1.10	0.40	5.77	19.53	20.91
7.249	0.001	299.49	293.05	6.44	10.222	4.35	6826	0.695	3211	30.28	23.51	1.10	0.41	5.77	20.28	21.62
3.566	0.953	295.03	289.81	5.22	10.224	4.30	6876	0.695	3981	37.85	28.02	1.10	0.40	5.77	24.06	25.20
4.176	0.927	296.41	290.35	6.06	10.224	4.31	6867	0.695	3437	32.63	24.97	1.10	0.39	5.77	21.17	22.45
5.370	0.953	298.24	291.40	6.84	10.223	4.33	6851	0.695	3042	28.80	22.61	1.10	0.39	5.77	19.21	20.62
6.703	0.927	299.44	292.58	6.86	10.222	4.34	6833	0.695	3024	28.55	22.44	1.10	0.40	5.77	19.21	20.62
7.313	0.914	299.60	293.11	6.49	10.222	4.35	6825	0.695	3183	30.01	23.34	1.10	0.42	5.77	20.16	21.50
3.528	-0.953	295.29	289.78	5.51	10.224	4.30	6876	0.695	3771	35.86	26.88	1.10	0.40	5.77	22.98	24.16
4.112	-0.914	296.48	290.30	6.19	10.224	4.31	6868	0.695	3365	31.95	24.56	1.10	0.39	5.77	20.81	22.11
5.408	-0.927	298.54	291.44	7.11	10.223	4.33	6851	0.695	2926	27.70	21.92	1.10	0.39	5.77	18.64	20.08
6.678	-0.978	299.63	292.35	7.07	10.222	4.34	6833	0.695	2934	27.70	21.90	1.10	0.40	5.77	18.76	20.20
7.313	-0.978	299.81	293.11	6.70	10.222	4.35	6825	0.695	3081	29.05	22.75	1.10	0.42	5.77	19.64	21.02

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	70.74	61.88	8.86	1482.9	14.11	6877	0.695	743.2	40.10	29.28	1.98	0.71	5.77	25.32	26.40
1.639	-0.010	73.59	62.92	10.66	1482.9	14.14	6868	0.695	619.5	33.38	25.41	1.98	0.70	5.77	21.57	22.83
2.129	-0.028	77.03	64.90	12.13	1482.8	14.20	6851	0.695	543.6	29.21	22.87	1.98	0.70	5.77	19.43	20.82
2.639	0.000	79.05	66.95	12.10	1482.6	14.25	6833	0.695	543.9	29.14	22.81	1.98	0.73	5.77	19.53	20.91
2.854	0.000	79.40	67.81	11.58	1482.6	14.27	6826	0.695	565.8	30.28	23.51	1.98	0.75	5.77	20.28	21.62
1.404	0.375	71.37	61.98	9.40	1482.9	14.12	6876	0.695	701.5	37.85	28.02	1.98	0.71	5.77	24.06	25.20
1.644	0.365	73.86	62.95	10.91	1482.9	14.14	6867	0.695	605.6	32.63	24.97	1.98	0.70	5.77	21.17	22.45
2.114	0.375	77.14	64.84	12.30	1482.8	14.19	6851	0.695	536.0	28.80	22.61	1.98	0.70	5.77	19.21	20.62
2.639	0.365	79.30	66.95	12.35	1482.6	14.25	6833	0.695	532.8	28.55	22.44	1.98	0.73	5.77	19.21	20.62
2.879	0.360	79.59	67.91	11.68	1482.6	14.27	6825	0.695	560.8	30.01	23.34	1.98	0.75	5.77	20.16	21.50
1.389	-0.375	71.83	61.92	9.92	1482.9	14.11	6876	0.695	664.5	35.86	26.88	1.98	0.71	5.77	22.98	24.16
1.619	-0.360	73.98	62.84	11.14	1482.9	14.14	6868	0.695	592.9	31.95	24.56	1.98	0.70	5.77	20.81	22.11
2.129	-0.365	77.69	64.90	12.79	1482.8	14.20	6851	0.695	515.6	27.70	21.92	1.98	0.70	5.77	18.64	20.08
2.629	-0.385	79.64	66.91	12.73	1482.6	14.25	6833	0.695	517.0	27.70	21.90	1.98	0.73	5.77	18.76	20.20
2.879	-0.385	79.98	67.91	12.07	1482.6	14.27	6825	0.695	542.9	29.05	22.75	1.98	0.75	5.77	19.64	21.02

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 3
Date: 6 January 1992
Time: 14:32:25

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
286.76	56.49	296.11	73.32	5.66	0.00346	10.229	1483.6	6.94	1.01	99.41	214	7.60	7.30	6.43

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.32	61.09
1.702	0.670	0.001	0.000	289.73	61.82
9.093	3.580	0.001	0.000	297.99	76.70
10.706	4.215	0.001	0.000	297.63	76.04

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	294.70	289.78	4.92	10.227	4.30	6877	0.695	4224	40.16	29.31	1.10	0.40	5.77	25.36	26.44
4.163	-0.025	296.28	290.36	5.92	10.227	4.31	6868	0.695	3521	33.42	25.44	1.10	0.39	5.77	21.60	22.86
5.408	-0.071	298.20	291.46	6.74	10.226	4.33	6851	0.695	3083	29.18	22.85	1.10	0.39	5.77	19.42	20.81
6.703	0.001	299.33	292.60	6.73	10.225	4.34	6834	0.695	3082	29.10	22.78	1.10	0.40	5.77	19.51	20.90
7.249	0.001	299.51	293.08	6.44	10.224	4.35	6827	0.695	3211	30.27	23.50	1.10	0.41	5.77	20.28	21.62
3.566	0.953	295.03	289.84	5.20	10.227	4.30	6876	0.695	3998	38.00	28.10	1.10	0.40	5.77	24.15	25.28
4.176	0.927	296.44	290.37	6.07	10.227	4.31	6868	0.695	3431	32.57	24.93	1.10	0.39	5.77	21.14	22.42
5.370	0.953	298.25	291.42	6.83	10.226	4.33	6852	0.695	3045	28.83	22.63	1.10	0.39	5.77	19.23	20.63
6.703	0.927	299.45	292.60	6.85	10.225	4.34	6834	0.695	3028	28.59	22.47	1.10	0.40	5.77	19.24	20.64
7.313	0.914	299.60	293.13	6.46	10.224	4.35	6826	0.695	3194	30.11	23.40	1.10	0.42	5.77	20.22	21.56
3.528	-0.953	295.31	289.80	5.50	10.227	4.30	6877	0.695	3774	35.88	26.89	1.10	0.40	5.77	22.99	24.18
4.112	-0.914	296.49	290.32	6.17	10.227	4.31	6869	0.695	3374	32.04	24.61	1.10	0.39	5.77	20.85	22.16
5.408	-0.927	298.54	291.46	7.08	10.226	4.33	6851	0.695	2935	27.78	21.97	1.10	0.39	5.77	18.68	20.13
6.678	-0.978	299.64	292.58	7.06	10.225	4.34	6834	0.695	2938	27.74	21.93	1.10	0.40	5.77	18.78	20.22
7.313	-0.978	299.80	293.13	6.67	10.224	4.35	6826	0.695	3095	29.17	22.82	1.10	0.42	5.77	19.71	21.08

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	70.77	61.92	8.85	1483.3	14.11	6877	0.695	744.3	40.16	29.31	1.98	0.71	5.77	25.36	26.44
1.639	-0.010	73.61	62.96	10.65	1483.2	14.14	6868	0.695	620.4	33.42	25.44	1.98	0.70	5.77	21.60	22.86
2.129	-0.028	77.08	64.94	12.14	1483.1	14.20	6851	0.695	543.2	29.18	22.85	1.98	0.70	5.77	19.42	20.81
2.639	0.000	79.10	66.99	12.12	1483.0	14.25	6834	0.695	543.0	29.10	22.78	1.98	0.73	5.77	19.51	20.90
2.854	0.000	79.43	67.85	11.58	1482.9	14.27	6827	0.695	565.8	30.27	23.50	1.98	0.75	5.77	20.28	21.62
1.404	0.375	71.37	62.02	9.36	1483.3	14.12	6876	0.695	704.4	38.00	28.10	1.98	0.71	5.77	24.15	25.28
1.644	0.365	73.91	62.98	10.93	1483.2	14.14	6868	0.695	604.5	32.57	24.93	1.98	0.70	5.77	21.14	22.42
2.114	0.375	77.17	64.88	12.29	1483.1	14.19	6852	0.695	536.5	28.83	22.63	1.98	0.70	5.77	19.23	20.63
2.639	0.365	79.32	66.99	12.33	1483.0	14.25	6834	0.695	533.5	28.59	22.47	1.98	0.73	5.77	19.24	20.64
2.879	0.360	79.59	67.95	11.64	1482.9	14.27	6826	0.695	562.8	30.11	23.40	1.98	0.75	5.77	20.22	21.56
1.389	-0.375	71.86	61.96	9.91	1483.3	14.11	6877	0.695	665.0	35.88	26.89	1.98	0.71	5.77	22.99	24.18
1.619	-0.360	73.99	62.88	11.11	1483.2	14.14	6869	0.695	594.5	32.04	24.61	1.98	0.70	5.77	20.85	22.16
2.129	-0.365	77.69	64.94	12.75	1483.1	14.20	6851	0.695	517.1	27.78	21.97	1.98	0.70	5.77	18.68	20.13
2.629	-0.385	79.66	66.95	12.71	1483.0	14.25	6834	0.695	517.7	27.74	21.93	1.98	0.73	5.77	18.78	20.22
2.879	-0.385	79.96	67.95	12.01	1482.9	14.27	6826	0.695	545.3	29.17	22.82	1.98	0.75	5.77	19.71	21.08

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 4
Date: 6 January 1992
Time: 14:38:25

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
283.15	49.97	288.23	59.12	10.55	0.00646	10.241	1485.3	29.12	4.22	23.68	216	13.93	7.36	6.49

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.38	52.19
1.702	0.670	0.001	0.000	284.57	52.53
9.093	3.580	0.001	0.000	289.36	61.16
10.706	4.215	0.001	0.000	289.06	60.62

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	287.65	284.78	2.86	10.231	7.89	12974	0.696	7346	70.73	44.38	1.10	0.38	5.77	43.25	43.90
4.163	-0.025	288.61	285.10	3.51	10.229	7.90	12965	0.696	6001	57.74	38.44	1.10	0.37	5.77	36.15	36.92
5.408	-0.071	289.72	285.70	4.03	10.225	7.92	12948	0.696	5224	50.18	34.70	1.10	0.37	5.77	32.28	33.14
6.703	0.001	290.34	286.31	4.03	10.221	7.94	12930	0.695	5215	50.02	34.61	1.10	0.38	5.77	32.38	33.23
7.249	0.001	290.43	286.57	3.86	10.220	7.94	12922	0.695	5422	51.98	35.59	1.10	0.39	5.77	33.60	34.42
3.566	0.953	287.94	284.81	3.12	10.230	7.89	12974	0.696	6736	64.85	41.76	1.10	0.38	5.77	40.06	40.75
4.176	0.927	288.80	285.11	3.70	10.229	7.90	12965	0.696	5702	54.86	37.05	1.10	0.37	5.77	34.65	35.45
5.370	0.953	289.81	285.68	4.14	10.225	7.92	12948	0.696	5089	48.89	34.05	1.10	0.37	5.77	31.62	32.50
6.703	0.927	290.48	286.31	4.16	10.221	7.94	12930	0.695	5045	48.39	33.78	1.10	0.38	5.77	31.54	32.42
7.313	0.914	290.55	286.61	3.95	10.220	7.95	12921	0.695	5295	50.75	34.97	1.10	0.39	5.77	32.99	33.83
3.528	-0.953	288.15	284.80	3.35	10.230	7.89	12974	0.696	6274	60.41	39.72	1.10	0.38	5.77	37.71	38.44
4.112	-0.914	288.86	285.08	3.78	10.229	7.90	12966	0.696	5575	53.64	36.45	1.10	0.37	5.77	34.02	34.84
5.408	-0.927	290.07	285.70	4.38	10.225	7.92	12948	0.696	4809	46.20	32.65	1.10	0.37	5.77	30.26	31.17
6.678	-0.978	290.69	286.30	4.39	10.221	7.93	12930	0.695	4789	45.94	32.50	1.10	0.38	5.77	30.29	31.20
7.313	-0.978	290.73	286.61	4.12	10.220	7.95	12921	0.695	5066	48.56	33.86	1.10	0.39	5.77	31.85	32.72

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	58.07	52.92	5.15	1483.8	25.88	12974	0.696	1294.4	70.73	44.38	1.98	0.69	5.77	43.25	43.90
1.639	-0.010	59.81	53.49	6.32	1483.5	25.91	12965	0.696	1057.4	57.74	38.44	1.98	0.67	5.77	36.15	36.92
2.129	-0.028	61.82	54.56	7.25	1483.0	25.97	12948	0.696	920.5	50.18	34.70	1.98	0.66	5.77	32.28	33.14
2.639	0.000	62.92	55.68	7.25	1482.5	26.04	12930	0.695	918.9	50.02	34.61	1.98	0.68	5.77	32.38	33.23
2.854	0.000	63.09	56.15	6.94	1482.3	26.06	12922	0.695	955.4	51.98	35.59	1.98	0.70	5.77	33.60	34.42
1.404	0.375	58.60	52.98	5.62	1483.8	25.88	12974	0.696	1186.9	64.85	41.76	1.98	0.68	5.77	40.06	40.75
1.644	0.365	60.16	53.50	6.65	1483.5	25.91	12965	0.696	1004.7	54.86	37.05	1.98	0.67	5.77	34.65	35.45
2.114	0.375	61.97	54.53	7.44	1483.0	25.97	12948	0.696	896.7	48.89	34.05	1.98	0.66	5.77	31.62	32.50
2.639	0.365	63.17	55.68	7.49	1482.5	26.04	12930	0.695	888.9	48.39	33.78	1.98	0.68	5.77	31.54	32.42
2.879	0.360	63.30	56.20	7.10	1482.2	26.07	12921	0.695	933.0	50.75	34.97	1.98	0.70	5.77	32.99	33.83
1.389	-0.375	58.98	52.94	6.03	1483.8	25.88	12974	0.696	1105.5	60.41	39.72	1.98	0.69	5.77	37.71	38.44
1.619	-0.360	60.25	53.45	6.81	1483.6	25.91	12966	0.696	982.3	53.64	36.45	1.98	0.67	5.77	34.02	34.84
2.129	-0.365	62.44	54.56	7.88	1483.0	25.97	12948	0.696	847.3	46.20	32.65	1.98	0.66	5.77	30.26	31.17
2.629	-0.385	63.55	55.66	7.89	1482.5	26.03	12930	0.695	843.8	45.94	32.50	1.98	0.68	5.77	30.29	31.20
2.879	-0.385	63.62	56.20	7.42	1482.2	26.07	12921	0.695	892.6	48.56	33.86	1.98	0.70	5.77	31.85	32.72

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 5
Date: 6 January 1992
Time: 14:38:50

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
283.07	49.84	288.19	59.05	10.55	0.00646	10.241	1485.3	29.13	4.22	23.67	218	13.83	7.43	6.55

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.32	52.09
1.702	0.670	0.001	0.000	284.49	52.40
9.093	3.580	0.001	0.000	289.31	61.06
10.706	4.215	0.001	0.000	289.00	60.51

Insulated-Side Temperatures and Calculated Data:
SI Units:

													---------Uncertainties---------			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	287.59	284.72	2.87	10.231	7.89	12981	0.696	7393	71.20	44.58	1.10	0.38	5.77	43.17	43.81
4.163	-0.025	288.55	285.04	3.51	10.229	7.90	12972	0.696	6050	58.22	38.67	1.10	0.37	5.77	36.12	36.89
5.408	-0.071	289.67	285.64	4.03	10.225	7.92	12954	0.696	5260	50.54	34.89	1.10	0.37	5.77	32.22	33.08
6.703	0.001	290.28	286.26	4.02	10.222	7.94	12936	0.695	5267	50.52	34.86	1.10	0.38	5.77	32.39	33.24
7.249	0.001	290.38	286.52	3.85	10.220	7.95	12928	0.695	5472	52.46	35.83	1.10	0.39	5.77	33.59	34.42
3.566	0.953	287.88	284.75	3.13	10.231	7.89	12980	0.696	6766	65.15	41.90	1.10	0.38	5.77	39.91	40.60
4.176	0.927	288.74	285.05	3.69	10.229	7.90	12972	0.696	5751	55.34	37.29	1.10	0.37	5.77	34.63	35.43
5.370	0.953	289.76	285.62	4.14	10.225	7.92	12955	0.696	5121	49.20	34.21	1.10	0.37	5.77	31.54	32.41
6.703	0.927	290.43	286.26	4.17	10.222	7.94	12936	0.695	5077	48.70	33.94	1.10	0.38	5.77	31.46	32.34
7.313	0.914	290.50	286.55	3.94	10.220	7.95	12927	0.695	5342	51.20	35.20	1.10	0.39	5.77	32.97	33.81
3.528	-0.953	288.10	284.73	3.36	10.231	7.89	12981	0.696	6299	60.66	39.83	1.10	0.38	5.77	37.55	38.29
4.112	-0.914	288.79	285.01	3.77	10.229	7.90	12973	0.696	5627	54.15	36.71	1.10	0.37	5.77	34.02	34.84
5.408	-0.927	290.02	285.64	4.38	10.225	7.92	12954	0.696	4842	46.52	32.82	1.10	0.37	5.77	30.19	31.11
6.678	-0.978	290.63	286.25	4.38	10.222	7.94	12936	0.695	4831	46.35	32.72	1.10	0.38	5.77	30.26	31.17
7.313	-0.978	290.67	286.55	4.12	10.220	7.95	12927	0.695	5118	49.06	34.11	1.10	0.39	5.77	31.87	32.73

English Units:

													---------Uncertainties---------			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	57.97	52.81	5.16	1483.9	25.88	12981	0.696	1302.6	71.20	44.58	1.98	0.69	5.77	43.17	43.81
1.639	-0.010	59.70	53.38	6.32	1483.6	25.92	12972	0.696	1066.0	58.22	38.67	1.98	0.67	5.77	36.12	36.89
2.129	-0.028	61.72	54.46	7.26	1483.1	25.98	12954	0.696	926.8	50.54	34.89	1.98	0.66	5.77	32.22	33.08
2.639	0.000	62.82	55.58	7.23	1482.5	26.04	12936	0.695	928.0	50.52	34.86	1.98	0.68	5.77	32.39	33.24
2.854	0.000	62.99	56.06	6.93	1482.3	26.07	12928	0.695	964.2	52.46	35.83	1.98	0.70	5.77	33.59	34.42
1.404	0.375	58.50	52.86	5.64	1483.8	25.89	12980	0.696	1192.2	65.15	41.90	1.98	0.68	5.77	39.91	40.60
1.644	0.365	60.04	53.39	6.65	1483.6	25.92	12972	0.696	1013.3	55.34	37.29	1.98	0.67	5.77	34.63	35.43
2.114	0.375	61.88	54.43	7.45	1483.1	25.97	12955	0.696	902.3	49.20	34.21	1.98	0.66	5.77	31.54	32.41
2.639	0.365	63.09	55.58	7.50	1482.5	26.04	12936	0.695	894.6	48.70	33.94	1.98	0.68	5.77	31.46	32.34
2.879	0.360	63.21	56.11	7.10	1482.3	26.07	12927	0.695	941.3	51.20	35.20	1.98	0.70	5.77	32.97	33.81
1.389	-0.375	58.88	52.83	6.06	1483.8	25.88	12981	0.696	1109.9	60.66	39.83	1.98	0.69	5.77	37.55	38.29
1.619	-0.360	60.13	53.34	6.79	1483.6	25.91	12973	0.696	991.5	54.15	36.71	1.98	0.67	5.77	34.02	34.84
2.129	-0.365	62.35	54.46	7.88	1483.1	25.98	12954	0.696	853.2	46.52	32.82	1.98	0.66	5.77	30.19	31.11
2.629	-0.385	63.45	55.56	7.88	1482.5	26.04	12936	0.695	851.2	46.35	32.72	1.98	0.68	5.77	30.26	31.17
2.879	-0.385	63.52	56.11	7.41	1482.3	26.07	12927	0.695	901.8	49.06	34.11	1.98	0.70	5.77	31.87	32.73

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 6
Date: 6 January 1992
Time: 14:39:16

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
283.01	49.73	288.12	58.93	10.55	0.00646	10.242	1485.5	29.12	4.22	23.68	218	13.85	7.43	6.55

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.23	51.93
1.702	0.670	0.001	0.000	284.42	52.26
9.093	3.580	0.001	0.000	289.23	60.92
10.706	4.215	0.001	0.000	288.93	60.39

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	287.52	284.66	2.86	10.232	7.89	12982	0.696	7379	71.08	44.53	1.10	0.38	5.77	43.19	43.83
4.163	-0.025	288.47	284.98	3.50	10.230	7.90	12972	0.696	6063	58.35	38.74	1.10	0.37	5.77	36.26	37.02
5.408	-0.071	289.61	285.58	4.04	10.227	7.91	12955	0.696	5240	50.36	34.80	1.10	0.37	5.77	32.18	33.04
6.703	0.001	290.21	286.20	4.01	10.223	7.93	12937	0.695	5265	50.51	34.86	1.10	0.38	5.77	32.44	33.30
7.249	0.001	290.30	286.46	3.84	10.221	7.94	12929	0.695	5479	52.54	35.87	1.10	0.39	5.77	33.70	34.52
3.566	0.953	287.80	284.69	3.11	10.232	7.89	12981	0.696	6791	65.41	42.02	1.10	0.38	5.77	40.12	40.81
4.176	0.927	288.67	284.98	3.68	10.230	7.90	12972	0.696	5754	55.38	37.31	1.10	0.37	5.77	34.72	35.51
5.370	0.953	289.69	285.56	4.13	10.227	7.91	12955	0.696	5120	49.21	34.22	1.10	0.37	5.77	31.60	32.47
6.703	0.927	290.36	286.20	4.16	10.223	7.93	12937	0.695	5076	48.70	33.94	1.10	0.38	5.77	31.52	32.39
7.313	0.914	290.41	286.49	3.92	10.221	7.94	12928	0.695	5365	51.44	35.32	1.10	0.39	5.77	33.16	33.99
3.528	-0.953	288.02	284.67	3.35	10.232	7.89	12981	0.696	6322	60.90	39.95	1.10	0.38	5.77	37.74	38.48
4.112	-0.914	288.72	284.95	3.77	10.230	7.89	12973	0.696	5631	54.19	36.73	1.10	0.37	5.77	34.11	34.92
5.408	-0.927	289.94	285.58	4.36	10.227	7.91	12955	0.696	4852	46.62	32.87	1.10	0.37	5.77	30.30	31.21
6.678	-0.978	290.55	286.19	4.36	10.223	7.93	12937	0.696	4838	46.42	32.76	1.10	0.38	5.77	30.35	31.26
7.313	-0.978	290.59	286.49	4.10	10.221	7.94	12928	0.695	5129	49.17	34.17	1.10	0.39	5.77	31.98	32.85

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	57.86	52.70	5.16	1484.0	25.87	12982	0.696	1300.2	71.08	44.53	1.98	0.69	5.77	43.19	43.83
1.639	-0.010	59.56	53.27	6.29	1483.8	25.91	12972	0.696	1068.3	58.35	38.74	1.98	0.67	5.77	36.26	37.02
2.129	-0.028	61.62	54.35	7.27	1483.2	25.96	12955	0.696	923.3	50.36	34.80	1.98	0.66	5.77	32.18	33.04
2.639	0.000	62.69	55.47	7.22	1482.7	26.03	12937	0.695	927.7	50.51	34.86	1.98	0.68	5.77	32.44	33.30
[illegible]854	0.000	62.85	55.94	6.91	1482.5	26.06	12929	0.695	965.4	52.54	35.87	1.98	0.70	5.77	33.70	34.52
[illegible]04	0.375	58.36	52.75	5.61	1484.0	25.88	12981	0.696	1196.6	65.41	42.02	1.98	0.68	5.77	40.12	40.81
[illegible]44	0.365	59.91	53.28	6.63	1483.8	25.91	12972	0.696	1013.9	55.38	37.31	1.98	0.67	5.77	34.72	35.51
2.114	0.375	61.76	54.31	7.44	1483.3	25.96	12955	0.696	902.1	49.21	34.22	1.98	0.66	5.77	31.60	32.47
2.639	0.365	62.96	55.47	7.49	1482.7	26.03	12937	0.695	894.4	48.70	33.94	1.98	0.68	5.77	31.52	32.39
2.879	0.360	63.04	55.99	7.05	1482.5	26.06	12928	0.695	945.3	51.44	35.32	1.98	0.70	5.77	33.16	33.99
1.389	-0.375	58.74	52.72	6.02	1484.0	25.87	12981	0.696	1113.9	60.90	39.95	1.98	0.69	5.77	37.74	38.48
1.619	-0.360	60.00	53.23	6.78	1483.8	25.90	12973	0.696	992.2	54.19	36.73	1.98	0.67	5.77	34.11	34.92
2.129	-0.365	62.20	54.35	7.85	1483.2	25.96	12955	0.696	854.9	46.62	32.87	1.98	0.66	5.77	30.30	31.21
2.629	-0.385	63.30	55.45	7.86	1482.7	26.03	12937	0.696	852.5	46.42	32.76	1.98	0.68	5.77	30.35	31.26
2.879	-0.385	63.37	55.99	7.37	1482.5	26.06	12928	0.695	903.7	49.17	34.17	1.98	0.70	5.77	31.98	32.85

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 7
Date: 6 January 1992
Time: 14:47:05

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
281.47	46.96	286.52	56.05	10.54	0.00645	10.254	1487.2	29.10	4.22	23.70	215	14.00	7.33	6.46

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	282.90	49.54
1.702	0.670	0.001	0.000	283.13	49.94
9.093	3.580	0.001	0.000	287.92	58.57
10.706	4.215	0.001	0.000	287.63	58.04

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.16	283.10	3.06	10.244	7.82	13008	0.696	6815	65.90	42.29	1.10	0.38	5.77	40.77	41.45
4.163	-0.025	287.12	283.41	3.71	10.242	7.83	12999	0.696	5644	54.54	36.94	1.10	0.37	5.77	34.59	35.39
5.408	-0.071	288.25	284.01	4.24	10.238	7.85	12981	0.696	4924	47.51	33.37	1.10	0.37	5.77	31.02	31.91
6.703	0.001	288.86	284.62	4.24	10.234	7.87	12963	0.696	4917	47.37	33.29	1.10	0.38	5.77	31.12	32.01
7.249	0.001	288.95	284.88	4.07	10.233	7.88	12955	0.696	5098	49.08	34.16	1.10	0.39	5.77	32.19	33.05
3.566	0.953	286.49	283.13	3.36	10.243	7.82	13007	0.696	6210	60.05	39.60	1.10	0.38	5.77	37.61	38.35
4.176	0.927	287.35	283.42	3.93	10.242	7.83	12998	0.696	5329	51.49	35.42	1.10	0.37	5.77	33.01	33.85
5.370	0.953	288.37	283.99	4.39	10.238	7.85	12982	0.696	4765	45.98	32.57	1.10	0.37	5.77	30.25	31.16
6.703	0.927	289.06	284.62	4.44	10.234	7.87	12963	0.696	4699	45.26	32.18	1.10	0.38	5.77	30.05	30.97
7.313	0.914	289.12	284.91	4.21	10.233	7.88	12955	0.696	4924	47.40	33.30	1.10	0.39	5.77	31.35	32.23
3.528	-0.953	286.74	283.11	3.63	10.244	7.82	13008	0.696	5760	55.70	37.51	1.10	0.38	5.77	35.33	36.12
4.112	-0.914	287.44	283.39	4.05	10.242	7.83	12999	0.696	5164	49.90	34.62	1.10	0.37	5.77	32.20	33.06
5.408	-0.927	288.67	284.01	4.66	10.238	7.85	12981	0.696	4478	43.21	31.09	1.10	0.37	5.77	28.87	29.82
6.678	-0.978	289.28	284.61	4.67	10.234	7.87	12963	0.696	4461	42.97	30.95	1.10	0.38	5.77	28.89	29.85
7.313	-0.978	289.34	284.91	4.43	10.233	7.88	12955	0.696	4686	45.11	32.09	1.10	0.39	5.77	30.18	31.09

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.40	49.89	5.51	1485.7	25.67	13008	0.696	1200.8	65.90	42.29	1.98	0.69	5.77	40.77	41.45
1.639	-0.010	57.13	50.46	6.67	1485.4	25.70	12999	0.696	994.5	54.54	36.94	1.98	0.67	5.77	34.59	35.39
2.129	-0.028	59.16	51.52	7.64	1484.9	25.76	12981	0.696	867.6	47.51	33.37	1.98	0.66	5.77	31.02	31.91
2.639	0.000	60.26	52.63	7.63	1484.4	25.82	12963	0.696	866.4	47.37	33.29	1.98	0.68	5.77	31.12	32.01
2.854	0.000	60.43	53.09	7.33	1484.2	25.85	12955	0.696	898.3	49.08	34.16	1.98	0.70	5.77	32.19	33.05
1.404	0.375	56.00	49.94	6.05	1485.7	25.67	13007	0.696	1094.2	60.05	39.60	1.98	0.68	5.77	37.61	38.35
1.644	0.365	57.54	50.47	7.07	1485.4	25.70	12998	0.696	939.0	51.49	35.42	1.98	0.67	5.77	33.01	33.85
2.114	0.375	59.38	51.49	7.89	1484.9	25.76	12982	0.696	839.6	45.98	32.57	1.98	0.66	5.77	30.25	31.16
2.639	0.365	60.62	52.63	7.99	1484.4	25.82	12963	0.696	828.0	45.26	32.18	1.98	0.68	5.77	30.05	30.97
2.879	0.360	60.73	53.15	7.59	1484.1	25.85	12955	0.696	867.6	47.40	33.30	1.98	0.70	5.77	31.35	32.23
1.389	-0.375	56.44	49.91	6.53	1485.7	25.67	13008	0.696	1014.9	55.70	37.51	1.98	0.69	5.77	35.33	36.12
1.619	-0.360	57.71	50.41	7.29	1485.5	25.70	12999	0.696	909.9	49.90	34.62	1.98	0.67	5.77	32.20	33.06
2.129	-0.365	59.92	51.52	8.40	1484.9	25.76	12981	0.696	789.0	43.21	31.09	1.98	0.66	5.77	28.87	29.82
2.629	-0.385	61.02	52.61	8.41	1484.4	25.82	12963	0.696	786.0	42.97	30.95	1.98	0.68	5.77	28.89	29.85
2.879	-0.385	61.12	53.15	7.97	1484.1	25.85	12955	0.696	825.7	45.11	32.09	1.98	0.70	5.77	30.18	31.09

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 8
Date: 6 January 1992
Time: 14:47:35

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
281.68	47.33	286.67	56.32	10.53	0.00645	10.254	1487.2	29.22	4.24	23.60	212	14.16	7.23	6.37

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.07	49.84
1.702	0.670	0.001	0.000	283.29	50.23
9.093	3.580	0.001	0.000	288.08	58.86
10.706	4.215	0.001	0.000	287.80	58.35

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.33	283.29	3.05	10.244	7.82	12992	0.696	6771	65.45	42.08	1.10	0.38	5.77	41.02	41.69
4.163	-0.025	287.30	283.60	3.70	10.242	7.83	12983	0.696	5594	54.02	36.68	1.10	0.37	5.77	34.73	35.53
5.408	-0.071	288.42	284.18	4.24	10.238	7.85	12965	0.696	4869	46.96	33.08	1.10	0.37	5.77	31.11	32.00
6.703	0.001	289.04	284.79	4.24	10.235	7.87	12948	0.696	4854	46.74	32.95	1.10	0.38	5.77	31.16	32.05
7.249	0.001	289.13	285.05	4.08	10.233	7.88	12940	0.696	5027	48.37	33.79	1.10	0.39	5.77	32.20	33.06
3.566	0.953	286.66	283.32	3.34	10.244	7.82	12991	0.696	6175	59.68	39.41	1.10	0.38	5.77	37.87	38.60
4.176	0.927	287.52	283.61	3.91	10.242	7.83	12983	0.696	5289	51.08	35.21	1.10	0.37	5.77	33.19	34.03
5.370	0.953	288.55	284.17	4.38	10.239	7.85	12966	0.696	4713	45.45	32.29	1.10	0.36	5.77	30.34	31.25
6.703	0.927	289.23	284.79	4.43	10.235	7.87	12948	0.696	4646	44.74	31.90	1.10	0.38	5.77	30.14	31.05
7.313	0.914	289.29	285.08	4.21	10.233	7.88	12939	0.696	4871	46.87	33.01	1.10	0.39	5.77	31.45	32.33
3.528	-0.953	286.89	283.30	3.59	10.244	7.82	12992	0.696	5746	55.53	37.42	1.10	0.38	5.77	35.67	36.45
4.112	-0.914	287.61	283.58	4.03	10.242	7.83	12983	0.696	5129	49.54	34.43	1.10	0.37	5.77	32.40	33.25
5.408	-0.927	288.83	284.18	4.65	10.238	7.85	12965	0.696	4441	42.83	30.88	1.10	0.37	5.77	29.02	29.97
6.678	-0.978	289.44	284.78	4.66	10.235	7.87	12948	0.696	4423	42.59	30.74	1.10	0.38	5.77	29.04	29.99
7.313	-0.978	289.50	285.08	4.42	10.233	7.88	12939	0.696	4638	44.63	31.83	1.10	0.39	5.77	30.28	31.20

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.71	50.23	5.48	1485.8	25.66	12992	0.696	1193.1	65.45	42.08	1.98	0.69	5.77	41.02	41.69
1.639	-0.010	57.44	50.79	6.65	1485.5	25.70	12983	0.696	985.7	54.02	36.68	1.98	0.67	5.77	34.73	35.53
2.129	-0.028	59.48	51.84	7.63	1485.0	25.75	12965	0.696	857.9	46.96	33.08	1.98	0.66	5.77	31.11	32.00
2.639	0.000	60.58	52.94	7.64	1484.4	25.82	12948	0.696	855.3	46.74	32.95	1.98	0.68	5.77	31.16	32.05
2.854	0.000	60.75	53.40	7.35	1484.2	25.84	12940	0.696	885.8	48.37	33.79	1.98	0.69	5.77	32.20	33.06
1.404	0.375	56.30	50.28	6.02	1485.7	25.67	12991	0.696	1088.0	59.68	39.41	1.98	0.68	5.77	37.87	38.60
1.644	0.365	57.84	50.80	7.04	1485.5	25.70	12983	0.696	931.9	51.08	35.21	1.98	0.67	5.77	33.19	34.03
2.114	0.375	59.70	51.81	7.89	1485.0	25.75	12966	0.696	830.4	45.45	32.29	1.98	0.66	5.77	30.34	31.25
2.639	0.365	60.92	52.94	7.98	1484.4	25.82	12948	0.696	818.6	44.74	31.90	1.98	0.68	5.77	30.14	31.05
2.879	0.360	61.03	53.45	7.58	1484.2	25.85	12939	0.696	858.3	46.87	33.01	1.98	0.70	5.77	31.45	32.33
1.389	-0.375	56.71	50.25	6.46	1485.7	25.67	12992	0.696	1012.4	55.53	37.42	1.98	0.69	5.77	35.67	36.45
1.619	-0.360	58.00	50.75	7.26	1485.5	25.69	12983	0.696	903.7	49.54	34.43	1.98	0.67	5.77	32.40	33.25
2.129	-0.365	60.21	51.84	8.37	1485.0	25.75	12965	0.696	782.5	42.83	30.88	1.98	0.66	5.77	29.02	29.97
2.629	-0.385	61.30	52.92	8.38	1484.4	25.82	12948	0.696	779.3	42.59	30.74	1.98	0.67	5.77	29.04	29.99
2.879	-0.385	61.41	53.45	7.96	1484.2	25.85	12939	0.696	817.2	44.63	31.83	1.98	0.70	5.77	30.28	31.20

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 9
Date: 6 January 1992
Time: 14:48:01

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
281.84	47.62	286.90	56.73	10.54	0.00645	10.255	1487.4	29.17	4.23	23.64	215	13.97	7.33	6.46

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.22	50.11
1.702	0.670	0.001	0.000	283.44	50.50
9.093	3.580	0.001	0.000	288.23	59.13
10.706	4.215	0.001	0.000	287.95	58.61

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.50	283.47	3.03	10.245	7.83	12996	0.696	6914	66.80	42.68	1.10	0.38	5.77	41.19	41.86
4.163	-0.025	287.47	283.79	3.68	10.243	7.84	12986	0.696	5701	55.03	37.17	1.10	0.37	5.77	34.79	35.59
5.408	-0.071	288.58	284.38	4.20	10.240	7.86	12969	0.696	4985	48.05	33.64	1.10	0.37	5.77	31.25	32.13
6.703	0.001	289.19	285.00	4.19	10.236	7.88	12951	0.696	4983	47.95	33.58	1.10	0.38	5.77	31.37	32.25
7.249	0.001	289.29	285.26	4.04	10.234	7.89	12943	0.696	5155	49.58	34.41	1.10	0.39	5.77	32.40	33.25
3.566	0.953	286.82	283.50	3.32	10.245	7.83	12995	0.696	6310	60.96	40.01	1.10	0.38	5.77	38.04	38.77
4.176	0.927	287.67	283.79	3.87	10.243	7.84	12986	0.696	5416	52.29	35.82	1.10	0.37	5.77	33.37	34.20
5.370	0.953	288.69	284.36	4.33	10.240	7.86	12969	0.696	4837	46.63	32.91	1.10	0.37	5.77	30.52	31.43
6.703	0.927	289.37	285.00	4.38	10.236	7.88	12951	0.696	4775	45.96	32.54	1.10	0.38	5.77	30.35	31.26
7.313	0.914	289.43	285.29	4.15	10.234	7.89	12942	0.696	5014	48.22	33.71	1.10	0.39	5.77	31.73	32.60
3.528	-0.953	287.03	283.48	3.55	10.245	7.83	12995	0.696	5894	56.95	38.11	1.10	0.38	5.77	35.93	36.70
4.112	-0.914	287.76	283.76	3.99	10.243	7.84	12987	0.696	5251	50.69	35.01	1.10	0.37	5.77	32.56	33.41
5.408	-0.927	288.98	284.38	4.60	10.240	7.86	12969	0.696	4551	43.87	31.44	1.10	0.37	5.77	29.15	30.10
6.678	-0.978	289.59	284.98	4.60	10.236	7.88	12951	0.696	4540	43.70	31.34	1.10	0.38	5.77	29.21	30.15
7.313	-0.978	289.64	285.29	4.35	10.234	7.89	12942	0.696	4778	45.95	32.53	1.10	0.39	5.77	30.56	31.46

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	56.01	50.56	5.45	1485.9	25.70	12996	0.696	1218.2	66.80	42.68	1.98	0.69	5.77	41.19	41.86
1.639	-0.010	57.75	51.13	6.62	1485.7	25.73	12986	0.696	1004.5	55.03	37.17	1.98	0.67	5.77	34.79	35.59
2.129	-0.028	59.76	52.20	7.56	1485.2	25.79	12969	0.696	878.4	48.05	33.64	1.98	0.66	5.77	31.25	32.13
2.639	0.000	60.86	53.31	7.55	1484.6	25.85	12951	0.696	878.0	47.95	33.58	1.98	0.68	5.77	31.37	32.25
2.854	0.000	61.04	53.77	7.27	1484.4	25.88	12943	0.696	908.3	49.58	34.41	1.98	0.70	5.77	32.40	33.25
1.404	0.375	56.59	50.61	5.97	1485.9	25.70	12995	0.696	1111.8	60.96	40.01	1.98	0.68	5.77	38.04	38.77
1.644	0.365	58.11	51.14	6.97	1485.7	25.73	12986	0.696	954.3	52.29	35.82	1.98	0.67	5.77	33.37	34.20
2.114	0.375	59.96	52.16	7.79	1485.2	25.79	12969	0.696	852.3	46.63	32.91	1.98	0.66	5.77	30.52	31.43
2.639	0.365	61.18	53.31	7.88	1484.6	25.85	12951	0.696	841.4	45.96	32.54	1.98	0.68	5.77	30.35	31.26
2.879	0.360	61.29	53.83	7.47	1484.4	25.88	12942	0.696	883.5	48.22	33.71	1.98	0.70	5.77	31.73	32.60
1.389	-0.375	56.97	50.58	6.39	1485.9	25.70	12995	0.696	1038.5	56.95	38.11	1.98	0.69	5.77	35.93	36.70
1.619	-0.360	58.27	51.08	7.19	1485.7	25.72	12987	0.696	925.2	50.69	35.01	1.98	0.67	5.77	32.56	33.41
2.129	-0.365	60.48	52.20	8.28	1485.2	25.79	12969	0.696	801.9	43.87	31.44	1.98	0.66	5.77	29.15	30.10
2.629	-0.385	61.57	53.28	8.29	1484.6	25.85	12951	0.696	799.9	43.70	31.34	1.98	0.68	5.77	29.21	30.15
2.879	-0.385	61.66	53.83	7.84	1484.4	25.88	12942	0.696	841.9	45.95	32.53	1.98	0.70	5.77	30.56	31.46

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 10
Date: 6 January 1992
Time: 14:53:06

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
283.28	50.21	293.04	67.79	5.41	0.00331	10.277	1490.5	6.11	0.89	112.81	213	7.28	7.26	6.40

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	286.19	55.45
1.702	0.670	0.001	0.000	286.61	56.21
9.093	3.580	0.001	0.000	295.24	71.74
10.706	4.215	0.001	0.000	294.87	71.08

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	291.77	286.43	5.34	10.275	4.05	6622	0.696	3880	37.20	27.70	1.10	0.40	5.77	23.50	24.66
4.163	-0.025	293.40	287.03	6.37	10.274	4.06	6613	0.695	3264	31.24	24.17	1.10	0.39	5.77	20.21	21.56
5.408	-0.071	295.43	288.18	7.26	10.274	4.07	6596	0.695	2861	27.31	21.70	1.10	0.39	5.77	18.23	19.70
6.703	0.001	296.60	289.37	7.23	10.273	4.09	6578	0.695	2865	27.27	21.67	1.10	0.41	5.77	18.33	19.80
7.249	0.001	296.78	289.87	6.91	10.273	4.10	6571	0.695	2984	28.37	22.36	1.10	0.42	5.77	19.05	20.47
3.566	0.953	292.12	286.48	5.63	10.275	4.05	6621	0.696	3683	35.31	26.61	1.10	0.40	5.77	22.45	23.66
4.176	0.927	293.59	287.05	6.54	10.274	4.06	6613	0.695	3177	30.42	23.67	1.10	0.39	5.77	19.78	21.15
5.370	0.953	295.50	288.14	7.35	10.274	4.07	6596	0.695	2823	26.95	21.47	1.10	0.39	5.77	18.03	19.53
6.703	0.927	296.75	289.37	7.38	10.273	4.09	6578	0.695	2807	26.71	21.31	1.10	0.41	5.77	18.04	19.53
7.313	0.914	296.90	289.93	6.98	10.272	4.10	6570	0.695	2954	28.07	22.17	1.10	0.42	5.77	18.91	20.34
3.528	-0.953	292.40	286.45	5.95	10.275	4.05	6622	0.696	3485	33.41	25.49	1.10	0.40	5.77	21.43	22.70
4.112	-0.914	293.67	286.99	6.68	10.274	4.05	6614	0.695	3111	29.79	23.28	1.10	0.39	5.77	19.45	20.84
5.408	-0.927	295.86	288.18	7.68	10.274	4.07	6596	0.695	2703	25.80	20.73	1.10	0.39	5.77	17.44	18.98
6.678	-0.978	296.97	289.35	7.63	10.273	4.09	6578	0.695	2715	25.84	20.75	1.10	0.41	5.77	17.58	19.11
7.313	-0.978	297.15	289.93	7.22	10.272	4.10	6570	0.695	2854	27.12	21.56	1.10	0.42	5.77	18.40	19.87

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	65.50	55.88	9.62	1490.2	13.28	6622	0.696	683.7	37.20	27.70	1.98	0.72	5.77	23.50	24.66
1.639	-0.010	68.44	56.97	11.47	1490.2	13.31	6613	0.695	575.1	31.24	24.17	1.98	0.70	5.77	20.21	21.56
2.129	-0.028	72.09	59.03	13.06	1490.1	13.36	6596	0.695	504.1	27.31	21.70	1.98	0.71	5.77	18.23	19.70
2.639	0.000	74.18	61.18	13.01	1489.9	13.42	6578	0.695	504.8	27.27	21.67	1.98	0.73	5.77	18.33	19.80
2.854	0.000	74.51	62.07	12.44	1489.9	13.44	6571	0.695	525.8	28.37	22.36	1.98	0.75	5.77	19.05	20.47
1.404	0.375	66.12	55.98	10.14	1490.2	13.28	6621	0.696	648.9	35.31	26.61	1.98	0.71	5.77	22.45	23.66
1.644	0.365	68.77	56.99	11.78	1490.2	13.31	6613	0.695	559.8	30.42	23.67	1.98	0.70	5.77	19.78	21.15
2.114	0.375	72.20	58.97	13.23	1490.1	13.36	6596	0.695	497.4	26.95	21.47	1.98	0.71	5.77	18.03	19.53
2.639	0.365	74.46	61.18	13.28	1489.9	13.42	6578	0.695	494.6	26.71	21.31	1.98	0.73	5.77	18.04	19.53
2.879	0.360	74.74	62.18	12.56	1489.9	13.44	6570	0.695	520.5	28.07	22.17	1.98	0.76	5.77	18.91	20.34
1.389	-0.375	66.63	55.92	10.71	1490.2	13.28	6622	0.696	614.1	33.41	25.49	1.98	0.72	5.77	21.43	22.70
1.619	-0.360	68.91	56.89	12.03	1490.2	13.30	6614	0.695	548.2	29.79	23.28	1.98	0.71	5.77	19.45	20.84
2.129	-0.365	72.86	59.03	13.82	1490.1	13.36	6596	0.695	476.3	25.80	20.73	1.98	0.71	5.77	17.44	18.98
2.629	-0.385	74.86	61.13	13.73	1490.0	13.41	6578	0.695	478.4	25.84	20.75	1.98	0.73	5.77	17.58	19.11
2.879	-0.385	75.18	62.18	13.00	1489.9	13.44	6570	0.695	502.9	27.12	21.56	1.98	0.76	5.77	18.40	19.87

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 11
Date: 6 January 1992
Time: 14:53:31

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
283.46	50.53	293.23	68.12	5.40	0.00331	10.278	1490.7	6.17	0.89	111.77	213	7.28	7.26	6.40

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	286.36	55.76
1.702	0.670	0.001	0.000	286.80	56.54
9.093	3.580	0.001	0.000	295.40	72.04
10.706	4.215	0.001	0.000	295.05	71.41

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	291.93	286.61	5.32	10.276	4.05	6615	0.696	3894	37.31	27.76	1.10	0.40	5.77	23.56	24.73
4.163	-0.025	293.57	287.22	6.35	10.276	4.05	6605	0.695	3274	31.33	24.22	1.10	0.39	5.77	20.27	21.60
5.408	-0.071	295.60	288.36	7.23	10.275	4.07	6588	0.695	2870	27.38	21.75	1.10	0.39	5.77	18.27	19.74
6.703	0.001	296.77	289.55	7.21	10.274	4.09	6571	0.695	2870	27.30	21.68	1.10	0.41	5.77	18.36	19.82
7.249	0.001	296.95	290.05	6.89	10.274	4.09	6563	0.695	2993	28.43	22.39	1.10	0.42	5.77	19.09	20.51
3.566	0.953	292.29	286.67	5.62	10.276	4.05	6614	0.696	3689	35.34	26.62	1.10	0.40	5.77	22.48	23.69
4.176	0.927	293.75	287.23	6.53	10.276	4.06	6605	0.695	3186	30.48	23.70	1.10	0.39	5.77	19.82	21.18
5.370	0.953	295.67	288.33	7.34	10.275	4.07	6589	0.695	2826	26.97	21.49	1.10	0.39	5.77	18.05	19.54
6.703	0.927	296.92	289.55	7.37	10.274	4.09	6571	0.695	2811	26.74	21.32	1.10	0.41	5.77	18.06	19.55
7.313	0.914	297.08	290.11	6.97	10.274	4.10	6562	0.695	2958	28.10	22.18	1.10	0.42	5.77	18.93	20.36
3.528	-0.953	292.58	286.63	5.95	10.276	4.05	6614	0.696	3485	33.40	25.48	1.10	0.40	5.77	21.43	22.70
4.112	-0.914	293.85	287.17	6.68	10.276	4.05	6606	0.695	3112	29.78	23.27	1.10	0.39	5.77	19.44	20.83
5.408	-0.927	296.03	288.36	7.67	10.275	4.07	6588	0.695	2707	25.83	20.75	1.10	0.39	5.77	17.46	19.00
6.678	-0.978	297.15	289.53	7.63	10.274	4.09	6571	0.695	2716	25.84	20.74	1.10	0.41	5.77	17.58	19.11
7.313	-0.978	297.34	290.11	7.23	10.274	4.10	6562	0.695	2852	27.09	21.54	1.10	0.42	5.77	18.39	19.86

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	65.79	56.21	9.58	1490.4	13.28	6615	0.696	686.1	37.31	27.76	1.98	0.72	5.77	23.56	24.73
1.639	-0.010	68.73	57.30	11.43	1490.3	13.30	6605	0.695	576.9	31.33	24.22	1.98	0.70	5.77	20.27	21.60
2.129	-0.028	72.38	59.37	13.02	1490.2	13.36	6588	0.695	505.7	27.38	21.75	1.98	0.71	5.77	18.27	19.74
2.639	0.000	74.49	61.51	12.99	1490.1	13.41	6571	0.695	505.7	27.30	21.68	1.98	0.73	5.77	18.36	19.82
2.854	0.000	74.81	62.41	12.41	1490.1	13.43	6563	0.695	527.4	28.43	22.39	1.98	0.75	5.77	19.09	20.51
1.404	0.375	66.43	56.31	10.12	1490.4	13.28	6614	0.696	650.0	35.34	26.62	1.98	0.71	5.77	22.48	23.69
1.644	0.365	69.07	57.32	11.75	1490.3	13.31	6605	0.695	561.4	30.48	23.70	1.98	0.70	5.77	19.82	21.18
2.114	0.375	72.52	59.30	13.22	1490.2	13.36	6589	0.695	497.9	26.97	21.49	1.98	0.71	5.77	18.05	19.54
2.639	0.365	74.77	61.51	13.26	1490.1	13.41	6571	0.695	495.3	26.74	21.32	1.98	0.73	5.77	18.06	19.55
2.879	0.360	75.06	62.51	12.54	1490.1	13.44	6562	0.695	521.2	28.10	22.18	1.98	0.76	5.77	18.93	20.36
1.389	-0.375	66.96	56.25	10.71	1490.4	13.28	6614	0.696	614.1	33.40	25.48	1.98	0.72	5.77	21.43	22.70
1.619	-0.360	69.24	57.22	12.03	1490.3	13.30	6606	0.695	548.3	29.78	23.27	1.98	0.71	5.77	19.44	20.83
2.129	-0.365	73.17	59.37	13.80	1490.2	13.36	6588	0.695	477.0	25.83	20.75	1.98	0.71	5.77	17.46	19.00
2.629	-0.385	75.19	61.47	13.72	1490.1	13.41	6571	0.695	478.6	25.84	20.74	1.98	0.73	5.77	17.58	19.11
2.879	-0.385	75.52	62.51	13.01	1490.1	13.44	6562	0.695	502.5	27.09	21.54	1.98	0.76	5.77	18.39	19.86

Table 3.1 (continued)

Aluminum Heat Exchanger
Experiment: 1, Data Point: 12
Date: 6 January 1992
Time: 14:53:57

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
283.60	50.79	293.42	68.47	5.41	0.00331	10.278	1490.7	6.20	0.90	111.14	215	7.24	7.33	6.46

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	286.53	56.07
1.702	0.670	0.001	0.000	286.98	56.87
9.093	3.580	0.001	0.000	295.59	72.38
10.706	4.215	0.001	0.000	295.23	71.72

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	292.12	286.77	5.35	10.276	4.05	6620	0.696	3900	37.36	27.79	1.10	0.40	5.77	23.46	24.63
4.163	-0.025	293.75	287.38	6.37	10.276	4.06	6611	0.695	3283	31.41	24.27	1.10	0.39	5.77	20.20	21.54
5.408	-0.071	295.77	288.53	7.24	10.275	4.08	6594	0.695	2885	27.51	21.83	1.10	0.40	5.77	18.24	19.72
6.703	0.001	296.95	289.73	7.22	10.274	4.09	6576	0.695	2887	27.45	21.78	1.10	0.41	5.77	18.34	19.81
7.249	0.001	297.14	290.23	6.91	10.274	4.10	6569	0.695	3004	28.53	22.45	1.10	0.42	5.77	19.04	20.46
3.566	0.953	292.47	286.83	5.64	10.276	4.05	6619	0.696	3700	35.43	26.67	1.10	0.40	5.77	22.40	23.62
4.176	0.927	293.95	287.39	6.56	10.276	4.06	6611	0.695	3190	30.51	23.72	1.10	0.39	5.77	19.73	21.10
5.370	0.953	295.85	288.49	7.35	10.275	4.08	6594	0.695	2841	27.10	21.57	1.10	0.39	5.77	18.02	19.51
6.703	0.927	297.10	289.73	7.38	10.274	4.09	6576	0.695	2824	26.85	21.39	1.10	0.41	5.77	18.03	19.52
7.313	0.914	297.25	290.29	6.96	10.274	4.10	6568	0.695	2978	28.27	22.29	1.10	0.42	5.77	18.93	20.35
3.528	-0.953	292.76	286.79	5.96	10.276	4.05	6620	0.696	3498	33.51	25.54	1.10	0.40	5.77	21.37	22.65
4.112	-0.914	294.02	287.33	6.69	10.276	4.06	6612	0.695	3126	29.91	23.35	1.10	0.39	5.77	19.41	20.80
5.408	-0.927	296.21	288.53	7.68	10.275	4.08	6594	0.695	2720	25.94	20.82	1.10	0.40	5.77	17.43	18.97
6.678	-0.978	297.32	289.70	7.62	10.274	4.09	6576	0.695	2735	26.01	20.85	1.10	0.41	5.77	17.58	19.11
7.313	-0.978	297.51	290.29	7.22	10.274	4.10	6568	0.695	2873	27.28	21.66	1.10	0.42	5.77	18.40	19.86

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	66.12	56.49	9.63	1490.4	13.30	6620	0.696	687.2	37.36	27.79	1.98	0.72	5.77	23.46	24.63
1.639	-0.010	69.06	57.59	11.47	1490.4	13.33	6611	0.695	578.5	31.41	24.27	1.98	0.71	5.77	20.20	21.54
2.129	-0.028	72.70	59.67	13.03	1490.3	13.38	6594	0.695	508.3	27.51	21.83	1.98	0.71	5.77	18.24	19.72
2.639	0.000	74.81	61.82	12.99	1490.2	13.43	6576	0.695	508.7	27.45	21.78	1.98	0.73	5.77	18.34	19.81
2.854	0.000	75.16	62.72	12.43	1490.1	13.46	6569	0.695	529.3	28.53	22.45	1.98	0.75	5.77	19.04	20.46
1.404	0.375	66.75	56.60	10.16	1490.4	13.30	6619	0.696	651.9	35.43	26.67	1.98	0.71	5.77	22.40	23.62
1.644	0.365	69.42	57.62	11.80	1490.4	13.33	6611	0.695	562.1	30.51	23.72	1.98	0.70	5.77	19.73	21.10
2.114	0.375	72.84	59.60	13.23	1490.3	13.38	6594	0.695	500.6	27.10	21.57	1.98	0.71	5.77	18.02	19.51
2.639	0.365	75.10	61.82	13.28	1490.2	13.43	6576	0.695	497.6	26.85	21.39	1.98	0.73	5.77	18.03	19.52
2.879	0.360	75.37	62.83	12.54	1490.1	13.46	6568	0.695	524.7	28.27	22.29	1.98	0.76	5.77	18.93	20.35
1.389	-0.375	67.27	56.54	10.74	1490.4	13.30	6620	0.696	616.3	33.51	25.54	1.98	0.72	5.77	21.37	22.65
1.619	-0.360	69.55	57.51	12.04	1490.4	13.33	6612	0.695	550.8	29.91	23.35	1.98	0.71	5.77	19.41	20.80
2.129	-0.365	73.48	59.67	13.82	1490.3	13.38	6594	0.695	479.3	25.94	20.82	1.98	0.71	5.77	17.43	18.97
2.629	-0.385	75.49	61.78	13.71	1490.2	13.43	6576	0.695	481.9	26.01	20.85	1.98	0.73	5.77	17.58	19.11
2.879	-0.385	75.82	62.83	12.99	1490.1	13.46	6568	0.695	506.2	27.28	21.66	1.98	0.76	5.77	18.40	19.86

Table 3.2. Data tables for experiment 2

Aluminum Heat Exchanger
Summary Data Table for Experiment 2
Date: 6 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	P0 MPa	P0-P1 kPa	T0 K	T1 K	T1-T0 K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	15:19:59	410	13.98	7.50	10.30	14.25	284.37	297.89	13.52	10.31	5.70	9093	0.695	3871	36.67	27.32
2	15:20:25	411	14.01	7.51	10.30	14.26	284.22	297.76	13.54	10.32	5.70	9102	0.695	3874	36.71	27.35
3	15:20:51	410	13.98	7.50	10.31	14.30	284.09	297.62	13.53	10.33	5.69	9094	0.695	3863	36.62	27.30
4	15:26:02	410	13.98	10.74	10.31	30.82	282.20	291.64	9.44	7.60	8.04	13136	0.696	5241	50.18	34.67
5	15:26:28	410	13.98	10.73	10.31	30.79	282.02	291.48	9.46	7.61	8.03	13133	0.696	5242	50.21	34.69
6	15:26:53	410	13.98	10.73	10.31	30.81	281.87	291.31	9.44	7.61	8.03	13141	0.696	5236	50.17	34.68
7	15:32:10	407	13.88	16.36	10.31	74.16	278.93	285.11	6.18	5.24	12.08	20247	0.696	7572	73.43	45.64
8	15:32:36	409	13.94	16.37	10.31	74.11	278.76	284.95	6.20	5.20	12.07	20262	0.696	7645	74.16	45.96
9	15:33:01	409	13.94	16.38	10.31	73.97	278.56	284.76	6.20	5.21	12.07	20281	0.696	7635	74.10	45.94
10	15:39:05	411	14.01	16.46	10.33	73.29	276.58	282.77	6.19	5.31	12.03	20478	0.696	7522	73.38	45.70
11	15:39:30	413	14.08	16.48	10.33	73.18	276.47	282.68	6.22	5.30	12.04	20507	0.696	7572	73.88	45.92
12	15:39:56	412	14.05	16.49	10.33	73.09	276.37	282.57	6.20	5.31	12.04	20520	0.696	7543	73.62	45.81
13	15:48:16	416	14.18	11.13	10.38	29.33	272.93	282.18	9.25	8.10	8.02	13908	0.696	4997	49.01	34.29
14	15:48:41	417	14.22	11.13	10.38	29.37	273.28	282.54	9.26	8.09	8.03	13900	0.696	5008	49.07	34.32
15	15:49:07	416	14.18	11.14	10.38	29.39	273.65	282.89	9.24	8.11	8.05	13905	0.696	4991	48.86	34.20
16	15:49:33	417	14.22	11.16	10.38	29.45	274.03	283.27	9.24	8.07	8.07	13917	0.696	5019	49.08	34.30
17	15:53:49	423	14.42	7.79	10.40	12.19	276.09	289.50	13.41	10.65	5.70	9617	0.696	3858	37.32	27.83
18	15:54:14	423	14.42	7.79	10.40	12.15	276.12	289.55	13.42	10.65	5.70	9617	0.696	3862	37.36	27.85
19	15:54:40	424	14.46	7.79	10.41	12.16	276.16	289.61	13.45	10.64	5.70	9622	0.696	3875	37.48	27.92

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 1
Date: 6 January 1992
Time: 15:19:59

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.37	52.17	297.89	76.52	7.50	0.00459	10.304	1494.5	14.25	2.07	48.37	410	5.31	13.98	12.31

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	287.90	58.53
1.702	0.670	0.001	0.000	288.51	59.64
9.093	3.580	0.001	0.000	300.79	81.72
10.706	4.215	0.001	0.000	300.17	80.62

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	296.30	288.73	7.57	10.299	5.65	9143	0.695	5267	50.20	34.64	1.10	0.42	5.77	17.02	18.59
4.163	-0.025	298.60	289.57	9.03	10.298	5.67	9125	0.695	4425	42.09	30.37	1.10	0.42	5.77	14.74	16.53
5.408	-0.071	301.46	291.16	10.31	10.297	5.70	9093	0.695	3871	36.67	27.32	1.10	0.43	5.77	13.38	15.33
6.703	0.001	303.07	292.80	10.26	10.295	5.73	9059	0.695	3879	36.60	27.26	1.10	0.44	5.77	13.47	15.41
7.249	0.001	303.31	293.50	9.82	10.294	5.74	9045	0.695	4039	38.04	28.06	1.10	0.46	5.77	13.96	15.84
3.566	0.953	296.77	288.81	7.96	10.299	5.65	9141	0.695	5009	47.74	33.39	1.10	0.42	5.77	16.32	17.95
4.176	0.927	298.90	289.59	9.31	10.298	5.67	9125	0.695	4292	40.82	29.68	1.10	0.42	5.77	14.40	16.23
5.370	0.953	301.57	291.11	10.46	10.297	5.70	9094	0.695	3814	36.13	27.01	1.10	0.43	5.77	13.23	15.20
6.703	0.927	303.31	292.80	10.50	10.295	5.73	9059	0.695	3790	35.75	26.77	1.10	0.44	5.77	13.24	15.21
7.313	0.914	303.51	293.58	9.93	10.294	5.74	9044	0.695	3989	37.56	27.79	1.10	0.46	5.77	13.85	15.74
3.528	-0.953	297.21	288.76	8.45	10.299	5.65	9142	0.695	4718	44.97	31.94	1.10	0.42	5.77	15.55	17.26
4.112	-0.914	299.03	289.51	9.53	10.298	5.66	9127	0.695	4195	39.91	29.18	1.10	0.42	5.77	14.15	16.01
5.408	-0.927	302.17	291 16	11.01	10.297	5.70	9093	0.695	3624	34.33	25.96	1.10	0.43	5.77	12.76	14.79
6.678	-0.978	303.70	292.77	10.92	10.295	5.73	9060	0.695	3644	34.38	25.97	1.10	0.44	5.77	12.87	14.89
7.313	-0.978	303.92	293.58	10.34	10.294	5.74	9044	0.695	3832	36.08	26.94	1.10	0.46	5.77	13.44	15.39

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	73.65	60.03	13.62	1493.8	18.53	9143	0.695	928.0	50.20	34.64	1.98	0.75	5.77	17.02	18.59
1.639	-0.010	77.80	61.54	16.26	1493.7	18.59	9125	0.695	779.7	42.09	30.37	1.98	0.75	5.77	14.74	16.53
2.129	-0.028	82.95	64.40	18.55	1493.4	18.69	9093	0.695	682.1	36.67	27.32	1.98	0.77	5.77	13.38	15.33
2.639	0.000	85.83	67.36	18.47	1493.1	18.80	9059	0.695	683.5	36.60	27.26	1.98	0.80	5.77	13.47	15.41
2.854	0.000	86.28	68.61	17.67	1493.0	18.84	9045	0.695	711.7	38.04	28.06	1.98	0.82	5.77	13.96	15.84
1.404	0.375	74.50	60.17	14.33	1493.8	18.54	9141	0.695	882.6	47.74	33.39	1.98	0.75	5.77	16.32	17.95
1.644	0.365	78.33	61.57	16.76	1493.7	18.59	9125	0.695	756.3	40.82	29.68	1.98	0.75	5.77	14.40	16.23
2.114	0.375	83.14	64.31	18.83	1493.4	18.69	9094	0.695	672.0	36.13	27.01	1.98	0.77	5.77	13.23	15.20
2.639	0.365	86.27	67.36	18.91	1493.1	18.80	9059	0.695	667.8	35.75	26.77	1.98	0.80	5.77	13.24	15.21
2.879	0.360	86.63	68.75	17.88	1493.0	18.84	9044	0.695	702.9	37.56	27.79	1.98	0.82	5.77	13.85	15.74
1.389	-0.375	75.29	60.08	15.21	1493.8	18.54	9142	0.695	831.3	44.97	31.94	1.98	0.75	5.77	15.55	17.26
1.619	-0.360	78.57	61.42	17.15	1493.7	18.58	9127	0.695	739.2	39.91	29.18	1.98	0.75	5.77	14.15	16.01
2.129	-0.365	84.21	64.40	19.82	1493.4	18.69	9093	0.695	638.5	34.33	25.96	1.98	0.77	5.77	12.76	14.79
2.629	-0.385	86.97	67.30	19.66	1493.1	18.79	9060	0.695	642.1	34.38	25.97	1.98	0.80	5.77	12.87	14.89
2.879	-0.385	87.36	68.75	18.61	1493.0	18.84	9044	0.695	675.2	36.08	26.94	1.98	0.82	5.77	13.44	15.39

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 2
Date: 6 January 1992
Time: 15:20:25

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.22	51.91	297.76	76.29	7.51	0.00460	10.305	1494.6	14.26	2.07	48.37	411	5.30	14.01	12.34

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	287.77	58.30
1.702	0.670	0.001	0.000	288.38	59.40
9.093	3.580	0.001	0.000	300.67	81.51
10.706	4.215	0.001	0.000	300.05	80.40

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	296.17	288.59	7.58	10.300	5.65	9152	0.695	5270	50.25	34.67	1.10	0.42	5.77	17.00	18.57
4.163	-0.025	298.48	289.43	9.05	10.299	5.67	9135	0.695	4425	42.10	30.38	1.10	0.42	5.77	14.71	16.51
5.408	-0.071	301.34	291.02	10.32	10.297	5.70	9102	0.695	3874	36.71	27.35	1.10	0.43	5.77	13.36	15.31
6.703	0.001	302.95	292.67	10.28	10.296	5.73	9069	0.695	3881	36.63	27.28	1.10	0.44	5.77	13.45	15.39
7.249	0.001	303.20	293.36	9.84	10.295	5.74	9055	0.695	4040	38.06	28.08	1.10	0.46	5.77	13.94	15.82
3.566	0.953	296.64	288.67	7.98	10.300	5.65	9151	0.695	5011	47.77	33.40	1.10	0.42	5.77	16.29	17.93
4.176	0.927	298.77	289.45	9.32	10.299	5.67	9135	0.695	4297	40.88	29.71	1.10	0.42	5.77	14.38	16.21
5.370	0.953	301.44	290.97	10.47	10.297	5.70	9103	0.695	3818	36.19	27.05	1.10	0.43	5.77	13.22	15.19
6.703	0.927	303.17	292.67	10.50	10.296	5.73	9069	0.695	3800	35.86	26.83	1.10	0.44	5.77	13.24	15.21
7.313	0.914	303.39	293.44	9.95	10.295	5.74	9053	0.695	3992	37.60	27.81	1.10	0.46	5.77	13.83	15.73
3.528	-0.953	297.09	288.62	8.47	10.300	5.65	9152	0.695	4715	44.95	31.93	1.10	0.42	5.77	15.51	17.22
4.112	-0.914	298.91	289.36	9.54	10.299	5.67	9136	0.695	4197	39.94	29.20	1.10	0.42	5.77	14.12	15.99
5.408	-0.927	302.03	291.02	11.01	10.297	5.70	9102	0.695	3632	34.42	26.02	1.10	0.43	5.77	12.75	14.79
6.678	-0.978	303.57	292.64	10.94	10.296	5.73	9070	0.695	3648	34.43	26.00	1.10	0.44	5.77	12.86	14.88
7.313	-0.978	303.80	293.44	10.36	10.295	5.74	9053	0.695	3834	36.11	26.96	1.10	0.46	5.77	13.42	15.37

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	73.41	59.77	13.64	1493.9	18.54	9152	0.695	928.6	50.25	34.67	1.98	0.75	5.77	17.00	18.57
1.639	-0.010	77.58	61.29	16.29	1493.8	18.59	9135	0.695	779.7	42.10	30.38	1.98	0.75	5.77	14.71	16.51
2.129	-0.028	82.73	64.15	18.58	1493.5	18.69	9102	0.695	682.6	36.71	27.35	1.98	0.77	5.77	13.36	15.31
2.639	0.000	85.62	67.11	18.50	1493.2	18.80	9069	0.695	683.8	36.63	27.28	1.98	0.80	5.77	13.45	15.39
2.854	0.000	86.07	68.36	17.71	1493.1	18.84	9055	0.695	711.8	38.06	28.08	1.98	0.82	5.77	13.94	15.82
1.404	0.375	74.27	59.91	14.36	1493.9	18.54	9151	0.695	882.9	47.77	33.40	1.98	0.75	5.77	16.29	17.93
1.644	0.365	78.09	61.32	16.78	1493.8	18.59	9135	0.695	757.1	40.88	29.71	1.98	0.75	5.77	14.38	16.21
2.114	0.375	82.91	64.06	18.85	1493.5	18.69	9103	0.695	672.7	36.19	27.05	1.98	0.77	5.77	13.22	15.19
2.639	0.365	86.02	67.11	18.90	1493.2	18.80	9069	0.695	669.6	35.86	26.83	1.98	0.80	5.77	13.24	15.21
2.879	0.360	86.41	68.51	17.90	1493.1	18.85	9053	0.695	703.4	37.60	27.81	1.98	0.82	5.77	13.83	15.73
1.389	-0.375	75.08	59.83	15.25	1493.9	18.54	9152	0.695	830.8	44.95	31.93	1.98	0.75	5.77	15.51	17.22
1.619	-0.360	78.35	61.17	17.18	1493.8	18.59	9136	0.695	739.5	39.94	29.20	1.98	0.75	5.77	14.12	15.99
2.129	-0.365	83.96	64.15	19.82	1493.5	18.69	9102	0.695	640.0	34.42	26.02	1.98	0.77	5.77	12.75	14.79
2.629	-0.385	86.75	67.06	19.69	1493.2	18.80	9070	0.695	642.8	34.43	26.00	1.98	0.80	5.77	12.86	14.88
2.879	-0.385	87.15	68.51	18.64	1493.1	18.85	9053	0.695	675.6	36.11	26.96	1.98	0.82	5.77	13.42	15.37

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 3
Date: 6 January 1992
Time: 15:20:51

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.09	51.68	297.62	76.04	7.50	0.00459	10.305	1494.6	14.30	2.07	48.21	410	5.30	13.98	12.31

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	287.66	58.10
1.702	0.670	0.001	0.000	288.27	59.19
9.093	3.580	0.001	0.000	300.55	81.30
10.706	4.215	0.001	0.000	299.92	80.17

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	296.05	288.46	7.59	10.300	5.64	9144	0.695	5252	50.09	34.59	1.10	0.42	5.77	16.98	18.56
4.163	-0.025	298.36	289.30	9.07	10.299	5.66	9126	0.695	4408	41.95	30.30	1.10	0.42	5.77	14.70	16.49
5.408	-0.071	301.21	290.89	10.33	10.298	5.69	9094	0.695	3863	36.62	27.30	1.10	0.43	5.77	13.36	15.31
6.703	0.001	302.82	292.53	10.28	10.296	5.72	9060	0.695	3872	36.55	27.23	1.10	0.44	5.77	13.45	15.39
7.249	0.001	303.08	293.23	9.85	10.295	5.73	9046	0.695	4025	37.93	28.00	1.10	0.46	5.77	13.93	15.81
3.566	0.953	296.52	288.54	7.99	10.300	5.64	9142	0.695	4992	47.61	33.32	1.10	0.42	5.77	16.27	17.91
4.176	0.927	298.65	289.32	9.33	10.299	5.66	9126	0.695	4281	40.75	29.65	1.10	0.42	5.77	14.37	16.20
5.370	0.953	301.32	290.84	10.48	10.298	5.69	9095	0.695	3805	36.08	26.99	1.10	0.43	5.77	13.21	15.18
6.703	0.927	303.06	292.53	10.53	10.296	5.72	9060	0.695	3781	35.70	26.74	1.10	0.44	5.77	13.22	15.19
7.313	0.914	303.27	293.31	9.96	10.295	5.74	9045	0.695	3977	37.48	27.75	1.10	0.46	5.77	13.82	15.72
3.528	-0.953	297.01	288.49	8.52	10.300	5.64	9143	0.695	4681	44.65	31.77	1.10	0.42	5.77	15.45	17.17
4.112	-0.914	298.79	289.23	9.55	10.299	5.66	9128	0.695	4182	39.81	29.13	1.10	0.42	5.77	14.11	15.98
5.408	-0.927	301.91	290.89	11.02	10.298	5.69	9094	0.695	3620	34.31	25.95	1.10	0.43	5.77	12.75	14.78
6.678	-0.978	303.45	292.50	10.95	10.296	5.72	9061	0.695	3636	34.33	25.94	1.10	0.44	5.77	12.85	14.87
7.313	-0.978	303.68	293.31	10.38	10.295	5.74	9045	0.695	3819	35.98	26.89	1.10	0.46	5.77	13.41	15.36

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	73.20	59.54	13.66	1493.9	18.51	9144	0.695	925.4	50.09	34.59	1.98	0.75	5.77	16.98	18.56
1.639	-0.010	77.37	61.05	16.32	1493.8	18.56	9126	0.695	776.7	41.95	30.30	1.98	0.75	5.77	14.70	16.49
2.129	-0.028	82.50	63.91	18.59	1493.5	18.66	9094	0.695	680.7	36.62	27.30	1.98	0.77	5.77	13.36	15.31
2.639	0.000	85.38	66.87	18.51	1493.3	18.77	9060	0.695	682.2	36.55	27.23	1.98	0.80	5.77	13.45	15.39
2.854	0.000	85.85	68.12	17.73	1493.2	18.81	9046	0.695	709.2	37.93	28.00	1.98	0.82	5.77	13.93	15.81
1.404	0.375	74.06	59.68	14.38	1493.9	18.51	9142	0.695	879.6	47.61	33.32	1.98	0.75	5.77	16.27	17.91
1.644	0.365	77.88	61.08	16.80	1493.8	18.56	9126	0.695	754.3	40.75	29.65	1.98	0.75	5.77	14.37	16.20
2.114	0.375	82.69	63.82	18.87	1493.5	18.66	9095	0.695	670.4	36.08	26.99	1.98	0.77	5.77	13.21	15.18
2.639	0.365	85.82	66.87	18.95	1493.3	18.77	9060	0.695	666.2	35.70	26.74	1.98	0.80	5.77	13.22	15.19
2.879	0.360	86.20	68.27	17.93	1493.1	18.82	9045	0.695	700.7	37.48	27.75	1.98	0.82	5.77	13.82	15.72
1.389	-0.375	74.92	59.59	15.33	1493.9	18.51	9143	0.695	824.8	44.65	31.77	1.98	0.75	5.77	15.45	17.17
1.619	-0.360	78.13	60.93	17.20	1493.8	18.56	9128	0.695	736.9	39.81	29.13	1.98	0.75	5.77	14.11	15.98
2.129	-0.365	83.75	63.91	19.84	1493.5	18.66	9094	0.695	637.8	34.31	25.95	1.98	0.77	5.77	12.75	14.78
2.629	-0.385	86.53	66.82	19.71	1493.3	18.77	9061	0.695	640.7	34.33	25.94	1.98	0.80	5.77	12.85	14.87
2.879	-0.385	86.94	68.27	18.67	1493.1	18.82	9045	0.695	672.9	35.98	26.89	1.98	0.82	5.77	13.41	15.36

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 4
Date: 6 January 1992
Time: 15:26:02

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
282.20	48.28	291.64	65.27	10.74	0.00657	10.306	1494.8	30.82	4.47	22.37	410	7.53	13.98	12.31

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.48	52.38
1.702	0.670	0.001	0.000	284.91	53.15
9.093	3.580	0.001	0.000	293.82	69.18
10.706	4.215	0.001	0.000	293.27	68.20

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	290.79	285.25	5.54	10.296	7.99	13186	0.696	7186	69.10	43.64	1.10	0.40	5.77	22.86	24.05
4.163	-0.025	292.48	285.83	6.64	10.294	8.01	13169	0.696	6006	57.67	38.39	1.10	0.39	5.77	19.62	21.00
5.408	-0.071	294.54	286.94	7.60	10.290	8.04	13136	0.696	5241	50.18	34.67	1.10	0.39	5.77	17.68	19.20
6.703	0.001	295.67	288.09	7.58	10.286	8.08	13102	0.695	5247	50.09	34.60	1.10	0.40	5.77	17.77	19.29
7.249	0.001	295.84	288.58	7.27	10.284	8.09	13087	0.695	5447	51.94	35.52	1.10	0.41	5.77	18.40	19.86
3.566	0.953	291.22	285.30	5.92	10.295	7.99	13185	0.696	6727	64.68	41.67	1.10	0.40	5.77	21.60	22.86
4.176	0.927	292.79	285.85	6.94	10.294	8.01	13168	0.696	5747	55.19	37.19	1.10	0.39	5.77	18.95	20.37
5.370	0.953	294.70	286.91	7.79	10.290	8.04	13137	0.696	5115	48.98	34.06	1.10	0.39	5.77	17.35	18.90
6.703	0.927	295.92	288.09	7.83	10.286	8.08	13102	0.695	5074	48.45	33.77	1.10	0.40	5.77	17.33	18.88
7.313	0.914	296.07	288.63	7.44	10.284	8.09	13086	0.695	5319	50.71	34.90	1.10	0.42	5.77	18.08	19.57
3.528	-0.953	291.58	285.27	6.31	10.296	7.99	13186	0.696	6309	60.67	39.82	1.10	0.40	5.77	20.50	21.82
4.112	-0.914	292.90	285.79	7.11	10.294	8.01	13170	0.696	5607	53.85	36.54	1.10	0.39	5.77	18.59	20.04
5.408	-0.927	295.17	286.94	8.22	10.290	8.04	13136	0.696	4844	46.38	32.72	1.10	0.39	5.77	16.68	18.28
6.678	-0.978	296.29	288.07	8.22	10.286	8.07	13102	0.695	4835	46.17	32.58	1.10	0.40	5.77	16.72	18.32
7.313	-0.978	296.42	288.63	7.78	10.284	8.09	13086	0.695	5082	48.45	33.75	1.10	0.42	5.77	17.47	19.00

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	63.73	53.76	9.97	1493.3	26.22	13186	0.696	1266.2	69.10	43.64	1.98	0.71	5.77	22.86	24.05
1.639	-0.010	66.77	54.81	11.96	1493.0	26.28	13169	0.696	1058.3	57.67	38.39	1.98	0.70	5.77	19.62	21.00
2.129	-0.028	70.49	56.81	13.68	1492.4	26.38	13136	0.696	923.5	50.18	34.67	1.98	0.71	5.77	17.68	19.20
2.639	0.000	72.51	58.88	13.64	1491.8	26.50	13102	0.695	924.5	50.09	34.60	1.98	0.73	5.77	17.77	19.29
2.854	0.000	72.83	59.75	13.08	1491.6	26.54	13087	0.695	959.8	51.94	35.52	1.98	0.75	5.77	18.40	19.86
1.404	0.375	64.51	53.86	10.65	1493.2	26.22	13185	0.696	1185.3	64.68	41.67	1.98	0.71	5.77	21.60	22.86
1.644	0.365	67.33	54.83	12.50	1493.0	26.28	13168	0.696	1012.6	55.19	37.19	1.98	0.70	5.77	18.95	20.37
2.114	0.375	70.77	56.75	14.02	1492.4	26.38	13137	0.696	901.3	48.98	34.06	1.98	0.70	5.77	17.35	18.90
2.639	0.365	72.98	58.88	14.10	1491.8	26.50	13102	0.695	894.0	48.45	33.77	1.98	0.73	5.77	17.33	18.88
2.879	0.360	73.24	59.85	13.39	1491.6	26.55	13086	0.695	937.2	50.71	34.90	1.98	0.75	5.77	18.08	19.57
1.389	-0.375	65.15	53.80	11.35	1493.2	26.22	13186	0.696	1111.6	60.67	39.82	1.98	0.71	5.77	20.50	21.82
1.619	-0.360	67.54	54.73	12.81	1493.0	26.27	13170	0.696	988.0	53.85	36.54	1.98	0.70	5.77	18.59	20.04
2.129	-0.365	71.61	56.81	14.80	1492.4	26.38	13136	0.696	853.5	46.38	32.72	1.98	0.71	5.77	16.68	18.28
2.629	-0.385	73.64	58.84	14.80	1491.9	26.49	13102	0.695	851.9	46.17	32.58	1.98	0.73	5.77	16.72	18.32
2.879	-0.385	73.86	59.85	14.01	1491.6	26.55	13086	0.695	895.4	48.45	33.75	1.98	0.75	5.77	17.47	19.00

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 5
Date: 6 January 1992
Time: 15:26:28

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
282.02	47.94	291.48	64.97	10.73	0.00657	10.307	1494.9	30.79	4.47	22.39	410	7.52	13.98	12.31

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.30	52.06
1.702	0.670	0.001	0.000	284.73	52.82
9.093	3.580	0.001	0.000	293.65	68.88
10.706	4.215	0.001	0.000	293.09	67.88

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	290.62	285.07	5.55	10.297	7.98	13184	0.696	7181	69.08	43.64	1.10	0.40	5.77	22.82	24.02
4.163	-0.025	292.31	285.66	6.66	10.295	8.00	13166	0.696	6000	57.64	38.38	1.10	0.39	5.77	19.59	20.97
5.408	-0.071	294.37	286.77	7.61	10.291	8.03	13133	0.696	5242	50.21	34.69	1.10	0.39	5.77	17.66	19.18
6.703	0.001	295.50	287.92	7.58	10.287	8.07	13099	0.695	5250	50.14	34.63	1.10	0.40	5.77	17.76	19.28
7.249	0.001	295.67	288.40	7.27	10.285	8.08	13085	0.695	5451	52.00	35.56	1.10	0.42	5.77	18.39	19.85
3.566	0.953	291.05	285.13	5.93	10.296	7.98	13182	0.696	6723	64.67	41.67	1.10	0.40	5.77	21.57	22.83
4.176	0.927	292.61	285.67	6.95	10.295	8.00	13166	0.696	5750	55.24	37.22	1.10	0.39	5.77	18.93	20.36
5.370	0.953	294.52	286.73	7.78	10.291	8.03	13134	0.696	5123	49.08	34.12	1.10	0.39	5.77	17.36	18.90
6.703	0.927	295.75	287.92	7.83	10.287	8.07	13099	0.695	5081	48.53	33.81	1.10	0.40	5.77	17.33	18.88
7.313	0.914	295.89	288.46	7.44	10.285	8.08	13083	0.695	5325	50.79	34.95	1.10	0.42	5.77	18.08	19.57
3.528	-0.953	291.43	285.09	6.34	10.297	7.98	13183	0.696	6287	60.48	39.74	1.10	0.40	5.77	20.42	21.75
4.112	-0.914	292.72	285.61	7.11	10.295	8.00	13168	0.696	5615	53.95	36.59	1.10	0.39	5.77	18.59	20.04
5.408	-0.927	295.00	286.77	8.23	10.291	8.03	13133	0.696	4843	46.39	32.73	1.10	0.39	5.77	16.66	18.26
6.678	-0.978	296.12	287.90	8.22	10.287	8.06	13100	0.695	4839	46.22	32.61	1.10	0.40	5.77	16.72	18.32
7.313	-0.978	296.24	288.46	7.78	10.285	8.08	13083	0.695	5091	48.56	33.81	1.10	0.42	5.77	17.47	19.01

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	63.42	53.44	9.98	1493.4	26.18	13184	0.696	1265.3	69.08	43.64	1.98	0.71	5.77	22.82	24.02
1.639	-0.010	66.48	54.49	11.98	1493.1	26.24	13166	0.696	1057.2	57.64	38.38	1.98	0.70	5.77	19.59	20.97
2.129	-0.028	70.18	56.49	13.69	1492.6	26.35	13133	0.696	923.6	50.21	34.69	1.98	0.71	5.77	17.66	19.18
2.639	0.000	72.20	58.56	13.64	1492.0	26.46	13099	0.695	925.0	50.14	34.63	1.98	0.73	5.77	17.76	19.28
2.854	0.000	72.52	59.44	13.09	1491.8	26.51	13085	0.695	960.5	52.00	35.56	1.98	0.75	5.77	18.39	19.85
1.404	0.375	64.21	53.54	10.67	1493.4	26.19	13182	0.696	1184.6	64.67	41.67	1.98	0.71	5.77	21.57	22.83
1.644	0.365	67.02	54.51	12.50	1493.1	26.24	13166	0.696	1013.2	55.24	37.22	1.98	0.70	5.77	18.93	20.36
2.114	0.375	70.44	56.43	14.01	1492.6	26.34	13134	0.696	902.7	49.08	34.12	1.98	0.70	5.77	17.36	18.90
2.639	0.365	72.66	58.56	14.10	1492.0	26.46	13099	0.695	895.3	48.53	33.81	1.98	0.73	5.77	17.33	18.88
2.879	0.360	72.92	59.54	13.38	1491.7	26.52	13083	0.695	938.3	50.79	34.95	1.98	0.75	5.77	18.08	19.57
1.389	-0.375	64.88	53.48	11.41	1493.4	26.19	13183	0.696	1107.8	60.48	39.74	1.98	0.71	5.77	20.42	21.75
1.619	-0.360	67.22	54.41	12.80	1493.1	26.24	13168	0.696	989.4	53.95	36.59	1.98	0.70	5.77	18.59	20.04
2.129	-0.365	71.31	56.49	14.82	1492.6	26.35	13133	0.696	853.3	46.39	32.73	1.98	0.71	5.77	16.66	18.26
2.629	-0.385	73.33	58.52	14.80	1492.0	26.46	13100	0.695	852.6	46.22	32.61	1.98	0.73	5.77	16.72	18.32
2.879	-0.385	73.54	59.54	14.00	1491.7	26.52	13083	0.695	897.0	48.56	33.81	1.98	0.75	5.77	17.47	19.01

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 6
Date: 6 January 1992
Time: 15:26:53

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
281.87	47.67	291.31	64.67	10.73	0.00657	10.308	1495.0	30.81	4.47	22.38	410	7.53	13.98	12.31

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.15	51.79
1.702	0.670	0.001	0.000	284.58	52.56
9.093	3.580	0.001	0.000	293.49	68.60
10.706	4.215	0.001	0.000	292.95	67.63

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	290.46	284.91	5.54	10.297	7.98	13192	0.696	7178	69.08	43.65	1.10	0.40	5.77	22.84	24.03
4.163	-0.025	292.15	285.50	6.65	10.295	8.00	13174	0.696	5997	57.63	38.38	1.10	0.39	5.77	19.60	20.98
5.408	-0.071	294.22	286.61	7.61	10.291	8.03	13141	0.696	5236	50.17	34.68	1.10	0.39	5.77	17.66	19.18
6.703	0.001	295.34	287.76	7.58	10.287	8.06	13107	0.695	5240	50.06	34.59	1.10	0.40	5.77	17.75	19.27
7.249	0.001	295.52	288.24	7.28	10.286	8.08	13093	0.695	5436	51.88	35.50	1.10	0.41	5.77	18.37	19.84
3.566	0.953	290.90	284.97	5.93	10.297	7.98	13190	0.696	6708	64.55	41.62	1.10	0.40	5.77	21.55	22.82
4.176	0.927	292.47	285.51	6.95	10.295	8.00	13174	0.696	5738	55.14	37.18	1.10	0.39	5.77	18.92	20.35
5.370	0.953	294.38	286.57	7.81	10.291	8.03	13142	0.696	5101	48.89	34.03	1.10	0.39	5.77	17.32	18.87
6.703	0.927	295.61	287.76	7.85	10.287	8.06	13107	0.695	5064	48.38	33.74	1.10	0.40	5.77	17.31	18.86
7.313	0.914	295.75	288.30	7.46	10.285	8.08	13091	0.695	5306	50.63	34.87	1.10	0.42	5.77	18.05	19.54
3.528	-0.953	291.28	284.93	6.35	10.297	7.98	13191	0.696	6270	60.34	39.68	1.10	0.40	5.77	20.39	21.72
4.112	-0.914	292.58	285.45	7.13	10.295	7.99	13176	0.696	5595	53.78	36.51	1.10	0.39	5.77	18.56	20.01
5.408	-0.927	294.85	286.61	8.25	10.291	8.03	13141	0.696	4830	46.29	32.68	1.10	0.39	5.77	16.64	18.25
6.678	-0.978	295.98	287.74	8.25	10.287	8.06	13108	0.695	4819	46.04	32.52	1.10	0.40	5.77	16.68	18.29
7.313	-0.978	296.11	288.30	7.81	10.285	8.08	13091	0.695	5062	48.31	33.69	1.10	0.42	5.77	17.42	18.96

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	63.13	53.16	9.98	1493.5	26.18	13192	0.696	1264.8	69.08	43.65	1.98	0.71	5.77	22.84	24.03
1.639	-0.010	66.19	54.21	11.98	1493.2	26.23	13174	0.696	1056.7	57.63	38.38	1.98	0.70	5.77	19.60	20.98
2.129	-0.028	69.90	56.21	13.69	1492.6	26.34	13141	0.696	922.6	50.17	34.68	1.98	0.71	5.77	17.66	19.18
2.639	0.000	71.93	58.28	13.65	1492.0	26.45	13107	0.695	923.3	50.06	34.59	1.98	0.73	5.77	17.75	19.27
2.854	0.000	72.26	59.15	13.11	1491.8	26.50	13093	0.695	957.8	51.88	35.50	1.98	0.75	5.77	18.37	19.84
1.404	0.375	63.94	53.26	10.68	1493.4	26.18	13190	0.696	1181.9	64.55	41.62	1.98	0.71	5.77	21.55	22.82
1.644	0.365	66.75	54.23	12.52	1493.2	26.24	13174	0.696	1011.0	55.14	37.18	1.98	0.70	5.77	18.92	20.35
2.114	0.375	70.20	56.15	14.06	1492.6	26.34	13142	0.696	898.8	48.89	34.03	1.98	0.70	5.77	17.32	18.87
2.639	0.365	72.40	58.28	14.13	1492.0	26.45	13107	0.695	892.3	48.38	33.74	1.98	0.73	5.77	17.31	18.86
2.879	0.360	72.67	59.25	13.42	1491.8	26.51	13091	0.695	934.9	50.63	34.87	1.98	0.75	5.77	18.05	19.54
1.389	-0.375	64.62	53.19	11.43	1493.4	26.18	13191	0.696	1104.8	60.34	39.68	1.98	0.71	5.77	20.39	21.72
1.619	-0.360	66.96	54.13	12.83	1493.2	26.23	13176	0.696	985.8	53.78	36.51	1.98	0.70	5.77	18.56	20.01
2.129	-0.365	71.05	56.21	14.84	1492.6	26.34	13141	0.696	851.0	46.29	32.68	1.98	0.71	5.77	16.64	18.25
2.629	-0.385	73.08	58.24	14.85	1492.1	26.45	13108	0.695	849.1	46.04	32.52	1.98	0.73	5.77	16.68	18.29
2.879	-0.385	73.31	59.25	14.07	1491.8	26.51	13091	0.695	891.9	48.31	33.69	1.98	0.75	5.77	17.42	18.96

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 7
Date: 6 January 1992
Time: 15:32:10

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.93	42.39	285.11	53.51	16.36	0.01002	10.307	1494.8	74.16	10.76	9.30	407	11.48	13.88	12.22

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	280.31	44.86
1.702	0.670	0.001	0.000	280.56	45.31
9.093	3.580	0.001	0.000	286.65	56.28
10.706	4.215	0.001	0.000	286.19	55.45

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	284.70	280.92	3.78	10.281	12.02	20298	0.696	10491	102.02	56.99	1.10	0.38	5.77	33.26	34.09
4.163	-0.025	285.86	281.31	4.56	10.276	12.04	20280	0.696	8716	84.67	50.33	1.10	0.37	5.77	28.34	29.31
5.408	-0.071	287.27	282.03	5.24	10.267	12.08	20247	0.696	7572	73.43	45.64	1.10	0.37	5.77	25.37	26.45
6.703	0.001	288.02	282.79	5.23	10.258	12.12	20212	0.696	7559	73.15	45.49	1.10	0.38	5.77	25.44	26.52
7.249	0.001	288.14	283.10	5.04	10.254	12.14	20198	0.696	7823	75.65	46.55	1.10	0.39	5.77	26.27	27.32
3.566	0.953	285.11	280.96	4.15	10.281	12.02	20296	0.696	9560	92.95	53.59	1.10	0.38	5.77	30.70	31.60
4.176	0.927	286.21	281.32	4.89	10.276	12.04	20280	0.696	8121	78.89	47.97	1.10	0.37	5.77	26.78	27.80
5.370	0.953	287.48	282.01	5.46	10.267	12.08	20248	0.696	7255	70.35	44.30	1.10	0.37	5.77	24.56	25.68
6.703	0.927	288.32	282.79	5.53	10.258	12.12	20212	0.696	7154	69.23	43.79	1.10	0.38	5.77	24.41	25.53
7.313	0.914	288.40	283.14	5.26	10.253	12.14	20196	0.696	7479	72.32	45.12	1.10	0.39	5.77	25.40	26.48
3.528	-0.953	285.40	280.94	4.46	10.281	12.02	20297	0.696	8880	86.35	51.02	1.10	0.38	5.77	28.90	29.85
4.112	-0.914	286.28	281.28	5.00	10.277	12.04	20282	0.696	7938	77.13	47.24	1.10	0.38	5.77	26.31	27.35
5.408	-0.927	287.84	282.03	5.81	10.267	12.08	20247	0.696	6826	66.19	42.46	1.10	0.37	5.77	23.48	24.65
6.678	-0.978	288.63	282.77	5.86	10.258	12.12	20213	0.696	6753	65.36	42.06	1.10	0.38	5.77	23.39	24.56
7.313	-0.978	288.70	283.14	5.56	10.253	12.14	20196	0.696	7086	68.52	43.46	1.10	0.39	5.77	24.38	25.51

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	52.77	45.98	6.80	1491.1	39.43	20298	0.696	1848.5	102.02	56.99	1.98	0.69	5.77	33.26	34.09
1.639	-0.010	54.87	46.67	8.20	1490.4	39.49	20280	0.696	1535.8	84.67	50.33	1.98	0.67	5.77	28.34	29.31
2.129	-0.028	57.39	47.97	9.42	1489.1	39.63	20247	0.696	1334.2	73.43	45.64	1.98	0.67	5.77	25.37	26.45
2.639	0.000	58.75	49.33	9.42	1487.7	39.76	20212	0.696	1331.9	73.15	45.49	1.98	0.69	5.77	25.44	26.52
2.854	0.000	58.96	49.90	9.06	1487.2	39.82	20198	0.696	1378.4	75.65	46.55	1.98	0.71	5.77	26.27	27.32
1.404	0.375	53.50	46.04	7.46	1491.1	39.43	20296	0.696	1684.5	92.95	53.59	1.98	0.69	5.77	30.70	31.60
1.644	0.365	55.48	46.68	8.80	1490.4	39.50	20280	0.696	1430.9	78.89	47.97	1.98	0.67	5.77	26.78	27.80
2.114	0.375	57.77	47.93	9.84	1489.2	39.62	20248	0.696	1278.3	70.35	44.30	1.98	0.67	5.77	24.56	25.68
2.639	0.365	59.28	49.33	9.95	1487.7	39.76	20212	0.696	1260.5	69.23	43.79	1.98	0.69	5.77	24.41	25.53
2.879	0.360	59.44	49.96	9.48	1487.1	39.83	20196	0.696	1317.8	72.32	45.12	1.98	0.71	5.77	25.40	26.48
1.389	-0.375	54.03	46.00	8.03	1491.1	39.43	20297	0.696	1564.7	86.35	51.02	1.98	0.69	5.77	28.90	29.85
1.619	-0.360	55.62	46.61	9.00	1490.5	39.49	20282	0.696	1398.7	77.13	47.24	1.98	0.67	5.77	26.31	27.35
2.129	-0.365	58.42	47.97	10.45	1489.1	39.63	20247	0.696	1202.7	66.19	42.46	1.98	0.67	5.77	23.48	24.65
2.629	-0.385	59.84	49.30	10.54	1487.8	39.76	20213	0.696	1189.9	65.36	42.06	1.98	0.69	5.77	23.39	24.56
2.879	-0.385	59.96	49.96	10.00	1487.1	39.83	20196	0.696	1248.6	68.52	43.46	1.98	0.71	5.77	24.38	25.51

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 8
Date: 6 January 1992
Time: 15:32:36

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.76	42.07	284.95	53.23	16.37	0.01002	10.308	1495.0	74.11	10.75	9.30	409	11.44	13.94	12.28

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	280.11	44.51
1.702	0.670	0.001	0.000	280.36	44.95
9.093	3.580	0.001	0.000	286.45	55.92
10.706	4.215	0.001	0.000	286.00	55.11

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	284.52	280.75	3.76	10.282	12.01	20313	0.696	10567	102.80	57.28	1.10	0.38	5.77	33.35	34.18
4.163	-0.025	285.67	281.14	4.53	10.278	12.03	20295	0.696	8799	85.52	50.68	1.10	0.37	5.77	28.46	29.42
5.408	-0.071	287.07	281.87	5.20	10.269	12.07	20262	0.696	7645	74.16	45.96	1.10	0.37	5.77	25.47	26.55
6.703	0.001	287.83	282.62	5.21	10.259	12.12	20227	0.696	7623	73.80	45.78	1.10	0.38	5.77	25.52	26.60
7.249	0.001	287.96	282.94	5.02	10.255	12.13	20212	0.696	7882	76.26	46.81	1.10	0.39	5.77	26.34	27.38
3.566	0.953	284.92	280.79	4.13	10.282	12.02	20311	0.696	9631	93.69	53.88	1.10	0.38	5.77	30.79	31.69
4.176	0.927	286.01	281.15	4.86	10.278	12.03	20295	0.696	8201	79.70	48.31	1.10	0.37	5.77	26.89	27.91
5.370	0.953	287.29	281.85	5.45	10.269	12.07	20263	0.696	7305	70.87	44.54	1.10	0.37	5.77	24.60	25.72
6.703	0.927	288.11	282.62	5.49	10.259	12.12	20227	0.696	7233	70.03	44.14	1.10	0.38	5.77	24.52	25.64
7.313	0.914	288.21	282.98	5.24	10.255	12.14	20211	0.696	7542	72.96	45.41	1.10	0.39	5.77	25.48	26.55
3.528	-0.953	285.21	280.77	4.44	10.282	12.01	20312	0.696	8956	87.13	51.34	1.10	0.38	5.77	29.00	29.95
4.112	-0.914	286.09	281.11	4.98	10.278	12.03	20296	0.696	7999	77.75	47.51	1.10	0.38	5.77	26.37	27.41
5.408	-0.927	287.65	281.87	5.78	10.269	12.07	20262	0.696	6878	66.72	42.70	1.10	0.37	5.77	23.53	24.69
6.678	-0.978	288.44	282.61	5.83	10.259	12.11	20228	0.696	6803	65.87	42.29	1.10	0.38	5.77	23.44	24.60
7.313	-0.978	288.49	282.98	5.51	10.255	12.14	20211	0.696	7166	69.32	43.82	1.10	0.39	5.77	24.51	25.62

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	52.44	45.67	6.77	1491.3	39.41	20313	0.696	1861.9	102.80	57.28	1.98	0.69	5.77	33.35	34.18
1.639	-0.010	54.52	46.36	8.15	1490.6	39.48	20295	0.696	1550.4	85.52	50.68	1.98	0.67	5.77	28.46	29.42
2.129	-0.028	57.04	47.67	9.37	1489.3	39.61	20262	0.696	1347.0	74.16	45.96	1.98	0.67	5.77	25.47	26.55
2.639	0.000	58.41	49.03	9.37	1488.0	39.75	20227	0.696	1343.2	73.80	45.78	1.98	0.69	5.77	25.52	26.60
2.854	0.000	58.63	49.60	9.03	1487.4	39.81	20212	0.696	1388.8	76.26	46.81	1.98	0.71	5.77	26.34	27.38
1.404	0.375	53.17	45.74	7.43	1491.3	39.42	20311	0.696	1697.0	93.69	53.88	1.98	0.69	5.77	30.79	31.69
1.644	0.365	55.12	46.38	8.75	1490.6	39.48	20295	0.696	1445.0	79.70	48.31	1.98	0.67	5.77	26.89	27.91
2.114	0.375	57.44	47.63	9.80	1489.4	39.61	20263	0.696	1287.1	70.87	44.54	1.98	0.67	5.77	24.60	25.72
2.639	0.365	58.91	49.03	9.88	1488.0	39.75	20227	0.696	1274.5	70.03	44.14	1.98	0.69	5.77	24.52	25.64
2.879	0.360	59.10	49.67	9.43	1487.3	39.81	20211	0.696	1328.9	72.96	45.41	1.98	0.71	5.77	25.48	26.55
1.389	-0.375	53.68	45.70	7.99	1491.3	39.41	20312	0.696	1578.0	87.13	51.34	1.98	0.69	5.77	29.00	29.95
1.619	-0.360	55.28	46.31	8.97	1490.7	39.47	20296	0.696	1409.4	77.75	47.51	1.98	0.67	5.77	26.37	27.41
2.129	-0.365	58.08	47.67	10.41	1489.3	39.61	20262	0.696	1211.9	66.72	42.70	1.98	0.67	5.77	23.53	24.69
2.629	-0.385	59.51	49.01	10.50	1488.0	39.75	20228	0.696	1198.7	65.87	42.29	1.98	0.69	5.77	23.44	24.60
2.879	-0.385	59.59	49.67	9.92	1487.3	39.81	20211	0.696	1262.6	69.32	43.82	1.98	0.71	5.77	24.51	25.62

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 9
Date: 6 January 1992
Time: 15:33:01

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.56	41.73	284.76	52.89	16.38	0.01003	10.308	1495.1	73.97	10.73	9.32	409	11.44	13.94	12.28

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	279.95	44.22
1.702	0.670	0.001	0.000	280.17	44.62
9.093	3.580	0.001	0.000	286.28	55.61
10.706	4.215	0.001	0.000	285.83	54.80

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	284.32	280.56	3.76	10.283	12.01	20332	0.696	10585	103.03	57.37	1.10	0.38	5.77	33.38	34.21
4.163	-0.025	285.48	280.95	4.53	10.278	12.03	20314	0.696	8808	85.65	50.74	1.10	0.37	5.77	28.47	29.44
5.408	-0.071	286.89	281.67	5.21	10.269	12.07	20281	0.696	7635	74.10	45.94	1.10	0.37	5.77	25.43	26.51
6.703	0.001	287.64	282.43	5.21	10.259	12.11	20246	0.696	7628	73.89	45.82	1.10	0.38	5.77	25.52	26.60
7.249	0.001	287.77	282.75	5.02	10.255	12.13	20232	0.696	7883	76.30	46.83	1.10	0.39	5.77	26.33	27.37
3.566	0.953	284.73	280.60	4.13	10.282	12.01	20330	0.696	9633	93.76	53.92	1.10	0.38	5.77	30.78	31.68
4.176	0.927	285.83	280.95	4.88	10.278	12.03	20314	0.696	8172	79.46	48.22	1.10	0.37	5.77	26.80	27.83
5.370	0.953	287.08	281.65	5.43	10.269	12.07	20282	0.696	7333	71.17	44.68	1.10	0.37	5.77	24.66	25.77
6.703	0.927	287.94	282.43	5.51	10.259	12.11	20246	0.696	7211	69.86	44.08	1.10	0.38	5.77	24.46	25.58
7.313	0.914	288.03	282.79	5.24	10.255	12.13	20230	0.696	7539	72.96	45.41	1.10	0.39	5.77	25.46	26.54
3.528	-0.953	285.02	280.58	4.45	10.283	12.01	20331	0.696	8942	87.04	51.31	1.10	0.38	5.77	28.95	29.90
4.112	-0.914	285.92	280.92	5.00	10.278	12.03	20316	0.696	7969	77.50	47.41	1.10	0.38	5.77	26.29	27.33
5.408	-0.927	287.47	281.67	5.79	10.269	12.07	20281	0.696	6873	66.71	42.70	1.10	0.37	5.77	23.51	24.67
6.678	-0.978	288.28	282.42	5.86	10.260	12.11	20247	0.696	6775	65.63	42.19	1.10	0.38	5.77	23.36	24.53
7.313	-0.978	288.33	282.79	5.54	10.255	12.13	20230	0.696	7129	69.00	43.69	1.10	0.39	5.77	24.40	25.53

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	52.09	45.32	6.76	1491.4	39.40	20332	0.696	1865.1	103.03	57.37	1.98	0.69	5.77	33.38	34.21
1.639	-0.010	54.17	46.02	8.15	1490.7	39.47	20314	0.696	1552.0	85.65	50.74	1.98	0.67	5.77	28.47	29.44
2.129	-0.028	56.71	47.33	9.39	1489.4	39.61	20281	0.696	1345.3	74.10	45.94	1.98	0.67	5.77	25.43	26.51
2.639	0.000	58.06	48.69	9.37	1488.0	39.74	20246	0.696	1344.1	73.89	45.82	1.98	0.69	5.77	25.52	26.60
2.854	0.000	58.29	49.26	9.03	1487.4	39.80	20232	0.696	1389.0	76.30	46.83	1.98	0.71	5.77	26.33	27.37
1.404	0.375	52.83	45.39	7.44	1491.3	39.41	20330	0.696	1697.3	93.76	53.92	1.98	0.69	5.77	30.78	31.68
1.644	0.365	54.81	46.03	8.78	1490.7	39.47	20314	0.696	1439.9	79.46	48.22	1.98	0.67	5.77	26.80	27.83
2.114	0.375	57.06	47.29	9.77	1489.4	39.60	20282	0.696	1292.1	71.17	44.68	1.98	0.67	5.77	24.66	25.77
2.639	0.365	58.60	48.69	9.91	1488.0	39.74	20246	0.696	1270.6	69.86	44.08	1.98	0.69	5.77	24.46	25.58
2.879	0.360	58.76	49.33	9.44	1487.4	39.81	20230	0.696	1328.4	72.96	45.41	1.98	0.71	5.77	25.46	26.54
1.389	-0.375	53.36	45.35	8.01	1491.4	39.41	20331	0.696	1575.6	87.04	51.31	1.98	0.69	5.77	28.95	29.90
1.619	-0.360	54.97	45.96	9.01	1490.7	39.47	20316	0.696	1404.1	77.50	47.41	1.98	0.67	5.77	26.29	27.33
2.129	-0.365	57.75	47.33	10.43	1489.4	39.61	20281	0.696	1211.0	66.71	42.70	1.98	0.67	5.77	23.51	24.67
2.629	-0.385	59.21	48.66	10.55	1488.0	39.74	20247	0.696	1193.8	65.63	42.19	1.98	0.69	5.77	23.36	24.53
2.879	-0.385	59.31	49.33	9.98	1487.4	39.81	20230	0.696	1256.1	69.00	43.69	1.98	0.71	5.77	24.40	25.53

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 10
Date: 6 January 1992
Time: 15:39:05

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.58	38.15	282.77	49.30	16.46	0.01008	10.325	1497.6	73.29	10.63	9.41	411	11.45	14.01	12.34

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	278.04	40.78
1.702	0.670	0.001	0.000	278.30	41.24
9.093	3.580	0.001	0.000	284.38	52.20
10.706	4.215	0.001	0.000	283.95	51.42

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.45	278.57	3.88	10.300	11.97	20530	0.696	10303	100.80	56.66	1.10	0.38	5.77	32.50	33.35
4.163	-0.025	283.60	278.96	4.65	10.295	11.99	20512	0.696	8616	84.21	50.25	1.10	0.37	5.77	27.87	28.86
5.408	-0.071	285.00	279.68	5.31	10.286	12.03	20478	0.696	7522	73.38	45.70	1.10	0.37	5.77	25.07	26.17
6.703	0.001	285.77	280.44	5.33	10.277	12.07	20443	0.696	7486	72.89	45.47	1.10	0.38	5.77	25.08	26.18
7.249	0.001	285.89	280.76	5.13	10.273	12.09	20428	0.696	7737	75.27	46.47	1.10	0.39	5.77	25.87	26.93
3.566	0.953	282.85	278.61	4.24	10.300	11.97	20528	0.696	9424	92.19	53.41	1.10	0.38	5.77	30.12	31.04
4.176	0.927	283.96	278.96	5.00	10.295	11.99	20511	0.696	8013	78.31	47.82	1.10	0.37	5.77	26.31	27.36
5.370	0.953	285.23	279.66	5.57	10.287	12.03	20479	0.696	7181	70.05	44.25	1.10	0.37	5.77	24.21	25.34
6.703	0.927	286.07	280.44	5.63	10.277	12.07	20443	0.696	7087	69.00	43.76	1.10	0.38	5.77	24.07	25.21
7.313	0.914	286.16	280.79	5.37	10.273	12.09	20426	0.696	7393	71.92	45.03	1.10	0.39	5.77	25.01	26.10
3.528	-0.953	283.18	278.59	4.59	10.300	11.97	20529	0.696	8695	85.07	50.61	1.10	0.38	5.77	28.20	29.18
4.112	-0.914	284.07	278.93	5.14	10.296	11.99	20513	0.696	7788	76.12	46.90	1.10	0.38	5.77	25.74	26.81
5.408	-0.927	285.61	279.68	5.93	10.286	12.03	20478	0.696	6744	65.79	42.35	1.10	0.37	5.77	23.13	24.31
6.678	-0.978	286.40	280.42	5.98	10.277	12.07	20444	0.696	6674	64.98	41.96	1.10	0.38	5.77	23.04	24.23
7.313	-0.978	286.46	280.79	5.67	10.273	12.09	20426	0.696	7002	68.11	43.36	1.10	0.39	5.77	24.01	25.15

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.72	41.74	6.98	1493.9	39.27	20530	0.696	1815.4	100.80	56.66	1.98	0.69	5.77	32.50	33.35
1.639	-0.010	50.80	42.43	8.36	1493.2	39.34	20512	0.696	1518.1	84.21	50.25	1.98	0.67	5.77	27.87	28.86
2.129	-0.028	53.31	43.74	9.56	1491.9	39.47	20478	0.696	1325.4	73.38	45.70	1.98	0.67	5.77	25.07	26.17
2.639	0.000	54.69	45.10	9.59	1490.5	39.61	20443	0.696	1319.0	72.89	45.47	1.98	0.69	5.77	25.08	26.18
2.854	0.000	54.91	45.67	9.24	1490.0	39.67	20428	0.696	1363.3	75.27	46.47	1.98	0.71	5.77	25.87	26.93
1.404	0.375	49.44	41.81	7.63	1493.8	39.28	20528	0.696	1660.5	92.19	53.41	1.98	0.69	5.77	30.12	31.04
1.644	0.365	51.44	42.45	8.99	1493.2	39.34	20511	0.696	1411.9	78.31	47.82	1.98	0.67	5.77	26.31	27.36
2.114	0.375	53.72	43.70	10.02	1491.9	39.47	20479	0.696	1265.3	70.05	44.25	1.98	0.67	5.77	24.21	25.34
2.639	0.365	55.23	45.10	10.13	1490.5	39.61	20443	0.696	1248.7	69.00	43.76	1.98	0.69	5.77	24.07	25.21
2.879	0.360	55.40	45.74	9.66	1489.9	39.67	20426	0.696	1302.6	71.92	45.03	1.98	0.71	5.77	25.01	26.10
1.389	-0.375	50.04	41.77	8.27	1493.9	39.27	20529	0.696	1532.1	85.07	50.61	1.98	0.69	5.77	28.20	29.18
1.619	-0.360	51.63	42.38	9.25	1493.3	39.34	20513	0.696	1372.2	76.12	46.90	1.98	0.67	5.77	25.74	26.81
2.129	-0.365	54.41	43.74	10.67	1491.9	39.47	20478	0.696	1188.3	65.79	42.35	1.98	0.67	5.77	23.13	24.31
2.629	-0.385	55.83	45.08	10.76	1490.6	39.61	20444	0.696	1176.0	64.98	41.96	1.98	0.69	5.77	23.04	24.23
2.879	-0.385	55.94	45.74	10.20	1489.9	39.67	20426	0.696	1233.8	68.11	43.36	1.98	0.71	5.77	24.01	25.15

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 11
Date: 6 January 1992
Time: 15:39:30

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.47	37.95	282.68	49.14	16.48	0.01009	10.326	1497.7	73.18	10.61	9.42	413	11.40	14.08	12.40

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	277.93	40.58
1.702	0.670	0.001	0.000	278.19	41.06
9.093	3.580	0.001	0.000	284.28	52.01
10.706	4.215	0.001	0.000	283.83	51.21

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.34	278.47	3.87	10.301	11.98	20559	0.696	10374	101.52	56.93	1.10	0.38	5.77	32.54	33.39
4.163	-0.025	283.49	278.86	4.63	10.296	12.00	20541	0.696	8690	84.96	50.55	1.10	0.38	5.77	27.94	28.93
5.408	-0.071	284.89	279.59	5.30	10.287	12.04	20507	0.696	7572	73.88	45.92	1.10	0.37	5.77	25.09	26.18
6.703	0.001	285.65	280.34	5.30	10.278	12.08	20471	0.696	7557	73.60	45.78	1.10	0.38	5.77	25.15	26.24
7.249	0.001	285.77	280.66	5.10	10.274	12.10	20457	0.696	7822	76.11	46.83	1.10	0.39	5.77	25.97	27.03
3.566	0.953	282.74	278.51	4.23	10.301	11.98	20557	0.696	9488	92.84	53.66	1.10	0.38	5.77	30.15	31.07
4.176	0.927	283.84	278.86	4.97	10.296	12.00	20540	0.696	8088	79.07	48.14	1.10	0.37	5.77	26.39	27.43
5.370	0.953	285.12	279.57	5.56	10.288	12.04	20508	0.696	7227	70.52	44.46	1.10	0.37	5.77	24.22	25.35
6.703	0.927	285.95	280.34	5.61	10.278	12.08	20471	0.696	7148	69.61	44.04	1.10	0.38	5.77	24.12	25.26
7.313	0.914	286.06	280.70	5.36	10.274	12.10	20455	0.696	7443	72.42	45.25	1.10	0.39	5.77	25.02	26.12
3.528	-0.953	283.06	278.49	4.57	10.301	11.98	20558	0.696	8781	85.93	50.96	1.10	0.38	5.77	28.30	29.27
4.112	-0.914	283.94	278.83	5.11	10.297	12.00	20542	0.696	7868	76.92	47.24	1.10	0.38	5.77	25.83	26.89
5.408	-0.927	285.50	279.59	5.92	10.287	12.04	20507	0.696	6789	66.25	42.56	1.10	0.37	5.77	23.14	24.32
6.678	-0.978	286.29	280.33	5.96	10.278	12.08	20472	0.696	6724	65.49	42.19	1.10	0.38	5.77	23.06	24.25
7.313	-0.978	286.35	280.70	5.65	10.274	12.10	20455	0.696	7058	68.67	43.61	1.10	0.39	5.77	24.04	25.18

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.52	41.56	6.96	1494.1	39.30	20559	0.696	1827.9	101.52	56.93	1.98	0.69	5.77	32.54	33.39
1.639	-0.010	50.59	42.26	8.33	1493.4	39.37	20541	0.696	1531.2	84.96	50.55	1.98	0.67	5.77	27.94	28.93
2.129	-0.028	53.12	43.57	9.55	1492.1	39.50	20507	0.696	1334.2	73.88	45.92	1.98	0.67	5.77	25.09	26.18
2.639	0.000	54.48	44.93	9.55	1490.7	39.64	20471	0.696	1331.5	73.60	45.78	1.98	0.69	5.77	25.15	26.24
2.854	0.000	54.69	45.50	9.19	1490.1	39.70	20457	0.696	1378.2	76.11	46.83	1.98	0.71	5.77	25.97	27.03
1.404	0.375	49.24	41.63	7.62	1494.0	39.31	20557	0.696	1671.8	92.84	53.66	1.98	0.69	5.77	30.15	31.07
1.644	0.365	51.22	42.27	8.95	1493.4	39.37	20540	0.696	1425.1	79.07	48.14	1.98	0.67	5.77	26.39	27.43
2.114	0.375	53.53	43.53	10.00	1492.1	39.50	20508	0.696	1273.4	70.52	44.46	1.98	0.67	5.77	24.22	25.35
2.639	0.365	55.02	44.93	10.09	1490.7	39.64	20471	0.696	1259.5	69.61	44.04	1.98	0.69	5.77	24.12	25.26
2.879	0.360	55.22	45.57	9.65	1490.1	39.70	20455	0.696	1311.5	72.42	45.25	1.98	0.71	5.77	25.02	26.12
1.389	-0.375	49.81	41.59	8.23	1494.0	39.30	20558	0.696	1547.2	85.93	50.96	1.98	0.69	5.77	28.30	29.27
1.619	-0.360	51.41	42.20	9.20	1493.4	39.37	20542	0.696	1386.3	76.92	47.24	1.98	0.67	5.77	25.83	26.89
2.129	-0.365	54.22	43.57	10.65	1492.1	39.50	20507	0.696	1196.2	66.25	42.56	1.98	0.67	5.77	23.14	24.32
2.629	-0.385	55.63	44.90	10.73	1490.7	39.64	20472	0.696	1184.8	65.49	42.19	1.98	0.69	5.77	23.06	24.25
2.879	-0.385	55.74	45.57	10.17	1490.1	39.70	20455	0.696	1243.6	68.67	43.61	1.98	0.71	5.77	24.04	25.18

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 12
Date: 6 January 1992
Time: 15:39:56

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.37	37.79	282.57	48.94	16.49	0.01010	10.328	1498.0	73.09	10.60	9.43	412	11.44	14.05	12.37

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	277.85	40.44
1.702	0.670	0.001	0.000	278.10	40.90
9.093	3.580	0.001	0.000	284.19	51.85
10.706	4.215	0.001	0.000	283.75	51.06

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.24	278.37	3.86	10.303	11.98	20573	0.696	10360	101.40	56.89	1.10	0.38	5.77	32.58	33.43
4.163	-0.025	283.39	278.76	4.63	10.298	12.00	20554	0.696	8663	84.71	50.45	1.10	0.37	5.77	27.94	28.92
5.408	-0.071	284.80	279.48	5.31	10.289	12.04	20520	0.696	7543	73.62	45.81	1.10	0.37	5.77	25.07	26.17
6.703	0.001	285.55	280.24	5.31	10.280	12.08	20485	0.696	7531	73.37	45.68	1.10	0.38	5.77	25.15	26.24
7.249	0.001	285.68	280.56	5.12	10.276	12.10	20470	0.696	7774	75.67	46.65	1.10	0.39	5.77	25.91	26.97
3.566	0.953	282.65	278.41	4.24	10.303	11.98	20571	0.696	9445	92.44	53.51	1.10	0.38	5.77	30.11	31.03
4.176	0.927	283.76	278.77	5.00	10.298	12.00	20554	0.696	8034	78.56	47.93	1.10	0.37	5.77	26.31	27.35
5.370	0.953	285.04	279.46	5.57	10.290	12.04	20521	0.696	7187	70.15	44.31	1.10	0.37	5.77	24.17	25.31
6.703	0.927	285.86	280.24	5.63	10.280	12.08	20485	0.696	7107	69.24	43.88	1.10	0.38	5.77	24.08	25.21
7.313	0.914	285.96	280.59	5.36	10.276	12.10	20469	0.696	7420	72.21	45.16	1.10	0.39	5.77	25.02	26.12
3.528	-0.953	282.97	278.39	4.58	10.303	11.98	20572	0.696	8738	85.52	50.79	1.10	0.38	5.77	28.25	29.23
4.112	-0.914	283.84	278.73	5.11	10.299	12.00	20556	0.696	7849	76.76	47.18	1.10	0.38	5.77	25.84	26.90
5.408	-0.927	285.41	279.48	5.92	10.289	12.04	20520	0.696	6767	66.04	42.47	1.10	0.37	5.77	23.14	24.32
6.678	-0.978	286.20	280.23	5.98	10.280	12.08	20486	0.696	6687	65.14	42.04	1.10	0.38	5.77	23.03	24.21
7.313	-0.978	286.27	280.59	5.67	10.276	12.10	20469	0.696	7016	68.28	43.44	1.10	0.39	5.77	24.00	25.14

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.34	41.38	6.96	1494.3	39.30	20573	0.696	1825.4	101.40	56.89	1.98	0.69	5.77	32.58	33.43
1.639	-0.010	50.42	42.08	8.34	1493.6	39.37	20554	0.696	1526.4	84.71	50.45	1.98	0.67	5.77	27.94	28.92
2.129	-0.028	52.95	43.38	9.56	1492.4	39.50	20520	0.696	1329.1	73.62	45.81	1.98	0.67	5.77	25.07	26.17
2.639	0.000	54.30	44.74	9.55	1491.0	39.64	20485	0.696	1327.0	73.37	45.68	1.98	0.69	5.77	25.15	26.24
2.854	0.000	54.54	45.31	9.22	1490.4	39.69	20470	0.696	1369.8	75.67	46.65	1.98	0.71	5.77	25.91	26.97
1.404	0.375	49.08	41.45	7.63	1494.3	39.30	20571	0.696	1664.2	92.44	53.51	1.98	0.69	5.77	30.11	31.03
1.644	0.365	51.08	42.09	8.99	1493.6	39.37	20554	0.696	1415.6	78.56	47.93	1.98	0.67	5.77	26.31	27.35
2.114	0.375	53.38	43.35	10.03	1492.4	39.49	20521	0.696	1266.3	70.15	44.31	1.98	0.67	5.77	24.17	25.31
2.639	0.365	54.87	44.74	10.13	1491.0	39.64	20485	0.696	1252.3	69.24	43.88	1.98	0.69	5.77	24.08	25.21
2.879	0.360	55.03	45.38	9.65	1490.4	39.70	20469	0.696	1307.4	72.21	45.16	1.98	0.71	5.77	25.02	26.12
1.389	-0.375	49.66	41.41	8.25	1494.3	39.30	20572	0.696	1539.6	85.52	50.79	1.98	0.69	5.77	28.25	29.23
1.619	-0.360	51.23	42.02	9.20	1493.7	39.36	20556	0.696	1383.0	76.76	47.18	1.98	0.67	5.77	25.84	26.90
2.129	-0.365	54.04	43.38	10.66	1492.4	39.50	20520	0.696	1192.3	66.04	42.47	1.98	0.67	5.77	23.14	24.32
2.629	-0.385	55.48	44.72	10.76	1491.0	39.63	20486	0.696	1178.2	65.14	42.04	1.98	0.69	5.77	23.03	24.21
2.879	-0.385	55.59	45.38	10.21	1490.4	39.70	20469	0.696	1236.2	68.28	43.44	1.98	0.71	5.77	24.00	25.14

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 13
Date: 6 January 1992
Time: 15:48:16

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.93	31.58	282.18	48.23	11.13	0.00681	10.378	1505.2	29.33	4.25	23.51	416	7.67	14.18	12.49

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.75	36.67
1.702	0.670	0.001	0.000	276.18	37.44
9.093	3.580	0.001	0.000	285.03	53.37
10.706	4.215	0.001	0.000	284.52	52.44

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.5[illegible]	[illegible].001	281.91	275.91	6.00	10.368	7.97	13961	0.696	6737	66.35	42.72	1.10	0.40	5.77	21.41	22.68
4.1[illegible]	[illegible].025	283.59	276.48	7.11	10.366	7.99	13943	0.696	5704	56.10	37.89	1.10	0.39	5.77	18.66	20.11
5.40[illegible]	-0.071	285.67	277.57	8.10	10.362	8.02	13908	0.696	4997	49.01	34.29	1.10	0.39	5.77	16.92	18.51
6.703	0.001	286.78	278.70	8.08	10.359	8.05	13872	0.696	4994	48.84	34.18	1.10	0.40	5.77	16.99	18.57
7.249	0.001	286.96	279.17	7.79	10.357	8.07	13857	0.696	5163	50.42	34.98	1.10	0.41	5.77	17.51	19.04
3.566	0.953	282.42	275.96	6.46	10.368	7.97	13960	0.696	6261	61.66	40.56	1.10	0.40	5.77	20.15	21.50
4.176	0.927	284.01	276.50	7.52	10.366	7.99	13943	0.696	5391	53.01	36.35	1.10	0.39	5.77	17.87	19.37
5.370	0.953	285.92	277.54	8.39	10.362	8.02	13909	0.696	4824	47.32	33.42	1.10	0.39	5.77	16.50	18.12
6.703	0.927	287.15	278.70	8.46	10.359	8.05	13872	0.696	4773	46.68	33.05	1.10	0.40	5.77	16.45	18.07
7.313	0.914	287.29	279.23	8.07	10.357	8.07	13855	0.696	4980	48.63	34.06	1.10	0.42	5.77	17.07	18.64
3.528	-0.953	282.89	275.93	6.96	10.368	7.97	13961	0.696	5810	57.22	38.45	1.10	0.40	5.77	19.00	20.42
4.112	-0.914	284.21	276.44	7.77	10.366	7.98	13944	0.696	5215	51.29	35.49	1.10	0.39	5.77	17.43	18.97
5.408	-0.927	286.48	277.57	8.91	10.362	8.02	13908	0.696	4540	44.53	31.93	1.10	0.39	5.77	15.81	17.50
6.678	-0.978	287.58	278.67	8.91	10.359	8.05	13873	0.696	4533	44.33	31.80	1.10	0.40	5.77	15.86	17.54
7.313	-0.978	287.74	279.23	8.51	10.357	8.07	13855	0.696	4721	46.10	32.73	1.10	0.42	5.77	16.42	18.05

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	47.75	36.95	10.80	1503.7	26.14	13961	0.696	1187.1	66.35	42.72	1.98	0.71	5.77	21.41	22.68
1.639	-0.010	50.77	37.98	12.79	1503.5	26.20	13943	0.696	1005.0	56.10	37.89	1.98	0.70	5.77	18.66	20.11
2.129	-0.028	54.51	39.94	14.57	1502.9	26.31	13908	0.696	880.5	49.01	34.29	1.98	0.70	5.77	16.92	18.51
2.639	0.000	56.52	41.97	14.55	1502.4	26.42	13872	0.696	879.9	48.84	34.18	1.98	0.73	5.77	16.99	18.57
2.854	0.000	56.84	42.82	14.02	1502.2	26.47	13857	0.696	909.7	50.42	34.98	1.98	0.75	5.77	17.51	19.04
1.404	0.375	48.67	37.05	11.63	1503.7	26.14	13960	0.696	1103.2	61.66	40.56	1.98	0.71	5.77	20.15	21.50
1.644	0.365	51.54	38.00	13.53	1503.5	26.20	13943	0.696	949.9	53.01	36.35	1.98	0.70	5.77	17.87	19.37
2.114	0.375	54.98	39.88	15.10	1503.0	26.30	13909	0.696	850.0	47.32	33.42	1.98	0.70	5.77	16.50	18.12
2.639	0.365	57.19	41.97	15.22	1502.4	26.42	13872	0.696	841.0	46.68	33.05	1.98	0.73	5.77	16.45	18.07
2.879	0.360	57.44	42.92	14.52	1502.1	26.47	13855	0.696	877.5	48 3	34.06	1.98	0.75	5.77	17.07	18.64
1.389	-0.375	49.51	36.99	12.52	1503.7	26.14	13961	0.696	1023.7	57.22	38.45	1.98	0.71	5.77	19.00	20.42
1.619	-0.360	51.89	37.90	13.99	1503.5	26.19	13944	0.696	918.9	51.29	35.49	1.98	0.70	5.77	17.43	18.97
2.129	-0.365	55.98	39.94	16.04	1502.9	26.31	13908	0.696	799.9	44.53	31.93	1.98	0.70	5.77	15.81	17.50
2.629	-0.385	57.96	41.93	16.03	1502.4	26.42	13873	0.696	798.7	44.33	31.80	1.98	0.72	5.77	15.86	17.54
2.879	-0.385	58.24	42.92	15.32	1502.1	26.47	13855	0.696	831.8	46.10	32.73	1.98	0.75	5.77	16.42	18.05

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 14
Date: 6 January 1992
Time: 15:48:41

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.28	32.22	282.54	48.89	11.13	0.00682	10.379	1505.3	29.37	4.26	23.48	417	7.67	14.22	12.52

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.11	37.31
1.702	0.670	0.001	0.000	276.56	38.12
9.093	3.580	0.001	0.000	285.39	54.02
10.706	4.215	0.001	0.000	284.88	53.10

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.29	276.27	6.02	10.369	7.98	13954	0.696	6721	66.14	42.62	1.10	0.40	5.77	21.35	22.62
4.163	-0.025	283.95	276.85	7.10	10.367	8.00	13935	0.696	5712	56.13	37.89	1.10	0.39	5.77	18.66	20.11
5.408	-0.071	286.02	277.93	8.09	10.363	8.03	13900	0.696	5008	49.07	34.32	1.10	0.39	5.77	16.93	18.51
6.703	0.001	287.14	279.06	8.08	10.360	8.06	13864	0.696	5004	48.89	34.20	1.10	0.40	5.77	17.00	18.57
7.249	0.001	287.33	279.53	7.80	10.358	8.08	13849	0.696	5160	50.35	34.94	1.10	0.41	5.77	17.48	19.02
3.566	0.953	282.79	276.32	6.47	10.369	7.98	13952	0.696	6258	61.58	40.51	1.10	0.40	5.77	20.12	21.47
4.176	0.927	284.38	276.86	7.52	10.367	8.00	13935	0.696	5393	52.99	36.34	1.10	0.39	5.77	17.86	19.36
5.370	0.953	286.28	277.90	8.39	10.363	8.03	13901	0.696	4831	47.34	33.42	1.10	0.39	5.77	16.50	18.12
6.703	0.927	287.51	279.06	8.45	10.360	8.06	13864	0.696	4783	46.73	33.07	1.10	0.40	5.77	16.45	18.08
7.313	0.914	287.66	279.59	8.07	10.358	8.08	13847	0.696	4986	48.64	34.06	1.10	0.42	5.77	17.06	18.63
3.528	-0.953	283.28	276.29	6.99	10.369	7.98	13953	0.696	5791	56.98	38.32	1.10	0.40	5.77	18.93	20.36
4.112	-0.914	284.59	276.80	7.79	10.367	8.00	13937	0.696	5209	51.19	35.43	1.10	0.39	5.77	17.40	18.94
5.408	-0.927	286.86	277.93	8.92	10.363	8.03	13900	0.696	4539	44.47	31.89	1.10	0.39	5.77	15.80	17.48
6.678	-0.978	287.96	279.04	8.92	10.360	8.06	13865	0.696	4532	44.28	31.77	1.10	0.40	5.77	15.84	17.52
7.313	-0.978	288.10	279.59	8.52	10.358	8.08	13847	0.696	4724	46.09	32.72	1.10	0.42	5.77	16.41	18.04

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.43	37.60	10.84	1503.9	26.18	13954	0.696	1184.2	66.14	42.62	1.98	0.71	5.77	21.35	22.62
1.639	-0.010	51.42	38.63	12.79	1503.6	26.24	13935	0.696	1006.5	56.13	37.89	1.98	0.70	5.77	18.66	20.11
2.129	-0.028	55.15	40.59	14.56	1503.1	26.34	13900	0.696	882.4	49.07	34.32	1.98	0.70	5.77	16.93	18.51
2.639	0.000	57.16	42.62	14.54	1502.5	26.46	13864	0.696	881.7	48.89	34.20	1.98	0.73	5.77	17.00	18.57
2.854	0.000	57.51	43.47	14.04	1502.3	26.51	13849	0.696	909.2	50.35	34.94	1.98	0.75	5.77	17.48	19.02
1.404	0.375	49.34	37.70	11.64	1503.9	26.18	13952	0.696	1102.7	61.58	40.51	1.98	0.71	5.77	20.12	21.47
1.644	0.365	52.20	38.65	13.54	1503.6	26.24	13935	0.696	950.2	52.99	36.34	1.98	0.70	5.77	17.86	19.36
2.114	0.375	55.62	40.53	15.09	1503.1	26.34	13901	0.696	851.2	47.34	33.42	1.98	0.70	5.77	16.50	18.12
2.639	0.365	57.83	42.62	15.21	1502.5	26.46	13864	0.696	842.8	46.73	33.07	1.98	0.73	5.77	16.45	18.08
2.879	0.360	58.09	43.57	14.52	1502.3	26.51	13847	0.696	878.5	48.64	34.06	1.98	0.75	5.77	17.06	18.63
1.389	-0.375	50.22	37.64	12.58	1503.9	26.18	13953	0.696	1020.4	56.98	38.32	1.98	0.71	5.77	18.93	20.36
1.619	-0.360	52.57	38.55	14.02	1503.6	26.23	13937	0.696	917.8	51.19	35.43	1.98	0.70	5.77	17.40	18.94
2.129	-0.365	56.65	40.59	16.06	1503.1	26.34	13900	0.696	799.8	44.47	31.89	1.98	0.70	5.77	15.80	17.48
2.629	-0.385	58.63	42.58	16.05	1502.5	26.45	13865	0.696	798.5	44.28	31.77	1.98	0.72	5.77	15.84	17.52
2.879	-0.385	58.90	43.57	15.33	1502.3	26.51	13847	0.696	832.4	46.09	32.72	1.98	0.75	5.77	16.41	18.04

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 15
Date: 6 January 1992
Time: 15:49:07

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.65	32.89	282.89	49.52	11.14	0.00682	10.381	1505.6	29.39	4.26	23.46	416	7.68	14.18	12.49

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.46	37.95
1.702	0.670	0.001	0.000	276.94	38.80
9.093	3.580	0.001	0.000	285.76	54.68
10.706	4.215	0.001	0.000	285.24	53.75

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.67	276.63	6.03	10.371	8.00	13958	0.696	6699	65.86	42.48	1.10	0.40	5.77	21.32	22.59
4.163	-0.025	284.32	277.21	7.12	10.369	8.02	13940	0.696	5696	55.91	37.77	1.10	0.39	5.77	18.64	20.09
5.408	-0.071	286.40	278.29	8.11	10.365	8.05	13905	0.696	4991	48.86	34.20	1.10	0.39	5.77	16.91	18.50
6.703	0.001	287.52	279.42	8.10	10.361	8.08	13869	0.696	4985	48.65	34.06	1.10	0.40	5.77	16.97	18.55
7.249	0.001	287.70	279.89	7.81	10.360	8.10	13854	0.696	5150	50.21	34.86	1.10	0.41	5.77	17.48	19.02
3.566	0.953	283.16	276.69	6.47	10.370	8.00	13957	0.696	6252	61.45	40.44	1.10	0.40	5.77	20.13	21.48
4.176	0.927	284.75	277.22	7.53	10.369	8.02	13939	0.696	5380	52.82	36.24	1.10	0.39	5.77	17.85	19.36
5.370	0.953	286.66	278.26	8.40	10.365	8.05	13906	0.696	4817	47.15	33.31	1.10	0.39	5.77	16.49	18.11
6.703	0.927	287.89	279.42	8.47	10.361	8.08	13869	0.696	4767	46.52	32.95	1.10	0.40	5.77	16.44	18.06
7.313	0.914	288.02	279.95	8.07	10.359	8.10	13852	0.696	4978	48.52	33.99	1.10	0.41	5.77	17.07	18.64
3.528	-0.953	283.65	276.66	6.99	10.370	8.00	13958	0.696	5779	56.81	38.23	1.10	0.40	5.77	18.92	20.35
4.112	-0.914	284.96	277.16	7.80	10.369	8.01	13941	0.696	5198	51.03	35.34	1.10	0.39	5.77	17.40	18.94
5.408	-0.927	287.22	278.29	8.93	10.365	8.05	13905	0.696	4531	44.35	31.82	1.10	0.39	5.77	15.80	17.48
6.678	-0.978	288.33	279.39	8.93	10.361	8.08	13870	0.696	4521	44.13	31.68	1.10	0.40	5.77	15.84	17.52
7.313	-0.978	288.49	279.95	8.54	10.359	8.10	13852	0.696	4704	45.85	32.59	1.10	0.41	5.77	16.39	18.02

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	49.11	38.25	10.86	1504.1	26.24	13958	0.696	1180.4	65.86	42.48	1.98	0.71	5.77	21.32	22.59
1.639	-0.010	52.10	39.29	12.81	1503.8	26.30	13940	0.696	1003.6	55.91	37.77	1.98	0.70	5.77	18.64	20.09
2.129	-0.028	55.83	41.24	14.59	1503.3	26.40	13905	0.696	879.4	48.86	34.20	1.98	0.70	5.77	16.91	18.50
2.639	0.000	57.84	43.26	14.58	1502.8	26.52	13869	0.696	878.4	48.65	34.06	1.98	0.73	5.77	16.97	18.55
2.854	0.000	58.17	44.11	14.05	1502.5	26.56	13854	0.696	907.4	50.21	34.86	1.98	0.75	5.77	17.48	19.02
1.404	0.375	49.99	38.35	11.64	1504.1	26.25	13957	0.696	1101.6	61.45	40.44	1.98	0.71	5.77	20.13	21.48
1.644	0.365	52.87	39.31	13.56	1503.8	26.30	13939	0.696	948.0	52.82	36.24	1.98	0.70	5.77	17.85	19.36
2.114	0.375	56.30	41.18	15.12	1503.3	26.40	13906	0.696	848.8	47.15	33.31	1.98	0.70	5.77	16.49	18.11
2.639	0.365	58.51	43.26	15.24	1502.8	26.52	13869	0.696	839.9	46.52	32.95	1.98	0.73	5.77	16.44	18.06
2.879	0.360	58.74	44.21	14.53	1502.5	26.57	13852	0.696	877.1	48.52	33.99	1.98	0.75	5.77	17.07	18.64
1.389	-0.375	50.88	38.29	12.59	1504.1	26.24	13958	0.696	1018.3	56.81	38.23	1.98	0.71	5.77	18.92	20.35
1.619	-0.360	53.24	39.21	14.03	1503.9	26.29	13941	0.696	915.9	51.03	35.34	1.98	0.70	5.77	17.40	18.94
2.129	-0.365	57.31	41.24	16.07	1503.3	26.40	13905	0.696	798.4	44.35	31.82	1.98	0.70	5.77	15.80	17.48
2.629	-0.385	59.30	43.22	16.08	1502.8	26.52	13870	0.696	796.6	44.13	31.68	1.98	0.72	5.77	15.84	17.52
2.879	-0.385	59.59	44.21	15.38	1502.5	26.57	13852	0.696	828.8	45.85	32.59	1.98	0.75	5.77	16.39	18.02

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 16
Date: 6 January 1992
Time: 15:49:33

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
274.03	33.57	283.27	50.20	11.16	0.00684	10.382	1505.7	29.45	4.27	23.42	417	7.68	14.22	12.52

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.82	38.58
1.702	0.670	0.001	0.000	277.28	39.42
9.093	3.580	0.001	0.000	286.12	55.32
10.706	4.215	0.001	0.000	285.60	54.40

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	283.03	277.01	6.01	10.371	8.02	13971	0.696	6732	66.12	42.59	1.10	0.40	5.77	21.37	22.65
4.163	-0.025	284.68	277.59	7.09	10.369	8.04	13952	0.696	5724	56.13	37.87	1.10	0.39	5.77	18.69	20.13
5.408	-0.071	286.74	278.67	8.07	10.366	8.07	13917	0.696	5019	49.08	34.30	1.10	0.39	5.77	16.96	18.54
6.703	0.001	287.87	279.80	8.08	10.362	8.11	13881	0.696	5006	48.81	34.14	1.10	0.40	5.77	17.00	18.58
7.249	0.001	288.05	280.27	7.78	10.361	8.12	13866	0.696	5176	50.41	34.95	1.10	0.41	5.77	17.52	19.06
3.566	0.953	283.54	277.07	6.47	10.371	8.02	13969	0.696	6263	61.50	40.45	1.10	0.40	5.77	20.13	21.48
4.176	0.927	285.13	277.60	7.53	10.369	8.04	13952	0.696	5393	52.88	36.26	1.10	0.39	5.77	17.86	19.36
5.370	0.953	287.01	278.64	8.38	10.366	8.07	13918	0.696	4839	47.32	33.39	1.10	0.39	5.77	16.52	18.14
6.703	0.927	288.24	279.80	8.44	10.362	8.11	13881	0.696	4790	46.70	33.04	1.10	0.40	5.77	16.47	18.09
7.313	0.914	288.39	280.32	8.07	10.360	8.12	13865	0.696	4989	48.58	34.01	1.10	0.41	5.77	17.07	18.64
3.528	-0.953	284.00	277.03	6.97	10.371	8.02	13970	0.696	5809	57.05	38.33	1.10	0.40	5.77	18.97	20.40
4.112	-0.914	285.31	277.54	7.77	10.370	8.04	13954	0.696	5226	51.25	35.44	1.10	0.39	5.77	17.44	18.98
5.408	-0.927	287.58	278.67	8.91	10.366	8.07	13917	0.696	4549	44.48	31.88	1.10	0.39	5.77	15.82	17.50
6.678	-0.978	288.69	279.77	8.91	10.362	8.11	13882	0.696	4538	44.25	31.73	1.10	0.40	5.77	15.86	17.54
7.313	-0.978	288.83	280.32	8.51	10.360	8.12	13865	0.696	4731	46.07	32.69	1.10	0.41	5.77	16.43	18.06

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F -	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	49.76	38.93	10.83	1504.2	26.32	13971	0.696	1186.2	66.12	42.59	1.98	0.71	5.77	21.37	22.65
1.639	-0.010	52.73	39.97	12.77	1504.0	26.37	13952	0.696	1008.6	56.13	37.87	1.98	0.70	5.77	18.69	20.13
2.129	-0.028	56.45	41.92	14.53	1503.4	26.48	13917	0.696	884.3	49.08	34.30	1.98	0.70	5.77	16.96	18.54
2.639	0.000	58.48	43.94	14.54	1502.9	26.60	13881	0.696	882.1	48.81	34.14	1.98	0.73	5.77	17.00	18.58
2.854	0.000	58.80	44.79	14.01	1502.7	26.64	13866	0.696	912.0	50.41	34.95	1.98	0.75	5.77	17.52	19.06
1.404	0.375	50.67	39.03	11.64	1504.2	26.33	13969	0.696	1103.5	61.50	40.45	1.98	0.71	5.77	20.13	21.48
1.644	0.365	53.54	39.99	13.55	1504.0	26.38	13952	0.696	950.2	52.88	36.26	1.98	0.70	5.77	17.86	19.36
2.114	0.375	56.94	41.86	15.08	1503.5	26.48	13918	0.696	852.6	47.32	33.39	1.98	0.70	5.77	16.52	18.14
2.639	0.365	59.14	43.94	15.20	1502.9	26.60	13881	0.696	844.0	46.70	33.04	1.98	0.73	5.77	16.47	18.09
2.879	0.360	59.42	44.89	14.52	1502.6	26.65	13865	0.696	879.1	48.58	34.01	1.98	0.75	5.77	17.07	18.64
1.389	-0.375	51.52	38.97	12.55	1504.2	26.32	13970	0.696	1023.5	57.05	38.33	1.98	0.71	5.77	18.97	20.40
1.619	-0.360	53.87	39.89	13.98	1504.0	26.37	13954	0.696	920.8	51.25	35.44	1.98	0.70	5.77	17.44	18.98
2.129	-0.365	57.96	41.92	16.04	1503.4	26.48	13917	0.696	801.5	44.48	31.88	1.98	0.70	5.77	15.82	17.50
2.629	-0.385	59.95	43.90	16.04	1502.9	26.59	13882	0.696	799.6	44.25	31.73	1.98	0.72	5.77	15.86	17.54
2.879	-0.385	60.21	44.89	15.31	1502.6	26.65	13865	0.696	833.6	46.07	32.69	1.98	0.75	5.77	16.43	18.06

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 17
Date: 6 January 1992
Time: 15:53:49

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.09	37.27	289.50	61.42	7.79	0.00477	10.402	1508.7	12.19	1.77	56.58	423	5.34	14.42	12.70

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	279.93	44.19
1.702	0.670	0.001	0.000	280.57	45.34
9.093	3.580	0.001	0.000	292.80	67.34
10.706	4.215	0.001	0.000	292.19	66.25

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	288.34	280.42	7.92	10.398	5.65	9670	0.696	5181	50.43	34.95	1.10	0.42	5.77	16.40	18.02
4.163	-0.025	290.61	281.25	9.36	10.397	5.67	9652	0.696	4398	42.72	30.88	1.10	0.41	5.77	14.35	16.19
5.408	-0.071	293.47	282.82	10.65	10.396	5.70	9617	0.696	3858	37.32	27.83	1.10	0.43	5.77	13.07	15.07
6.703	0.001	295.06	284.46	10.60	10.394	5.73	9581	0.696	3867	37.25	27.76	1.10	0.44	5.77	13.16	15.14
7.249	0.001	295.30	285.14	10.15	10.393	5.74	9566	0.696	4022	38.67	28.56	1.10	0.45	5.77	13.63	15.55
3.566	0.953	288.80	280.50	8.31	10.398	5.65	9668	0.696	4943	48.11	33.76	1.10	0.42	5.77	15.77	17.46
4.176	0.927	290.94	281.27	9.68	10.397	5.67	9651	0.696	4253	41.31	30.10	1.10	0.41	5.77	13.99	15.87
5.370	0.953	293.61	282.77	10.84	10.396	5.70	9618	0.696	3791	36.68	27.46	1.10	0.43	5.77	12.91	14.92
6.703	0.927	295.32	284.46	10.87	10.394	5.73	9581	0.696	3772	36.34	27.24	1.10	0.44	5.77	12.93	14.94
7.313	0.914	295.54	285.22	10.32	10.393	5.75	9565	0.696	3954	38.02	28.19	1.10	0.46	5.77	13.47	15.41
3.528	-0.953	289.30	280.45	8.85	10.398	5.65	9670	0.696	4637	45.13	32.19	1.10	0.42	5.77	14.99	16.76
4.112	-0.914	291.11	281.18	9.93	10.397	5.66	9653	0.696	4144	40.26	29.52	1.10	0.41	5.77	13.72	15.63
5.408	-0.927	294.23	282.82	11.41	10.396	5.70	9617	0.696	3602	34.84	26.39	1.10	0.43	5.77	12.46	14.53
6.678	-0.978	295.77	284.42	11.35	10.394	5.73	9582	0.696	3613	34.81	26.34	1.10	0.44	5.77	12.54	14.61
7.313	-0.978	296.00	285.22	10.78	10.393	5.75	9565	0.696	3785	36.39	27.25	1.10	0.46	5.77	13.05	15.05

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	59.32	45.06	14.26	1508.1	18.54	9670	0.696	912.9	50.43	34.95	1.98	0.75	5.77	16.40	18.02
1.639	-0.010	63.40	46.56	16.84	1508.0	18.59	9652	0.696	774.9	42.72	30.88	1.98	0.75	5.77	14.35	16.19
2.129	-0.028	68.57	49.39	19.17	1507.8	18.69	9617	0.696	679.8	37.32	27.83	1.98	0.77	5.77	13.07	15.07
2.639	0.000	71.41	52.33	19.08	1507.5	18.80	9581	0.696	681.4	37.25	27.76	1.98	0.79	5.77	13.16	15.14
2.854	0.000	71.84	53.57	18.28	1507.4	18.85	9566	0.696	708.7	38.67	28.56	1.98	0.82	5.77	13.63	15.55
1.404	0.375	60.16	45.20	14.95	1508.1	18.54	9668	0.696	871.0	48.11	33.76	1.98	0.75	5.77	15.77	17.46
1.644	0.365	64.01	46.59	17.42	1508.0	18.59	9651	0.696	749.4	41.31	30.10	1.98	0.75	5.77	13.99	15.87
2.114	0.375	68.82	49.31	19.51	1507.8	18.69	9618	0.696	668.0	36.68	27.46	1.98	0.77	5.77	12.91	14.92
2.639	0.365	71.90	52.33	19.56	1507.5	18.80	9581	0.696	664.6	36.34	27.24	1.98	0.79	5.77	12.93	14.94
2.879	0.360	72.29	53.71	18.57	1507.4	18.85	9565	0.696	696.7	38.02	28.19	1.98	0.82	5.77	13.47	15.41
1.389	-0.375	61.05	45.12	15.93	1508.1	18.54	9670	0.696	817.0	45.13	32.19	1.98	0.75	5.77	14.99	16.76
1.619	-0.360	64.32	46.44	17.87	1508.0	18.59	9653	0.696	730.2	40.26	29.52	1.98	0.75	5.77	13.72	15.63
2.129	-0.365	69.93	49.39	20.53	1507.8	18.69	9617	0.696	634.7	34.84	26.39	1.98	0.77	5.77	12.46	14.53
2.629	-0.385	72.70	52.28	20.43	1507.5	18.80	9582	0.696	636.6	34.81	26.34	1.98	0.79	5.77	12.54	14.61
2.879	-0.385	73.12	53.71	19.40	1507.4	18.85	9565	0.696	666.9	36.39	27.25	1.98	0.82	5.77	13.05	15.05

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 18
Date: 6 January 1992
Time: 15:54:14

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.12	37.33	289.55	61.50	7.79	0.00477	10.403	1508.9	12.15	1.76	56.73	423	5.33	14.42	12.70

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	279.97	44.26
1.702	0.670	0.001	0.000	280.61	45.41
9.093	3.580	0.001	0.000	292.84	67.42
10.706	4.215	0.001	0.000	292.23	66.32

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	288.37	280.45	7.92	10.399	5.65	9671	0.696	5187	50.48	34.98	1.10	0.42	5.77	16.39	18.02
4.163	-0.025	290.64	281.29	9.36	10.398	5.67	9652	0.696	4404	42.77	30.90	1.10	0.41	5.77	14.35	16.19
5.408	-0.071	293.51	282.86	10.65	10.397	5.70	9617	0.696	3862	37.36	27.85	1.10	0.43	5.77	13.07	15.07
6.703	0.001	295.08	284.50	10.58	10.395	5.73	9582	0.696	3879	37.36	27.82	1.10	0.44	5.77	13.18	15.16
7.249	0.001	295.34	285.18	10.16	10.395	5.75	9567	0.696	4025	38.70	28.57	1.10	0.45	5.77	13.62	15.54
3.566	0.953	288.85	280.53	8.32	10.399	5.65	9669	0.696	4941	48.09	33.75	1.10	0.42	5.77	15.75	17.44
4.176	0.927	290.98	281.30	9.68	10.398	5.67	9652	0.696	4256	41.33	30.11	1.10	0.41	5.77	13.99	15.86
5.370	0.953	293.65	282.81	10.83	10.397	5.70	9619	0.696	3797	36.73	27.49	1.10	0.43	5.77	12.91	14.93
6.703	0.927	295.36	284.50	10.86	10.395	5.73	9582	0.696	3779	36.40	27.27	1.10	0.44	5.77	12.93	14.94
7.313	0.914	295.59	285.27	10.32	10.394	5.75	9565	0.696	3956	38.03	28.19	1.10	0.46	5.77	13.46	15.41
3.528	-0.953	289.34	280.48	8.85	10.399	5.65	9670	0.696	4641	45.17	32.21	1.10	0.42	5.77	14.99	16.76
4.112	-0.914	291.16	281.22	9.94	10.398	5.67	9654	0.696	4146	40.27	29.52	1.10	0.41	5.77	13.71	15.62
5.408	-0.927	294.28	282.86	11.41	10.397	5.70	9617	0.696	3604	34.86	26.40	1.10	0.43	5.77	12.45	14.53
6.678	-0.978	295.81	284.47	11.35	10.395	5.73	9582	0.696	3617	34.85	26.37	1.10	0.44	5.77	12.54	14.61
7.313	-0.978	296.06	285.27	10.79	10.394	5.75	9565	0.696	3784	36.38	27.25	1.10	0.46	5.77	13.04	15.04

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	59.39	45.13	14.26	1508.2	18.54	9671	0.696	913.9	50.48	34.98	1.98	0.75	5.77	16.39	18.02
1.639	-0.010	63.47	46.63	16.84	1508.1	18.60	9652	0.696	776.0	42.77	30.90	1.98	0.75	5.77	14.35	16.19
2.129	-0.028	68.63	49.46	19.17	1507.9	18.70	9617	0.696	680.5	37.36	27.85	1.98	0.77	5.77	13.07	15.07
2.639	0.000	71.45	52.41	19.04	1507.7	18.81	9582	0.696	683.5	37.36	27.82	1.98	0.79	5.77	13.18	15.16
2.854	0.000	71.92	53.64	18.28	1507.6	18.85	9567	0.696	709.2	38.70	28.57	1.98	0.82	5.77	13.62	15.54
1.404	0.375	60.24	45.27	14.97	1508.2	18.54	9669	0.696	870.6	48.09	33.75	1.98	0.75	5.77	15.75	17.44
1.644	0.365	64.08	46.66	17.42	1508.1	18.60	9652	0.696	749.9	41.33	30.11	1.98	0.75	5.77	13.99	15.86
2.114	0.375	68.88	49.38	19.50	1507.9	18.69	9619	0.696	669.0	36.73	27.49	1.98	0.77	5.77	12.91	14.93
2.639	0.365	71.95	52.41	19.55	1507.7	18.81	9582	0.696	665.9	36.40	27.27	1.98	0.79	5.77	12.93	14.94
2.879	0.360	72.37	53.79	18.58	1507.6	18.85	9565	0.696	697.0	38.03	28.19	1.98	0.82	5.77	13.46	15.41
1.389	-0.375	61.12	45.18	15.94	1508.2	18.54	9670	0.696	817.7	45.17	32.21	1.98	0.75	5.77	14.99	16.76
1.619	-0.360	64.40	46.51	17.89	1508.1	18.59	9654	0.696	730.5	40.27	29.52	1.98	0.75	5.77	13.71	15.62
2.129	-0.365	70.01	49.46	20.55	1507.9	18.70	9617	0.696	635.0	34.86	26.40	1.98	0.77	5.77	12.45	14.53
2.629	-0.385	72.77	52.35	20.42	1507.7	18.80	9582	0.696	637.3	34.85	26.37	1.98	0.79	5.77	12.54	14.61
2.879	-0.385	73.22	53.79	19.43	1507.6	18.85	9565	0.696	666.7	36.38	27.25	1.98	0.82	5.77	13.04	15.04

Table 3.2 (continued)

Aluminum Heat Exchanger
Experiment: 2, Data Point: 19
Date: 6 January 1992
Time: 15:54:40

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.16	37.40	289.61	61.62	7.79	0.00477	10.405	1509.2	12.16	1.76	56.70	424	5.32	14.46	12.73

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	280.03	44.36
1.702	0.670	0.001	0.000	280.68	45.53
9.093	3.580	0.001	0.000	292.89	67.51
10.706	4.215	0.001	0.000	292.27	66.41

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	288.42	280.50	7.92	10.401	5.65	9675	0.696	5203	50.64	35.06	1.10	0.42	5.77	16.40	18.02
4.163	-0.025	290.70	281.34	9.37	10.400	5.67	9656	0.696	4410	42.82	30.93	1.10	0.41	5.77	14.33	16.17
5.408	-0.071	293.56	282.92	10.64	10.399	5.70	9622	0.696	3875	37.48	27.92	1.10	0.43	5.77	13.07	15.07
6.703	0.001	295.14	284.55	10.59	10.397	5.74	9586	0.696	3886	37.42	27.86	1.10	0.44	5.77	13.17	15.15
7.249	0.001	295.40	285.24	10.16	10.397	5.75	9571	0.696	4034	38.78	28.62	1.10	0.45	5.77	13.61	15.54
3.566	0.953	288.89	280.58	8.32	10.401	5.66	9673	0.696	4958	48.24	33.82	1.10	0.42	5.77	15.75	17.44
4.176	0.927	291.04	281.35	9.68	10.400	5.67	9656	0.696	4266	41.43	30.17	1.10	0.41	5.77	13.98	15.86
5.370	0.953	293.70	282.87	10.83	10.399	5.70	9623	0.696	3807	36.83	27.55	1.10	0.43	5.77	12.91	14.92
6.703	0.927	295.42	284.55	10.86	10.397	5.74	9586	0.696	3788	36.49	27.32	1.10	0.44	5.77	12.93	14.94
7.313	0.914	295.64	285.32	10.32	10.397	5.75	9569	0.696	3971	38.17	28.27	1.10	0.46	5.77	13.47	15.41
3.528	-0.953	289.41	280.53	8.88	10.401	5.65	9674	0.696	4641	45.16	32.21	1.10	0.42	5.77	14.95	16.72
4.112	-0.914	291.20	281.27	9.93	10.400	5.67	9658	0.696	4160	40.40	29.60	1.10	0.41	5.77	13.71	15.63
5.408	-0.927	294.34	282.92	11.42	10.399	5.70	9622	0.696	3610	34.92	26.43	1.10	0.43	5.77	12.44	14.52
6.678	-0.978	295.85	284.52	11.33	10.397	5.73	9586	0.696	3632	34.98	26.44	1.10	0.44	5.77	12.55	14.61
7.313	-0.978	296.11	285.32	10.78	10.397	5.75	9569	0.696	3799	36.51	27.32	1.10	0.46	5.77	13.04	15.04

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	59.47	45.21	14.25	1508.6	18.55	9675	0.696	916.8	50.64	35.06	1.98	0.75	5.77	16.40	18.02
1.639	-0.010	63.58	46.72	16.86	1508.5	18.61	9656	0.696	777.0	42.82	30.93	1.98	0.75	5.77	14.33	16.17
2.129	-0.028	68.72	49.56	19.16	1508.2	18.71	9622	0.696	682.8	37.48	27.92	1.98	0.77	5.77	13.07	15.07
2.639	0.000	71.57	52.51	19.06	1508.0	18.82	9586	0.696	684.7	37.42	27.86	1.98	0.80	5.77	13.17	15.15
2.854	0.000	72.04	53.75	18.29	1507.9	18.86	9571	0.696	710.8	38.78	28.62	1.98	0.82	5.77	13.61	15.54
1.404	0.375	60.32	45.36	14.97	1508.6	18.55	9673	0.696	873.6	48.24	33.82	1.98	0.75	5.77	15.75	17.44
1.644	0.365	64.18	46.75	17.43	1508.5	18.61	9656	0.696	751.7	41.43	30.17	1.98	0.75	5.77	13.98	15.86
2.114	0.375	68.97	49.47	19.50	1508.2	18.70	9623	0.696	670.8	36.83	27.55	1.98	0.77	5.77	12.91	14.92
2.639	0.365	72.06	52.51	19.55	1508.0	18.82	9586	0.696	667.4	36.49	27.32	1.98	0.80	5.77	12.93	14.94
2.879	0.360	72.46	53.89	18.57	1507.9	18.86	9569	0.696	699.7	38.17	28.27	1.98	0.82	5.77	13.47	15.41
1.389	-0.375	61.25	45.27	15.98	1508.6	18.55	9674	0.696	817.7	45.16	32.21	1.98	0.75	5.77	14.95	16.72
1.619	-0.360	64.48	46.60	17.88	1508.5	18.60	9658	0.696	733.0	40.40	29.60	1.98	0.75	5.77	13.71	15.63
2.129	-0.365	70.12	49.56	20.56	1508.2	18.71	9622	0.696	636.1	34.92	26.43	1.98	0.77	5.77	12.44	14.52
2.629	-0.385	72.85	52.45	20.40	1508.0	18.81	9586	0.696	640.0	34.98	26.44	1.98	0.79	5.77	12.55	14.61
2.879	-0.385	73.30	53.89	19.41	1507.9	18.86	9569	0.696	669.4	36.51	27.32	1.98	0.82	5.77	13.04	15.04

Table 3.3. Data tables for experiment 3

Aluminum Heat Exchanger
Summary Data Table for Experiment 3
Date: 7 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	PO MPa	PO-P1 kPa	TO K	T1 K	T1-TO K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	09:51:15	613	20.90	10.53	10.41	22.19	273.92	288.32	14.40	11.85	7.66	13057	0.696	5032	48.89	34.15
2	09:51:41	612	20.86	10.53	10.41	22.20	273.93	288.30	14.37	11.86	7.66	13058	0.696	5021	48.78	34.09
3	09:52:06	613	20.90	10.54	10.42	22.16	273.92	288.30	14.39	11.85	7.66	13069	0.696	5033	48.90	34.15
4	09:56:11	612	20.86	17.21	10.44	62.17	273.72	282.52	8.80	7.70	12.38	21478	0.696	7726	75.65	46.73
5	09:56:36	611	20.83	17.21	10.44	62.15	273.70	282.49	8.79	7.70	12.37	21479	0.696	7720	75.59	46.70
6	09:57:02	607	20.69	17.20	10.44	62.18	273.71	282.45	8.74	7.69	12.37	21474	0.696	7682	75.23	46.55
7	10:04:47	607	20.69	19.50	10.48	80.57	273.32	281.03	7.71	6.86	13.94	24395	0.696	8601	84.42	50.40
8	10:05:13	604	20.59	19.50	10.48	80.57	273.33	281.02	7.69	6.84	13.93	24386	0.696	8600	84.41	50.40
9	10:05:38	605	20.63	19.50	10.48	80.59	273.29	280.98	7.69	6.87	13.94	24397	0.696	8570	84.12	50.28
10	10:08:06	2	0.07	19.47	10.49	80.44	273.19	273.24	0.05	0.09	13.71	24575	0.697	0	0.00	0.00
11	10:08:32	0	0.00	19.46	10.49	80.50	273.16	273.18	0.02	0.11	13.70	24572	0.697	0	0.00	0.00
12	10:08:57	2	0.07	19.46	10.49	80.51	273.14	273.19	0.05	0.09	13.70	24565	0.697	0	0.00	0.00
13	10:14:08	601	20.49	19.43	10.50	80.77	272.96	280.63	7.67	6.84	13.85	24320	0.696	8552	84.02	50.25
14	10:14:33	603	20.56	19.44	10.50	80.72	272.95	280.64	7.69	6.85	13.85	24330	0.696	8569	84.19	50.32
15	10:14:59	600	20.46	19.42	10.50	80.64	272.96	280.62	7.66	6.85	13.85	24317	0.696	8528	83.78	50.16
16	10:18:14	606	20.66	15.38	10.51	49.24	272.92	282.67	9.75	8.54	10.98	19212	0.696	6903	67.63	43.24
17	10:18:39	606	20.66	15.38	10.50	49.21	272.94	282.70	9.76	8.54	10.98	19202	0.696	6909	67.69	43.26
18	10:19:05	611	20.83	15.38	10.50	49.21	272.92	282.75	9.83	8.51	10.98	19201	0.696	6977	68.36	43.56
19	10:23:03	611	20.83	10.96	10.50	23.84	273.02	286.80	13.78	11.47	7.87	13619	0.696	5180	50.48	34.99
20	10:23:29	609	20.76	10.96	10.50	23.85	273.05	286.80	13.74	11.48	7.87	13616	0.696	5159	50.27	34.88
21	10:23:54	609	20.76	10.94	10.50	23.81	273.07	286.83	13.76	11.48	7.86	13597	0.696	5160	50.27	34.88

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 1
Date: 7 January 1992
Time: 09:51:15

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.92	33.37	288.32	59.28	10.53	0.00645	10.407	1509.5	22.19	3.22	31.07	613	4.99	20.90	18.41

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	277.73	40.23
1.702	0.670	0.001	0.000	278.52	41.64
9.093	3.580	0.001	0.000	291.83	65.60
10.706	4.215	0.001	0.000	291.07	64.24

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	287.40	278.56	8.83	10.400	7.59	13135	0.696	6744	65.96	42.46	1.10	0.42	5.77	14.92	16.69
4.163	-0.025	289.90	279.46	10.44	10.398	7.62	13108	0.696	5721	55.83	37.67	1.10	0.42	5.77	13.11	15.10
5.408	-0.071	293.00	281.15	11.85	10.395	7.66	13057	0.696	5032	48.89	34.15	1.10	0.44	5.77	12.01	14.15
6.703	0.001	294.71	282.90	11.81	10.393	7.71	13005	0.696	5040	48.74	34.03	1.10	0.45	5.77	12.09	14.22
7.249	0.001	294.98	283.64	11.35	10.391	7.73	12983	0.696	5224	50.43	34.88	1.10	0.46	5.77	12.47	14.54
3.566	0.953	287.99	278.65	9.34	10.400	7.59	13132	0.696	6383	62.42	40.83	1.10	0.42	5.77	14.28	16.12
4.176	0.927	290.34	279.48	10.87	10.398	7.62	13107	0.696	5497	53.64	36.59	1.10	0.42	5.77	12.73	14.77
5.370	0.953	293.24	281.10	12.15	10.396	7.66	13059	0.696	4909	47.70	33.53	1.10	0.44	5.77	11.81	13.98
6.703	0.927	295.11	282.90	12.21	10.393	7.71	13005	0.696	4874	47.14	33.20	1.10	0.45	5.77	11.81	13.98
7.313	0.914	295.31	283.72	11.59	10.391	7.73	12980	0.696	5110	49.32	34.31	1.10	0.47	5.77	12.29	14.39
3.528	-0.953	288.59	278.60	10.00	10.400	7.59	13134	0.696	5960	58.29	38.89	1.10	0.42	5.77	13.55	15.48
4.112	-0.914	290.57	279.39	11.18	10.398	7.61	13110	0.696	5343	52.14	35.84	1.10	0.42	5.77	12.47	14.55
5.408	-0.927	293.98	281.15	12.83	10.395	7.66	13057	0.696	4648	45.15	32.19	1.10	0.44	5.77	11.38	13.63
6.678	-0.978	295.64	282.87	12.78	10.393	7.71	13006	0.696	4658	45.06	32.10	1.10	0.45	5.77	11.45	13.68
7.313	-0.978	295.89	283.72	12.17	10.391	7.73	12980	0.696	4867	46.98	33.10	1.10	0.47	5.77	11.88	14.04

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	57.63	41.73	15.90	1508.3	24.90	13135	0.696	1188.3	65.96	42.46	1.98	0.76	5.77	14.92	16.69
1.639	-0.010	62.13	43.34	18.80	1508.1	24.99	13108	0.696	1008.0	55.83	37.67	1.98	0.76	5.77	13.11	15.10
2.129	-0.028	67.71	46.38	21.33	1507.7	25.14	13057	0.696	886.6	48.89	34.15	1.98	0.79	5.77	12.01	14.15
2.639	0.000	70.78	49.53	21.25	1507.3	25.30	13005	0.696	888.0	48.74	34.03	1.98	0.81	5.77	12.09	14.22
2.854	0.000	71.28	50.86	20.42	1507.2	25.36	12983	0.696	920.5	50.43	34.88	1.98	0.84	5.77	12.47	14.54
1.404	0.375	58.69	41.88	16.81	1508.3	24.91	13132	0.696	1124.7	62.42	40.83	1.98	0.76	5.77	14.28	16.12
1.644	0.365	62.93	43.37	19.56	1508.1	24.99	13107	0.696	968.6	53.64	36.59	1.98	0.76	5.77	12.73	14.77
2.114	0.375	68.15	46.28	21.87	1507.7	25.13	13059	0.696	865.0	47.70	33.53	1.98	0.78	5.77	11.81	13.98
2.639	0.365	71.51	49.53	21.98	1507.3	25.30	13005	0.696	858.8	47.14	33.20	1.98	0.81	5.77	11.81	13.98
2.879	0.360	71.88	51.01	20.86	1507.1	25.37	12980	0.696	900.4	49.32	34.31	1.98	0.84	5.77	12.29	14.39
1.389	-0.375	59.78	41.79	17.99	1508.3	24.91	13134	0.696	1050.2	58.29	38.89	1.98	0.76	5.77	13.55	15.48
1.619	-0.360	63.34	43.21	20.12	1508.1	24.98	13110	0.696	941.4	52.14	35.84	1.98	0.76	5.77	12.47	14.55
2.129	-0.365	69.47	46.38	23.10	1507.7	25.14	13057	0.696	819.0	45.15	32.19	1.98	0.79	5.77	11.38	13.63
2.629	-0.385	72.47	49.47	23.00	1507.3	25.29	13006	0.696	820.7	45.06	32.10	1.98	0.81	5.77	11.45	13.68
2.879	-0.385	72.92	51.01	21.90	1507.1	25.37	12980	0.696	857.6	46.98	33.10	1.98	0.84	5.77	11.88	14.04

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 2
Date: 7 January 1992
Time: 09:51:41

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.93	33.38	288.30	59.25	10.53	0.00645	10.412	1510.1	22.20	3.22	31.06	612	5.00	20.86	18.38

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	277.74	40.24
1.702	0.670	0.001	0.000	278.51	41.62
9.093	3.580	0.001	0.000	291.82	65.59
10.706	4.215	0.001	0.000	291.07	64.23

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	287.40	278.57	8.83	10.404	7.59	13135	0.696	6732	65.84	42.41	1.10	0.42	5.77	14.92	16.70
4.163	-0.025	289.90	279.46	10.44	10.403	7.61	13108	0.696	5712	55.74	37.63	1.10	0.42	5.77	13.11	15.10
5.408	-0.071	293.00	281.14	11.86	10.400	7.66	13058	0.696	5021	48.78	34.09	1.10	0.44	5.77	12.01	14.15
6.703	0.001	294.70	282.89	11.81	10.397	7.71	13005	0.696	5030	48.65	33.98	1.10	0.45	5.77	12.09	14.22
7.249	0.001	294.98	283.63	11.35	10.396	7.73	12984	0.696	5213	50.33	34.83	1.10	0.46	5.77	12.47	14.54
3.566	0.953	287.98	278.65	9.33	10.404	7.59	13133	0.696	6376	62.35	40.80	1.10	0.42	5.77	14.29	16.13
4.176	0.927	290.35	279.48	10.87	10.403	7.61	13108	0.696	5486	53.53	36.54	1.10	0.42	5.77	12.73	14.77
5.370	0.953	293.24	281.09	12.15	10.400	7.66	13059	0.696	4900	47.62	33.49	1.10	0.44	5.77	11.81	13.98
6.703	0.927	295.11	282.89	12.21	10.397	7.71	13005	0.696	4864	47.04	33.15	1.10	0.45	5.77	11.81	13.98
7.313	0.914	295.31	283.72	11.60	10.396	7.73	12981	0.696	5098	49.20	34.25	1.10	0.47	5.77	12.29	14.39
3.528	-0.953	288.56	278.60	9.96	10.404	7.59	13134	0.696	5972	58.41	38.94	1.10	0.42	5.77	13.59	15.52
4.112	-0.914	290.56	279.39	11.17	10.403	7.61	13110	0.696	5338	52.10	35.83	1.10	0.42	5.77	12.48	14.56
5.408	-0.927	293.97	281.14	12.82	10.400	7.66	13058	0.696	4643	45.11	32.17	1.10	0.44	5.77	11.39	13.63
6.678	-0.978	295.64	282.86	12.78	10.397	7.71	13006	0.696	4647	44.95	32.04	1.10	0.45	5.77	11.45	13.68
7.313	-0.978	295.88	283.72	12.16	10.396	7.73	12981	0.696	4860	46.91	33.06	1.10	0.47	5.77	11.89	14.05

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	57.63	41.73	15.90	1509.0	24.90	13135	0.696	1186.2	65.84	42.41	1.98	0.76	5.77	14.92	16.70
1.639	-0.010	62.13	43.34	18.79	1508.8	24.98	13108	0.696	1006.5	55.74	37.63	1.98	0.76	5.77	13.11	15.10
2.129	-0.028	67.72	46.37	21.35	1508.4	25.13	13058	0.696	884.7	48.78	34.09	1.98	0.79	5.77	12.01	14.15
2.639	0.000	70.78	49.52	21.26	1508.0	25.29	13005	0.696	886.3	48.65	33.98	1.98	0.81	5.77	12.09	14.22
2.854	0.000	71.28	50.85	20.43	1507.8	25.35	12984	0.696	918.5	50.33	34.83	1.98	0.84	5.77	12.47	14.54
1.404	0.375	58.68	41.88	16.80	1509.0	24.90	13133	0.696	1123.5	62.35	40.80	1.98	0.76	5.77	14.29	16.13
1.644	0.365	62.93	43.37	19.57	1508.8	24.98	13108	0.696	966.6	53.53	36.54	1.98	0.76	5.77	12.73	14.77
2.114	0.375	68.15	46.28	21.87	1508.4	25.12	13059	0.696	863.4	47.62	33.49	1.98	0.78	5.77	11.81	13.98
2.639	0.365	71.51	49.52	21.99	1508.0	25.29	13005	0.696	857.0	47.04	33.15	1.98	0.81	5.77	11.81	13.98
2.879	0.360	71.88	51.00	20.88	1507.8	25.36	12981	0.696	898.3	49.20	34.25	1.98	0.84	5.77	12.29	14.39
1.389	-0.375	59.72	41.79	17.93	1509.0	24.90	13134	0.696	1052.3	58.41	38.94	1.98	0.76	5.77	13.59	15.52
1.619	-0.360	63.32	43.21	20.11	1508.8	24.97	13110	0.696	940.6	52.10	35.83	1.98	0.76	5.77	12.48	14.56
2.129	-0.365	69.45	46.37	23.08	1508.4	25.13	13058	0.696	818.1	45.11	32.17	1.98	0.79	5.77	11.39	13.63
2.629	-0.385	72.47	49.46	23.01	1508.0	25.29	13006	0.696	818.8	44.95	32.04	1.98	0.81	5.77	11.45	13.68
2.879	-0.385	72.90	51.00	21.90	1507.8	25.36	12981	0.696	856.3	46.91	33.06	1.98	0.84	5.77	11.89	14.05

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 3
Date: 7 January 1992
Time: 09:52:06

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.92	33.36	288.30	59.25	10.54	0.00646	10.417	1510.8	22.16	3.21	31.11	613	4.99	20.90	18.41

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	277.73	40.23
1.702	0.670	0.001	0.000	278.51	41.62
9.093	3.580	0.001	0.000	291.80	65.55
10.706	4.215	0.001	0.000	291.04	64.19

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	287.39	278.56	8.83	10.409	7.59	13146	0.696	6745	65.98	42.47	1.10	0.42	5.77	14.92	16.70
4.163	-0.025	289.88	279.45	10.43	10.408	7.62	13119	0.696	5730	55.91	37.71	1.10	0.42	5.77	13.12	15.11
5.408	-0.071	292.99	281.14	11.85	10.405	7.66	13069	0.696	5033	48.90	34.15	1.10	0.44	5.77	12.01	14.16
6.703	0.001	294.69	282.89	11.80	10.402	7.71	13016	0.696	5041	48.76	34.04	1.10	0.45	5.77	12.09	14.22
7.249	0.001	294.96	283.63	11.33	10.401	7.73	12994	0.696	5229	50.48	34.90	1.10	0.46	5.77	12.48	14.55
3.566	0.953	287.96	278.64	9.32	10.409	7.59	13144	0.696	6393	62.51	40.87	1.10	0.42	5.77	14.30	16.14
4.176	0.927	290.34	279.47	10.87	10.408	7.62	13119	0.696	5497	53.64	36.59	1.10	0.42	5.77	12.73	14.77
5.370	0.953	293.22	281.09	12.14	10.405	7.66	13070	0.696	4914	47.75	33.56	1.10	0.44	5.77	11.82	13.99
6.703	0.927	295.08	282.89	12.19	10.402	7.71	13016	0.696	4880	47.20	33.23	1.10	0.45	5.77	11.82	13.99
7.313	0.914	295.30	283.71	11.58	10.401	7.73	12992	0.696	5113	49.35	34.33	1.10	0.47	5.77	12.30	14.40
3.528	-0.953	288.54	278.59	9.95	10.409	7.59	13145	0.696	5988	58.56	39.01	1.10	0.42	5.77	13.60	15.52
4.112	-0.914	290.54	279.38	11.16	10.408	7.61	13122	0.696	5355	52.26	35.90	1.10	0.42	5.77	12.49	14.56
5.408	-0.927	293.95	281.14	12.82	10.405	7.66	13069	0.696	4653	45.21	32.22	1.10	0.44	5.77	11.40	13.63
6.678	-0.978	295.61	282.86	12.75	10.402	7.71	13017	0.696	4667	45.14	32.15	1.10	0.45	5.77	11.47	13.70
7.313	-0.978	295.86	283.71	12.14	10.401	7.73	12992	0.696	4877	47.07	33.15	1.10	0.47	5.77	11.90	14.06

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	57.61	41.71	15.90	1509.7	24.90	13146	0.696	1188.5	65.98	42.47	1.98	0.76	5.77	14.92	16.70
1.639	-0.010	62.09	43.32	18.77	1509.5	24.99	13119	0.696	1009.6	55.91	37.71	1.98	0.76	5.77	13.12	15.11
2.129	-0.028	67.69	46.36	21.33	1509.1	25.14	13069	0.696	886.8	48.90	34.15	1.98	0.79	5.77	12.01	14.16
2.639	0.000	70.76	49.51	21.25	1508.7	25.30	13016	0.696	888.2	48.76	34.04	1.98	0.81	5.77	12.09	14.22
2.854	0.000	71.24	50.84	20.40	1508.5	25.36	12994	0.696	921.3	50.48	34.90	1.98	0.84	5.77	12.48	14.55
1.404	0.375	58.65	41.87	16.78	1509.7	24.91	13144	0.696	1126.4	62.51	40.87	1.98	0.76	5.77	14.30	16.14
1.644	0.365	62.92	43.35	19.56	1509.5	24.99	13119	0.696	968.6	53.64	36.59	1.98	0.76	5.77	12.73	14.77
2.114	0.375	68.12	46.27	21.85	1509.1	25.13	13070	0.696	865.8	47.75	33.56	1.98	0.78	5.77	11.82	13.99
2.639	0.365	71.46	49.51	21.95	1508.7	25.30	13016	0.696	859.9	47.20	33.23	1.98	0.81	5.77	11.82	13.99
2.879	0.360	71.84	50.99	20.85	1508.5	25.37	12992	0.696	900.9	49.35	34.33	1.98	0.84	5.77	12.30	14.40
1.389	-0.375	59.69	41.77	17.91	1509.7	24.91	13145	0.696	1055.1	58.56	39.01	1.98	0.76	5.77	13.60	15.52
1.619	-0.360	63.28	43.20	20.08	1509.5	24.98	13122	0.696	943.6	52.26	35.90	1.98	0.76	5.77	12.49	14.56
2.129	-0.365	69.43	46.36	23.07	1509.1	25.14	13069	0.696	819.9	45.21	32.22	1.98	0.79	5.77	11.40	13.63
2.629	-0.385	72.41	49.45	22.96	1508.7	25.29	13017	0.696	822.3	45.14	32.15	1.98	0.81	5.77	11.47	13.70
2.879	-0.385	72.85	50.99	21.86	1508.5	25.37	12992	0.696	859.3	47.07	33.15	1.98	0.84	5.77	11.90	14.06

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 4
Date: 7 January 1992
Time: 09:56:11

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.72	33.00	282.52	48.85	17.21	0.01054	10.437	1513.7	62.17	9.02	11.09	612	8.07	20.86	18.38

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.81	36.77
1.702	0.670	0.001	0.000	276.31	37.67
9.093	3.580	0.001	0.000	284.83	53.00
10.706	4.215	0.001	0.000	284.23	51.93

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.27	276.56	5.71	10.415	12.30	21556	0.696	10410	102.35	57.33	1.10	0.39	5.77	22.45	23.67
4.163	-0.025	283.87	277.10	6.76	10.411	12.33	21529	0.696	8813	86.53	51.25	1.10	0.39	5.77	19.55	20.93
5.408	-0.071	285.84	278.14	7.70	10.403	12.38	21478	0.696	7726	75.65	46.73	1.10	0.39	5.77	17.73	19.24
6.703	0.001	286.91	279.21	7.71	10.396	12.43	21425	0.696	7705	75.23	46.51	1.10	0.40	5.77	17.77	19.28
7.249	0.001	287.09	279.66	7.43	10.392	12.46	21403	0.696	7955	77.59	47.49	1.10	0.41	5.77	18.30	19.77
3.566	0.953	282.78	276.61	6.17	10.415	12.30	21554	0.696	9633	94.70	54.46	1.10	0.39	5.77	21.05	22.34
4.176	0.927	284.35	277.11	7.23	10.411	12.33	21529	0.696	8242	80.92	48.98	1.10	0.39	5.77	18.57	20.02
5.370	0.953	286.17	278.11	8.06	10.404	12.38	21480	0.696	7379	72.26	45.27	1.10	0.39	5.77	17.15	18.71
6.703	0.927	287.35	279.21	8.14	10.396	12.43	21425	0.696	7290	71.19	44.77	1.10	0.40	5.77	17.07	18.64
7.313	0.914	287.47	279.71	7.76	10.392	12.46	21401	0.696	7614	74.25	46.07	1.10	0.41	5.77	17.73	19.24
3.528	-0.953	283.27	276.58	6.69	10.415	12.30	21555	0.696	8885	87.35	51.60	1.10	0.39	5.77	19.75	21.12
4.112	-0.914	284.50	277.06	7.44	10.411	12.32	21531	0.696	8008	78.63	48.03	1.10	0.39	5.77	18.18	19.66
5.408	-0.927	286.71	278.14	8.57	10.403	12.38	21478	0.696	6941	67.97	43.38	1.10	0.39	5.77	16.43	18.06
6.678	-0.978	287.82	279.19	8.64	10.396	12.43	21426	0.696	6875	67.13	42.97	1.10	0.40	5.77	16.39	18.02
7.313	-0.978	287.94	279.71	8.23	10.392	12.46	21401	0.696	7183	70.05	44.25	1.10	0.41	5.77	17.00	18.58

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.39	38.11	10.28	1510.6	40.35	21556	0.696	1834.2	102.35	57.33	1.98	0.71	5.77	22.45	23.67
1.639	-0.010	51.27	39.10	12.17	1510.0	40.44	21529	0.696	1552.9	86.53	51.25	1.98	0.69	5.77	19.55	20.93
2.129	-0.028	54.82	40.96	13.86	1508.9	40.61	21478	0.696	1361.3	75.65	46.73	1.98	0.70	5.77	17.73	19.24
2.639	0.000	56.76	42.89	13.87	1507.7	40.79	21425	0.696	1357.6	75.23	46.51	1.98	0.72	5.77	17.77	19.28
2.854	0.000	57.08	43.70	13.38	1507.3	40.87	21403	0.696	1401.7	77.59	47.49	1.98	0.74	5.77	18.30	19.77
1.404	0.375	49.32	38.21	11.11	1510.5	40.35	21554	0.696	1697.3	94.70	54.46	1.98	0.71	5.77	21.05	22.34
1.644	0.365	52.13	39.12	13.02	1510.0	40.44	21529	0.696	1452.2	80.92	48.98	1.98	0.69	5.77	18.57	20.02
2.114	0.375	55.41	40.90	14.51	1508.9	40.61	21480	0.696	1300.2	72.26	45.27	1.98	0.70	5.77	17.15	18.71
2.639	0.365	57.54	42.89	14.66	1507.7	40.79	21425	0.696	1284.5	71.19	44.77	1.98	0.72	5.77	17.07	18.64
2.879	0.360	57.76	43.79	13.97	1507.2	40.88	21401	0.696	1341.6	74.25	46.07	1.98	0.74	5.77	17.73	19.24
1.389	-0.375	50.19	38.15	12.04	1510.6	40.35	21555	0.696	1565.5	87.35	51.60	1.98	0.71	5.77	19.75	21.12
1.619	-0.360	52.42	39.02	13.40	1510.0	40.43	21531	0.696	1411.0	78.63	48.03	1.98	0.69	5.77	18.18	19.66
2.129	-0.365	56.38	40.96	15.43	1508.9	40.61	21478	0.696	1223.0	67.97	43.38	1.98	0.70	5.77	16.43	18.06
2.629	-0.385	58.40	42.85	15.54	1507.8	40.79	21426	0.696	1211.4	67.13	42.97	1.98	0.72	5.77	16.39	18.02
2.879	-0.385	58.60	43.79	14.81	1507.2	40.88	21401	0.696	1265.6	70.05	44.25	1.98	0.74	5.77	17.00	18.58

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 5
Date: 7 January 1992
Time: 09:56:36

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.70	32.97	282.49	48.80	17.21	0.01054	10.440	1514.2	62.15	9.01	11.09	611	8.08	20.83	18.35

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.79	36.73
1.702	0.670	0.001	0.000	276.29	37.63
9.093	3.580	0.001	0.000	284.80	52.95
10.706	4.215	0.001	0.000	284.19	51.86

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.23	276.54	5.70	10.419	12.29	21557	0.696	10416	102.42	57.35	1.10	0.39	5.77	22.49	23.70
4.163	-0.025	283.82	277.08	6.74	10.415	12.32	21530	0.696	8834	86.73	51.33	1.10	0.39	5.77	19.61	20.99
5.408	-0.071	285.81	278.11	7.70	10.407	12.37	21479	0.696	7720	75.59	46.70	1.10	0.39	5.77	17.73	19.25
6.703	0.001	286.88	279.18	7.69	10.399	12.43	21427	0.696	7709	75.28	46.53	1.10	0.40	5.77	17.79	19.30
7.249	0.001	287.06	279.64	7.42	10.396	12.45	21405	0.696	7957	77.61	47.50	1.10	0.41	5.77	18.32	19.79
3.566	0.953	282.75	276.59	6.16	10.418	12.30	21555	0.696	9643	94.80	54.50	1.10	0.39	5.77	21.09	22.38
4.176	0.927	284.31	277.09	7.22	10.414	12.32	21530	0.696	8247	80.97	49.00	1.10	0.39	5.77	18.60	20.05
5.370	0.953	286.14	278.08	8.06	10.407	12.37	21481	0.696	7372	72.20	45.25	1.10	0.39	5.77	17.15	18.72
6.703	0.927	287.32	279.18	8.13	10.399	12.43	21427	0.696	7292	71.21	44.78	1.10	0.40	5.77	17.09	18.66
7.313	0.914	287.44	279.69	7.76	10.395	12.45	21402	0.696	7610	74.21	46.06	1.10	0.41	5.77	17.74	19.25
3.528	-0.953	283.23	276.56	6.67	10.418	12.29	21556	0.696	8897	87.47	51.65	1.10	0.39	5.77	19.79	21.16
4.112	-0.914	284.47	277.04	7.43	10.415	12.32	21532	0.696	8013	78.68	48.05	1.10	0.39	5.77	18.20	19.68
5.408	-0.927	286.67	278.11	8.55	10.407	12.37	21479	0.696	6947	68.03	43.41	1.10	0.39	5.77	16.46	18.08
6.678	-0.978	287.77	279.16	8.61	10.399	12.43	21428	0.696	6887	67.26	43.03	1.10	0.40	5.77	16.42	18.05
7.313	-0.978	287.89	279.69	8.20	10.395	12.45	21402	0.696	7194	70.16	44.30	1.10	0.41	5.77	17.04	18.61

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.33	38.08	10.26	1511.1	40.33	21557	0.696	1835.3	102.42	57.35	1.98	0.71	5.77	22.49	23.70
1.639	-0.010	51.19	39.06	12.13	1510.5	40.42	21530	0.696	1556.6	86.73	51.33	1.98	0.69	5.77	19.61	20.99
2.129	-0.028	54.77	40.92	13.86	1509.4	40.60	21479	0.696	1360.3	75.59	46.70	1.98	0.70	5.77	17.73	19.25
2.639	0.000	56.69	42.84	13.85	1508.2	40.78	21427	0.696	1358.3	75.28	46.53	1.98	0.72	5.77	17.79	19.30
2.854	0.000	57.02	43.66	13.36	1507.8	40.85	21405	0.696	1402.0	77.61	47.50	1.98	0.74	5.77	18.32	19.79
1.404	0.375	49.26	38.17	11.09	1511.0	40.34	21555	0.696	1699.1	94.80	54.50	1.98	0.71	5.77	21.09	22.38
1.644	0.365	52.07	39.08	12.99	1510.5	40.43	21530	0.696	1453.1	80.97	49.00	1.98	0.69	5.77	18.60	20.05
2.114	0.375	55.37	40.86	14.51	1509.4	40.59	21481	0.696	1298.9	72.20	45.25	1.98	0.69	5.77	17.15	18.72
2.639	0.365	57.48	42.84	14.64	1508.2	40.78	21427	0.696	1284.9	71.21	44.78	1.98	0.72	5.77	17.09	18.66
2.879	0.360	57.71	43.75	13.96	1507.7	40.86	21402	0.696	1340.9	74.21	46.06	1.98	0.74	5.77	17.74	19.25
1.389	-0.375	50.13	38.11	12.01	1511.1	40.33	21556	0.696	1567.7	87.47	51.65	1.98	0.71	5.77	19.79	21.16
1.619	-0.360	52.36	38.98	13.37	1510.5	40.42	21532	0.696	1411.9	78.68	48.05	1.98	0.69	5.77	18.20	19.68
2.129	-0.365	56.31	40.92	15.40	1509.4	40.60	21479	0.696	1224.1	68.03	43.41	1.98	0.70	5.77	16.46	18.08
2.629	-0.385	58.31	42.81	15.50	1508.3	40.77	21428	0.696	1213.5	67.26	43.03	1.98	0.72	5.77	16.42	18.05
2.879	-0.385	58.52	43.75	14.77	1507.7	40.86	21402	0.696	1267.6	70.16	44.30	1.98	0.74	5.77	17.04	18.61

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 6
Date: 7 January 1992
Time: 09:57:02

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.71	32.99	282.45	48.72	17.20	0.01054	10.444	1514.8	62.18	9.02	11.09	607	8.12	20.69	18.23

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.76	36.69
1.702	0.670	0.001	0.000	276.26	37.58
9.093	3.580	0.001	0.000	284.76	52.89
10.706	4.215	0.001	0.000	284.18	51.83

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.21	276.52	5.69	10.423	12.28	21552	0.696	10374	102.00	57.20	1.10	0.39	5.77	22.54	23.75
4.163	-0.025	283.80	277.07	6.73	10.419	12.31	21525	0.696	8787	86.28	51.15	1.10	0.39	5.77	19.64	21.02
5.408	-0.071	285.78	278.09	7.69	10.411	12.37	21474	0.696	7682	75.23	46.55	1.10	0.39	5.77	17.77	19.29
6.703	0.001	286.86	279.16	7.70	10.403	12.42	21422	0.696	7655	74.75	46.31	1.10	0.40	5.77	17.80	19.31
7.249	0.001	287.05	279.61	7.45	10.400	12.44	21400	0.696	7883	76.90	47.20	1.10	0.41	5.77	18.30	19.77
3.566	0.953	282.74	276.58	6.16	10.422	12.29	21549	0.696	9578	94.16	54.25	1.10	0.39	5.77	21.10	22.39
4.176	0.927	284.29	277.08	7.21	10.418	12.31	21525	0.696	8201	80.52	48.81	1.10	0.39	5.77	18.63	20.08
5.370	0.953	286.11	278.06	8.05	10.411	12.36	21476	0.696	7338	71.87	45.11	1.10	0.39	5.77	17.20	18.75
6.703	0.927	287.29	279.16	8.13	10.403	12.42	21422	0.696	7246	70.76	44.58	1.10	0.40	5.77	17.12	18.68
7.313	0.914	287.42	279.66	7.77	10.399	12.45	21398	0.696	7553	73.66	45.82	1.10	0.41	5.77	17.74	19.26
3.528	-0.953	283.21	276.55	6.66	10.422	12.29	21551	0.696	8858	87.09	51.50	1.10	0.39	5.77	19.84	21.20
4.112	-0.914	284.47	277.03	7.44	10.419	12.31	21527	0.696	7949	78.05	47.78	1.10	0.39	5.77	18.20	19.68
5.408	-0.927	286.66	278.09	8.57	10.411	12.37	21474	0.696	6895	67.52	43.18	1.10	0.39	5.77	16.46	18.09
6.678	-0.978	287.76	279.14	8.62	10.403	12.42	21423	0.696	6834	66.74	42.79	1.10	0.40	5.77	16.43	18.05
7.313	-0.978	287.87	279.66	8.21	10.399	12.45	21398	0.696	7143	69.67	44.08	1.10	0.41	5.77	17.05	18.62

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.30	38.06	10.24	1511.7	40.30	21552	0.696	1827.9	102.00	57.20	1.98	0.71	5.77	22.54	23.75
1.639	-0.010	51.16	39.04	12.12	1511.1	40.40	21525	0.696	1548.3	86.28	51.15	1.98	0.69	5.77	19.64	21.02
2.129	-0.028	54.72	40.88	13.84	1510.0	40.57	21474	0.696	1353.6	75.23	46.55	1.98	0.69	5.77	17.77	19.29
2.639	0.000	56.65	42.80	13.86	1508.8	40.75	21422	0.696	1348.8	74.75	46.31	1.98	0.72	5.77	17.80	19.31
2.854	0.000	57.01	43.60	13.40	1508.3	40.82	21400	0.696	1389.0	76.90	47.20	1.98	0.74	5.77	18.30	19.77
1.404	0.375	49.25	38.15	11.10	1511.6	40.31	21549	0.696	1687.6	94.16	54.25	1.98	0.71	5.77	21.10	22.39
1.644	0.365	52.04	39.06	12.98	1511.1	40.40	21525	0.696	1445.0	80.52	48.81	1.98	0.69	5.77	18.63	20.08
2.114	0.375	55.31	40.83	14.49	1510.0	40.56	21476	0.696	1293.0	71.87	45.11	1.98	0.69	5.77	17.20	18.75
2.639	0.365	57.44	42.80	14.64	1508.8	40.75	21422	0.696	1276.7	70.76	44.58	1.98	0.72	5.77	17.12	18.68
2.879	0.360	57.68	43.70	13.98	1508.3	40.83	21398	0.696	1330.8	73.66	45.82	1.98	0.74	5.77	17.74	19.26
1.389	-0.375	50.09	38.09	11.99	1511.6	40.31	21551	0.696	1560.8	87.09	51.50	1.98	0.71	5.77	19.84	21.20
1.619	-0.360	52.36	38.96	13.40	1511.1	40.39	21527	0.696	1400.6	78.05	47.78	1.98	0.69	5.77	18.20	19.68
2.129	-0.365	56.30	40.88	15.42	1510.0	40.57	21474	0.696	1214.9	67.52	43.18	1.98	0.69	5.77	16.46	18.09
2.629	-0.385	58.28	42.76	15.52	1508.8	40.74	21423	0.696	1204.2	66.74	42.79	1.98	0.72	5.77	16.43	18.05
2.879	-0.385	58.48	43.70	14.78	1508.3	40.83	21398	0.696	1258.6	69.67	44.08	1.98	0.74	5.77	17.05	18.62

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 7
Date: 7 January 1992
Time: 10:04:47

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.32	32.28	281.03	46.16	19.50	0.01194	10.481	1520.1	80.57	11.69	8.56	607	9.20	20.69	18.23

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.09	35.48
1.702	0.670	0.001	0.000	275.54	36.29
9.093	3.580	0.001	0.000	283.11	49.90
10.706	4.215	0.001	0.000	282.55	48.90

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	280.88	275.80	5.08	10.453	13.85	24472	0.697	11609	114.35	61.64	1.10	0.39	5.77	25.16	26.25
4.163	-0.025	282.28	276.28	6.00	10.448	13.88	24445	0.697	9848	96.88	55.30	1.10	0.38	5.77	21.93	23.17
5.408	-0.071	284.05	277.18	6.86	10.438	13.94	24395	0.696	8601	84.42	50.40	1.10	0.38	5.77	19.81	21.17
6.703	0.001	285.00	278.12	6.87	10.428	14.00	24342	0.696	8567	83.88	50.14	1.10	0.39	5.77	19.83	21.20
7.249	0.001	285.17	278.52	6.65	10.423	14.02	24320	0.696	8820	86.28	51.09	1.10	0.40	5.77	20.38	21.71
3.566	0.953	281.38	275.85	5.53	10.453	13.86	24470	0.697	10660	104.99	58.32	1.10	0.39	5.77	23.44	24.61
4.176	0.927	282.78	276.29	6.49	10.448	13.88	24445	0.697	9102	89.55	52.48	1.10	0.38	5.77	20.64	21.96
5.370	0.953	284.39	277.16	7.23	10.438	13.94	24396	0.696	8162	80.12	48.64	1.10	0.38	5.77	19.07	20.49
6.703	0.927	285.44	278.12	7.32	10.428	14.00	24342	0.696	8047	78.79	48.05	1.10	0.39	5.77	18.96	20.38
7.313	0.914	285.54	278.56	6.98	10.423	14.03	24318	0.696	8403	82.18	49.43	1.10	0.40	5.77	19.68	21.05
3.528	-0.953	281.82	275.82	6.00	10.453	13.85	24471	0.697	9832	96.84	55.31	1.10	0.39	5.77	21.99	23.23
4.112	-0.914	282.92	276.24	6.68	10.448	13.88	24447	0.697	8853	87.10	51.51	1.10	0.38	5.77	20.22	21.56
5.408	-0.927	284.88	277.18	7.69	10.438	13.94	24395	0.696	7671	75.30	46.62	1.10	0.38	5.77	18.26	19.74
6.678	-0.978	285.87	278.11	7.76	10.428	14.00	24343	0.696	7586	74.28	46.14	1.10	0.39	5.77	18.19	19.67
7.313	-0.978	285.98	278.56	7.42	10.423	14.03	24318	0.696	7898	77.25	47.39	1.10	0.40	5.77	18.82	20.26

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	45.90	36.75	9.14	1516.1	45.45	24472	0.697	2045.5	114.35	61.64	1.98	0.70	5.77	25.16	26.25
1.639	-0.010	48.42	37.62	10.81	1515.3	45.55	24445	0.697	1735.2	96.88	55.30	1.98	0.69	5.77	21.93	23.17
2.129	-0.028	51.[illegible]	39.24	12.35	1513.9	45.73	24395	0.696	1515.5	84.42	50.40	1.98	0.68	5.77	19.81	21.17
2.639	0.000	53	40.94	12.37	1512.4	45.93	24342	0.696	1509.5	83.88	50.14	1.98	0.70	5.77	19.83	21.20
2.854	0.000	53.e1	41.64	11.97	1511.8	46.01	24320	0.696	1554.1	86.28	51.09	1.98	0.72	5.77	20.38	21.71
1.404	0.375	46.80	36.83	9.96	1516.0	45.46	24470	0.697	1878.3	104.99	58.32	1.98	0.70	5.77	23.44	24.61
1.644	0.365	49.32	37.63	11.69	1515.3	45.55	24445	0.697	1603.8	89.55	52.48	1.98	0.69	5.77	20.64	21.96
2.114	0.375	52.21	39.19	13.02	1513.9	45.73	24396	0.696	1438.1	80.12	48.64	1.98	0.68	5.77	19.07	20.49
2.639	0.365	54.11	40.94	13.17	1512.4	45.93	24342	0.696	1417.9	78.79	48.05	1.98	0.70	5.77	18.96	20.38
2.879	0.360	54.28	41.73	12.56	1511.7	46.02	24318	0.696	1480.6	82.18	49.43	1.98	0.73	5.77	19.68	21.05
1.389	-0.375	47.58	36.78	10.80	1516.1	45.46	24471	0.697	1732.4	96.84	55.31	1.98	0.70	5.77	21.99	23.23
1.619	-0.360	49.57	37.55	12.02	1515.4	45.54	24447	0.697	1559.9	87.10	51.51	1.98	0.69	5.77	20.22	21.56
2.129	-0.365	53.09	39.24	13.85	1513.9	45.73	24395	0.696	1351.6	75.30	46.62	1.98	0.68	5.77	18.26	19.74
2.629	-0.385	54.87	40.90	13.97	1512.4	45.92	24343	0.696	1336.7	74.28	46.14	1.98	0.70	5.77	18.19	19.67
2.879	-0.385	55.08	41.73	13.36	1511.7	46.02	24318	0.696	1391.6	77.25	47.39	1.98	0.73	5.77	18.82	20.26

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 8
Date: 7 January 1992
Time: 10:05:13

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.33	32.31	281.02	46.15	19.50	0.01194	10.483	1520.4	80.57	11.69	8.56	604	9.23	20.59	18.14

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.06	35.42
1.702	0.670	0.001	0.000	275.52	36.24
9.093	3.580	0.001	0.000	283.09	49.87
10.706	4.215	0.001	0.000	282.53	48.86

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	280.85	275.81	5.04	10.455	13.85	24464	0.697	11662	114.87	61.82	1.10	0.39	5.77	25.35	26.43
4.163	-0.025	282.26	276.29	5.97	10.450	13.88	24437	0.697	9869	97.09	55.38	1.10	0.38	5.77	22.04	23.28
5.408	-0.071	284.03	277.19	6.84	10.440	13.93	24386	0.696	8600	84.41	50.40	1.10	0.38	5.77	19.87	21.23
6.703	0.001	284.97	278.13	6.85	10.430	13.99	24334	0.696	8570	83.91	50.15	1.10	0.39	5.77	19.90	21.26
7.249	0.001	285.14	278.52	6.62	10.425	14.02	24312	0.696	8831	86.38	51.13	1.10	0.40	5.77	20.46	21.79
3.566	0.953	281.35	275.86	5.50	10.455	13.85	24461	0.697	10693	105.31	58.44	1.10	0.39	5.77	23.58	24.74
4.176	0.927	282.76	276.30	6.46	10.450	13.88	24436	0.697	9112	89.65	52.52	1.10	0.38	5.77	20.73	22.04
5.370	0.953	284.38	277.16	7.21	10.440	13.93	24388	0.696	8153	80.02	48.60	1.10	0.38	5.77	19.12	20.53
6.703	0.927	285.40	278.13	7.27	10.430	13.99	24334	0.696	8066	78.98	48.13	1.10	0.39	5.77	19.05	20.47
7.313	0.914	285.54	278.57	6.97	10.425	14.02	24310	0.696	8379	81.95	49.34	1.10	0.40	5.77	19.70	21.08
3.528	-0.953	281.79	275.83	5.96	10.455	13.85	24463	0.697	9859	97.11	55.41	1.10	0.39	5.77	22.11	23.34
4.112	-0.914	282.90	276.25	6.65	10.450	13.88	24439	0.697	8853	87.10	51.51	1.10	0.38	5.77	20.29	21.62
5.408	-0.927	284.86	277.19	7.67	10.440	13.93	24386	0.696	7668	75.26	46.60	1.10	0.38	5.77	18.31	19.78
6.678	-0.978	285.86	278.11	7.75	10.430	13.99	24335	0.696	7572	74.15	46.09	1.10	0.39	5.77	18.23	19.70
7.313	-0.978	285.96	278.57	7.39	10.425	14.02	24310	0.696	7899	77.25	47.39	1.10	0.40	5.77	18.89	20.32

English Units:

												Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	45.84	36.77	9.07	1516.4	45.43	24464	0.697	2054.8	114.87	61.82	1.98	0.70	5.77	25.35	26.43
1.639	-0.010	48.37	37.63	10.75	1515.6	45.53	24437	0.697	1738.9	97.09	55.38	1.98	0.69	5.77	22.04	23.28
2.129	-0.028	51.56	39.25	12.31	1514.2	45.71	24386	0.696	1515.3	84.41	50.40	1.98	0.68	5.77	19.87	21.23
2.639	0.000	53.26	40.94	12.33	1512.7	45.90	24334	0.696	1510.0	83.91	50.15	1.98	0.70	5.77	19.90	21.26
2.854	0.000	53.56	41.65	11.91	1512.1	45.98	24312	0.696	1556.0	86.38	51.13	1.98	0.72	5.77	20.46	21.79
1.404	0.375	46.75	36.85	9.90	1516.3	45.44	24461	0.697	1884.1	105.31	58.44	1.98	0.70	5.77	23.58	24.74
1.644	0.365	49.28	37.65	11.64	1515.6	45.53	24436	0.697	1605.5	89.65	52.52	1.98	0.69	5.77	20.73	22.04
2.114	0.375	52.19	39.20	12.98	1514.2	45.71	24388	0.696	1436.6	80.02	48.60	1.98	0.68	5.77	19.12	20.53
2.639	0.365	54.03	40.94	13.09	1512.7	45.90	24334	0.696	1421.2	78.98	48.13	1.98	0.70	5.77	19.05	20.47
2.879	0.360	54.27	41.73	12.55	1512.0	45.99	24310	0.696	1476.4	81.95	49.34	1.98	0.73	5.77	19.70	21.08
1.389	-0.375	47.53	36.80	10.73	1516.3	45.44	24463	0.697	1737.2	97.11	55.41	1.98	0.70	5.77	22.11	23.34
1.619	-0.360	49.54	37.56	11.98	1515.7	45.52	24439	0.697	1559.9	87.10	51.51	1.98	0.69	5.77	20.29	21.62
2.129	-0.365	53.06	39.25	13.80	1514.2	45.71	24386	0.696	1351.1	75.26	46.60	1.98	0.68	5.77	18.31	19.78
2.629	-0.385	54.85	40.90	13.95	1512.7	45.90	24335	0.696	1334.2	74.15	46.09	1.98	0.70	5.77	18.23	19.70
2.879	-0.385	55.04	41.73	13.31	1512.0	45.99	24310	0.696	1391.8	77.25	47.39	1.98	0.73	5.77	18.89	20.32

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 9
Date: 7 January 1992
Time: 10:05:38

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.29	32.23	280.98	46.07	19.50	0.01194	10.484	1520.5	80.59	11.69	8.56	605	9.23	20.63	18.17

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.06	35.43
1.702	0.670	0.001	0.000	275.51	36.22
9.093	3.580	0.001	0.000	283.07	49.83
10.706	4.215	0.001	0.000	282.53	48.86

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	280.83	275.77	5.07	10.456	13.85	24474	0.697	11605	114.32	61.64	1.10	0.39	5.77	25.23	26.32
4.163	-0.025	282.25	276.25	6.00	10.451	13.88	24448	0.697	9820	96.62	55.21	1.10	0.38	5.77	21.94	23.18
5.408	-0.071	284.02	277.15	6.87	10.441	13.94	24397	0.696	8570	84.12	50.28	1.10	0.38	5.77	19.81	21.18
6.703	0.001	284.96	278.08	6.88	10.431	13.99	24345	0.696	8538	83.61	50.03	1.10	0.39	5.77	19.84	21.20
7.249	0.001	285.13	278.48	6.66	10.426	14.02	24323	0.696	8786	85.95	50.96	1.10	0.40	5.77	20.37	21.71
3.566	0.953	281.35	275.81	5.54	10.455	13.85	24472	0.697	10623	104.64	58.20	1.10	0.39	5.77	23.44	24.61
4.176	0.927	282.74	276.26	6.48	10.451	13.88	24447	0.697	9091	89.44	52.44	1.10	0.38	5.77	20.68	21.99
5.370	0.953	284.35	277.12	7.23	10.441	13.93	24399	0.696	8144	79.94	48.57	1.10	0.38	5.77	19.09	20.51
6.703	0.927	285.40	278.08	7.32	10.431	13.99	24345	0.696	8023	78.56	47.96	1.10	0.39	5.77	18.97	20.39
7.313	0.914	285.51	278.52	6.99	10.426	14.02	24320	0.696	8366	81.83	49.29	1.10	0.40	5.77	19.67	21.05
3.528	-0.953	281.81	275.79	6.02	10.456	13.85	24473	0.697	9765	96.19	55.06	1.10	0.39	5.77	21.93	23.17
4.112	-0.914	282.88	276.21	6.67	10.451	13.88	24450	0.697	8829	86.88	51.43	1.10	0.38	5.77	20.23	21.57
5.408	-0.927	284.84	277.15	7.70	10.441	13.94	24397	0.696	7645	75.05	46.51	1.10	0.38	5.77	18.27	19.74
6.678	-0.978	285.85	278.07	7.79	10.431	13.99	24346	0.696	7540	73.83	45.95	1.10	0.39	5.77	18.16	19.65
7.313	-0.978	285.96	278.52	7.43	10.426	14.02	24320	0.696	7862	76.90	47.24	1.10	0.40	5.77	18.81	20.25

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	45.81	36.69	9.12	1516.5	45.44	24474	0.697	2044.8	114.32	61.64	1.98	0.70	5.77	25.23	26.32
1.639	-0.010	48.36	37.55	10.81	1515.7	45.53	24448	0.697	1730.3	96.62	55.21	1.98	0.69	5.77	21.94	23.18
2.129	-0.028	51.54	39.18	12.36	1514.3	45.72	24397	0.696	1510.0	84.12	50.28	1.98	0.68	5.77	19.81	21.18
2.639	0.000	53.24	40.86	12.38	1512.8	45.91	24345	0.696	1504.4	83.61	50.03	1.98	0.70	5.77	19.84	21.20
2.854	0.000	53.55	41.57	11.98	1512.2	45.99	24323	0.696	1548.1	85.95	50.96	1.98	0.72	5.77	20.37	21.71
1.404	0.375	46.74	36.78	9.97	1516.4	45.45	24472	0.697	1871.8	104.64	58.20	1.98	0.70	5.77	23.44	24.61
1.644	0.365	49.24	37.57	11.67	1515.7	45.54	24447	0.697	1601.8	89.44	52.44	1.98	0.69	5.77	20.68	21.99
2.114	0.375	52.14	39.13	13.01	1514.4	45.71	24399	0.696	1435.0	79.94	48.57	1.98	0.68	5.77	19.09	20.51
2.639	0.365	54.04	40.86	13.17	1512.8	45.91	24345	0.696	1413.7	78.56	47.96	1.98	0.70	5.77	18.97	20.39
2.879	0.360	54.23	41.66	12.57	1512.1	46.00	24320	0.696	1474.1	81.83	49.29	1.98	0.73	5.77	19.67	21.05
1.389	-0.375	47.56	36.73	10.84	1516.5	45.44	24473	0.697	1720.6	96.19	55.06	1.98	0.70	5.77	21.93	23.17
1.619	-0.360	49.50	37.49	12.01	1515.8	45.53	24450	0.697	1555.7	86.88	51.43	1.98	0.69	5.77	20.23	21.57
2.129	-0.365	53.03	39.18	13.85	1514.3	45.72	24397	0.696	1347.0	75.05	46.51	1.98	0.68	5.77	18.27	19.74
2.629	-0.385	54.85	40.83	14.02	1512.8	45.90	24346	0.696	1328.5	73.83	45.95	1.98	0.70	5.77	18.16	19.65
2.879	-0.385	55.03	41.66	13.38	1512.1	46.00	24320	0.696	1385.3	76.90	47.24	1.98	0.73	5.77	18.81	20.25

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 10
Date: 7 January 1992
Time: 10:08:06

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.19	32.05	273.24	32.14	19.47	0.01192	10.490	1521.4	80.44	11.67	8.57	2	0.00	0.07	0.06

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	273.25	32.17
1.702	0.670	0.001	0.000	273.19	32.05
9.093	3.580	0.001	0.000	273.29	32.24
10.706	4.215	0.001	0.000	273.24	32.15

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	273.19	273.20	-0.01	10.462	13.69	24575	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	273.23	273.20	0.02	10.457	13.70	24575	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	273.30	273.21	0.09	10.447	13.71	24575	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	273.30	273.22	0.08	10.437	13.72	24575	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	273.27	273.22	0.05	10.432	13.73	24576	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	273.21	273.20	0.01	10.461	13.69	24575	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	273.26	273.20	0.06	10.457	13.70	24575	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	273.29	273.21	0.08	10.447	13.71	24575	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	273.35	273.22	0.14	10.437	13.72	24575	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	273.34	273.22	0.12	10.432	13.73	24576	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	273.20	273.20	-0.00	10.462	13.69	24575	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	273.21	273.20	0.01	10.457	13.70	24575	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	273.29	273.21	0.08	10.447	13.71	24575	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	273.31	273.22	0.09	10.437	13.72	24575	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	273.24	273.22	0.02	10.432	13.73	24576	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	32.06	32.07	-0.01	1517.4	44.92	24575	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	32.12	32.08	0.04	1516.6	44.94	24575	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	32.25	32.09	0.16	1515.2	44.98	24575	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	32.25	32.10	0.15	1513.7	45.02	24575	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	32.20	32.11	0.09	1513.1	45.04	24576	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	32.09	32.07	0.02	1517.3	44.92	24575	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	32.19	32.08	0.11	1516.6	44.94	24575	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	32.24	32.09	0.15	1515.2	44.98	24575	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	32.35	32.10	0.25	1513.7	45.02	24575	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	32.32	32.11	0.21	1513.0	45.04	24576	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	32.07	32.07	-0.00	1517.3	44.92	24575	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	32.10	32.08	0.02	1516.7	44.94	24575	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	32.23	32.09	0.14	1515.2	44.98	24575	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	32.27	32.10	0.17	1513.7	45.02	24575	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	32.14	32.11	0.03	1513.0	45.04	24576	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 11
Date: 7 January 1992
Time: 10:08:32

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.16	32.00	273.18	32.04	19.46	0.01192	10.491	1521.6	80.50	11.68	8.57	0	0.00	0.00	0.00

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	273.22	32.11
1.702	0.670	0.001	0.000	273.16	32.00
9.093	3.580	0.001	0.000	273.25	32.16
10.706	4.215	0.001	0.000	273.22	32.11

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	273.19	273.16	0.02	10.464	13.68	24571	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	273.20	273.17	0.03	10.458	13.69	24571	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	273.27	273.17	0.11	10.448	13.70	24572	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	273.27	273.17	0.09	10.438	13.72	24572	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	273.23	273.17	0.06	10.434	13.72	24572	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	273.18	273.16	0.01	10.463	13.69	24571	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	273.24	273.17	0.07	10.458	13.69	24571	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	273.26	273.17	0.10	10.449	13.70	24571	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	273.34	273.17	0.17	10.438	13.72	24572	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	273.30	273.17	0.12	10.433	13.72	24572	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	273.18	273.16	0.02	10.463	13.68	24571	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	273.20	273.17	0.03	10.459	13.69	24571	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	273.25	273.17	0.08	10.448	13.70	24572	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	273.28	273.17	0.11	10.438	13.72	24572	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	273.21	273.17	0.03	10.433	13.72	24572	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	32.05	32.01	0.04	1517.6	44.89	24571	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	32.07	32.01	0.06	1516.8	44.92	24571	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	32.20	32.01	0.19	1515.4	44.96	24572	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	32.19	32.02	0.17	1513.9	45.00	24572	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	32.13	32.02	0.11	1513.3	45.02	24572	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	32.03	32.01	0.02	1517.5	44.90	24571	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	32.14	32.01	0.13	1516.8	44.92	24571	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	32.19	32.01	0.17	1515.5	44.96	24571	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	32.32	32.02	0.30	1513.9	45.00	24572	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	32.25	32.02	0.22	1513.2	45.02	24572	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	32.04	32.01	0.04	1517.6	44.89	24571	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	32.07	32.01	0.06	1516.9	44.91	24571	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	32.17	32.01	0.15	1515.4	44.96	24572	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	32.21	32.02	0.19	1514.0	45.00	24572	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	32.08	32.02	0.06	1513.2	45.02	24572	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 12
Date: 7 January 1992
Time: 10:08:57

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.14	31.96	273.19	32.05	19.46	0.01192	10.493	1521.8	80.51	11.68	8.56	2	0.00	0.07	0.06

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	273.20	32.08
1.702	0.670	0.001	0.000	273.15	31.97
9.093	3.580	0.001	0.000	273.23	32.12
10.706	4.215	0.001	0.000	273.20	32.07

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	273.16	273.15	0.01	10.465	13.68	24565	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	273.17	273.16	0.01	10.460	13.69	24565	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	273.25	273.16	0.09	10.450	13.70	24565	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	273.25	273.17	0.08	10.440	13.71	24566	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	273.23	273.17	0.06	10.435	13.72	24566	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	273.17	273.15	0.02	10.464	13.68	24565	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	273.21	273.16	0.06	10.460	13.69	24565	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	273.25	273.16	0.09	10.450	13.70	24565	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	273.31	273.17	0.14	10.440	13.71	24566	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	273.29	273.17	0.12	10.435	13.72	24566	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	273.17	273.15	0.02	10.465	13.68	24565	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	273.17	273.16	0.02	10.460	13.69	24565	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	273.23	273.16	0.07	10.450	13.70	24565	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	273.25	273.17	0.08	10.440	13.71	24566	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	273.21	273.17	0.04	10.435	13.72	24566	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	32.00	31.99	0.01	1517.8	44.88	24565	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	32.02	31.99	0.03	1517.0	44.90	24565	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	32.16	32.00	0.16	1515.6	44.94	24565	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	32.16	32.02	-0.15	1514.1	44.98	24566	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	32.12	32.02	0.10	1513.5	45.00	24566	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	32.03	31.99	0.04	1517.7	44.88	24565	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	32.10	31.99	0.11	1517.0	44.90	24565	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	32.16	32.00	0.16	1515.7	44.94	24565	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	32.28	32.02	0.26	1514.1	44.98	24566	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	32.23	32.02	0.21	1513.4	45.00	24566	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	32.02	31.99	0.03	1517.8	44.88	24565	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	32.02	31.99	0.03	1517.1	44.90	24565	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	32.13	32.00	0.12	1515.6	44.94	24565	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	32.17	32.02	0.15	1514.2	44.98	24566	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	32.08	32.02	0.06	1513.4	45.00	24566	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 13
Date: 7 January 1992
Time: 10:14:08

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.96	31.63	280.63	45.44	19.43	0.01190	10.497	1522.5	80.77	11.71	8.54	601	9.25	20.49	18.05

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	274.71	34.78
1.702	0.670	0.001	0.000	275.15	35.57
9.093	3.580	0.001	0.000	282.71	49.19
10.706	4.215	0.001	0.000	282.15	48.19

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	280.48	275.43	5.05	10.469	13.76	24397	0.697	11570	114.07	61.57	1.10	0.39	5.77	25.30	26.39
4.163	-0.025	281.89	275.90	5.99	10.464	13.79	24370	0.697	9786	96.36	55.12	1.10	0.38	5.77	22.00	23.24
5.408	-0.071	283.64	276.80	6.84	10.454	13.85	24320	0.696	8552	84.02	50.25	1.10	0.38	5.77	19.88	21.24
6.703	0.001	284.61	277.74	6.87	10.444	13.90	24268	0.696	8491	83.21	49.88	1.10	0.39	5.77	19.86	21.22
7.249	0.001	284.76	278.13	6.63	10.439	13.93	24246	0.696	8762	85.79	50.91	1.10	0.40	5.77	20.44	21.77
3.566	0.953	280.99	275.47	5.52	10.469	13.77	24394	0.697	10591	104.41	58.13	1.10	0.39	5.77	23.51	24.68
4.176	0.927	282.39	275.91	6.48	10.464	13.79	24369	0.697	9045	89.07	52.31	1.10	0.38	5.77	20.71	22.02
5.370	0.953	283.99	276.78	7.22	10.454	13.85	24321	0.696	8104	79.62	48.45	1.10	0.38	5.77	19.12	20.53
6.703	0.927	285.06	277.74	7.32	10.444	13.90	24268	0.696	7970	78.11	47.78	1.10	0.39	5.77	18.97	20.40
7.313	0.914	285.17	278.18	7.00	10.439	13.93	24244	0.696	8298	81.24	49.06	1.10	0.40	5.77	19.65	21.03
3.528	-0.953	281.42	275.45	5.97	10.469	13.76	24396	0.697	9787	96.49	55.19	1.10	0.39	5.77	22.09	23.32
4.112	-0.914	282.54	275.87	6.67	10.464	13.79	24372	0.697	8782	86.49	51.29	1.10	0.38	5.77	20.26	21.60
5.408	-0.927	284.49	276.80	7.69	10.454	13.85	24320	0.696	7606	74.72	46.38	1.10	0.38	5.77	18.29	19.76
6.678	-0.978	285.48	277.72	7.76	10.444	13.90	24269	0.696	7522	73.72	45.92	1.10	0.39	5.77	18.22	19.70
7.313	-0.978	285.61	278.18	7.43	10.439	13.93	24244	0.696	7818	76.54	47.10	1.10	0.40	5.77	18.83	20.27

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	45.17	36.08	9.09	1518.4	45.15	24397	0.697	2038.6	114.07	61.57	1.98	0.70	5.77	25.30	26.39
1.639	-0.010	47.72	36.94	10.77	1517.7	45.25	24370	0.697	1724.3	96.36	55.12	1.98	0.69	5.77	22.00	23.24
2.129	-0.028	50.87	38.56	12.31	1516.2	45.43	24320	0.696	1506.9	84.02	50.25	1.98	0.68	5.77	19.88	21.24
2.639	0.000	52.61	40.24	12.37	1514.7	45.62	24268	0.696	1496.1	83.21	49.88	1.98	0.70	5.77	19.86	21.22
2.854	0.000	52.89	40.95	11.94	1514.1	45.70	24246	0.696	1543.9	85.79	50.91	1.98	0.72	5.77	20.44	21.77
1.404	0.375	46.10	36.16	9.93	1518.4	45.16	24394	0.697	1866.1	104.41	58.13	1.98	0.70	5.77	23.51	24.68
1.644	0.365	48.61	36.96	11.66	1517.7	45.25	24369	0.697	1593.7	89.07	52.31	1.98	0.68	5.77	20.71	22.02
2.114	0.375	51.50	38.51	12.99	1516.3	45.43	24321	0.696	1427.9	79.62	48.45	1.98	0.68	5.77	19.12	20.53
2.639	0.365	53.42	40.24	13.18	1514.7	45.62	24268	0.696	1404.3	78.11	47.78	1.98	0.70	5.77	18.97	20.40
2.879	0.360	53.63	41.03	12.60	1514.0	45.71	24244	0.696	1462.1	81.24	49.06	1.98	0.73	5.77	19.65	21.03
1.389	-0.375	46.86	36.11	10.75	1518.4	45.15	24396	0.697	1724.5	96.49	55.19	1.98	0.70	5.77	22.09	23.32
1.619	-0.360	48.88	36.87	12.00	1517.7	45.24	24372	0.697	1547.4	86.49	51.29	1.98	0.69	5.77	20.26	21.60
2.129	-0.365	52.40	38.56	13.84	1516.2	45.43	24320	0.696	1340.2	74.72	46.38	1.98	0.68	5.77	18.29	19.76
2.629	-0.385	54.17	40.21	13.96	1514.8	45.62	24269	0.696	1325.4	73.72	45.92	1.98	0.70	5.77	18.22	19.70
2.879	-0.385	54.40	41.03	13.37	1514.0	45.71	24244	0.696	1377.5	76.54	47.10	1.98	0.73	5.77	18.83	20.27

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 14
Date: 7 January 1992
Time: 10:14:33

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.95	31.62	280.64	45.47	19.44	0.01190	10.497	1522.5	80.72	11.71	8.54	603	9.23	20.56	18.11

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	274.70	34.77
1.702	0.670	0.001	0.000	275.16	35.59
9.093	3.580	0.001	0.000	282.70	49.17
10.706	4.215	0.001	0.000	282.16	48.20

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	280.46	275.43	5.03	10.469	13.77	24408	0.697	11642	114.79	61.82	1.10	0.39	5.77	25.36	26.45
4.163	-0.025	281.88	275.91	5.97	10.464	13.80	24381	0.697	9838	96.88	55.32	1.10	0.38	5.77	22.03	23.27
5.408	-0.071	283.65	276.81	6.85	10.454	13.85	24330	0.696	8569	84.19	50.32	1.10	0.38	5.77	19.85	21.22
6.703	0.001	284.60	277.75	6.85	10.444	13.91	24278	0.696	8546	83.76	50.11	1.10	0.39	5.77	19.90	21.26
7.249	0.001	284.77	278.14	6.63	10.440	13.94	24257	0.696	8791	86.07	51.02	1.10	0.40	5.77	20.43	21.76
3.566	0.953	280.98	275.48	5.51	10.469	13.77	24405	0.697	10645	104.94	58.32	1.10	0.39	5.77	23.54	24.70
4.176	0.927	282.38	275.92	6.46	10.464	13.80	24380	0.697	9093	89.54	52.49	1.10	0.38	5.77	20.73	22.04
5.370	0.953	283.99	276.78	7.21	10.455	13.85	24332	0.696	8140	79.98	48.60	1.10	0.38	5.77	19.13	20.54
6.703	0.927	285.05	277.75	7.30	10.444	13.91	24278	0.696	8013	78.53	47.96	1.10	0.39	5.77	18.99	20.42
7.313	0.914	285.16	278.19	6.98	10.439	13.94	24254	0.696	8348	81.72	49.26	1.10	0.40	5.77	19.68	21.06
3.528	-0.953	281.45	275.45	6.01	10.469	13.77	24407	0.697	9761	96.24	55.10	1.10	0.39	5.77	21.98	23.22
4.112	-0.914	282.54	275.87	6.67	10.465	13.80	24383	0.697	8809	86.75	51.39	1.10	0.38	5.77	20.25	21.59
5.408	-0.927	284.48	276.81	7.67	10.454	13.85	24330	0.696	7645	75.11	46.55	1.10	0.38	5.77	18.31	19.78
6.678	-0.978	285.49	277.73	7.76	10.444	13.91	24279	0.696	7544	73.94	46.01	1.10	0.39	5.77	18.21	19.69
7.313	-0.978	285.58	278.19	7.40	10.439	13.94	24254	0.696	7873	77.07	47.33	1.10	0.40	5.77	18.87	20.30

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	45.15	36.08	9.06	1518.4	45.17	24408	0.697	2051.3	114.79	61.82	1.98	0.70	5.77	25.36	26.45
1.639	-0.010	47.70	36.94	10.75	1517.7	45.27	24381	0.697	1733.5	96.88	55.32	1.98	0.69	5.77	22.03	23.27
2.129	-0.028	50.89	38.57	12.32	1516.3	45.45	24330	0.696	1509.9	84.19	50.32	1.98	0.68	5.77	19.85	21.22
2.639	0.000	52.58	40.25	12.33	1514.8	45.64	24278	0.696	1505.8	83.76	50.11	1.98	0.70	5.77	19.90	21.26
2.854	0.000	52.90	40.96	11.94	1514.1	45.72	24257	0.696	1549.0	86.07	51.02	1.98	0.72	5.77	20.43	21.76
1.404	0.375	46.08	36.17	9.91	1518.4	45.18	24405	0.697	1875.6	104.94	58.32	1.98	0.70	5.77	23.54	24.70
1.644	0.365	48.59	36.96	11.63	1517.7	45.27	24380	0.697	1602.2	89.54	52.49	1.98	0.69	5.77	20.73	22.04
2.114	0.375	51.49	38.52	12.97	1516.3	45.45	24332	0.696	1434.3	79.98	48.60	1.98	0.68	5.77	19.13	20.54
2.639	0.365	53.40	40.25	13.15	1514.8	45.64	24278	0.696	1411.9	78.53	47.96	1.98	0.70	5.77	18.99	20.42
2.879	0.360	53.61	41.05	12.56	1514.1	45.73	24254	0.696	1470.9	81.72	49.26	1.98	0.73	5.77	19.68	21.06
1.389	-0.375	46.93	36.12	10.81	1518.4	45.17	24407	0.697	1719.9	96.24	55.10	1.98	0.70	5.77	21.98	23.22
1.619	-0.360	48.88	36.88	12.01	1517.7	45.26	24383	0.697	1552.1	86.75	51.39	1.98	0.69	5.77	20.25	21.59
2.129	-0.365	52.38	38.57	13.81	1516.3	45.45	24330	0.696	1347.0	75.11	46.55	1.98	0.68	5.77	18.31	19.78
2.629	-0.385	54.19	40.22	13.97	1514.8	45.64	24279	0.696	1329.3	73.94	46.01	1.98	0.70	5.77	18.21	19.69
2.879	-0.385	54.36	41.05	13.32	1514.1	45.73	24254	0.696	1387.2	77.07	47.33	1.98	0.73	5.77	18.87	20.30

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 15
Date: 7 January 1992
Time: 10:14:59

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.96	31.64	280.62	45.42	19.42	0.01190	10.497	1522.4	80.64	11.70	8.55	600	9.26	20.46	18.02

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	274.69	34.75
1.702	0.670	0.001	0.000	275.14	35.56
9.093	3.580	0.001	0.000	282.71	49.18
10.706	4.215	0.001	0.000	282.16	48.20

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	280.45	275.43	5.03	10.469	13.76	24394	0.697	11606	114.43	61.69	1.10	0.39	5.77	25.41	26.49
4.163	-0.025	281.89	275.90	5.98	10.464	13.79	24367	0.697	9775	96.26	55.09	1.10	0.38	5.77	22.02	23.25
5.408	-0.071	283.65	276.80	6.85	10.454	13.85	24317	0.696	8528	83.78	50.16	1.10	0.38	5.77	19.87	21.23
6.703	0.001	284.60	277.73	6.87	10.443	13.90	24265	0.696	8478	83.09	49.84	1.10	0.39	5.77	19.87	21.23
7.249	0.001	284.77	278.13	6.64	10.439	13.93	24244	0.696	8731	85.48	50.78	1.10	0.40	5.77	20.42	21.75
3.566	0.953	280.99	275.47	5.52	10.468	13.76	24391	0.697	10579	104.29	58.09	1.10	0.39	5.77	23.53	24.69
4.176	0.927	282.38	275.91	6.47	10.463	13.79	24367	0.697	9035	88.97	52.27	1.10	0.38	5.77	20.72	22.03
5.370	0.953	284.00	276.77	7.22	10.454	13.84	24319	0.696	8081	79.40	48.36	1.10	0.38	5.77	19.11	20.53
6.703	0.927	285.06	277.73	7.32	10.443	13.90	24265	0.696	7953	77.95	47.71	1.10	0.39	5.77	18.98	20.40
7.313	0.914	285.17	278.17	7.00	10.439	13.93	24241	0.696	8284	81.10	49.01	1.10	0.40	5.77	19.66	21.04
3.528	-0.953	281.42	275.44	5.97	10.469	13.76	24393	0.697	9768	96.30	55.12	1.10	0.39	5.77	22.09	23.32
4.112	-0.914	282.52	275.86	6.66	10.464	13.79	24369	0.697	8779	86.46	51.27	1.10	0.38	5.77	20.29	21.62
5.408	-0.927	284.48	276.80	7.68	10.454	13.85	24317	0.696	7599	74.65	46.35	1.10	0.38	5.77	18.31	19.78
6.678	-0.978	285.49	277.72	7.78	10.444	13.90	24266	0.696	7490	73.41	45.78	1.10	0.39	5.77	18.20	19.68
7.313	-0.978	285.60	278.17	7.43	10.439	13.93	24241	0.696	7799	76.36	47.03	1.10	0.40	5.77	18.83	20.26

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	45.13	36.08	9.05	1518.4	45.15	24394	0.697	2045.0	114.43	61.69	1.98	0.70	5.77	25.41	26.49
1.639	-0.010	47.71	36.94	10.77	1517.6	45.24	24367	0.697	1722.4	96.26	55.09	1.98	0.69	5.77	22.02	23.25
2.129	-0.028	50.87	38.55	12.32	1516.2	45.43	24317	0.696	1502.6	83.78	50.16	1.98	0.68	5.77	19.87	21.23
2.639	0.000	52.60	40.23	12.37	1514.7	45.62	24265	0.696	1493.8	83.09	49.84	1.98	0.70	5.77	19.87	21.23
2.854	0.000	52.90	40.94	11.96	1514.1	45.69	24244	0.696	1538.4	85.48	50.78	1.98	0.72	5.77	20.42	21.75
1.404	0.375	46.09	36.16	9.93	1518.3	45.16	24391	0.697	1864.0	104.29	58.09	1.98	0.70	5.77	23.53	24.69
1.644	0.365	48.60	36.95	11.65	1517.6	45.25	24367	0.697	1592.0	88.97	52.27	1.98	0.68	5.77	20.72	22.03
2.114	0.375	51.51	38.50	13.00	1516.2	45.42	24319	0.696	1423.9	79.40	48.36	1.98	0.68	5.77	19.11	20.53
2.639	0.365	53.41	40.23	13.18	1514.7	45.62	24265	0.696	1401.3	77.95	47.71	1.98	0.70	5.77	18.98	20.40
2.879	0.360	53.62	41.02	12.60	1514.0	45.70	24241	0.696	1459.6	81.10	49.01	1.98	0.73	5.77	19.66	21.04
1.389	-0.375	46.86	36.11	10.75	1518.3	45.15	24393	0.697	1721.1	96.30	55.12	1.98	0.70	5.77	22.09	23.32
1.619	-0.360	48.86	36.87	11.99	1517.7	45.24	24369	0.697	1546.9	86.46	51.27	1.98	0.69	5.77	20.29	21.62
2.129	-0.365	52.38	38.55	13.83	1516.2	45.43	24317	0.696	1338.9	74.65	46.35	1.98	0.68	5.77	18.31	19.78
2.629	-0.385	54.20	40.20	14.00	1514.7	45.61	24266	0.696	1319.7	73.41	45.78	1.98	0.70	5.77	18.20	19.68
2.879	-0.385	54.40	41.02	13.38	1514.0	45.70	24241	0.696	1374.2	76.36	47.03	1.98	0.73	5.77	18.83	20.26

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 16
Date: 7 January 1992
Time: 10:18:14

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.92	31.56	282.67	49.12	15.38	0.00942	10.505	1523.7	49.24	7.14	14.00	606	7.29	20.66	18.20

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.31	35.88
1.702	0.670	0.001	0.000	275.86	36.85
9.093	3.580	0.001	0.000	285.28	53.82
10.706	4.215	0.001	0.000	284.66	52.70

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.40	276.06	6.33	10.488	10.90	19289	0.697	9298	91.52	53.26	1.10	0.40	5.77	20.35	21.69
4.163	-0.025	284.15	276.67	7.49	10.485	10.93	19262	0.697	7889	77.53	47.58	1.10	0.39	5.77	17.78	19.29
5.408	-0.071	286.35	277.81	8.54	10.479	10.98	19212	0.696	6903	67.63	43.24	1.10	0.39	5.77	16.13	17.78
6.703	0.001	287.55	279.00	8.55	10.473	11.03	19159	0.696	6877	67.18	43.00	1.10	0.41	5.77	16.16	17.81
7.249	0.001	287.75	279.50	8.25	10.470	11.05	19137	0.696	7101	69.27	43.91	1.10	0.42	5.77	16.63	18.24
3.566	0.953	282.94	276.12	6.82	10.488	10.91	19287	0.697	8635	84.98	50.67	1.10	0.40	5.77	19.15	20.56
4.176	0.927	284.67	276.68	7.99	10.485	10.93	19262	0.697	7389	72.61	45.47	1.10	0.39	5.77	16.92	18.50
5.370	0.953	286.69	277.78	8.91	10.479	10.98	19213	0.696	6616	64.83	41.97	1.10	0.39	5.77	15.64	17.34
6.703	0.927	287.99	279.00	8.99	10.473	11.03	19159	0.696	6543	63.91	41.51	1.10	0.41	5.77	15.59	17.30
7.313	0.914	288.13	279.56	8.57	10.470	11.06	19135	0.696	6833	66.65	42.74	1.10	0.42	5.77	16.18	17.83
3.528	-0.953	283.44	276.09	7.36	10.488	10.90	19288	0.697	8005	78.79	48.13	1.10	0.40	5.77	18.05	19.54
4.112	-0.914	284.83	276.62	8.21	10.485	10.93	19264	0.697	7195	70.72	44.65	1.10	0.39	5.77	16.59	18.20
5.408	-0.927	287.26	277.81	9.45	10.479	10.98	19212	0.696	6242	61.16	40.27	1.10	0.39	5.77	15.03	16.79
6.678	-0.978	288.47	278.98	9.49	10.473	11.03	19160	0.696	6197	60.54	39.94	1.10	0.41	5.77	15.02	16.78
7.313	-0.978	288.62	279.56	9.06	10.470	11.06	19135	0.696	6463	63.04	41.09	1.10	0.42	5.77	15.56	17.27

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.63	37.23	11.40	1521.2	35.77	19289	0.697	1638.3	91.52	53.26	1.98	0.72	5.77	20.35	21.69
1.639	-0.010	51.79	38.32	13.47	1520.7	35.86	19262	0.697	1390.0	77.53	47.58	1.98	0.70	5.77	17.78	19.29
2.129	-0.028	55.75	40.38	15.37	1519.9	36.02	19212	0.696	1216.3	67.63	43.24	1.98	0.71	5.77	16.13	17.78
2.639	0.000	57.91	42.51	15.40	1519.0	36.19	19159	0.696	1211.7	67.18	43.00	1.98	0.73	5.77	16.16	17.81
2.854	0.000	58.26	43.41	14.85	1518.6	36.26	19137	0.696	1251.2	69.27	43.91	1.98	0.75	5.77	16.63	18.24
1.404	0.375	49.61	37.33	12.28	1521.2	35.78	19287	0.697	1521.5	84.98	50.67	1.98	0.71	5.77	19.15	20.56
1.644	0.365	52.73	38.34	14.39	1520.7	35.86	19262	0.697	1301.9	72.61	45.47	1.98	0.70	5.77	16.92	18.50
2.114	0.375	56.35	40.31	16.04	1519.9	36.02	19213	0.696	1165.7	64.83	41.97	1.98	0.71	5.77	15.64	17.34
2.639	0.365	58.70	42.51	16.18	1519.0	36.19	19159	0.696	1152.9	63.91	41.51	1.98	0.73	5.77	15.59	17.30
2.879	0.360	58.94	43.52	15.42	1518.5	36.27	19135	0.696	1204.0	66.65	42.74	1.98	0.76	5.77	16.18	17.83
1.389	-0.375	50.51	37.27	13.24	1521.2	35.77	19288	0.697	1410.5	78.79	48.13	1.98	0.72	5.77	18.05	19.54
1.619	-0.360	53.00	38.23	14.77	1520.8	35.85	19264	0.697	1267.8	70.72	44.65	1.98	0.71	5.77	16.59	18.20
2.129	-0.365	57.38	40.38	17.00	1519.9	36.02	19212	0.696	1099.8	61.16	40.27	1.98	0.71	5.77	15.03	16.79
2.629	-0.385	59.56	42.47	17.09	1519.0	36.19	19160	0.696	1091.9	60.54	39.94	1.98	0.73	5.77	15.02	16.78
2.879	-0.385	59.82	43.52	16.31	1518.5	36.27	19135	0.696	1138.8	63.04	41.09	1.98	0.76	5.77	15.56	17.27

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 17
Date: 7 January 1992
Time: 10:18:39

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.94	31.60	282.70	49.16	15.38	0.00942	10.504	1523.5	49.21	7.14	14.01	606	7.28	20.66	18.20

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.31	35.88
1.702	0.670	0.001	0.000	275.86	36.86
9.093	3.580	0.001	0.000	285.32	53.89
10.706	4.215	0.001	0.000	284.66	52.70

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.40	276.08	6.32	10.487	10.90	19280	0.697	9321	91.74	53.34	1.10	0.40	5.77	20.39	21.72
4.163	-0.025	284.17	276.69	7.48	10.484	10.93	19253	0.697	7899	77.62	47.61	1.10	0.39	5.77	17.79	19.30
5.408	-0.071	286.37	277.83	8.54	10.478	10.98	19202	0.696	6909	67.69	43.26	1.10	0.39	5.77	16.13	17.78
6.703	0.001	287.56	279.02	8.54	10.472	11.03	19150	0.696	6894	67.34	43.07	1.10	0.41	5.77	16.18	17.83
7.249	0.001	287.76	279.52	8.24	10.469	11.05	19128	0.696	7112	69.38	43.96	1.10	0.42	5.77	16.64	18.25
3.566	0.953	282.96	276.14	6.82	10.487	10.90	19278	0.697	8649	85.11	50.72	1.10	0.40	5.77	19.17	20.58
4.176	0.927	284.67	276.70	7.97	10.484	10.93	19253	0.697	7410	72.81	45.56	1.10	0.39	5.77	16.95	18.53
5.370	0.953	286.70	277.80	8.90	10.478	10.98	19204	0.696	6629	64.95	42.02	1.10	0.39	5.77	15.66	17.36
6.703	0.927	288.00	279.02	8.98	10.472	11.03	19150	0.696	6552	64.00	41.55	1.10	0.41	5.77	15.60	17.31
7.313	0.914	288.14	279.58	8.56	10.469	11.05	19126	0.696	6843	66.74	42.78	1.10	0.42	5.77	16.19	17.84
3.528	-0.953	283.44	276.11	7.34	10.487	10.90	19279	0.697	8031	79.04	48.23	1.10	0.40	5.77	18.08	19.57
4.112	-0.914	284.85	276.64	8.20	10.484	10.93	19255	0.697	7199	70.75	44.66	1.10	0.39	5.77	16.59	18.20
5.408	-0.927	287.27	277.83	9.44	10.478	10.98	19202	0.696	6250	61.24	40.31	1.10	0.39	5.77	15.04	16.80
6.678	-0.978	288.48	279.00	9.48	10.472	11.03	19151	0.696	6207	60.63	39.98	1.10	0.41	5.77	15.03	16.79
7.313	-0.978	288.62	279.58	9.04	10.469	11.05	19126	0.696	6478	63.18	41.15	1.10	0.42	5.77	15.58	17.28

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.64	37.26	11.38	1521.1	35.76	19280	0.697	1642.4	91.74	53.34	1.98	0.72	5.77	20.39	21.72
1.639	-0.010	51.81	38.35	13.46	1520.6	35.85	19253	0.697	1391.8	77.62	47.61	1.98	0.70	5.77	17.79	19.30
2.129	-0.028	55.78	40.41	15.37	1519.7	36.01	19202	0.696	1217.4	67.69	43.26	1.98	0.71	5.77	16.13	17.78
2.639	0.000	57.92	42.55	15.36	1518.8	36.18	19150	0.696	1214.7	67.34	43.07	1.98	0.73	5.77	16.18	17.83
2.854	0.000	58.29	43.45	14.83	1518.4	36.25	19128	0.696	1253.1	69.38	43.96	1.98	0.75	5.77	16.64	18.25
1.404	0.375	49.63	37.37	12.27	1521.0	35.77	19278	0.697	1524.0	85.11	50.72	1.98	0.71	5.77	19.17	20.58
1.644	0.365	52.73	38.37	14.35	1520.6	35.85	19253	0.697	1305.6	72.81	45.56	1.98	0.70	5.77	16.95	18.53
2.114	0.375	56.37	40.35	16.02	1519.7	36.01	19204	0.696	1168.0	64.95	42.02	1.98	0.71	5.77	15.66	17.36
2.639	0.365	58.72	42.55	16.17	1518.8	36.18	19150	0.696	1154.5	64.00	41.55	1.98	0.73	5.77	15.60	17.31
2.879	0.360	58.97	43.56	15.41	1518.4	36.26	19126	0.696	1205.7	66.74	42.78	1.98	0.76	5.77	16.19	17.84
1.389	-0.375	50.51	37.30	13.21	1521.0	35.76	19279	0.697	1415.1	79.04	48.23	1.98	0.72	5.77	18.08	19.57
1.619	-0.360	53.04	38.27	14.77	1520.6	35.84	19255	0.697	1268.5	70.75	44.66	1.98	0.71	5.77	16.59	18.20
2.129	-0.365	57.40	40.41	16.98	1519.7	36.01	19202	0.696	1101.3	61.24	40.31	1.98	0.71	5.77	15.04	16.80
2.629	-0.385	59.58	42.51	17.07	1518.8	36.18	19151	0.696	1093.7	60.63	39.98	1.98	0.73	5.77	15.03	16.79
2.879	-0.385	59.83	43.56	16.27	1518.4	36.26	19126	0.696	1141.4	63.18	41.15	1.98	0.76	5.77	15.58	17.28

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 18
Date: 7 January 1992
Time: 10:19:05

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.92	31.56	282.75	49.26	15.38	0.00942	10.503	1523.3	49.21	7.14	14.01	611	7.23	20.83	18.35

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.31	35.86
1.702	0.670	0.001	0.000	275.86	36.86
9.093	3.580	0.001	0.000	285.31	53.87
10.706	4.215	0.001	0.000	284.68	52.73

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------			
X	Y	Tw	Tf	Tw-Tf	P.	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	282.39	276.09	6.31	10.486	10.90	19279	0.697	9409	92.61	53.68	1.10	0.40	5.77	20.41	21.74
4.163	-0.025	284.18	276.70	7.48	10.483	10.93	19252	0.697	7956	78.18	47.85	1.10	0.39	5.77	17.77	19.28
5.408	-0.071	286.37	277.85	8.51	10.477	10.98	19201	0.696	6977	68.36	43.56	1.10	0.40	5.77	16.14	17.79
6.703	0.001	287.57	279.05	8.52	10.470	11.03	19148	0.696	6960	67.98	43.35	1.10	0.41	5.77	16.18	17.83
7.249	0.001	287.76	279.55	8.21	10.468	11.05	19126	0.696	7190	70.13	44.29	1.10	0.42	5.77	16.67	18.27
3.566	0.953	282.94	276.15	6.80	10.486	10.90	19277	0.697	8737	85.97	51.06	1.10	0.40	5.77	19.20	20.60
4.176	0.927	284.67	276.71	7.96	10.483	10.93	19252	0.697	7479	73.49	45.85	1.10	0.39	5.77	16.95	18.53
5.370	0.953	286.70	277.82	8.88	10.477	10.98	19203	0.696	6691	65.56	42.30	1.10	0.39	5.77	15.66	17.36
6.703	0.927	288.01	279.05	8.96	10.470	11.03	19148	0.696	6615	64.61	41.83	1.10	0.41	5.77	15.61	17.31
7.313	0.914	288.14	279.61	8.53	10.468	11.05	19124	0.696	6915	67.44	43.09	1.10	0.42	5.77	16.21	17.86
3.528	-0.953	283.44	276.11	7.33	10.486	10.90	19278	0.697	8096	79.68	48.50	1.10	0.40	5.77	18.08	19.57
4.112	-0.914	284.85	276.65	8.20	10.483	10.93	19254	0.697	7258	71.33	44.92	1.10	0.39	5.77	16.58	18.19
5.408	-0.927	287.28	277.85	9.43	10.477	10.98	19201	0.696	6303	61.75	40.54	1.10	0.40	5.77	15.03	16.79
6.678	-0.978	288.48	279.03	9.46	10.471	11.03	19150	0.696	6267	61.22	40.26	1.10	0.41	5.77	15.03	16.79
7.313	-0.978	288.62	279.61	9.01	10.468	11.05	19124	0.696	6549	63.87	41.47	1.10	0.42	5.77	15.59	17.30

English Units:

												---------Uncertainties---------			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	48.62	37.27	11.35	1520.9	35.76	19279	0.697	1657.9	92.61	53.68	1.98	0.72	5.77	20.41	21.74
1.639	-0.010	51.83	38.37	13.46	1520.4	35.85	19252	0.697	1401.8	78.18	47.85	1.98	0.71	5.77	17.77	19.28
2.129	-0.028	55.77	40.45	15.33	1519.5	36.02	19201	0.696	1229.3	68.36	43.56	1.98	0.71	5.77	16.14	17.79
2.639	0.000	57.93	42.60	15.33	1518.6	36.19	19148	0.696	1226.4	67.98	43.35	1.98	0.73	5.77	16.18	17.83
2.854	0.000	58.29	43.51	14.78	1518.2	36.26	19126	0.696	1266.9	70.13	44.29	1.98	0.75	5.77	16.67	18.27
1.404	0.375	49.61	37.37	12.23	1520.8	35.77	19277	0.697	1539.5	85.97	51.06	1.98	0.71	5.77	19.20	20.60
1.644	0.365	52.71	38.39	14.32	1520.4	35.85	19252	0.697	1317.8	73.49	45.85	1.98	0.71	5.77	16.95	18.53
2.114	0.375	56.36	40.38	15.98	1519.5	36.01	19203	0.696	1179.0	65.56	42.30	1.98	0.71	5.77	15.66	17.36
2.639	0.365	58.73	42.60	16.13	1518.6	36.19	19148	0.696	1165.6	64.61	41.83	1.98	0.73	5.77	15.61	17.31
2.879	0.360	58.97	43.61	15.36	1518.2	36.27	19124	0.696	1218.4	67.44	43.09	1.98	0.76	5.77	16.21	17.86
1.389	-0.375	50.51	37.31	13.20	1520.8	35.77	19278	0.697	1426.5	79.68	48.50	1.98	0.72	5.77	18.08	19.57
1.619	-0.360	53.04	38.29	14.76	1520.4	35.85	19254	0.697	1278.9	71.33	44.92	1.98	0.71	5.77	16.58	18.19
2.129	-0.365	57.41	40.45	16.97	1519.5	36.02	19201	0.696	1110.6	61.75	40.54	1.98	0.71	5.77	15.03	16.79
2.629	-0.385	59.58	42.56	17.02	1518.6	36.18	19150	0.696	1104.2	61.22	40.26	1.98	0.73	5.77	15.03	16.79
2.879	-0.385	59.83	43.61	16.21	1518.2	36.27	19124	0.696	1153.9	63.87	41.47	1.98	0.76	5.77	15.59	17.30

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 19
Date: 7 January 1992
Time: 10:23:03

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.02	31.76	286.80	56.56	10.96	0.00671	10.504	1523.4	23.84	3.46	28.92	611	5.20	20.83	18.35

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.65	38.28
1.702	0.670	0.001	0.000	277.39	39.61
9.093	3.580	0.001	0.000	290.23	62.72
10.706	4.215	0.001	0.000	289.48	61.38

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	285.98	277.47	8.52	10.495	7.80	13697	0.696	6967	68.32	43.56	1.10	0.42	5.77	15.42	17.15
4.163	-0.025	288.42	278.33	10.10	10.494	7.83	13670	0.696	5893	57.66	38.59	1.10	0.42	5.77	13.51	15.45
5.408	-0.071	291.41	279.94	11.47	10.491	7.87	13619	0.696	5180	50.48	34.99	1.10	0.43	5.77	12.36	14.45
6.703	0.001	293.05	281.62	11.43	10.488	7.92	13567	0.696	5186	50.32	34.87	1.10	0.44	5.77	12.44	14.52
7.249	0.001	293.31	282.33	10.98	10.487	7.94	13545	0.696	5375	52.05	35.72	1.10	0.46	5.77	12.83	14.86
3.566	0.953	286.59	277.55	9.04	10.495	7.80	13695	0.696	6567	64.39	41.78	1.10	0.42	5.77	14.71	16.51
4.176	0.927	288.89	278.34	10.55	10.494	7.83	13670	0.696	5640	55.18	37.38	1.10	0.42	5.77	13.08	15.07
5.370	0.953	291.68	279.89	11.79	10.491	7.87	13621	0.696	5040	49.12	34.29	1.10	0.43	5.77	12.13	14.25
6.703	0.927	293.47	281.62	11.85	10.488	7.92	13567	0.696	5002	48.53	33.95	1.10	0.44	5.77	12.13	14.25
7.313	0.914	293.65	282.41	11.25	10.486	7.94	13543	0.696	5244	50.78	35.08	1.10	0.46	5.77	12.62	14.67
3.528	-0.953	287.17	277.50	9.67	10.495	7.80	13696	0.696	6138	60.19	39.82	1.10	0.42	5.77	13.97	15.85
4.112	-0.914	289.08	278.26	10.82	10.494	7.82	13672	0.696	5497	53.79	36.70	1.10	0.42	5.77	12.84	14.86
5.408	-0.927	292.39	279.94	12.45	10.491	7.87	13619	0.696	4771	46.49	32.92	1.10	0.43	5.77	11.69	13.89
6.678	-0.978	294.00	281.59	12.42	10.488	7.92	13568	0.696	4773	46.32	32.80	1.10	0.44	5.77	11.75	13.93
7.313	-0.978	294.21	282.41	11.80	10.486	7.94	13543	0.696	4997	48.38	33.85	1.10	0.46	5.77	12.20	14.32

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.08	39.75	15.33	1522.2	25.59	13697	0.696	1227.6	68.32	43.56	1.98	0.75	5.77	15.42	17.15
1.639	-0.010	59.47	41.30	18.17	1522.0	25.68	13670	0.696	1038.3	57.66	38.59	1.98	0.75	5.77	13.51	15.45
2.129	-0.028	64.84	44.21	20.64	1521.6	25.83	13619	0.696	912.7	50.48	34.99	1.98	0.78	5.77	12.36	14.45
2.639	0.000	67.79	47.23	20.57	1521.1	25.98	13567	0.696	913.8	50.32	34.87	1.98	0.80	5.77	12.44	14.52
2.854	0.000	68.26	48.50	19.77	1520.9	26.05	13545	0.696	947.1	52.05	35.72	1.98	0.82	5.77	12.83	14.86
1.404	0.375	56.17	39.90	16.27	1522.2	25.60	13695	0.696	1157.1	64.39	41.78	1.98	0.75	5.77	14.71	16.51
1.644	0.365	60.32	41.33	18.99	1522.0	25.68	13670	0.696	993.8	55.18	37.38	1.98	0.75	5.77	13.08	15.07
2.114	0.375	65.33	44.12	21.21	1521.6	25.82	13621	0.696	888.0	49.12	34.29	1.98	0.77	5.77	12.13	14.25
2.639	0.365	68.55	47.23	21.32	1521.1	25.98	13567	0.696	881.4	48.53	33.95	1.98	0.80	5.77	12.13	14.25
2.879	0.360	68.89	48.64	20.24	1520.9	26.06	13543	0.696	924.0	50.78	35.08	1.98	0.83	5.77	12.62	14.67
1.389	-0.375	57.22	39.81	17.40	1522.2	25.60	13696	0.696	1081.5	60.19	39.82	1.98	0.75	5.77	13.97	15.85
1.619	-0.360	60.66	41.18	19.48	1522.0	25.67	13672	0.696	968.6	53.79	36.70	1.98	0.75	5.77	12.84	14.86
2.129	-0.365	66.61	44.21	22.41	1521.6	25.83	13619	0.696	840.7	46.49	32.92	1.98	0.78	5.77	11.69	13.89
2.629	-0.385	69.52	47.17	22.35	1521.1	25.98	13568	0.696	841.0	46.32	32.80	1.98	0.80	5.77	11.75	13.93
2.879	-0.385	69.89	48.64	21.25	1520.9	26.06	13543	0.696	880.5	48.38	33.85	1.98	0.83	5.77	12.20	14.32

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 20
Date: 7 January 1992
Time: 10:23:29

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.05	31.81	286.80	56.55	10.96	0.00671	10.502	1523.2	23.85	3.46	28.91	609	5.21	20.76	18.29

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.67	38.33
1.702	0.670	0.001	0.000	277.40	39.63
9.093	3.580	0.001	0.000	290.26	62.78
10.706	4.215	0.001	0.000	289.51	61.43

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.01	277.49	8.52	10.494	7.80	13693	0.696	6943	68.08	43.45	1.10	0.42	5.77	15.42	17.14
4.163	-0.025	288.44	278.34	10.10	10.493	7.82	13666	0.696	5875	57.48	38.50	1.10	0.42	5.77	13.51	15.45
5.408	-0.071	291.43	279.95	11.48	10.490	7.87	13616	0.696	5159	50.27	34.88	1.10	0.43	5.77	12.36	14.45
6.703	0.001	293.08	281.63	11.45	10.487	7.92	13563	0.696	5162	50.08	34.75	1.10	0.44	5.77	12.42	14.50
7.249	0.001	293.34	282.33	11.01	10.485	7.94	13542	0.696	5347	51.78	35.59	1.10	0.46	5.77	12.81	14.84
3.566	0.953	286.60	277.57	9.04	10.494	7.80	13691	0.696	6551	64.23	41.70	1.10	0.42	5.77	14.72	16.51
4.176	0.927	288.92	278.36	10.56	10.493	7.82	13666	0.696	5617	54.95	37.27	1.10	0.42	5.77	13.07	15.06
5.370	0.953	291.71	279.90	11.80	10.490	7.87	13617	0.696	5019	48.91	34.19	1.10	0.43	5.77	12.12	14.25
6.703	0.927	293.49	281.63	11.86	10.487	7.92	13563	0.696	4982	48.33	33.85	1.10	0.44	5.77	12.12	14.25
7.313	0.914	293.68	282.41	11.27	10.485	7.94	13539	0.696	5221	50.55	34.97	1.10	0.46	5.77	12.61	14.66
3.528	-0.953	287.20	277.52	9.68	10.494	7.80	13692	0.696	6115	59.96	39.71	1.10	0.42	5.77	13.96	15.84
4.112	-0.914	289.11	278.27	10.83	10.493	7.82	13668	0.696	5478	53.61	36.61	1.10	0.42	5.77	12.84	14.86
5.408	-0.927	292.41	279.95	12.46	10.490	7.87	13616	0.696	4755	46.33	32.84	1.10	0.43	5.77	11.69	13.89
6.678	-0.978	294.03	281.60	12.43	10.487	7.92	13564	0.696	4753	46.12	32.69	1.10	0.44	5.77	11.75	13.93
7.313	-0.978	294.24	282.41	11.83	10.485	7.94	13539	0.696	4974	48.16	33.74	1.10	0.46	5.77	12.19	14.31

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.13	39.79	15.34	1522.0	25.59	13693	0.696	1223.4	68.08	43.45	1.98	0.75	5.77	15.42	17.14
1.639	-0.010	59.50	41.33	18.18	1521.8	25.67	13666	0.696	1035.2	57.48	38.50	1.98	0.75	5.77	13.51	15.45
2.129	-0.028	64.89	44.23	20.66	1521.4	25.82	13616	0.696	909.0	50.27	34.88	1.98	0.77	5.77	12.36	14.45
2.639	0.000	67.85	47.24	20.61	1521.0	25.98	13563	0.696	909.5	50.08	34.75	1.98	0.80	5.77	12.42	14.50
2.854	0.000	68.32	48.51	19.81	1520.8	26.05	13542	0.696	942.1	51.78	35.59	1.98	0.82	5.77	12.81	14.84
1.404	0.375	56.20	39.93	16.26	1522.0	25.60	13691	0.696	1154.3	64.23	41.70	1.98	0.75	5.77	14.72	16.51
1.644	0.365	60.37	41.36	19.01	1521.8	25.67	13666	0.696	989.7	54.95	37.27	1.98	0.75	5.77	13.07	15.06
2.114	0.375	65.38	44.14	21.25	1521.4	25.82	13617	0.696	884.3	48.91	34.19	1.98	0.77	5.77	12.12	14.25
2.639	0.365	68.59	47.24	21.35	1521.0	25.98	13563	0.696	877.8	48.33	33.85	1.98	0.80	5.77	12.12	14.25
2.879	0.360	68.94	48.66	20.28	1520.7	26.05	13539	0.696	919.9	50.55	34.97	1.98	0.83	5.77	12.61	14.66
1.389	-0.375	57.26	39.85	17.42	1522.0	25.59	13692	0.696	1077.5	59.96	39.71	1.98	0.75	5.77	13.96	15.84
1.619	-0.360	60.70	41.21	19.49	1521.8	25.67	13668	0.696	965.2	53.61	36.61	1.98	0.75	5.77	12.84	14.86
2.129	-0.365	66.65	44.23	22.42	1521.4	25.82	13616	0.696	837.8	46.33	32.84	1.98	0.77	5.77	11.69	13.89
2.629	-0.385	69.56	47.18	22.38	1521.0	25.98	13564	0.696	837.5	46.12	32.69	1.98	0.80	5.77	11.75	13.93
2.879	-0.385	69.94	48.66	21.29	1520.7	26.05	13539	0.696	876.4	48.16	33.74	1.98	0.83	5.77	12.19	14.31

Table 3.3 (continued)

Aluminum Heat Exchanger
Experiment: 3, Data Point: 21
Date: 7 January 1992
Time: 10:23:54

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.07	31.84	286.83	56.61	10.94	0.00670	10.501	1523.0	23.81	3.45	28.96	609	5.21	20.76	18.29

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.69	38.36
1.702	0.670	0.001	0.000	277.43	39.68
9.093	3.580	0.001	0.000	290.26	62.79
10.706	4.215	0.001	0.000	289.52	61.44

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.03	277.51	8.52	10.493	7.79	13675	0.696	6942	68.07	43.44	1.10	0.42	5.77	15.42	17.14
4.163	-0.025	288.45	278.37	10.08	10.491	7.82	13648	0.696	5883	57.56	38.54	1.10	0.42	5.77	13.52	15.46
5.408	-0.071	291.46	279.98	11.48	10.488	7.86	13597	0.696	5160	50.27	34.88	1.10	0.43	5.77	12.36	14.45
6.703	0.001	293.09	281.66	11.44	10.485	7.91	13545	0.696	5167	50.12	34.76	1.10	0.44	5.77	12.43	14.51
7.249	0.001	293.34	282.36	10.98	10.484	7.93	13524	0.696	5360	51.90	35.65	1.10	0.46	5.77	12.83	14.86
3.566	0.953	286.63	277.59	9.04	10.493	7.79	13672	0.696	6550	64.22	41.70	1.10	0.42	5.77	14.71	16.51
4.176	0.927	288.93	278.38	10.55	10.491	7.82	13648	0.696	5626	55.04	37.31	1.10	0.42	5.77	13.09	15.08
5.370	0.953	291.72	279.93	11.79	10.488	7.86	13599	0.696	5026	48.97	34.21	1.10	0.43	5.77	12.13	14.26
6.703	0.927	293.51	281.66	11.85	10.485	7.91	13545	0.696	4988	48.39	33.88	1.10	0.44	5.77	12.13	14.25
7.313	0.914	293.70	282.44	11.26	10.484	7.93	13521	0.696	5223	50.57	34.98	1.10	0.46	5.77	12.61	14.67
3.528	-0.953	287.20	277.54	9.66	10.493	7.79	13674	0.696	6126	60.07	39.76	1.10	0.42	5.77	13.98	15.86
4.112	-0.914	289.13	278.30	10.83	10.491	7.82	13650	0.696	5479	53.61	36.61	1.10	0.42	5.77	12.84	14.86
5.408	-0.927	292.43	279.98	12.45	10.488	7.86	13597	0.696	4759	46.36	32.85	1.10	0.43	5.77	11.70	13.89
6.678	-0.978	294.04	281.62	12.42	10.485	7.91	13546	0.696	4760	46.18	32.72	1.10	0.44	5.77	11.75	13.94
7.313	-0.978	294.25	282.44	11.81	10.484	7.93	13521	0.696	4982	48.23	33.78	1.10	0.46	5.77	12.20	14.32

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.17	39.83	15.34	1521.8	25.56	13675	0.696	1223.2	68.07	43.44	1.98	0.75	5.77	15.42	17.14
1.639	-0.010	59.52	41.37	18.15	1521.6	25.64	13648	0.696	1036.6	57.56	38.54	1.98	0.75	5.77	13.52	15.46
2.129	-0.028	64.94	44.28	20.66	1521.2	25.79	13597	0.696	909.2	50.27	34.88	1.98	0.78	5.77	12.36	14.45
2.639	0.000	67.88	47.29	20.59	1520.8	25.95	13545	0.696	910.4	50.12	34.76	1.98	0.80	5.77	12.43	14.51
2.854	0.000	68.33	48.56	19.77	1520.6	26.02	13524	0.696	944.4	51.90	35.65	1.98	0.82	5.77	12.83	14.86
1.404	0.375	56.24	39.98	16.27	1521.8	25.57	13672	0.696	1154.1	64.22	41.70	1.98	0.75	5.77	14.71	16.51
1.644	0.365	60.38	41.40	18.98	1521.6	25.65	13648	0.696	991.3	55.04	37.31	1.98	0.75	5.77	13.09	15.08
2.114	0.375	65.40	44.19	21.21	1521.2	25.79	13599	0.696	885.6	48.97	34.21	1.98	0.77	5.77	12.13	14.26
2.639	0.365	68.62	47.29	21.33	1520.8	25.95	13545	0.696	878.9	48.39	33.88	1.98	0.80	5.77	12.13	14.25
2.879	0.360	68.98	48.71	20.27	1520.6	26.03	13521	0.696	920.3	50.57	34.98	1.98	0.83	5.77	12.61	14.67
1.389	-0.375	57.28	39.89	17.39	1521.8	25.57	13674	0.696	1079.4	60.07	39.76	1.98	0.75	5.77	13.98	15.86
1.619	-0.360	60.74	41.25	19.49	1521.6	25.64	13650	0.696	965.4	53.61	36.61	1.98	0.75	5.77	12.84	14.86
2.129	-0.365	66.68	44.28	22.40	1521.2	25.79	13597	0.696	838.5	46.36	32.85	1.98	0.78	5.77	11.70	13.89
2.629	-0.385	69.59	47.24	22.35	1520.8	25.95	13546	0.696	838.7	46.18	32.72	1.98	0.80	5.77	11.75	13.94
2.879	-0.385	69.96	48.71	21.25	1520.6	26.03	13521	0.696	877.8	48.23	33.78	1.98	0.83	5.77	12.20	14.32

Table 3.4. Data tables for experiment 4

Aluminum Heat Exchanger
Summary Data Table for Experiment 4
Date: 7 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	PO MPa	PO-P1 kPa	TO K	T1 K	T1-TO K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	10:37:56	809	27.58	14.65	10.13	46.54	273.18	286.84	13.66	11.81	10.90	18225	0.696	6662	64.96	41.97
2	10:38:21	808	27.55	14.66	10.13	46.52	273.16	286.80	13.65	11.80	10.91	18236	0.696	6659	64.94	41.96
3	10:38:47	806	27.48	14.67	10.13	46.58	273.16	286.76	13.60	11.80	10.91	18243	0.696	6643	64.78	41.89
4	10:42:11	801	27.31	18.31	10.13	73.91	272.89	283.73	10.84	9.63	13.56	22864	0.696	8088	79.22	48.24
5	10:42:37	802	27.34	18.32	10.13	73.94	272.85	283.70	10.85	9.63	13.56	22872	0.696	8096	79.31	48.27
6	10:43:02	802	27.34	18.32	10.13	73.93	272.83	283.68	10.85	9.62	13.56	22875	0.696	8111	79.45	48.33
7	10:45:28	7	0.24	18.30	10.14	73.70	272.67	272.78	0.11	0.10	13.27	23152	0.696	0	0.00	0.00
8	10:45:54	6	0.20	18.29	10.15	73.82	272.63	272.74	0.11	0.09	13.26	23138	0.696	0	0.00	0.00
9	10:46:19	2	0.07	18.28	10.15	73.81	272.63	272.68	0.05	0.09	13.26	23133	0.696	0	0.00	0.00
10	10:50:52	798	27.21	18.28	10.16	74.29	272.54	283.35	10.81	9.64	13.48	22842	0.696	8053	78.94	48.13
11	10:51:18	800	27.27	18.28	10.17	74.22	272.52	283.37	10.84	9.64	13.48	22845	0.696	8077	79.18	48.23
12	10:51:43	800	27.27	18.29	10.17	74.25	272.51	283.35	10.84	9.67	13.48	22855	0.696	8048	78.89	48.11
13	10:55:01	802	27.34	14.64	10.19	46.35	272.66	286.22	13.56	11.81	10.81	18233	0.696	6608	64.52	41.78
14	10:55:26	805	27.44	14.65	10.19	46.34	272.65	286.25	13.60	11.81	10.82	18243	0.696	6627	64.70	41.86
15	10:55:52	802	27.34	14.66	10.19	46.31	272.68	286.23	13.55	11.79	10.83	18251	0.696	6616	64.60	41.82

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 1
Date: 7 January 1992
Time: 10:37:56

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.18	32.03	286.84	56.63	14.65	0.00897	10.130	1469.2	46.54	6.75	14.81	809	5.25	27.58	24.29

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.56	38.12
1.702	0.670	0.001	0.000	277.32	39.50
9.093	3.580	0.001	0.000	290.37	62.98
10.706	4.215	0.001	0.000	289.51	61.42

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.36	277.59	8.78	10.114	10.80	18328	0.696	8951	87.84	51.76	1.10	0.42	5.77	15.07	16.83
4.163	-0.025	288.82	278.43	10.38	10.111	10.84	18292	0.696	7590	74.32	46.16	1.10	0.42	5.77	13.25	15.22
5.408	-0.071	291.85	280.04	11.81	10.105	10.90	18225	0.696	6662	64.96	41.97	1.10	0.43	5.77	12.13	14.26
6.703	0.001	293.49	281.70	11.79	10.099	10.97	18155	0.696	6657	64.63	41.76	1.10	0.44	5.77	12.19	14.30
7.249	0.001	293.76	282.40	11.35	10.097	11.00	18126	0.696	6884	66.72	42.69	1.10	0.46	5.77	12.55	14.61
3.566	0.953	287.09	277.67	9.43	10.114	10.81	18325	0.696	8340	81.83	49.34	1.10	0.42	5.77	14.25	16.10
4.176	0.927	289.47	278.45	11.02	10.111	10.84	18291	0.696	7152	70.02	44.29	1.10	0.42	5.77	12.70	14.74
5.370	0.953	292.27	279.99	12.28	10.105	10.90	18227	0.696	6405	62.46	40.82	1.10	0.43	5.77	11.82	13.99
6.703	0.927	294.07	281.70	12.36	10.099	10.97	18155	0.696	6348	61.63	40.38	1.10	0.44	5.77	11.80	13.98
7.313	0.914	294.25	282.48	11.77	10.096	11.01	18123	0.696	6638	64.32	41.60	1.10	0.46	5.77	12.25	14.35
3.528	-0.953	287.75	277.62	10.13	10.114	10.81	18327	0.696	7760	76.14	46.97	1.10	0.42	5.77	13.50	15.44
4.112	-0.914	289.69	278.37	11.32	10.111	10.84	18295	0.696	6958	68.14	43.46	1.10	0.42	5.77	12.45	14.53
5.408	-0.927	293.04	280.04	13.00	10.105	10.90	18225	0.696	6052	59.01	39.20	1.10	0.43	5.77	11.39	13.63
6.678	-0.978	294.69	281.67	13.02	10.099	10.97	18156	0.696	6028	58.53	38.92	1.10	0.44	5.77	11.41	13.65
7.313	-0.978	294.90	282.48	12.41	10.096	11.01	18123	0.696	6293	60.97	40.05	1.10	0.46	5.77	11.81	13.99

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.77	39.97	15.80	1466.9	35.45	18328	0.696	1577.2	87.84	51.76	1.98	0.75	5.77	15.07	16.83
1.639	-0.010	60.18	41.49	18.69	1466.4	35.56	18292	0.696	1337.4	74.32	46.16	1.98	0.75	5.77	13.25	15.22
2.129	-0.028	65.63	44.38	21.25	1465.6	35.78	18225	0.696	1173.8	64.96	41.97	1.98	0.77	5.77	12.13	14.26
2.639	0.000	68.60	47.38	21.22	1464.8	36.00	18155	0.696	1173.0	64.63	41.76	1.98	0.80	5.77	12.19	14.30
2.854	0.000	69.07	48.64	20.44	1464.4	36.10	18126	0.696	1213.0	66.72	42.69	1.98	0.82	5.77	12.55	14.61
1.404	0.375	57.08	40.11	16.97	1466.8	35.46	18325	0.696	1469.5	81.83	49.34	1.98	0.75	5.77	14.25	16.10
1.644	0.365	61.36	41.53	19.83	1466.4	35.56	18291	0.696	1260.2	70.02	44.29	1.98	0.75	5.77	12.70	14.74
2.114	0.375	66.40	44.29	22.11	1465.6	35.77	18227	0.696	1128.6	62.46	40.82	1.98	0.77	5.77	11.82	13.99
2.639	0.365	69.63	47.38	22.25	1464.8	36.00	18155	0.696	1118.5	61.63	40.38	1.98	0.80	5.77	11.80	13.98
2.879	0.360	69.97	48.78	21.18	1464.4	36.11	18123	0.696	1169.6	64.32	41.60	1.98	0.82	5.77	12.25	14.35
1.389	-0.375	58.25	40.02	18.23	1466.9	35.45	18327	0.696	1367.3	76.14	46.97	1.98	0.75	5.77	13.50	15.44
1.619	-0.360	61.76	41.38	20.38	1466.5	35.55	18295	0.696	1226.0	68.14	43.46	1.98	0.75	5.77	12.45	14.53
2.129	-0.365	67.78	44.38	23.39	1465.6	35.78	18225	0.696	1066.4	59.01	39.20	1.98	0.77	5.77	11.39	13.63
2.629	-0.385	70.75	47.32	23.44	1464.8	36.00	18156	0.696	1062.1	58.53	38.92	1.98	0.80	5.77	11.41	13.65
2.879	-0.385	71.13	48.78	22.35	1464.4	36.11	18123	0.696	1108.8	60.97	40.05	1.98	0.82	5.77	11.81	13.99

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 2
Date: 7 January 1992
Time: 10:38:21

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.16	31.99	286.80	56.56	14.66	0.00898	10.131	1469.4	46.52	6.75	14.82	808	5.25	27.55	24.26

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.53	38.07
1.702	0.670	0.001	0.000	277.31	39.46
9.093	3.580	0.001	0.000	290.33	62.90
10.706	4.215	0.001	0.000	289.48	61.38

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.33	277.56	8.77	10.115	10.81	18339	0.696	8954	87.88	51.78	1.10	0.42	5.77	15.08	16.84
4.163	-0.025	288.79	278.41	10.38	10.112	10.84	18303	0.696	7584	74.27	46.14	1.10	0.42	5.77	13.25	15.22
5.408	-0.071	291.81	280.01	11.80	10.106	10.91	18236	0.696	6659	64.94	41.96	1.10	0.43	5.77	12.14	14.26
6.703	0.001	293.47	281.67	11.80	10.100	10.98	18166	0.696	6646	64.53	41.72	1.10	0.44	5.77	12.18	14.30
7.249	0.001	293.74	282.37	11.37	10.098	11.01	18137	0.696	6873	66.61	42.64	1.10	0.46	5.77	12.54	14.60
3.566	0.953	287.05	277.64	9.42	10.115	10.81	18336	0.696	8344	81.87	49.36	1.10	0.42	5.77	14.27	16.11
4.176	0.927	289.43	278.42	11.00	10.112	10.84	18303	0.696	7157	70.08	44.32	1.10	0.42	5.77	12.71	14.75
5.370	0.953	292.24	279.96	12.28	10.107	10.91	18238	0.696	6399	62.41	40.80	1.10	0.43	5.77	11.82	13.99
6.703	0.927	294.04	281.67	12.37	10.100	10.98	18166	0.696	6343	61.59	40.36	1.10	0.44	5.77	11.80	13.98
7.313	0.914	294.22	282.45	11.77	10.098	11.01	18134	0.696	6634	64.29	41.59	1.10	0.46	5.77	12.25	14.36
3.528	-0.953	287.73	277.59	10.14	10.115	10.81	18338	0.696	7743	75.99	46.91	1.10	0.42	5.77	13.49	15.43
4.112	-0.914	289.65	278.34	11.31	10.112	10.84	18306	0.696	6960	68.17	43.47	1.10	0.42	5.77	12.46	14.54
5.408	-0.927	293.00	280.01	12.99	10.106	10.91	18236	0.696	6051	59.01	39.20	1.10	0.43	5.77	11.40	13.64
6.678	-0.978	294.66	281.64	13.02	10.101	10.98	18168	0.696	6026	58.51	38.91	1.10	0.44	5.77	11.42	13.65
7.313	-0.978	294.87	282.45	12.42	10.098	11.01	18134	0.696	6287	60.92	40.03	1.10	0.46	5.77	11.81	13.99

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.70	39.92	15.79	1467.1	35.46	18339	0.696	1577.7	87.88	51.78	1.98	0.75	5.77	15.08	16.84
1.639	-0.010	60.13	41.44	18.69	1466.6	35.57	18303	0.696	1336.3	74.27	46.14	1.98	0.75	5.77	13.25	15.22
2.129	-0.028	65.58	44.33	21.25	1465.8	35.79	18236	0.696	1173.3	64.94	41.96	1.98	0.77	5.77	12.14	14.26
2.639	0.000	68.56	47.32	21.24	1464.9	36.01	18166	0.696	1171.0	64.53	41.72	1.98	0.80	5.77	12.18	14.30
2.854	0.000	69.04	48.58	20.46	1464.6	36.11	18137	0.696	1211.0	66.61	42.64	1.98	0.82	5.77	12.54	14.60
1.404	0.375	57.01	40.06	16.95	1467.0	35.47	18336	0.696	1470.2	81.87	49.36	1.98	0.75	5.77	14.27	16.11
1.644	0.365	61.28	41.47	19.81	1466.6	35.57	18303	0.696	1261.1	70.08	44.32	1.98	0.75	5.77	12.71	14.75
2.114	0.375	66.35	44.24	22.11	1465.8	35.78	18238	0.696	1127.5	62.41	40.80	1.98	0.77	5.77	11.82	13.99
2.639	0.365	69.58	47.32	22.26	1464.9	36.01	18166	0.696	1117.6	61.59	40.36	1.98	0.80	5.77	11.80	13.98
2.879	0.360	69.91	48.72	21.18	1464.5	36.12	18134	0.696	1168.9	64.29	41.59	1.98	0.82	5.77	12.25	14.36
1.389	-0.375	58.23	39.97	18.26	1467.1	35.46	18338	0.696	1364.3	75.99	46.91	1.98	0.75	5.77	13.49	15.43
1.619	-0.360	61.69	41.33	20.36	1466.7	35.56	18306	0.696	1226.4	68.17	43.47	1.98	0.75	5.77	12.46	14.54
2.129	-0.365	67.71	44.33	23.39	1465.8	35.79	18236	0.696	1066.2	59.01	39.20	1.98	0.77	5.77	11.40	13.64
2.629	-0.385	70.69	47.26	23.43	1465.0	36.01	18168	0.696	1061.8	58.51	38.91	1.98	0.80	5.77	11.42	13.65
2.879	-0.385	71.07	48.72	22.35	1464.5	36.12	18134	0.696	1107.8	60.92	40.03	1.98	0.82	5.77	11.81	13.99

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 3
Date: 7 January 1992
Time: 10:38:47

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
273.16	31.99	286.76	56.48	14.67	0.00898	10.133	1469.6	46.58	6.76	14.80	806	5.27	27.48	24.20

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.50	38.01
1.702	0.670	0.001	0.000	277.28	39.41
9.093	3.580	0.001	0.000	290.31	62.87
10.706	4.215	0.001	0.000	289.46	61.33

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	286.31	277.54	8.76	10.117	10.81	18347	0.696	8935	87.69	51.71	1.10	0.42	5.77	15.10	16.85
4.163	-0.025	288.75	278.39	10.36	10.114	10.84	18311	0.696	7575	74.18	46.10	1.10	0.42	5.77	13.27	15.24
5.408	-0.071	291.79	279.98	11.80	10.108	10.91	18243	0.696	6643	64.78	41.89	1.10	0.43	5.77	12.15	14.27
6.703	0.001	293.42	281.64	11.78	10.102	10.98	18174	0.696	6637	64.45	41.68	1.10	0.44	5.77	12.20	14.31
7.249	0.001	293.71	282.34	11.37	10.099	11.01	18145	0.696	6852	66.41	42.55	1.10	0.46	5.77	12.54	14.61
3.566	0.953	287.03	277.62	9.40	10.116	10.81	18343	0.696	8330	81.74	49.30	1.10	0.42	5.77	14.29	16.13
4.176	0.927	289.41	278.41	11.01	10.114	10.85	18310	0.696	7133	69.85	44.22	1.10	0.42	5.77	12.71	14.75
5.370	0.953	292.21	279.94	12.27	10.108	10.91	18246	0.696	6386	62.29	40.74	1.10	0.43	5.77	11.83	14.00
6.703	0.927	294.01	281.64	12.36	10.102	10.98	18174	0.696	6325	61.42	40.29	1.10	0.44	5.77	11.81	13.98
7.313	0.914	294.18	282.42	11.76	10.099	11.01	18142	0.696	6616	64.11	41.50	1.10	0.46	5.77	12.26	14.36
3.528	-0.953	287.72	277.58	10.14	10.116	10.81	18345	0.696	7720	75.76	46.81	1.10	0.42	5.77	13.50	15.43
4.112	-0.914	289.63	278.32	11.31	10.114	10.84	18313	0.696	6944	68.01	43.40	1.10	0.42	5.77	12.48	14.55
5.408	-0.927	292.98	279.98	12.99	10.108	10.91	18243	0.696	6033	58.83	39.11	1.10	0.43	5.77	11.40	13.64
6.678	-0.978	294.64	281.61	13.03	10.102	10.98	18176	0.696	6004	58.30	38.81	1.10	0.44	5.77	11.42	13.65
7.313	-0.978	294.85	282.42	12.43	10.099	11.01	18142	0.696	6264	60.71	39.93	1.10	0.46	5.77	11.82	13.99

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	55.66	39.89	15.77	1467.3	35.46	18347	0.696	1574.3	87.69	51.71	1.98	0.75	5.77	15.10	16.85
1.639	-0.010	60.07	41.41	18.66	1466.8	35.58	18311	0.696	1334.7	74.18	46.10	1.98	0.75	5.77	13.27	15.24
2.129	-0.028	65.53	44.28	21.24	1466.0	35.79	18243	0.696	1170.5	64.78	41.89	1.98	0.77	5.77	12.15	14.27
2.639	0.000	68.48	47.27	21.21	1465.2	36.02	18174	0.696	1169.4	64.45	41.68	1.98	0.80	5.77	12.20	14.31
2.854	0.000	68.98	48.52	20.46	1464.8	36.12	18145	0.696	1207.3	66.41	42.55	1.98	0.82	5.77	12.54	14.61
1.404	0.375	56.96	40.04	16.93	1467.2	35.47	18343	0.696	1467.7	81.74	49.30	1.98	0.75	5.77	14.29	16.13
1.644	0.365	61.26	41.44	19.81	1466.8	35.58	18310	0.696	1256.8	69.85	44.22	1.98	0.75	5.77	12.71	14.75
2.114	0.375	66.29	44.20	22.09	1466.0	35.79	18246	0.696	1125.2	62.29	40.74	1.98	0.77	5.77	11.83	14.00
2.639	0.365	69.52	47.27	22.26	1465.2	36.02	18174	0.696	1114.5	61.42	40.29	1.98	0.80	5.77	11.81	13.98
2.879	0.360	69.84	48.67	21.18	1464.8	36.12	18142	0.696	1165.7	64.11	41.50	1.98	0.82	5.77	12.26	14.36
1.389	-0.375	58.21	39.95	18.26	1467.3	35.47	18345	0.696	1360.3	75.76	46.81	1.98	0.75	5.77	13.50	15.43
1.619	-0.360	61.65	41.30	20.35	1466.9	35.57	18313	0.696	1223.5	68.01	43.40	1.98	0.75	5.77	12.48	14.55
2.129	-0.365	67.67	44.28	23.39	1466.0	35.79	18243	0.696	1063.0	58.83	39.11	1.98	0.77	5.77	11.40	13.64
2.629	-0.385	70.66	47.21	23.45	1465.2	36.01	18176	0.696	1057.9	58.30	38.81	1.98	0.80	5.77	11.42	13.65
2.879	-0.385	71.03	48.67	22.37	1464.8	36.12	18142	0.696	1103.7	60.71	39.93	1.98	0.82	5.77	11.82	13.99

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 4
Date: 7 January 1992
Time: 10:42:11

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.89	31.51	283.73	51.02	18.31	0.01121	10.132	1469.5	73.91	10.72	9.33	801	6.58	27.31	24.05

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.40	36.04
1.702	0.670	0.001	0.000	276.05	37.21
9.093	3.580	0.001	0.000	286.65	56.27
10.706	4.215	0.001	0.000	285.88	54.90

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	283.48	276.38	7.10	10.106	13.45	22967	0.696	10966	107.96	59.38	1.10	0.40	5.77	18.33	19.80
4.163	-0.025	285.48	277.06	8.43	10.102	13.49	22931	0.696	9259	90.99	53.02	1.10	0.40	5.77	15.99	17.66
5.408	-0.071	287.96	278.33	9.63	10.093	13.56	22864	0.696	8088	79.22	48.24	1.10	0.40	5.77	14.53	16.34
6.703	0.001	289.28	279.65	9.64	10.083	13.64	22795	0.696	8067	78.74	47.98	1.10	0.42	5.77	14.57	16.38
7.249	0.001	289.51	280.20	9.30	10.079	13.67	22766	0.696	8319	81.09	48.93	1.10	0.43	5.77	14.97	16.74
3.566	0.953	284.18	276.45	7.73	10.106	13.46	22963	0.696	10072	99.13	56.15	1.10	0.40	5.77	17.11	18.68
4.176	0.927	286.15	277.07	9.07	10.102	13.49	22930	0.696	8598	84.49	50.45	1.10	0.40	5.77	15.14	16.89
5.370	0.953	288.42	278.29	10.13	10.093	13.56	22866	0.696	7693	75.36	46.61	1.10	0.40	5.77	14.03	15.90
6.703	0.927	289.87	279.65	10.22	10.083	13.64	22795	0.696	7601	74.20	46.07	1.10	0.42	5.77	13.98	15.86
7.313	0.914	290.02	280.27	9.75	10.079	13.67	22762	0.696	7937	77.36	47.38	1.10	0.43	5.77	14.50	16.31
3.528	-0.953	284.79	276.41	8.38	10.106	13.45	22965	0.696	9290	91.45	53.23	1.10	0.40	5.77	16.08	17.74
4.112	-0.914	286.32	277.01	9.31	10.102	13.49	22934	0.696	8378	82.35	49.58	1.10	0.40	5.77	14.86	16.64
5.408	-0.927	289.08	278.33	10.75	10.093	13.56	22864	0.696	7249	71.00	44.73	1.10	0.40	5.77	13.49	15.43
6.678	-0.978	290.45	279.62	10.83	10.083	13.63	22796	0.696	7176	70.05	44.26	1.10	0.42	5.77	13.45	15.40
7.313	-0.978	290.59	280.27	10.32	10.079	13.67	22762	0.696	7497	73.06	45.55	1.10	0.43	5.77	13.94	15.82

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	50.58	37.80	12.77	1465.8	44.13	22967	0.696	1932.2	107.96	59.38	1.98	0.73	5.77	18.33	19.80
1.639	-0.010	54.18	39.02	15.17	1465.1	44.26	22931	0.696	1631.4	90.99	53.02	1.98	0.72	5.77	15.99	17.66
2.129	-0.028	58.64	41.30	17.34	1463.8	44.49	22864	0.696	1425.1	79.22	48.24	1.98	0.73	5.77	14.53	16.34
2.639	0.000	61.02	43.68	17.34	1462.4	44.74	22795	0.696	1421.4	78.74	47.98	1.98	0.75	5.77	14.57	16.38
2.854	0.000	61.43	44.68	16.75	1461.9	44.84	22766	0.696	1465.8	81.09	48.93	1.98	0.77	5.77	14.97	16.74
1.404	0.375	51.83	37.92	13.91	1465.8	44.15	22963	0.696	1774.7	99.13	56.15	1.98	0.72	5.77	17.11	18.68
1.644	0.365	55.37	39.04	16.33	1465.1	44.26	22930	0.696	1515.0	84.49	50.45	1.98	0.71	5.77	15.14	16.89
2.114	0.375	59.46	41.24	18.22	1463.9	44.48	22866	0.696	1355.5	75.36	46.61	1.98	0.72	5.77	14.03	15.90
2.639	0.365	62.08	43.68	18.40	1462.4	44.74	22795	0.696	1339.3	74.20	46.07	1.98	0.75	5.77	13.98	15.86
2.879	0.360	62.34	44.80	17.54	1461.8	44.85	22762	0.696	1398.5	77.36	47.38	1.98	0.77	5.77	14.50	16.31
1.389	-0.375	52.93	37.85	15.08	1465.8	44.14	22965	0.696	1636.9	91.45	53.23	1.98	0.73	5.77	16.08	17.74
1.619	-0.360	55.68	38.92	16.76	1465.2	44.25	22934	0.696	1476.2	82.35	49.58	1.98	0.72	5.77	14.86	16.64
2.129	-0.365	60.65	41.30	19.34	1463.8	44.49	22864	0.696	1277.3	71.00	44.73	1.98	0.73	5.77	13.49	15.43
2.629	-0.385	63.13	43.64	19.50	1462.5	44.73	22796	0.696	1264.4	70.05	44.26	1.98	0.75	5.77	13.45	15.40
2.879	-0.385	63.37	44.80	18.57	1461.8	44.85	22762	0.696	1321.0	73.06	45.55	1.98	0.77	5.77	13.94	15.82

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 5
Date: 7 January 1992
Time: 10:42:37

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.85	31.44	283.70	50.96	18.32	0.01122	10.134	1469.7	73.94	10.72	9.33	802	6.57	27.34	24.08

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.38	35.99
1.702	0.670	0.001	0.000	275.99	37.10
9.093	3.580	0.001	0.000	286.61	56.21
10.706	4.215	0.001	0.000	285.86	54.86

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	283.46	276.35	7.11	10.108	13.45	22975	0.696	10952	107.82	59.33	1.10	0.40	5.77	18.29	19.76
4.163	-0.025	285.45	277.02	8.43	10.103	13.49	22939	0.696	9269	91.09	53.06	1.10	0.40	5.77	15.99	17.65
5.408	-0.071	287.92	278.29	9.63	10.094	13.56	22872	0.696	8096	79.31	48.27	1.10	0.40	5.77	14.52	16.34
6.703	0.001	289.26	279.61	9.64	10.085	13.64	22803	0.696	8069	78.77	48.00	1.10	0.42	5.77	14.55	16.37
7.249	0.001	289.48	280.17	9.32	10.081	13.67	22774	0.696	8321	81.11	48.94	1.10	0.43	5.77	14.96	16.73
3.566	0.953	284.15	276.41	7.74	10.108	13.46	22972	0.696	10074	99.17	56.17	1.10	0.40	5.77	17.10	18.67
4.176	0.927	286.12	277.03	9.09	10.103	13.49	22939	0.696	8594	84.46	50.44	1.10	0.40	5.77	15.12	16.87
5.370	0.953	288.38	278.25	10.13	10.094	13.56	22874	0.696	7701	75.44	46.65	1.10	0.40	5.77	14.03	15.90
6.703	0.927	289.84	279.61	10.23	10.085	13.64	22803	0.696	7607	74.26	46.09	1.10	0.42	5.77	13.97	15.85
7.313	0.914	290.00	280.23	9.76	10.080	13.67	22770	0.696	7932	77.31	47.36	1.10	0.43	5.77	14.47	16.30
3.528	-0.953	284.76	276.37	8.39	10.108	13.45	22974	0.696	9292	91.47	53.24	1.10	0.40	5.77	16.07	17.73
4.112	-0.914	286.32	276.97	9.35	10.104	13.49	22942	0.696	8355	82.13	49.49	1.10	0.40	5.77	14.82	16.60
5.408	-0.927	289.07	278.29	10.78	10.094	13.56	22872	0.696	7235	70.87	44.67	1.10	0.40	5.77	13.46	15.40
6.678	-0.[illegible]	290.43	279.59	10.85	10.085	13.63	22804	0.696	7174	70.04	44.26	1.10	0.42	5.77	13.44	15.38
7.313	-0.	290.57	280.23	10.34	10.080	13.67	22770	0.696	7492	73.02	45.54	1.10	0.43	5.77	13.92	15.80

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	50	37.73	12.81	1466.0	44.13	22975	0.696	1929.7	107.82	59.33	1.98	0.73	5.77	18.29	19.76
1.639	-0.010	54	38.95	15.17	1465.3	44.26	22939	0.696	1633.2	91.09	53.06	1.98	0.72	5.77	15.99	17.65
2.129	-0.028	58.[illegible]	41.24	17.34	1464.0	44.49	22872	0.696	1426.5	79.31	48.27	1.98	0.73	5.77	14.52	16.34
2.639	0.000	60.97	43.62	17.36	1462.7	44.74	22803	0.696	1421.8	78.77	48.00	1.98	0.75	5.77	14.55	16.37
2.854	0.000	61.38	[illegible]4.61	16.77	1462.1	44.84	22774	0.696	1466.2	81.11	48.94	1.98	0.77	5.77	14.96	16.73
1.404	0.375	51.77	37.85	13.93	1466.0	44.15	22972	0.696	1775.0	99.17	56.17	1.98	0.72	5.77	17.10	18.67
1.644	0.365	55.33	38.97	16.36	1465.3	44.26	22939	0.696	1514.3	84.46	50.44	1.98	0.72	5.77	15.12	16.87
2.114	0.375	59.40	41.17	18.23	1464.1	44.48	22874	0.696	1356.9	75.44	46.65	1.98	0.73	5.77	14.03	15.90
2.639	0.365	62.03	43.62	18.41	1462.7	44.74	22803	0.696	1340.4	74.26	46.09	1.98	0.75	5.77	13.97	15.85
2.879	0.360	62.31	44.73	17.58	1462.0	44.85	22770	0.696	1397.6	77.31	47.36	1.98	0.77	5.77	14.47	16.30
1.389	-0.375	52.87	37.78	15.09	1466.0	44.14	22974	0.696	1637.3	91.47	53.24	1.98	0.73	5.77	16.07	17.73
1.619	-0.360	55.68	38.85	16.83	1465.4	44.25	22942	0.696	1472.2	82.13	49.49	1.98	0.72	5.77	14.82	16.60
2.129	-0.365	60.64	41.24	19.40	1464.0	44.49	22872	0.696	1274.8	70.87	44.67	1.98	0.73	5.77	13.46	15.40
2.629	-0.385	63.09	43.57	19.52	1462.7	44.73	22804	0.696	1264.1	70.04	44.26	1.98	0.75	5.77	13.44	15.38
2.879	-0.385	63.34	44.73	18.61	1462.0	44.85	22770	0.696	1320.1	73.02	45.54	1.98	0.77	5.77	13.92	15.80

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 6
Date: 7 January 1992
Time: 10:43:02

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.83	31.40	283.68	50.93	18.32	0.01122	10.135	1469.9	73.93	10.72	9.33	802	6.57	27.34	24.08

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.34	35.92
1.702	0.670	0.001	0.000	275.97	37.06
9.093	3.580	0.001	0.000	286.58	56.16
10.706	4.215	0.001	0.000	285.81	54.77

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	283.43	276.32	7.11	10.109	13.45	22978	0.696	10964	107.95	59.38	1.10	0.40	5.77	18.30	19.77
4.163	-0.025	285.42	277.00	8.42	10.104	13.49	22942	0.696	9287	91.28	53.14	1.10	0.40	5.77	16.00	17.67
5.408	-0.071	287.89	278.27	9.62	10.095	13.56	22875	0.696	8111	79.45	48.33	1.10	0.40	5.77	14.53	16.35
6.703	0.001	289.22	279.59	9.63	10.086	13.63	22805	0.696	8087	78.95	48.07	1.10	0.42	5.77	14.57	16.38
7.249	0.001	289.45	280.15	9.30	10.082	13.67	22776	0.696	8338	81.28	49.01	1.10	0.43	5.77	14.97	16.74
3.566	0.953	284.11	276.39	7.73	10.109	13.45	22974	0.696	10093	99.36	56.24	1.10	0.40	5.77	17.11	18.68
4.176	0.927	286.08	277.01	9.07	10.104	13.49	22941	0.696	8618	84.70	50.53	1.10	0.40	5.77	15.14	16.89
5.370	0.953	288.35	278.23	10.11	10.096	13.56	22877	0.696	7716	75.59	46.71	1.10	0.40	5.77	14.04	15.91
6.703	0.927	289.81	279.59	10.21	10.086	13.63	22805	0.696	7623	74.42	46.16	1.10	0.42	5.77	13.99	15.86
7.313	0.914	289.95	280.21	9.74	10.082	13.67	22773	0.696	7954	77.53	47.46	1.10	0.43	5.77	14.50	16.31
3.528	-0.953	284.68	276.35	8.33	10.109	13.45	22976	0.696	9354	92.09	53.48	1.10	0.40	5.77	16.14	17.80
4.112	-0.914	286.28	276.95	9.33	10.105	13.49	22945	0.696	8373	82.31	49.57	1.10	0.40	5.77	14.83	16.61
5.408	-0.927	289.02	278.27	10.74	10.095	13.56	22875	0.696	7263	71.15	44.79	1.10	0.40	5.77	13.48	15.42
6.678	-0.978	290.39	279.57	10.83	10.086	13.63	22807	0.696	7191	70.21	44.34	1.10	0.42	5.77	13.45	15.39
7.313	-0.978	290.53	280.21	10.32	10.082	13.67	22773	0.696	7510	73.20	45.61	1.10	0.43	5.77	13.93	15.82

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	50.49	37.70	12.80	1466.2	44.13	22978	0.696	1931.9	107.95	59.38	1.98	0.73	5.77	18.30	19.77
1.639	-0.010	54.06	38.91	15.15	1465.5	44.25	22942	0.696	1636.4	91.28	53.14	1.98	0.72	5.77	16.00	17.67
2.129	-0.028	58.52	41.20	17.32	1464.2	44.49	22875	0.696	1429.2	79.45	48.33	1.98	0.73	5.77	14.53	16.35
2.639	0.000	60.91	43.58	17.33	1462.8	44.73	22805	0.696	1424.9	78.95	48.07	1.98	0.75	5.77	14.57	16.38
2.854	0.000	61.32	44.58	16.74	1462.3	44.84	22776	0.696	1469.2	81.28	49.01	1.98	0.77	5.77	14.97	16.74
1.404	0.375	51.72	37.81	13.91	1466.2	44.14	22974	0.696	1778.4	99.36	56.24	1.98	0.72	5.77	17.11	18.68
1.644	0.365	55.26	38.93	16.32	1465.5	44.25	22941	0.696	1518.5	84.70	50.53	1.98	0.72	5.77	15.14	16.89
2.114	0.375	59.33	41.13	18.20	1464.3	44.48	22877	0.696	1359.6	75.59	46.71	1.98	0.73	5.77	14.04	15.91
2.639	0.365	61.96	43.58	18.38	1462.8	44.73	22805	0.696	1343.2	74.42	46.16	1.98	0.75	5.77	13.99	15.86
2.879	0.360	62.23	44.70	17.53	1462.2	44.85	22773	0.696	1401.5	77.53	47.46	1.98	0.77	5.77	14.50	16.31
1.389	-0.375	52.74	37.74	15.00	1466.2	44.13	22976	0.696	1648.2	92.09	53.48	1.98	0.73	5.77	16.14	17.80
1.619	-0.360	55.62	38.81	16.80	1465.6	44.24	22945	0.696	1475.3	82.31	49.57	1.98	0.72	5.77	14.83	16.61
2.129	-0.365	60.54	41.20	19.34	1464.2	44.49	22875	0.696	1279.7	71.15	44.79	1.98	0.73	5.77	13.48	15.42
2.629	-0.385	63.02	43.53	19.49	1462.9	44.73	22807	0.696	1267.1	70.21	44.34	1.98	0.75	5.77	13.45	15.39
2.879	-0.385	63.27	44.70	18.57	1462.2	44.85	22773	0.696	1323.3	73.20	45.61	1.98	0.77	5.77	13.93	15.82

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 7
Date: 7 January 1992
Time: 10:45:28

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.67	31.12	272.78	31.32	18.30	0.01121	10.144	1471.2	73.70	10.69	9.35	7	0.00	0.24	0.21

Manifold Temperetures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	272.77	31.30
1.702	0.670	0.001	0.000	272.68	31.13
9.093	3.580	0.001	0.000	272.82	31.39
10.706	4.215	0.001	0.000	272.77	31.30

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	272.70	272.70	-0.01	10.118	13.26	23152	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	272.72	272.71	0.01	10.114	13.26	23152	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	272.83	272.73	0.10	10.105	13.27	23152	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	272.82	272.74	0.08	10.095	13.29	23151	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	272.79	272.74	0.05	10.091	13.29	23151	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	272.71	272.70	0.00	10.118	13.26	23152	0.696	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	272.79	272.71	0.08	10.113	13.26	23152	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	272.80	272.72	0.08	10.105	13.27	23152	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	272.88	272.74	0.14	10.095	13.29	23151	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	272.85	272.75	0.11	10.091	13.29	23151	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	272.74	272.70	0.04	10.118	13.26	23152	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	272.72	272.71	0.01	10.114	13.26	23152	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	272.81	272.73	0.09	10.105	13.27	23152	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	272.83	272.74	0.09	10.095	13.29	23151	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	272.73	272.75	-0.01	10.091	13.29	23151	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	31.17	31.18	-0.01	1467.5	43.49	23152	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	31.21	31.19	0.02	1466.8	43.51	23152	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	31.41	31.22	0.19	1465.5	43.55	23152	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	31.38	31.24	0.14	1464.2	43.59	23151	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	31.33	31.25	0.08	1463.6	43.61	23151	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	31.18	31.18	0.00	1467.5	43.49	23152	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	31.33	31.19	0.14	1466.8	43.51	23152	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	31.36	31.22	0.14	1465.6	43.55	23152	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	31.50	31.24	0.26	1464.2	43.59	23151	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	31.45	31.25	0.19	1463.5	43.61	23151	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	31.24	31.18	0.06	1467.5	43.49	23152	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	31.21	31.19	0.02	1466.9	43.51	23152	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	31.37	31.22	0.15	1465.5	43.55	23152	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	31.41	31.24	0.16	1464.2	43.59	23151	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	31.23	31.25	-0.02	1463.5	43.61	23151	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 8
Date: 7 January 1992
Time: 10:45:54

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.63	31.05	272.74	31.25	18.29	0.01120	10.145	1471.5	73.82	10.71	9.34	6	0.00	0.20	0.18

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	272.73	31.22
1.702	0.670	0.001	0.000	272.65	31.08
9.093	3.580	0.001	0.000	272.79	31.33
10.706	4.215	0.001	0.000	272.73	31.22

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	272.67	272.67	0.00	10.120	13.24	23139	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	272.68	272.67	0.01	10.115	13.25	23139	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	272.77	272.68	0.09	10.106	13.26	23138	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	272.76	272.70	0.06	10.097	13.27	23138	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	272.74	272.70	0.04	10.093	13.28	23138	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	272.69	272.67	0.02	10.119	13.24	23139	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	272.75	272.67	0.07	10.115	13.25	23139	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	272.78	272.68	0.10	10.106	13.26	23138	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	272.84	272.70	0.14	10.097	13.27	23138	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	272.81	272.70	0.11	10.092	13.28	23138	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	272.71	272.67	0.04	10.120	13.24	23139	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	272.68	272.67	0.01	10.115	13.25	23139	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	272.76	272.68	0.07	10.106	13.26	23138	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	272.79	272.70	0.10	10.097	13.27	23138	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	272.69	272.70	-0.01	10.092	13.28	23138	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	31.12	31.11	0.01	1467.8	43.45	23139	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	31.14	31.12	0.01	1467.1	43.47	23139	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	31.31	31.14	0.16	1465.8	43.51	23138	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	31.27	31.17	0.10	1464.4	43.55	23138	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	31.25	31.18	0.07	1463.8	43.57	23138	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	31.15	31.11	0.04	1467.7	43.45	23139	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	31.25	31.12	0.13	1467.1	43.47	23139	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	31.32	31.14	0.18	1465.8	43.51	23138	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	31.43	31.17	0.26	1464.4	43.55	23138	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	31.38	31.18	0.19	1463.8	43.57	23138	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	31.19	31.11	0.08	1467.7	43.45	23139	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	31.14	31.12	0.03	1467.1	43.47	23139	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	31.27	31.14	0.13	1465.8	43.51	23138	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	31.34	31.17	0.17	1464.4	43.55	23138	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	31.16	31.18	-0.02	1463.8	43.57	23138	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 9
Date: 7 January 1992
Time: 10:46:19

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.63	31.05	272.68	31.14	18.28	0.01120	10.147	1471.7	73.81	10.70	9.34	2	0.00	0.07	0.06

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	272.70	31.17
1.702	0.670	0.001	0.000	272.63	31.04
9.093	3.580	0.001	0.000	272.74	31.24
10.706	4.215	0.001	0.000	272.70	31.18

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	272.63	272.64	-0.01	10.122	13.24	23133	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	272.64	272.65	-0.00	10.117	13.24	23133	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	272.74	272.65	0.09	10.108	13.26	23133	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	272.73	272.66	0.07	10.098	13.27	23134	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	272.72	272.66	0.05	10.094	13.27	23134	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	272.65	272.65	0.00	10.121	13.24	23133	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	272.70	272.65	0.06	10.117	13.24	23133	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	272.73	272.65	0.07	10.108	13.25	23133	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	272.81	272.66	0.15	10.098	13.27	23134	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	272.77	272.66	0.11	10.094	13.27	23134	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	272.64	272.64	-0.00	10.122	13.24	23133	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	272.65	272.65	0.01	10.117	13.24	23133	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	272.73	272.65	0.07	10.108	13.26	23133	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	272.75	272.66	0.09	10.099	13.27	23134	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	272.68	272.66	0.01	10.094	13.27	23134	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	31.05	31.07	-0.02	1468.0	43.43	23133	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	31.07	31.08	-0.01	1467.3	43.45	23133	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	31.25	31.09	0.16	1466.0	43.49	23133	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	31.22	31.10	0.12	1464.7	43.53	23134	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	31.20	31.11	0.10	1464.1	43.54	23134	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	31.08	31.07	0.00	1468.0	43.43	23133	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	31.18	31.08	0.10	1467.3	43.45	23133	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	31.22	31.09	0.13	1466.1	43.48	23133	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	31.38	31.10	0.27	1464.7	43.53	23134	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	31.30	31.11	0.20	1464.0	43.54	23134	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	31.07	31.07	-0.01	1468.0	43.43	23133	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	31.09	31.08	0.01	1467.4	43.45	23133	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	31.22	31.09	0.13	1466.0	43.49	23133	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	31.27	31.10	0.17	1464.7	43.52	23134	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	31.13	31.11	0.02	1464.0	43.54	23134	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 10
Date: 7 January 1992
Time: 10:50:52

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.54	30.88	283.35	50.35	18.28	0.01119	10.164	1474.1	74.29	10.78	9.28	798	6.59	27.21	23.96

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.08	35.45
1.702	0.670	0.001	0.000	275.71	36.59
9.093	3.580	0.001	0.000	286.29	55.64
10.706	4.215	0.001	0.000	285.55	54.31

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	283.15	276.02	7.13	10.138	13.37	22944	0.696	10872	107.12	59.10	1.10	0.40	5.77	18.26	19.74
4.163	-0.025	285.15	276.70	8.45	10.133	13.41	22909	0.696	9198	90.47	52.84	1.10	0.40	5.77	15.96	17.63
5.408	-0.071	287.60	277.97	9.64	10.124	13.48	22842	0.696	8053	78.94	48.13	1.10	0.40	5.77	14.53	16.34
6.703	0.001	288.93	279.28	9.65	10.115	13.56	22773	0.696	8026	78.41	47.86	1.10	0.42	5.77	14.56	16.37
7.249	0.001	289.17	279.84	9.34	10.111	13.59	22744	0.696	8259	80.58	48.74	1.10	0.43	5.77	14.94	16.71
3.566	0.953	283.85	276.09	7.77	10.138	13.38	22941	0.696	9988	98.39	55.89	1.10	0.40	5.77	17.06	18.63
4.176	0.927	285.81	276.71	9.10	10.133	13.41	22908	0.696	8545	84.04	50.28	1.10	0.40	5.77	15.12	16.87
5.370	0.953	288.08	277.93	10.15	10.124	13.48	22844	0.696	7646	74.96	46.45	1.10	0.40	5.77	14.02	15.89
6.703	0.927	289.53	279.28	10.25	10.115	13.56	22773	0.696	7553	73.79	45.90	1.10	0.42	5.77	13.96	15.84
7.313	0.914	289.69	279.90	9.79	10.110	13.59	22741	0.696	7874	76.80	47.16	1.10	0.43	5.77	14.46	16.28
3.528	-0.953	284.46	276.05	8.42	10.138	13.37	22943	0.696	9213	90.77	52.98	1.10	0.40	5.77	16.04	17.70
4.112	-0.914	286.02	276.64	9.37	10.134	13.41	22911	0.696	8292	81.57	49.27	1.10	0.40	5.77	14.80	16.58
5.408	-0.927	288.74	277.97	10.77	10.124	13.48	22842	0.696	7201	70.60	44.56	1.10	0.40	5.77	13.47	15.41
6.678	-0.978	290.12	279.26	10.86	10.115	13.55	22774	0.696	7127	69.64	44.09	1.10	0.41	5.77	13.43	15.38
7.313	-0.978	290.28	279.90	10.38	10.110	13.59	22741	0.696	7422	72.39	45.27	1.10	0.43	5.77	13.89	15.77

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	49.99	37.16	12.83	1470.4	43.87	22944	0.696	1915.6	107.12	59.10	1.98	0.73	5.77	18.26	19.74
1.639	-0.010	53.58	38.37	15.21	1469.7	44.00	22909	0.696	1620.7	90.47	52.84	1.98	0.71	5.77	15.96	17.63
2.129	-0.028	58.00	40.65	17.34	1468.4	44.23	22842	0.696	1418.9	78.94	48.13	1.98	0.73	5.77	14.53	16.34
2.639	0.000	60.39	43.02	17.36	1467.0	44.47	22773	0.696	1414.2	78.41	47.86	1.98	0.75	5.77	14.56	16.37
2.854	0.000	60.82	44.02	16.80	1466.4	44.57	22744	0.696	1455.2	80.58	48.74	1.98	0.77	5.77	14.94	16.71
1.404	0.375	51.25	37.27	13.98	1470.3	43.88	22941	0.696	1759.9	98.39	55.89	1.98	0.72	5.77	17.06	18.63
1.644	0.365	54.76	38.39	16.37	1469.7	44.00	22908	0.696	1505.6	84.04	50.28	1.98	0.71	5.77	15.12	16.87
2.114	0.375	58.85	40.58	18.27	1468.4	44.22	22844	0.696	1347.2	74.96	46.45	1.98	0.72	5.77	14.02	15.89
2.639	0.365	61.47	43.02	18.45	1467.0	44.47	22773	0.696	1330.8	73.79	45.90	1.98	0.75	5.77	13.96	15.84
2.879	0.360	61.75	44.13	17.62	1466.4	44.59	22741	0.696	1387.4	76.80	47.16	1.98	0.77	5.77	14.46	16.28
1.389	-0.375	52.35	37.20	15.15	1470.4	43.88	22943	0.696	1623.3	90.77	52.98	1.98	0.73	5.77	16.04	17.70
1.619	-0.360	55.14	38.27	16.87	1469.8	43.99	22911	0.696	1461.1	81.57	49.27	1.98	0.72	5.77	14.80	16.58
2.129	-0.365	60.04	40.65	19.39	1468.4	44.23	22842	0.696	1268.8	70.60	44.56	1.98	0.73	5.77	13.47	15.41
2.629	-0.385	62.53	42.98	19.55	1467.0	44.47	22774	0.696	1255.8	69.64	44.09	1.98	0.75	5.77	13.43	15.38
2.879	-0.385	62.82	44.13	18.69	1466.4	44.59	22741	0.696	1307.8	72.39	45.27	1.98	0.77	5.77	13.89	15.77

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 11
Date: 7 January 1992
Time: 10:51:18

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.52	30.86	283.37	50.37	18.28	0.01120	10.165	1474.3	74.22	10.77	9.29	800	6.57	27.27	24.02

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.08	35.46
1.702	0.670	0.001	0.000	275.71	36.59
9.093	3.580	0.001	0.000	286.31	55.67
10.706	4.215	0.001	0.000	285.54	54.29

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	283.14	276.02	7.12	10.139	13.37	22948	0.696	10915	107.55	59.25	1.10	0.40	5.77	18.27	19.74
4.163	-0.025	285.14	276.69	8.44	10.135	13.41	22912	0.696	9233	90.81	52.97	1.10	0.40	5.77	15.97	17.64
5.408	-0.071	287.60	277.97	9.64	10.126	13.48	22845	0.696	8077	79.18	48.23	1.10	0.40	5.77	14.52	16.34
6.703	0.001	288.93	279.29	9.64	10.116	13.56	22776	0.696	8053	78.68	47.97	1.10	0.42	5.77	14.56	16.37
7.249	0.001	289.16	279.84	9.32	10.112	13.59	22747	0.696	8300	80.97	48.90	1.10	0.43	5.77	14.96	16.73
3.566	0.953	283.85	276.08	7.77	10.139	13.38	22944	0.696	10012	98.63	55.99	1.10	0.40	5.77	17.04	18.62
4.176	0.927	285.80	276.71	9.09	10.135	13.41	22911	0.696	8577	84.36	50.41	1.10	0.40	5.77	15.12	16.87
5.370	0.953	288.06	277.93	10.13	10.126	13.48	22847	0.696	7682	75.31	46.60	1.10	0.40	5.77	14.02	15.90
6.703	0.927	289.54	279.29	10.25	10.116	13.56	22776	0.696	7576	74.02	46.00	1.10	0.42	5.77	13.96	15.84
7.313	0.914	289.68	279.91	9.77	10.112	13.59	22743	0.696	7908	77.13	47.30	1.10	0.43	5.77	14.46	16.29
3.528	-0.953	284.45	276.05	8.40	10.139	13.37	22946	0.696	9252	91.15	53.13	1.10	0.40	5.77	16.04	17.71
4.112	-0.914	286.02	276.64	9.38	10.135	13.41	22915	0.696	8314	81.78	49.36	1.10	0.40	5.77	14.79	16.57
.408	-0.927	288.74	277.97	10.78	10.126	13.48	22845	0.696	7221	70.79	44.65	1.10	0.40	5.77	13.46	15.40
.678	-0.978	290.11	279.26	10.85	10.116	13.55	22777	0.696	7157	69.92	44.22	1.10	0.42	5.77	13.43	15.38
7.313	-0.978	290.27	279.91	10.37	10.112	13.59	22743	0.696	7454	72.70	45.41	1.10	0.43	5.77	13.89	15.78

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	49.97	37.15	12.82	1470.6	43.87	22948	0.696	1923.2	107.55	59.25	1.98	0.73	5.77	18.27	19.74
1.639	-0.010	53.56	38.36	15.20	1469.9	44.00	22912	0.696	1626.9	90.81	52.97	1.98	0.72	5.77	15.97	17.64
2.129	-0.028	57.99	40.65	17.34	1468.6	44.23	22845	0.696	1423.2	79.18	48.23	1.98	0.73	5.77	14.52	16.34
2.539	0.000	60.38	43.03	17.35	1467.2	44.47	22776	0.696	1418.9	78.68	47.97	1.98	0.75	5.77	14.56	16.37
2.854	0.000	60.80	44.03	16.77	1466.6	44.58	22747	0.696	1462.5	80.97	48.90	1.98	0.77	5.77	14.96	16.73
1.404	0.375	51.25	37.26	13.98	1470.5	43.88	22944	0.696	1764.1	98.63	55.99	1.98	0.72	5.77	17.04	18.62
1.644	0.365	54.74	38.38	16.36	1469.9	44.00	22911	0.696	1511.3	84.36	50.41	1.98	0.72	5.77	15.12	16.87
2.114	0.375	58.82	40.58	18.24	1468.6	44.22	22847	0.696	1353.6	75.31	46.60	1.98	0.73	5.77	14.02	15.90
2.639	0.365	61.47	43.03	18.45	1467.2	44.47	22776	0.696	1334.9	74.02	46.00	1.98	0.75	5.77	13.96	15.84
2.879	0.360	61.74	44.14	17.59	1466.6	44.59	22743	0.696	1393.4	77.13	47.30	1.98	0.77	5.77	14.46	16.29
1.389	-0.375	52.32	37.19	15.13	1470.6	43.88	22946	0.696	1630.2	91.15	53.13	1.98	0.73	5.77	16.04	17.71
1.619	-0.360	55.14	38.27	16.88	1470.0	43.99	22915	0.696	1464.9	81.78	49.36	1.98	0.72	5.77	14.79	16.57
2.129	-0.365	60.05	40.65	19.40	1468.6	44.23	22845	0.696	1272.3	70.79	44.65	1.98	0.73	5.77	13.46	15.40
2.629	-0.385	62.51	42.98	19.53	1467.2	44.47	22777	0.696	1261.1	69.92	44.22	1.98	0.75	5.77	13.43	15.38
2.879	-0.385	62.81	44.14	18.66	1466.6	44.59	22743	0.696	1313.4	72.70	45.41	1.98	0.77	5.77	13.89	15.78

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 12
Date: 7 January 1992
Time: 10:51:43

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.51	30.83	283.35	50.33	18.29	0.01120	10.166	1474.5	74.25	10.77	9.29	800	6.58	27.27	24.02

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.09	35.48
1.702	0.670	0.001	0.000	275.72	36.61
9.093	3.580	0.001	0.000	286.31	55.67
10.706	4.215	0.001	0.000	285.55	54.30

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	283.16	276.00	7.16	10.141	13.38	22958	0.696	10856	106.97	59.05	1.10	0.40	5.77	18.20	19.68
4.163	-0.025	285.16	276.68	8.48	10.136	13.41	22922	0.696	9190	90.40	52.81	1.10	0.40	5.77	15.92	17.59
5.408	-0.071	287.61	277.95	9.67	10.127	13.48	22855	0.696	8048	78.89	48.11	1.10	0.40	5.77	14.49	16.31
6.703	0.001	288.95	279.27	9.68	10.117	13.56	22786	0.696	8020	78.36	47.84	1.10	0.42	5.77	14.52	16.33
7.249	0.001	289.18	279.82	9.36	10.113	13.59	22757	0.696	8259	80.58	48.74	1.10	0.43	5.77	14.91	16.68
3.566	0.953	283.87	276.07	7.80	10.140	13.38	22955	0.696	9970	98.22	55.83	1.10	0.40	5.77	16.99	18.57
4.176	0.927	285.81	276.69	9.13	10.136	13.41	22922	0.696	8540	84.00	50.26	1.10	0.40	5.77	15.08	16.83
5.370	0.953	288.08	277.91	10.17	10.127	13.48	22857	0.696	7651	75.01	46.47	1.10	0.40	5.77	13.99	15.87
6.703	0.927	289.54	279.27	10.27	10.117	13.56	22786	0.696	7559	73.85	45.93	1.10	0.42	5.77	13.94	15.82
7.313	0.914	289.70	279.89	9.81	10.113	13.59	22754	0.696	7874	76.80	47.16	1.10	0.43	5.77	14.43	16.25
3.528	-0.953	284.46	276.03	8.44	10.141	13.38	22957	0.696	9214	90.79	52.99	1.10	0.40	5.77	16.00	17.67
4.112	-0.914	286.02	276.62	9.40	10.136	13.41	22925	0.696	8289	81.54	49.26	1.10	0.40	5.77	14.76	16.55
5.408	-0.927	288.75	277.95	10.81	10.127	13.48	22855	0.696	7200	70.59	44.56	1.10	0.40	5.77	13.44	15.38
6.678	-0.978	290.14	279.24	10.89	10.117	13.56	22787	0.696	7125	69.62	44.09	1.10	0.42	5.77	13.40	15.35
7.313	-0.978	290.27	279.89	10.39	10.113	13.59	22754	0.696	7439	72.56	45.35	1.10	0.43	5.77	13.88	15.77

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	50.00	37.12	12.89	1470.8	43.88	22958	0.696	1912.8	106.97	59.05	1.98	0.73	5.77	18.20	19.68
1.639	-0.010	53.59	38.33	15.26	1470.1	44.01	22922	0.696	1619.3	90.40	52.81	1.98	0.72	5.77	15.92	17.59
2.129	-0.028	58.02	40.62	17.40	1468.8	44.24	22855	0.696	1418.1	78.89	48.11	1.98	0.73	5.77	14.49	16.31
2.639	0.000	60.41	42.99	17.42	1467.4	44.48	22786	0.696	1413.1	78.36	47.84	1.98	0.75	5.77	14.52	16.33
2.854	0.000	60.84	43.99	16.85	1466.8	44.59	22757	0.696	1455.2	80.58	48.74	1.98	0.77	5.77	14.91	16.68
1.404	0.375	51.27	37.23	14.04	1470.7	43.90	22955	0.696	1756.7	98.22	55.83	1.98	0.72	5.77	16.99	18.57
1.644	0.365	54.78	38.35	16.42	1470.1	44.01	22922	0.696	1504.7	84.00	50.26	1.98	0.71	5.77	15.08	16.83
2.114	0.375	58.85	40.55	18.30	1468.8	44.24	22857	0.696	1348.1	75.01	46.47	1.98	0.72	5.77	13.99	15.87
2.639	0.365	61.48	42.99	18.48	1467.4	44.48	22786	0.696	1331.9	73.85	45.93	1.98	0.75	5.77	13.94	15.82
2.879	0.360	61.77	44.11	17.66	1466.7	44.60	22754	0.696	1387.4	76.80	47.16	1.98	0.77	5.77	14.43	16.25
1.389	-0.375	52.35	37.16	15.18	1470.8	43.89	22957	0.696	1623.5	90.79	52.99	1.98	0.73	5.77	16.00	17.67
1.619	-0.360	55.16	38.24	16.92	1470.1	44.00	22925	0.696	1460.5	81.54	49.26	1.98	0.72	5.77	14.76	16.55
2.129	-0.365	60.07	40.62	19.45	1468.8	44.24	22855	0.696	1268.6	70.59	44.56	1.98	0.73	5.77	13.44	15.38
2.629	-0.385	62.56	42.95	19.61	1467.4	44.48	22787	0.696	1255.4	69.62	44.09	1.98	0.75	5.77	13.40	15.35
2.879	-0.385	62.80	44.11	18.69	1466.7	44.60	22754	0.696	1310.8	72.56	45.35	1.98	0.77	5.77	13.88	15.77

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 13
Date: 7 January 1992
Time: 10:55:01

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.66	31.09	286.22	55.50	14.64	0.00897	10.190	1477.9	46.35	6.72	14.88	802	5.29	27.34	24.08

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.01	37.13
1.702	0.670	0.001	0.000	276.78	38.51
9.093	3.580	0.001	0.000	289.80	61.95
10.706	4.215	0.001	0.000	288.94	60.40

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	285.79	277.03	8.76	10.174	10.72	18335	0.696	8901	87.46	51.63	1.10	0.42	5.77	15.11	16.86
4.163	-0.025	288.24	277.87	10.37	10.171	10.75	18300	0.696	7536	73.88	45.99	1.10	0.42	5.77	13.27	15.24
5.408	-0.071	291.27	279.46	11.81	10.165	10.81	18233	0.696	6608	64.52	41.78	1.10	0.43	5.77	12.15	14.27
6.703	0.001	292.92	281.12	11.80	10.159	10.88	18163	0.696	6596	64.13	41.55	1.10	0.44	5.77	12.19	14.31
7.249	0.001	293.18	281.81	11.37	10.156	10.91	18135	0.696	6819	66.18	42.46	1.10	0.46	5.77	12.55	14.61
3.566	0.953	286.52	277.11	9.41	10.173	10.72	18332	0.696	8287	81.41	49.19	1.10	0.42	5.77	14.29	16.13
4.176	0.927	288.88	277.89	10.99	10.170	10.75	18299	0.696	7110	69.71	44.17	1.10	0.42	5.77	12.73	14.77
5.370	0.953	291.70	279.42	12.29	10.165	10.81	18235	0.696	6349	62.00	40.62	1.10	0.43	5.77	11.83	14.00
6.703	0.927	293.48	281.12	12.36	10.159	10.88	18163	0.696	6297	61.22	40.21	1.10	0.44	5.77	11.82	13.99
7.313	0.914	293.67	281.89	11.78	10.156	10.91	18131	0.696	6576	63.81	41.38	1.10	0.46	5.77	12.25	14.36
3.528	-0.953	287.17	277.06	10.10	10.173	10.72	18334	0.696	7715	75.80	46.84	1.10	0.42	5.77	13.54	15.47
4.112	-0.914	289.12	277.81	11.31	10.171	10.75	18302	0.696	6907	67.73	43.29	1.10	0.42	5.77	12.48	14.55
5.408	-0.927	292.47	279.46	13.01	10.165	10.81	18233	0.696	5999	58.57	39.00	1.10	0.43	5.77	11.40	13.64
6.678	-0.978	294.11	281.08	13.02	10.159	10.88	18165	0.696	5978	58.12	38.74	1.10	0.44	5.77	11.43	13.66
7.313	-0.978	294.32	281.89	12.43	10.156	10.91	18131	0.696	6235	60.50	39.85	1.10	0.46	5.77	11.82	13.99

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	54.73	38.97	15.76	1475.5	35.15	18335	0.696	1568.4	87.46	51.63	1.98	0.75	5.77	15.11	16.86
1.639	-0.010	59.15	40.48	18.67	1475.1	35.27	18300	0.696	1327.8	73.88	45.99	1.98	0.75	5.77	13.27	15.24
2.129	-0.028	64.60	43.35	21.25	1474.3	35.48	18233	0.696	1164.3	64.52	41.78	1.98	0.77	5.77	12.15	14.27
2.639	0.000	67.56	46.32	21.24	1473.4	35.70	18163	0.696	1162.2	64.13	41.55	1.98	0.80	5.77	12.19	14.31
2.854	0.000	68.04	47.57	20.47	1473.1	35.80	18135	0.696	1201.5	66.18	42.46	1.98	0.82	5.77	12.55	14.61
1.404	0.375	56.05	39.11	16.93	1475.5	35.17	18332	0.696	1460.2	81.41	49.19	1.98	0.75	5.77	14.29	16.13
1.644	0.365	60.30	40.51	19.78	1475.1	35.27	18299	0.696	1252.8	69.71	44.17	1.98	0.75	5.77	12.73	14.77
2.114	0.375	65.38	43.26	22.12	1474.3	35.48	18235	0.696	1118.7	62.00	40.62	1.98	0.77	5.77	11.83	14.00
2.639	0.365	68.57	46.32	22.25	1473.4	35.70	18163	0.696	1109.5	61.22	40.21	1.98	0.80	5.77	11.82	13.99
2.879	0.360	68.92	47.72	21.21	1473.0	35.81	18131	0.696	1158.7	63.81	41.38	1.98	0.82	5.77	12.25	14.36
1.389	-0.375	57.21	39.02	18.19	1475.5	35.16	18334	0.696	1359.4	75.80	46.84	1.98	0.75	5.77	13.54	15.47
1.619	-0.360	60.73	40.37	20.37	1475.1	35.26	18302	0.696	1217.0	67.73	43.29	1.98	0.75	5.77	12.48	14.55
2.129	-0.365	66.76	43.35	23.41	1474.3	35.48	18233	0.696	1057.0	58.57	39.00	1.98	0.77	5.77	11.40	13.64
2.629	-0.385	69.70	46.26	23.44	1473.4	35.70	18165	0.696	1053.3	58.12	38.74	1.98	0.80	5.77	11.43	13.66
2.879	-0.385	70.08	47.72	22.37	1473.0	35.81	18131	0.696	1098.6	60.50	39.85	1.98	0.82	5.77	11.82	13.99

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 14
Date: 7 January 1992
Time: 10:55:26

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.65	31.08	286.25	55.55	14.65	0.00897	10.190	1477.9	46.34	6.72	14.88	805	5.27	27.44	24.17

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.03	37.17
1.702	0.670	0.001	0.000	276.80	38.56
9.093	3.580	0.001	0.000	289.81	61.96
10.706	4.215	0.001	0.000	288.95	60.42

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	285.79	277.03	8.76	10.174	10.72	18346	0.696	8927	87.71	51.73	1.10	0.42	5.77	15.10	16.86
4.163	-0.025	288.24	277.88	10.36	10.171	10.76	18310	0.696	7569	74.21	46.13	1.10	0.42	5.77	13.28	15.24
5.408	-0.071	291.29	279.47	11.81	10.165	10.82	18243	0.696	6627	64.70	41.86	1.10	0.43	5.77	12.14	14.26
6.703	0.001	292.92	281.13	11.79	10.159	10.89	18174	0.696	6628	64.43	41.69	1.10	0.44	5.77	12.20	14.31
7.249	0.001	293.18	281.83	11.35	10.157	10.92	18145	0.696	6852	66.49	42.60	1.10	0.46	5.77	12.56	14.62
3.566	0.953	286.52	277.11	9.41	10.173	10.73	18343	0.696	8314	81.68	49.30	1.10	0.42	5.77	14.28	16.12
4.176	0.927	288.90	277.89	11.01	10.171	10.76	18309	0.696	7125	69.85	44.23	1.10	0.42	5.77	12.71	14.75
5.370	0.953	291.70	279.42	12.27	10.165	10.82	18245	0.696	6378	62.28	40.75	1.10	0.43	5.77	11.83	14.00
6.703	0.927	293.49	281.13	12.37	10.159	10.89	18174	0.696	6317	61.41	40.29	1.10	0.44	5.77	11.81	13.98
7.313	0.914	293.67	281.91	11.76	10.156	10.92	18141	0.696	6607	64.11	41.52	1.10	0.46	5.77	12.26	14.36
3.528	-0.953	287.19	277.06	10.13	10.174	10.72	18345	0.696	7725	75.90	46.89	1.10	0.42	5.77	13.51	15.45
4.112	-0.914	289.13	277.81	11.32	10.171	10.75	18313	0.696	6928	67.93	43.38	1.10	0.42	5.77	12.47	14.54
5.408	-0.927	292.50	279.47	13.03	10.165	10.82	18243	0.696	6009	58.67	39.05	1.10	0.43	5.77	11.38	13.63
6.678	-0.978	294.12	281.10	13.03	10.159	10.89	18175	0.696	5997	58.31	38.83	1.10	0.44	5.77	11.42	13.65
7.313	-0.978	294.33	281.91	12.42	10.156	10.92	18141	0.696	6258	60.72	39.95	1.10	0.46	5.77	11.82	13.99

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	54.74	38.97	15.77	1475.6	35.17	18346	0.696	1572.9	87.71	51.73	1.98	0.75	5.77	15.10	16.86
1.639	-0.010	59.14	40.49	18.65	1475.1	35.29	18310	0.696	1333.7	74.21	46.13	1.98	0.75	5.77	13.28	15.24
2.129	-0.028	64.63	43.36	21.26	1474.3	35.50	18243	0.696	1167.7	64.70	41.86	1.98	0.77	5.77	12.14	14.26
2.639	0.000	67.56	46.34	21.21	1473.5	35.73	18174	0.696	1167.9	64.43	41.69	1.98	0.80	5.77	12.20	14.31
2.854	0.000	68.04	47.60	20.44	1473.1	35.82	18145	0.696	1207.3	66.49	42.60	1.98	0.82	5.77	12.56	14.62
1.404	0.375	56.05	39.12	16.94	1475.5	35.19	18343	0.696	1464.9	81.68	49.30	1.98	0.75	5.77	14.28	16.12
1.644	0.365	60.33	40.52	19.81	1475.1	35.29	18309	0.696	1255.4	69.85	44.23	1.98	0.75	5.77	12.71	14.75
2.114	0.375	65.37	43.28	22.09	1474.3	35.50	18245	0.696	1123.8	62.28	40.75	1.98	0.77	5.77	11.83	14.00
2.639	0.365	68.60	46.34	22.26	1473.5	35.73	18174	0.696	1113.1	61.41	40.29	1.98	0.80	5.77	11.81	13.98
2.879	0.360	68.92	47.74	21.18	1473.1	35.83	18141	0.696	1164.2	64.11	41.52	1.98	0.82	5.77	12.26	14.36
1.389	-0.375	57.25	39.03	18.23	1475.6	35.18	18345	0.696	1361.1	75.90	46.89	1.98	0.75	5.77	13.51	15.45
1.619	-0.360	60.75	40.37	20.37	1475.2	35.28	18313	0.696	1220.7	67.93	43.38	1.98	0.75	5.77	12.47	14.54
2.129	-0.365	66.81	43.36	23.45	1474.3	35.50	18243	0.696	1058.8	58.67	39.05	1.98	0.77	5.77	11.38	13.63
2.629	-0.385	69.73	46.29	23.45	1473.5	35.72	18175	0.696	1056.7	58.31	38.83	1.98	0.80	5.77	11.42	13.65
2.879	-0.385	70.10	47.74	22.36	1473.1	35.83	18141	0.696	1102.7	60.72	39.95	1.98	0.82	5.77	11.82	13.99

Table 3.4 (continued)

Aluminum Heat Exchanger
Experiment: 4, Data Point: 15
Date: 7 January 1992
Time: 10:55:52

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.68	31.13	286.23	55.52	14.66	0.00898	10.191	1478.1	46.31	6.72	14.89	802	5.29	27.34	24.08

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.03	37.16
1.702	0.670	0.001	0.000	276.80	38.55
9.093	3.580	0.001	0.000	289.80	61.95
10.706	4.215	0.001	0.000	288.95	60.42

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	285.79	277.05	8.74	10.175	10.73	18354	0.696	8918	87.62	51.70	1.10	0.42	5.77	15.13	16.88
4.163	-0.025	288.24	277.89	10.35	10.172	10.76	18318	0.696	7550	74.02	46.05	1.10	0.42	5.77	13.29	15.26
5.408	-0.071	291.27	279.48	11.79	10.167	10.83	18251	0.696	6616	64.60	41.82	1.10	0.43	5.77	12.16	14.28
6.703	0.001	292.91	281.13	11.78	10.161	10.89	18182	0.696	6607	64.23	41.60	1.10	0.44	5.77	12.21	14.32
7.249	0.001	293.17	281.82	11.34	10.158	10.92	18153	0.696	6836	66.34	42.53	1.10	0.46	5.77	12.57	14.63
3.566	0.953	286.52	277.13	9.39	10.175	10.73	18351	0.696	8304	81.58	49.26	1.10	0.42	5.77	14.31	16.15
4.176	0.927	288.89	277.90	10.99	10.172	10.76	18318	0.696	7114	69.74	44.18	1.10	0.42	5.77	12.74	14.77
5.370	0.953	291.69	279.43	12.26	10.167	10.82	18253	0.696	6365	62.15	40.69	1.10	0.43	5.77	11.85	14.01
6.703	0.927	293.48	281.13	12.36	10.161	10.89	18182	0.696	6301	61.25	40.22	1.10	0.44	5.77	11.82	14.00
7.313	0.914	293.68	281.90	11.78	10.158	10.93	18150	0.696	6580	63.84	41.39	1.10	0.46	5.77	12.26	14.36
3.528	-0.953	287.18	277.08	10.11	10.175	10.73	18353	0.696	7714	75.78	46.83	1.10	0.42	5.77	13.54	15.47
4.112	-0.914	289.13	277.82	11.30	10.172	10.76	18321	0.696	6914	67.80	43.32	1.10	0.42	5.77	12.48	14.56
5.408	-0.927	292.48	279.48	13.00	10.167	10.83	18251	0.696	6004	58.62	39.02	1.10	0.43	5.77	11.41	13.65
6.678	-0.978	294.12	281.10	13.02	10.161	10.89	18183	0.696	5978	58.12	38.74	1.10	0.44	5.77	11.43	13.66
7.313	-0.978	294.32	281.90	12.42	10.158	10.93	18150	0.696	6241	60.55	39.87	1.10	0.46	5.77	11.83	14.00

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	54.73	38.99	15.73	1475.8	35.19	18354	0.696	1571.4	87.62	51.70	1.98	0.75	5.77	15.13	16.88
1.639	-0.010	59.15	40.51	18.63	1475.4	35.30	18318	0.696	1330.3	74.02	46.05	1.98	0.75	5.77	13.29	15.26
2.129	-0.028	64.60	43.37	21.23	1474.5	35.52	18251	0.696	1165.7	64.60	41.82	1.98	0.77	5.77	12.16	14.28
2.639	0.000	67.55	46.34	21.21	1473.7	35.74	18182	0.696	1164.2	64.23	41.60	1.98	0.80	5.77	12.21	14.32
2.854	0.000	68.01	47.59	20.42	1473.3	35.83	18153	0.696	1204.5	66.34	42.53	1.98	0.82	5.77	12.57	14.63
1.404	0.375	56.04	39.14	16.90	1475.7	35.20	18351	0.696	1463.2	81.58	49.26	1.98	0.75	5.77	14.31	16.15
1.644	0.365	60.32	40.54	19.78	1475.3	35.30	18318	0.696	1253.5	69.74	44.18	1.98	0.75	5.77	12.74	14.77
2.114	0.375	65.35	43.28	22.07	1474.6	35.51	18253	0.696	1121.5	62.15	40.69	1.98	0.77	5.77	11.85	14.01
2.639	0.365	68.58	46.34	22.24	1473.7	35.74	18182	0.696	1110.2	61.25	40.22	1.98	0.80	5.77	11.82	14.00
2.879	0.360	68.93	47.74	21.20	1473.3	35.84	18150	0.696	1159.4	63.84	41.39	1.98	0.82	5.77	12.26	14.36
1.389	-0.375	57.24	39.05	18.19	1475.8	35.19	18353	0.696	1359.2	75.78	46.83	1.98	0.75	5.77	13.54	15.47
1.619	-0.360	60.74	40.39	20.35	1475.4	35.29	18321	0.696	1218.2	67.80	43.32	1.98	0.75	5.77	12.48	14.56
2.129	-0.365	66.77	43.37	23.39	1474.5	35.52	18251	0.696	1057.9	58.62	39.02	1.98	0.77	5.77	11.41	13.65
2.629	-0.385	69.73	46.28	23.44	1473.7	35.73	18183	0.696	1053.3	58.12	38.74	1.98	0.80	5.77	11.43	13.66
2.879	-0.385	70.09	47.74	22.35	1473.3	35.84	18150	0.696	1099.7	60.55	39.87	1.98	0.82	5.77	11.83	14.00

Table 3.5. Data tables for experiment 5

Aluminum Heat Exchanger
Summary Data Table for Experiment 5
Date: 7 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	P0 MPa	P0-P1 kPa	T0 K	T1 K	T1-T0 K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	11:03:01	1021	34.81	14.67	10.21	46.43	272.71	289.94	17.23	14.93	10.89	18184	0.696	6651	64.62	41.77
2	11:03:27	1023	34.88	14.68	10.21	46.39	272.70	289.94	17.24	14.96	10.90	18202	0.696	6650	64.61	41.76
3	11:03:53	1022	34.84	14.68	10.21	46.43	272.69	289.93	17.23	14.98	10.89	18201	0.696	6635	64.47	41.70
4	11:07:02	1015	34.60	19.49	10.20	84.12	272.44	285.35	12.91	11.58	14.38	24296	0.696	8525	83.36	49.91
5	11:07:28	1017	34.67	19.48	10.20	84.20	272.39	285.33	12.94	11.53	14.37	24292	0.696	8586	83.96	50.15
6	11:07:54	1015	34.60	19.49	10.20	84.18	272.36	285.27	12.91	11.56	14.37	24298	0.696	8545	83.57	50.00
7	11:11:57	4	0.14	19.37	10.20	84.13	272.03	272.11	0.08	0.11	13.95	24543	0.697	0	0.00	0.00
8	11:12:23	1	0.03	19.37	10.20	84.13	272.02	272.06	0.04	0.09	13.94	24533	0.697	0	0.00	0.00
9	11:12:49	1	0.03	19.35	10.20	84.16	271.98	272.03	0.04	0.11	13.93	24511	0.697	0	0.00	0.00
10	11:16:57	1012	34.50	19.31	10.19	84.43	271.94	284.92	12.98	11.56	14.24	24106	0.696	8512	83.33	49.92
11	11:17:23	1005	34.26	19.31	10.18	84.28	271.98	284.87	12.89	11.54	14.25	24105	0.696	8468	82.91	49.75
12	11:17:48	1005	34.26	19.31	10.18	84.24	271.96	284.86	12.90	11.57	14.26	24105	0.696	8455	82.79	49.70
13	11:22:02	1014	34.57	14.67	10.18	46.85	272.16	289.27	17.11	14.91	10.89	18207	0.696	6616	64.38	41.68
14	11:22:28	1015	34.60	14.66	10.17	46.85	272.15	289.29	17.14	14.96	10.89	18194	0.696	6599	64.22	41.61
15	11:22:53	1015	34.60	14.64	10.16	46.80	272.20	289.35	17.15	14.96	10.90	18178	0.696	6596	64.19	41.59

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 1
Date: 7 January 1992
Time: 11:03:01

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.71	31.19	289.94	62.21	14.67	0.00898	10.208	1480.5	46.43	6.73	14.85	1021	4.20	34.81	30.66

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	277.00	38.92
1.702	0.670	0.001	0.000	277.97	40.67
9.093	3.580	0.001	0.000	294.44	70.31
10.706	4.215	0.001	0.000	293.35	68.34

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	289.37	278.27	11.10	10.192	10.76	18314	0.696	8936	87.52	51.60	1.10	0.44	5.77	12.31	14.40
4.163	-0.025	292.47	279.34	13.13	10.189	10.81	18269	0.696	7578	74.01	45.99	1.10	0.45	5.77	10.91	13.23
5.408	-0.071	296.30	281.36	14.93	10.183	10.89	18184	0.696	6651	64.62	41.77	1.10	0.47	5.77	10.07	12.55
6.703	0.001	298.38	283.46	14.92	10.177	10.97	18097	0.696	6644	64.20	41.51	1.10	0.49	5.77	10.12	12.59
7.249	0.001	298.71	284.34	14.37	10.175	11.01	18061	0.696	6869	66.23	42.40	1.10	0.50	5.77	10.40	12.81
3.566	0.953	290.30	278.37	11.93	10.191	10.77	18310	0.696	8319	81.46	49.16	1.10	0.44	5.77	11.67	13.86
4.176	0.927	293.31	279.36	13.95	10.189	10.81	18268	0.696	7134	69.67	44.10	1.10	0.45	5.77	10.47	12.88
5.370	0.953	296.84	281.30	15.54	10.183	10.89	18187	0.696	6393	62.12	40.62	1.10	0.47	5.77	9.82	12.35
6.703	0.927	299.12	283.46	15.66	10.177	10.97	18097	0.696	6330	61.17	40.11	1.10	0.49	5.77	9.82	12.35
7.313	0.914	299.33	284.45	14.88	10.174	11.01	18056	0.696	6629	63.89	41.34	1.10	0.50	5.77	10.17	12.63
3.528	-0.953	291.14	278.31	12.83	10.192	10.76	18312	0.696	7734	75.73	46.76	1.10	0.44	5.77	11.08	13.37
4.112	-0.914	293.59	279.26	14.33	10.189	10.80	18272	0.696	6942	67.82	43.28	1.10	0.44	5.77	10.29	12.72
5.408	-0.927	297.86	281.36	16.50	10.183	10.89	18184	0.696	6020	58.49	38.91	1.10	0.47	5.77	9.48	12.08
6.678	-0.978	299.94	283.42	16.52	10.177	10.97	18099	0.696	6000	57.99	38.61	1.10	0.48	5.77	9.50	12.10
7.313	-0.978	300.21	284.45	15.76	10.174	11.01	18056	0.696	6259	60.33	39.69	1.10	0.50	5.77	9.82	12.34

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	61.18	41.20	19.99	1478.2	35.31	18314	0.696	1574.5	87.52	51.60	1.98	0.80	5.77	12.31	14.40
1.639	-0.010	66.76	43.13	23.63	1477.8	35.45	18269	0.696	1335.2	74.01	45.99	1.98	0.80	5.77	10.91	13.23
2.129	-0.028	73.65	46.76	26.88	1476.9	35.72	18184	0.696	1171.9	64.62	41.77	1.98	0.84	5.77	10.07	12.55
2.639	0.000	77.39	50.54	26.85	1476.1	36.00	18097	0.696	1170.7	64.20	41.51	1.98	0.87	5.77	10.12	12.59
2.854	0.000	78.00	52.13	25.87	1475.7	36.12	18061	0.696	1210.3	66.23	42.40	1.98	0.90	5.77	10.40	12.81
1.404	0.375	62.86	41.38	21.48	1478.1	35.32	18310	0.696	1465.8	81.46	49.16	1.98	0.80	5.77	11.67	13.86
1.644	0.365	68.27	43.16	25.10	1477.7	35.46	18268	0.696	1257.0	69.67	44.10	1.98	0.80	5.77	10.47	12.88
2.114	0.375	74.62	46.65	27.97	1477.0	35.71	18187	0.696	1126.4	62.12	40.62	1.98	0.84	5.77	9.82	12.35
2.639	0.365	78.72	50.54	28.18	1476.1	36.00	18097	0.696	1115.3	61.17	40.11	1.98	0.87	5.77	9.82	12.35
2.879	0.360	79.10	52.31	26.78	1475.7	36.13	18056	0.696	1168.0	63.89	41.34	1.98	0.90	5.77	10.17	12.63
1.389	-0.375	64.37	41.27	23.10	1478.2	35.31	18312	0.696	1362.7	75.73	46.76	1.98	0.80	5.77	11.08	13.37
1.619	-0.360	68.77	42.98	25.80	1477.8	35.44	18272	0.696	1223.2	67.82	43.28	1.98	0.80	5.77	10.29	12.72
2.129	-0.365	76.46	46.76	29.70	1476.9	35.72	18184	0.696	1060.7	58.49	38.91	1.98	0.84	5.77	9.48	12.08
2.629	-0.385	80.20	50.47	29.73	1476.1	35.99	18099	0.696	1057.2	57.99	38.61	1.98	0.87	5.77	9.50	12.10
2.879	-0.385	80.68	52.31	28.37	1475.7	36.13	18056	0.696	1102.8	60.33	39.69	1.98	0.90	5.77	9.82	12.34

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 2
Date: 7 January 1992
Time: 11:03:27

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.70	31.17	289.94	62.20	14.68	0.00899	10.209	1480.7	46.39	6.73	14.86	1023	4.20	34.88	30.72

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	277.01	38.93
1.702	0.670	0.001	0.000	277.99	40.69
9.093	3.580	0.001	0.000	294.44	70.31
10.706	4.215	0.001	0.000	293.36	68.36

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	289.36	278.26	11.10	10.193	10.77	18332	0.696	8952	87.68	51.67	1.10	0.44	5.77	12.31	14.41
4.163	-0.025	292.47	279.33	13.14	10.190	10.81	18286	0.696	7581	74.04	46.00	1.10	0.45	5.77	10.90	13.22
5.408	-0.071	296.31	281.35	14.96	10.185	10.90	18202	0.696	6650	64.61	41.76	1.10	0.47	5.77	10.06	12.54
6.703	0.001	298.37	283.45	14.92	10.179	10.98	18114	0.696	6651	64.27	41.54	1.10	0.49	5.77	10.11	12.58
7.249	0.001	298.70	284.33	14.37	10.176	11.02	18078	0.696	6880	66.34	42.45	1.10	0.50	5.77	10.40	12.82
3.566	0.953	290.29	278.36	11.93	10.193	10.77	18327	0.696	8329	81.55	49.19	1.10	0.44	5.77	11.66	13.86
4.176	0.927	293.31	279.35	13.96	10.190	10.81	18286	0.696	7137	69.71	44.12	1.10	0.45	5.77	10.47	12.87
5.370	0.953	296.88	281.29	15.59	10.185	10.89	18204	0.696	6382	62.02	40.57	1.10	0.47	5.77	9.80	12.34
6.703	0.927	299.12	283.45	15.67	10.179	10.98	18114	0.696	6332	61.19	40.12	1.10	0.49	5.77	9.81	12.34
7.313	0.914	299.35	284.44	14.92	10.176	11.02	18074	0.696	6622	63.83	41.31	1.10	0.50	5.77	10.16	12.62
3.528	-0.953	291.18	278.30	12.88	10.193	10.77	18330	0.696	7714	75.55	46.69	1.10	0.44	5.77	11.05	13.35
4.112	-0.914	293.60	279.25	14.36	10.190	10.81	18290	0.696	6940	67.79	43.27	1.10	0.44	5.77	10.28	12.71
5.408	-0.927	297.85	281.35	16.50	10.185	10.90	18202	0.696	6028	58.57	38.95	1.10	0.47	5.77	9.48	12.08
6.678	-0.978	299.95	283.41	16.54	10.179	10.98	18116	0.696	5999	57.98	38.61	1.10	0.48	5.77	9.50	12.09
7.313	-0.978	300.20	284.44	15.77	10.176	11.02	18074	0.696	6265	60.39	39.72	1.10	0.50	5.77	9.81	12.34

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	61.15	41.17	19.98	1478.4	35.34	18332	0.696	1577.3	87.68	51.67	1.98	0.80	5.77	12.31	14.41
1.639	-0.010	66.76	43.10	23.66	1478.0	35.48	18286	0.696	1335.8	74.04	46.00	1.98	0.80	5.77	10.90	13.22
2.129	-0.028	73.67	46.74	26.92	1477.1	35.75	18202	0.696	1171.7	64.61	41.76	1.98	0.84	5.77	10.06	12.54
2.639	0.000	77.38	50.52	26.86	1476.3	36.02	18114	0.696	1171.9	64.27	41.54	1.98	0.87	5.77	10.11	12.58
2.854	0.000	77.97	52.11	25.86	1475.9	36.14	18078	0.696	1212.3	66.34	42.45	1.98	0.90	5.77	10.40	12.82
1.404	0.375	62.84	41.36	21.48	1478.4	35.35	18327	0.696	1467.6	81.55	49.19	1.98	0.80	5.77	11.66	13.86
1.644	0.365	68.27	43.14	25.13	1478.0	35.48	18286	0.696	1257.5	69.71	44.12	1.98	0.80	5.77	10.47	12.87
2.114	0.375	74.69	46.63	28.05	1477.2	35.74	18204	0.696	1124.5	62.02	40.57	1.98	0.84	5.77	9.80	12.34
2.639	0.365	78.74	50.52	28.21	1476.3	36.02	18114	0.696	1115.7	61.19	40.12	1.98	0.87	5.77	9.81	12.34
2.879	0.360	79.15	52.30	26.85	1475.9	36.15	18074	0.696	1166.8	63.83	41.31	1.98	0.90	5.77	10.16	12.62
1.389	-0.375	64.43	41.25	23.19	1478.4	35.34	18330	0.696	1359.2	75.55	46.69	1.98	0.80	5.77	11.05	13.35
1.619	-0.360	68.80	42.95	25.84	1478.0	35.47	18290	0.696	1222.8	67.79	43.27	1.98	0.80	5.77	10.28	12.71
2.129	-0.365	76.44	46.74	29.70	1477.1	35.75	18202	0.696	1062.1	58.57	38.95	1.98	0.84	5.77	9.48	12.08
2.629	-0.385	80.23	50.45	29.78	1476.3	36.02	18116	0.696	1057.0	57.98	38.61	1.98	0.87	5.77	9.50	12.09
2.879	-0.385	80.68	52.30	28.38	1475.9	36.15	18074	0.696	1103.9	60.39	39.72	1.98	0.90	5.77	9.81	12.34

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 3
Date: 7 January 1992
Time: 11:03:53

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.69	31.16	289.93	62.18	14.68	0.00899	10.210	1480.8	46.43	6.73	14.85	1022	4.20	34.84	30.69

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.99	38.90
1.702	0.670	0.001	0.000	277.97	40.66
9.093	3.580	0.001	0.000	294.43	70.29
10.706	4.215	0.001	0.000	293.34	68.32

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	289.37	278.25	11.12	10.194	10.77	18331	0.696	8932	87.48	51.59	1.10	0.44	5.77	12.29	14.39
4.163	-0.025	292.49	279.32	13.16	10.191	10.81	18286	0.696	7567	73.90	45.94	1.10	0.45	5.77	10.89	13.22
5.408	-0.071	296.33	281.35	14.98	10.185	10.89	18201	0.696	6635	64.47	41.70	1.10	0.47	5.77	10.05	12.53
6.703	0.001	298.40	283.44	14.96	10.179	10.98	18114	0.696	6633	64.10	41.47	1.10	0.49	5.77	10.10	12.57
7.249	0.001	298.74	284.33	14.41	10.177	11.02	18077	0.696	6858	66.12	42.35	1.10	0.50	5.77	10.38	12.80
3.566	0.953	290.31	278.36	11.96	10.194	10.77	18327	0.696	8311	81.38	49.12	1.10	0.44	5.77	11.65	13.85
4.176	0.927	293.32	279.35	13.97	10.191	10.81	18285	0.696	7129	69.62	44.08	1.10	0.45	5.77	10.46	12.87
5.370	0.953	296.86	281.28	15.58	10.185	10.89	18204	0.696	6384	62.03	40.58	1.10	0.47	5.77	9.81	12.34
6.703	0.927	299.13	283.44	15.68	10.179	10.98	18114	0.696	6325	61.13	40.10	1.10	0.49	5.77	9.81	12.34
7.313	0.914	299.36	284.43	14.93	10.177	11.02	18073	0.696	6614	63.76	41.28	1.10	0.50	5.77	10.15	12.61
3.528	-0.953	291.11	278.29	12.82	10.194	10.77	18329	0.696	7749	75.89	46.83	1.10	0.44	5.77	11.09	13.38
4.112	-0.914	293.58	279.24	14.34	10.191	10.81	18289	0.696	6945	67.85	43.30	1.10	0.44	5.77	10.28	12.72
5.408	-0.927	297.84	281.35	16.49	10.185	10.89	18201	0.696	6030	58.58	38.95	1.10	0.47	5.77	9.48	12.08
6.678	-0.978	299.93	283.40	16.53	10.179	10.98	18115	0.696	6002	58.01	38.62	1.10	0.48	5.77	9.50	12.10
7.313	-0.978	300.16	284.43	15.73	10.177	11.02	18073	0.696	6276	60.49	39.76	1.10	0.50	5.77	9.83	12.35

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	61.18	41.17	20.02	1478.5	35.33	18331	0.696	1573.8	87.48	51.59	1.98	0.80	5.77	12.29	14.39
1.639	-0.010	66.79	43.10	23.69	1478.1	35.48	18286	0.696	1333.3	73.90	45.94	1.98	0.80	5.77	10.89	13.22
2.129	-0.028	73.71	46.73	26.97	1477.3	35.74	18201	0.696	1169.1	64.47	41.70	1.98	0.84	5.77	10.05	12.53
2.639	0.000	77.43	50.51	26.92	1476.4	36.02	18114	0.696	1168.7	64.10	41.47	1.98	0.87	5.77	10.10	12.57
2.854	0.000	78.04	52.10	25.94	1476.0	36.14	18077	0.696	1208.4	66.12	42.35	1.98	0.90	5.77	10.38	12.80
1.404	0.375	62.87	41.35	21.52	1478.5	35.35	18327	0.696	1464.4	81.38	49.12	1.98	0.80	5.77	11.65	13.85
1.644	0.365	68.28	43.13	25.15	1478.1	35.48	18285	0.696	1256.1	69.62	44.08	1.98	0.80	5.77	10.46	12.87
2.114	0.375	74.66	46.62	28.04	1477.3	35.73	18204	0.696	1124.9	62.03	40.58	1.98	0.84	5.77	9.81	12.34
2.639	0.365	78.74	50.51	28.23	1476.4	36.02	18114	0.696	1114.5	61.13	40.10	1.98	0.87	5.77	9.81	12.34
2.879	0.360	79.16	52.29	26.87	1476.0	36.15	18073	0.696	1165.4	63.76	41.28	1.98	0.90	5.77	10.15	12.61
1.389	-0.375	64.32	41.24	23.08	1478.5	35.34	18329	0.696	1365.4	75.89	46.83	1.98	0.80	5.77	11.09	13.38
1.619	-0.360	68.76	42.95	25.81	1478.1	35.46	18289	0.696	1223.7	67.85	43.30	1.98	0.80	5.77	10.28	12.72
2.129	-0.365	76.42	46.73	29.68	1477.3	35.74	18201	0.696	1062.5	58.58	38.95	1.98	0.84	5.77	9.48	12.08
2.629	-0.385	80.19	50.44	29.76	1476.4	36.01	18115	0.696	1057.6	58.01	38.62	1.98	0.87	5.77	9.50	12.10
2.879	-0.385	80.61	52.29	28.32	1476.0	36.15	18073	0.696	1105.8	60.49	39.76	1.98	0.90	5.77	9.83	12.35

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 4
Date: 7 January 1992
Time: 11:07:02

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.44	30.70	285.35	53.93	19.49	0.01193	10.199	1479.3	84.12	12.20	8.20	1015	5.55	34.60	30.48

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.44	36.11
1.702	0.670	0.001	0.000	276.19	37.45
9.093	3.580	0.001	0.000	288.88	60.30
10.706	4.215	0.001	0.000	287.96	58.64

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	285.14	276.60	8.54	10.170	14.24	24426	0.696	11551	113.63	61.37	1.10	0.41	5.77	15.50	17.21
4.163	-0.025	287.53	277.40	10.13	10.165	14.29	24380	0.696	9770	95.91	54.89	1.10	0.41	5.77	13.60	15.53
5.408	-0.071	290.50	278.92	11.58	10.154	14.38	24296	0.696	8525	83.36	49.91	1.10	0.42	5.77	12.41	14.49
6.703	0.001	292.04	280.49	11.55	10.144	14.47	24208	0.696	8529	83.06	49.72	1.10	0.44	5.77	12.47	14.55
7.249	0.001	292.31	281.15	11.16	10.139	14.51	24172	0.696	8790	85.46	50.66	1.10	0.45	5.77	12.80	14.83
3.566	0.953	286.01	276.68	9.33	10.170	14.25	24421	0.696	10577	104.03	57.95	1.10	0.41	5.77	14.47	16.29
4.176	0.927	288.35	277.42	10.93	10.165	14.29	24380	0.696	9050	88.83	52.16	1.10	0.41	5.77	12.88	14.90
5.370	0.953	291.05	278.87	12.18	10.155	14.38	24298	0.696	8104	79.25	48.22	1.10	0.42	5.77	12.00	14.14
6.703	0.927	292.81	280.49	12.32	10.144	14.47	24208	0.696	7998	77.89	47.59	1.10	0.44	5.77	11.95	14.10
7.313	0.914	292.98	281.23	11.76	10.139	14.52	24167	0.696	8340	81.06	48.88	1.10	0.45	5.77	12.37	14.46
3.528	-0.953	286.77	276.63	10.14	10.170	14.24	24424	0.696	9725	95.66	54.84	1.10	0.41	5.77	13.60	15.52
4.112	-0.914	288.60	277.34	11.26	10.165	14.29	24384	0.696	8781	86.21	51.12	1.10	0.41	5.77	12.62	14.67
5.408	-0.927	291.88	278.92	12.97	10.154	14.38	24296	0.696	7616	74.47	46.21	1.10	0.42	5.77	11.54	13.75
6.678	-0.978	293.54	280.46	13.08	10.144	14.47	24210	0.696	7531	73.35	45.67	1.10	0.44	5.77	11.50	13.73
7.313	-0.978	293.72	281.23	12.49	10.139	14.52	24167	0.696	7850	76.30	46.90	1.10	0.45	5.77	11.88	14.05

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	53.56	38.19	15.37	1475.1	46.73	24426	0.696	2035.3	113.63	61.37	1.98	0.75	5.77	15.50	17.21
1.639	-0.010	57.86	39.64	18.22	1474.3	46.88	24380	0.696	1721.5	95.91	54.89	1.98	0.74	5.77	13.60	15.53
2.129	-0.028	63.21	42.36	20.85	1472.8	47.18	24296	0.696	1502.1	83.36	49.91	1.98	0.76	5.77	12.41	14.49
2.639	0.000	65.98	45.19	20.79	1471.2	47.48	24208	0.696	1502.8	83.06	49.72	1.98	0.78	5.77	12.47	14.55
2.854	0.000	66.48	46.38	20.10	1470.6	47.61	24172	0.696	1548.8	85.46	50.66	1.98	0.81	5.77	12.80	14.83
1.404	0.375	55.12	38.33	16.80	1475.0	46.74	24421	0.696	1863.7	104.03	57.95	1.98	0.75	5.77	14.47	16.29
1.644	0.365	59.34	39.66	19.67	1474.2	46.89	24380	0.696	1594.6	88.83	52.16	1.98	0.74	5.77	12.88	14.90
2.114	0.375	64.21	42.28	21.93	1472.8	47.17	24298	0.696	1427.9	79.25	48.22	1.98	0.76	5.77	12.00	14.14
2.639	0.365	67.36	45.19	22.17	1471.2	47.48	24208	0.696	1409.2	77.89	47.59	1.98	0.78	5.77	11.95	14.10
2.879	0.360	67.68	46.52	21.16	1470.5	47.62	24167	0.696	1469.5	81.06	48.88	1.98	0.81	5.77	12.37	14.46
1.389	-0.375	56.51	38.25	18.26	1475.0	46.73	24424	0.696	1713.5	95.66	54.84	1.98	0.75	5.77	13.60	15.52
1.619	-0.360	59.80	39.52	20.28	1474.3	46.87	24384	0.696	1547.2	86.21	51.12	1.98	0.74	5.77	12.62	14.67
2.129	-0.365	65.70	42.36	23.34	1472.8	47.18	24296	0.696	1341.9	74.47	46.21	1.98	0.76	5.77	11.54	13.75
2.629	-0.385	68.69	45.14	23.55	1471.2	47.48	24210	0.696	1327.0	73.35	45.67	1.98	0.78	5.77	11.50	13.73
2.879	-0.385	69.00	46.52	22.49	1470.5	47.62	24167	0.696	1383.2	76.30	46.90	1.98	0.81	5.77	11.88	14.05

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 5
Date: 7 January 1992
Time: 11:07:28

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.39	30.62	285.33	53.90	19.48	0.01193	10.200	1479.4	84.20	12.21	8.19	1017	5.54	34.67	30.54

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.41	36.05
1.702	0.670	0.001	0.000	276.14	37.37
9.093	3.580	0.001	0.000	288.82	60.19
10.706	4.215	0.001	0.000	287.89	58.51

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	285.08	276.56	8.52	10.171	14.24	24422	0.696	11604	114.16	61.55	1.10	0.41	5.77	15.52	17.23
4.163	-0.025	287.44	277.37	10.07	10.165	14.28	24377	0.696	9841	96.62	55.17	1.10	0.41	5.77	13.65	15.57
5.408	-0.071	290.41	278.88	11.53	10.155	14.37	24292	0.696	8586	83.96	50.15	1.10	0.42	5.77	12.45	14.52
6.703	0.001	291.97	280.46	11.51	10.144	14.47	24204	0.696	8580	83.56	49.93	1.10	0.44	5.77	12.50	14.57
7.249	0.001	292.25	281.12	11.13	10.140	14.51	24167	0.696	8838	85.93	50.85	1.10	0.45	5.77	12.83	14.85
3.566	0.953	285.94	276.64	9.30	10.170	14.24	24417	0.696	10633	104.59	58.15	1.10	0.41	5.77	14.50	16.32
4.176	0.927	288.29	277.38	10.90	10.165	14.28	24376	0.696	9090	89.24	52.32	1.10	0.41	5.77	12.90	14.91
5.370	0.953	291.00	278.84	12.16	10.155	14.37	24294	0.696	8139	79.60	48.37	1.10	0.42	5.77	12.01	14.15
6.703	0.927	292.73	280.46	12.27	10.144	14.47	24204	0.696	8047	78.38	47.80	1.10	0.44	5.77	11.98	14.13
7.313	0.914	292.91	281.20	11.71	10.139	14.51	24163	0.696	8389	81.55	49.08	1.10	0.45	5.77	12.39	14.48
3.528	-0.953	286.68	276.59	10.09	10.171	14.24	24420	0.696	9796	96.37	55.11	1.10	0.41	5.77	13.64	15.56
4.112	-0.914	288.54	277.30	11.24	10.166	14.28	24380	0.696	8821	86.61	51.28	1.10	0.41	5.77	12.63	14.68
5.408	-0.927	291.81	278.88	12.93	10.155	14.37	24292	0.696	7653	74.84	46.37	1.10	0.42	5.77	11.55	13.76
6.678	-0.978	293.48	280.43	13.05	10.145	14.47	24206	0.696	7565	73.68	45.81	1.10	0.44	5.77	11.52	13.74
7.313	-0.978	293.66	281.20	12.46	10.139	14.51	24163	0.696	7887	76.67	47.05	1.10	0.45	5.77	11.90	14.06

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	53.46	38.12	15.34	1475.2	46.71	24422	0.696	2044.6	114.16	61.55	1.98	0.75	5.77	15.52	17.23
1.639	-0.010	57.70	39.57	18.13	1474.4	46.86	24377	0.696	1734.0	96.62	55.17	1.98	0.74	5.77	13.65	15.57
2.129	-0.028	63.05	42.30	20.75	1472.9	47.16	24292	0.696	1512.9	83.96	50.15	1.98	0.76	5.77	12.45	14.52
2.639	0.000	65.85	45.14	20.71	1471.3	47.46	24204	0.696	1511.8	83.56	49.93	1.98	0.78	5.77	12.50	14.57
2.854	0.000	66.36	46.33	20.03	1470.7	47.59	24167	0.696	1557.3	85.93	50.85	1.98	0.81	5.77	12.83	14.85
1.404	0.375	55.00	38.26	16.74	1475.1	46.72	24417	0.696	1873.5	104.59	58.15	1.98	0.75	5.77	14.50	16.32
1.644	0.365	59.23	39.60	19.63	1474.3	46.87	24376	0.696	1601.7	89.24	52.32	1.98	0.74	5.77	12.90	14.91
2.114	0.375	64.10	42.22	21.89	1472.9	47.15	24294	0.696	1434.1	79.60	48.37	1.98	0.76	5.77	12.01	14.15
2.639	0.365	67.22	45.14	22.08	1471.3	47.46	24204	0.696	1417.9	78.38	47.80	1.98	0.78	5.77	11.98	14.13
2.879	0.360	67.56	46.47	21.09	1470.6	47.60	24163	0.696	1478.1	81.55	49.08	1.98	0.81	5.77	12.39	14.48
1.389	-0.375	56.34	38.18	18.17	1475.1	46.72	24420	0.696	1726.1	96.37	55.11	1.98	0.75	5.77	13.64	15.56
1.619	-0.360	59.68	39.46	20.22	1474.4	46.85	24380	0.696	1554.3	86.61	51.28	1.98	0.74	5.77	12.63	14.68
2.129	-0.365	65.58	42.30	23.27	1472.9	47.16	24292	0.696	1348.5	74.84	46.37	1.98	0.76	5.77	11.55	13.76
2.629	-0.385	68.58	45.08	23.49	1471.3	47.46	24206	0.696	1333.0	73.68	45.81	1.98	0.78	5.77	11.52	13.74
2.879	-0.385	68.90	46.47	22.43	1470.6	47.60	24163	0.696	1389.7	76.67	47.05	1.98	0.81	5.77	11.90	14.06

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 6
Date: 7 January 1992
Time: 11:07:54

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.36	30.56	285.27	53.80	19.49	0.01193	10.200	1479.4	84.18	12.21	8.19	1015	5.55	34.60	30.48

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.38	35.99
1.702	0.670	0.001	0.000	276.13	37.34
9.093	3.580	0.001	0.000	288.80	60.14
10.706	4.215	0.001	0.000	287.87	58.47

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	285.06	276.52	8.54	10.171	14.24	24428	0.696	11552	113.66	61.38	1.10	0.41	5.77	15.49	17.21
4.163	-0.025	287.44	277.32	10.12	10.166	14.28	24383	0.696	9781	96.03	54.94	1.10	0.41	5.77	13.61	15.53
5.408	-0.071	290.40	278.84	11.56	10.156	14.37	24298	0.696	8545	83.57	50.00	1.10	0.42	5.77	12.43	14.51
6.703	0.001	291.98	280.41	11.57	10.145	14.47	24210	0.696	8515	82.94	49.68	1.10	0.44	5.77	12.45	14.53
7.249	0.001	292.26	281.07	11.19	10.140	14.51	24174	0.696	8775	85.33	50.61	1.10	0.45	5.77	12.79	14.82
3.566	0.953	285.95	276.60	9.35	10.171	14.24	24424	0.696	10560	103.88	57.90	1.10	0.41	5.77	14.45	16.27
4.176	0.927	288.29	277.34	10.95	10.166	14.28	24382	0.696	9038	88.74	52.13	1.10	0.41	5.77	12.87	14.89
5.370	0.953	290.99	278.79	12.20	10.156	14.37	24300	0.696	8099	79.21	48.21	1.10	0.42	5.77	11.99	14.14
6.703	0.927	292.73	280.41	12.32	10.145	14.47	24210	0.696	8002	77.94	47.62	1.10	0.44	5.77	11.95	14.10
7.313	0.914	292.90	281.15	11.75	10.140	14.51	24170	0.696	8346	81.14	48.91	1.10	0.45	5.77	12.37	14.46
3.528	-0.953	286.65	276.55	10.10	10.171	14.24	24426	0.696	9770	96.12	55.02	1.10	0.41	5.77	13.64	15.56
4.112	-0.914	288.51	277.26	11.25	10.166	14.28	24386	0.696	8797	86.39	51.20	1.10	0.41	5.77	12.63	14.68
5.408	-0.927	291.80	278.84	12.96	10.156	14.37	24298	0.696	7621	74.54	46.24	1.10	0.42	5.77	11.54	13.75
6.678	-0.978	293.45	280.38	13.07	10.145	14.46	24212	0.696	7543	73.48	45.73	1.10	0.44	5.77	11.51	13.73
7.313	-0.978	293.60	281.15	12.45	10.140	14.51	24170	0.696	7876	76.57	47.01	1.10	0.45	5.77	11.91	14.07

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	53.43	38.05	15.38	1475.2	46.71	24428	0.696	2035.5	113.66	61.38	1.98	0.75	5.77	15.49	17.21
1.639	-0.010	57.70	39.49	18.21	1474.4	46.86	24383	0.696	1723.4	96.03	54.94	1.98	0.74	5.77	13.61	15.53
2.129	-0.028	63.03	42.22	20.81	1472.9	47.15	24298	0.696	1505.6	83.57	50.00	1.98	0.76	5.77	12.43	14.51
2.639	0.000	65.88	45.05	20.83	1471.4	47.46	24210	0.696	1500.3	82.94	49.68	1.98	0.78	5.77	12.45	14.53
2.854	0.000	66.38	46.24	20.14	1470.7	47.59	24174	0.696	1546.2	85.33	50.61	1.98	0.81	5.77	12.79	14.82
1.404	0.375	55.01	38.19	16.83	1475.2	46.72	24424	0.696	1860.7	103.88	57.90	1.98	0.75	5.77	14.45	16.27
1.644	0.365	59.23	39.52	19.71	1474.4	46.86	24382	0.696	1592.5	88.74	52.13	1.98	0.74	5.77	12.87	14.89
2.114	0.375	64.09	42.14	21.95	1473.0	47.15	24300	0.696	1427.0	79.21	48.21	1.98	0.76	5.77	11.99	14.14
2.639	0.365	67.22	45.05	22.17	1471.4	47.46	24210	0.696	1410.0	77.94	47.62	1.98	0.78	5.77	11.95	14.10
2.879	0.360	67.54	46.38	21.16	1470.7	47.60	24170	0.696	1470.6	81.14	48.91	1.98	0.81	5.77	12.37	14.46
1.389	-0.375	56.29	38.10	18.18	1475.2	46.71	24426	0.696	1721.5	96.12	55.02	1.98	0.75	5.77	13.64	15.56
1.619	-0.360	59.63	39.38	20.24	1474.5	46.85	24386	0.696	1550.0	86.39	51.20	1.98	0.74	5.77	12.63	14.68
2.129	-0.365	65.55	42.22	23.33	1472.9	47.15	24298	0.696	1342.8	74.54	46.24	1.98	0.76	5.77	11.54	13.75
2.629	-0.385	68.51	45.00	23.52	1471.4	47.45	24212	0.696	1329.1	73.48	45.73	1.98	0.78	5.77	11.51	13.73
2.879	-0.385	68.80	46.38	22.42	1470.7	47.60	24170	0.696	1387.8	76.57	47.01	1.98	0.81	5.77	11.91	14.07

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 7
Date: 7 January 1992
Time: 11:11:57

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.03	29.96	272.11	30.11	19.37	0.01186	10.203	1479.7	84.13	12.20	8.20	4	0.00	0.14	0.12

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	272.13	30.15
1.702	0.670	0.001	0.000	272.05	29.99
9.093	3.580	0.001	0.000	272.17	30.22
10.706	4.215	0.001	0.000	272.13	30.15

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	272.05	272.05	-0.01	10.174	13.93	24543	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	272.07	272.06	0.01	10.168	13.94	24543	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	272.18	272.07	0.11	10.158	13.95	24543	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	272.17	272.08	0.09	10.147	13.97	24544	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	272.13	272.08	0.05	10.142	13.97	24544	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	272.06	272.05	0.01	10.173	13.93	24543	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	272.13	272.06	0.07	10.168	13.94	24543	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	272.16	272.07	0.09	10.158	13.95	24543	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	272.24	272.08	0.17	10.147	13.97	24544	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	272.20	272.08	0.12	10.142	13.97	24544	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	272.05	272.05	-0.00	10.173	13.93	24543	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	272.08	272.06	0.03	10.168	13.94	24543	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	272.15	272.07	0.08	10.158	13.95	24543	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	272.19	272.08	0.11	10.147	13.97	24544	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	272.08	272.08	0.00	10.142	13.97	24544	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	30.00	30.01	-0.01	1475.5	45.70	24543	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	30.03	30.02	0.01	1474.7	45.73	24543	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	30.23	30.03	0.20	1473.3	45.77	24543	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	30.21	30.05	0.16	1471.7	45.82	24544	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	30.14	30.06	0.08	1471.0	45.84	24544	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	30.02	30.01	0.01	1475.5	45.70	24543	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	30.15	30.02	0.13	1474.7	45.73	24543	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	30.19	30.03	0.16	1473.3	45.77	24543	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	30.35	30.05	0.30	1471.7	45.82	24544	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	30.28	30.06	0.22	1471.0	45.84	24544	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	30.00	30.01	-0.01	1475.5	45.70	24543	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	30.06	30.02	0.05	1474.8	45.72	24543	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	30.18	30.03	0.15	1473.3	45.77	24543	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	30.25	30.05	0.20	1471.7	45.82	24544	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	30.06	30.06	0.00	1471.0	45.84	24544	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 8
Date: 7 January 1992
Time: 11:12:23

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.02	29.95	272.06	30.03	19.37	0.01186	10.203	1479.7	84.13	12.20	8.20	1	0.00	0.03	0.03

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	272.09	30.08
1.702	0.670	0.001	0.000	272.01	29.93
9.093	3.580	0.001	0.000	272.14	30.17
10.706	4.215	0.001	0.000	272.10	30.09

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	272.01	272.03	-0.03	10.174	13.92	24533	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	272.02	272.04	-0.01	10.168	13.93	24533	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	272.13	272.04	0.09	10.158	13.94	24533	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	272.11	272.05	0.07	10.147	13.96	24534	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	272.10	272.05	0.05	10.142	13.96	24534	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	272.02	272.03	-0.02	10.173	13.92	24533	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	272.10	272.04	0.06	10.168	13.93	24533	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	272.12	272.04	0.08	10.158	13.94	24533	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	272.20	272.05	0.16	10.147	13.96	24534	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	272.17	272.05	0.12	10.142	13.96	24534	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	272.05	272.03	0.02	10.173	13.92	24533	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	272.04	272.04	0.01	10.168	13.93	24533	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	272.11	272.04	0.07	10.158	13.94	24533	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	272.14	272.05	0.10	10.147	13.96	24534	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	272.06	272.05	0.01	10.142	13.96	24534	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	29.92	29.97	-0.05	1475.5	45.68	24533	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	29.96	29.98	-0.02	1474.7	45.70	24533	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	30.15	29.98	0.17	1473.3	45.75	24533	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	30.12	29.99	0.12	1471.7	45.79	24534	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	30.09	30.00	0.09	1471.0	45.81	24534	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	29.94	29.97	-0.03	1475.5	45.68	24533	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	30.09	29.98	0.11	1474.7	45.70	24533	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	30.14	29.98	0.15	1473.3	45.74	24533	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	30.28	29.99	0.28	1471.7	45.79	24534	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	30.22	30.00	0.22	1471.0	45.81	24534	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	30.01	29.97	0.03	1475.5	45.68	24533	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	29.99	29.98	0.01	1474.8	45.70	24533	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	30.12	29.98	0.13	1473.3	45.75	24533	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	30.17	29.99	0.17	1471.7	45.79	24534	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	30.02	30.00	0.02	1471.0	45.81	24534	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 9
Date: 7 January 1992
Time: 11:12:49

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
271.98	29.88	272.03	29.96	19.35	0.01185	10.203	1479.8	84.16	12.21	8.19	1	0.00	0.03	0.03

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	272.08	30.06
1.702	0.670	0.001	0.000	272.00	29.90
9.093	3.580	0.001	0.000	272.11	30.11
10.706	4.215	0.001	0.000	272.08	30.05

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	271.99	272.00	-0.00	10.174	13.91	24511	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	272.02	272.00	0.02	10.168	13.91	24511	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	272.11	272.00	0.11	10.158	13.93	24511	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	272.10	272.01	0.09	10.147	13.94	24512	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	272.08	272.01	0.07	10.143	13.95	24512	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	272.01	272.00	0.01	10.173	13.91	24511	0.697	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	272.06	272.00	0.07	10.168	13.91	24511	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	272.09	272.00	0.09	10.158	13.93	24511	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	272.18	272.01	0.17	10.147	13.94	24512	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	272.15	272.01	0.14	10.142	13.95	24512	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	272.02	272.00	0.03	10.173	13.91	24511	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	272.02	272.00	0.02	10.169	13.91	24511	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	272.09	272.00	0.08	10.158	13.93	24511	0.697	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	272.12	272.01	0.11	10.147	13.94	24512	0.697	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	272.04	272.01	0.03	10.142	13.95	24512	0.697	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	29.90	29.90	-0.00	1475.6	45.63	24511	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	29.94	29.91	0.03	1474.8	45.65	24511	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	30.11	29.92	0.19	1473.3	45.69	24511	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	30.10	29.93	0.17	1471.7	45.74	24512	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	30.05	29.93	0.12	1471.1	45.76	24512	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	29.93	29.90	0.02	1475.5	45.63	24511	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	30.03	29.91	0.12	1474.7	45.65	24511	0.697	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	30.08	29.92	0.16	1473.3	45.69	24511	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	30.24	29.93	0.31	1471.7	45.74	24512	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	30.18	29.93	0.25	1471.0	45.76	24512	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	29.96	29.90	0.05	1475.5	45.63	24511	0.697	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	29.95	29.91	0.04	1474.8	45.65	24511	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	30.07	29.92	0.15	1473.3	45.69	24511	0.697	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	30.12	29.93	0.19	1471.7	45.74	24512	0.697	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	29.99	29.93	0.05	1471.0	45.76	24512	0.697	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 10
Date: 7 January 1992
Time: 11:16:57

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
271.94	29.81	284.92	53.17	19.31	0.01183	10.189	1477.8	84.43	12.24	8.17	1012	5.52	34.50	30.39

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	275.00	35.31
1.702	0.670	0.001	0.000	275.78	36.71
9.093	3.580	0.001	0.000	288.43	59.49
10.706	4.215	0.001	0.000	287.52	57.84

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	284.71	276.13	8.58	10.160	14.11	24236	0.696	11454	112.82	61.11	1.10	0.41	5.77	15.43	17.15
4.163	-0.025	287.09	276.93	10.15	10.155	14.15	24191	0.696	9709	95.42	54.73	1.10	0.41	5.77	13.56	15.49
5.408	-0.071	290.02	278.45	11.56	10.144	14.24	24106	0.696	8512	83.33	49.92	1.10	0.42	5.77	12.41	14.50
6.703	0.001	291.61	280.04	11.57	10.133	14.34	24019	0.696	8487	82.75	49.62	1.10	0.44	5.77	12.45	14.52
7.249	0.001	291.89	280.70	11.19	10.129	14.37	23982	0.696	8740	85.08	50.53	1.10	0.45	5.77	12.77	14.81
3.566	0.953	285.60	276.20	9.40	10.160	14.11	24231	0.696	10463	103.04	57.61	1.10	0.41	5.77	14.38	16.21
4.176	0.927	287.92	276.95	10.97	10.154	14.15	24190	0.696	8985	88.31	51.98	1.10	0.41	5.77	12.84	14.86
5.370	0.953	290.61	278.41	12.21	10.145	14.24	24109	0.696	8063	78.95	48.12	1.10	0.42	5.77	11.97	14.12
6.703	0.927	292.36	280.04	12.32	10.133	14.34	24019	0.696	7968	77.69	47.53	1.10	0.44	5.77	11.94	14.09
7.313	0.914	292.54	280.78	11.76	10.128	14.38	23978	0.696	8308	80.85	48.81	1.10	0.45	5.77	12.35	14.44
3.528	-0.953	286.33	276.16	10.18	10.160	14.11	24234	0.696	9662	95.16	54.67	1.10	0.41	5.77	13.55	15.48
4.112	-0.914	288.19	276.87	11.32	10.155	14.15	24194	0.696	8707	85.59	50.90	1.10	0.41	5.77	12.56	14.62
5.408	-0.927	291.44	278.45	12.99	10.144	14.24	24106	0.696	7578	74.19	46.10	1.10	0.42	5.77	11.51	13.73
6.678	-0.978	293.09	280.01	13.08	10.134	14.33	24020	0.696	7506	73.19	45.62	1.10	0.44	5.77	11.49	13.72
7.313	-0.978	293.30	280.78	12.53	10.128	14.38	23978	0.696	7802	75.92	46.75	1.10	0.45	5.77	11.85	14.02

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	52.79	37.34	15.45	1473.6	46.28	24236	0.696	2018.2	112.82	61.11	1.98	0.75	5.77	15.43	17.15
1.639	-0.010	57.07	38.79	18.28	1472.8	46.43	24191	0.696	1710.7	95.42	54.73	1.98	0.74	5.77	13.56	15.49
2.129	-0.028	62.34	41.53	20.81	1471.3	46.73	24106	0.696	1499.8	83.33	49.92	1.98	0.76	5.77	12.41	14.50
2.639	0.000	65.20	44.38	20.82	1469.7	47.03	24019	0.696	1495.4	82.75	49.62	1.98	0.79	5.77	12.45	14.52
2.854	0.000	65.71	45.57	20.14	1469.1	47.16	23982	0.696	1540.0	85.08	50.53	1.98	0.81	5.77	12.77	14.81
1.404	0.375	54.40	37.48	16.92	1473.5	46.30	24231	0.696	1843.6	103.04	57.61	1.98	0.75	5.77	14.38	16.21
1.644	0.365	58.57	38.82	19.75	1472.8	46.44	24190	0.696	1583.2	88.31	51.98	1.98	0.74	5.77	12.84	14.86
2.114	0.375	63.42	41.45	21.97	1471.3	46.72	24109	0.696	1420.7	78.95	48.12	1.98	0.76	5.77	11.97	14.12
2.639	0.365	66.56	44.38	22.18	1469.7	47.03	24019	0.696	1404.0	77.69	47.53	1.98	0.79	5.77	11.94	14.09
2.879	0.360	66.89	45.71	21.17	1469.0	47.17	23978	0.696	1463.9	80.85	48.81	1.98	0.81	5.77	12.35	14.44
1.389	-0.375	55.71	37.39	18.32	1473.6	46.29	24234	0.696	1702.4	95.16	54.67	1.98	0.75	5.77	13.55	15.48
1.619	-0.360	59.05	38.68	20.38	1472.9	46.42	24194	0.696	1534.2	85.59	50.90	1.98	0.74	5.77	12.56	14.62
2.129	-0.365	64.90	41.53	23.37	1471.3	46.73	24106	0.696	1335.2	74.19	46.10	1.98	0.76	5.77	11.51	13.73
2.629	-0.385	67.87	44.32	23.55	1469.8	47.02	24020	0.696	1322.6	73.19	45.62	1.98	0.78	5.77	11.49	13.72
2.879	-0.385	68.26	45.71	22.55	1469.0	47.17	23978	0.696	1374.7	75.92	46.75	1.98	0.81	5.77	11.85	14.02

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 11
Date: 7 January 1992
Time: 11:17:23

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
271.98	29.88	284.87	53.08	19.31	0.01183	10.184	1477.0	84.28	12.22	8.18	1005	5.56	34.26	30.18

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	274.98	35.27
1.702	0.670	0.001	0.000	275.73	36.63
9.093	3.580	0.001	0.000	288.38	59.40
10.706	4.215	0.001	0.000	287.50	57.81

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	284.68	276.14	8.55	10.154	14.11	24234	0.696	11425	112.53	61.01	1.10	0.41	5.77	15.49	17.21
4.163	-0.025	287.06	276.94	10.12	10.149	14.16	24189	0.696	9674	95.09	54.61	1.10	0.41	5.77	13.61	15.53
5.408	-0.071	289.99	278.45	11.54	10.139	14.25	24105	0.696	8468	82.91	49.75	1.10	0.42	5.77	12.44	14.52
6.703	0.001	291.59	280.02	11.57	10.128	14.34	24019	0.696	8432	82.22	49.40	1.10	0.44	5.77	12.46	14.54
7.249	0.001	291.86	280.68	11.18	10.123	14.38	23982	0.696	8684	84.54	50.31	1.10	0.45	5.77	12.79	14.82
3.566	0.953	285.57	276.21	9.36	10.154	14.12	24230	0.696	10435	102.76	57.51	1.10	0.41	5.77	14.43	16.26
4.176	0.927	287.89	276.95	10.94	10.149	14.16	24189	0.696	8948	87.95	51.83	1.10	0.41	5.77	12.88	14.89
5.370	0.953	290.58	278.40	12.17	10.139	14.25	24108	0.696	8030	78.62	47.98	1.10	0.42	5.77	12.01	14.15
6.703	0.927	292.34	280.02	12.32	10.128	14.34	24019	0.696	7916	77.18	47.31	1.10	0.44	5.77	11.95	14.11
7.313	0.914	292.50	280.76	11.74	10.123	14.38	23978	0.696	8264	80.43	48.64	1.10	0.45	5.77	12.38	14.47
3.528	-0.953	286.29	276.17	10.12	10.154	14.11	24233	0.696	9646	95.00	54.61	1.10	0.41	5.77	13.62	15.54
4.112	-0.914	288.15	276.88	11.27	10.149	14.16	24193	0.696	8683	85.36	50.80	1.10	0.41	5.77	12.61	14.67
5.408	-0.927	291.41	278.45	12.96	10.139	14.25	24105	0.696	7542	73.84	45.95	1.10	0.42	5.77	11.54	13.76
6.678	-0.978	293.04	279.99	13.05	10.128	14.34	24020	0.696	7474	72.88	45.48	1.10	0.44	5.77	11.53	13.74
7.313	-0.978	293.26	280.76	12.50	10.123	14.38	23978	0.696	7763	75.55	46.60	1.10	0.45	5.77	11.88	14.04

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	52.74	37.36	15.38	1472.8	46.30	24234	0.696	2013.1	112.53	61.01	1.98	0.75	5.77	15.49	17.21
1.639	-0.010	57.02	38.80	18.22	1472.0	46.46	24189	0.696	1704.6	95.09	54.61	1.98	0.74	5.77	13.61	15.53
2.129	-0.028	62.30	41.52	20.77	1470.5	46.75	24105	0.696	1492.1	82.91	49.75	1.98	0.76	5.77	12.44	14.52
2.639	0.000	65.17	44.35	20.82	1468.9	47.05	24019	0.696	1485.7	82.22	49.40	1.98	0.78	5.77	12.46	14.54
2.854	0.000	65.67	45.54	20.13	1468.3	47.18	23982	0.696	1530.1	84.54	50.31	1.98	0.81	5.77	12.79	14.82
1.404	0.375	54.35	37.50	16.85	1472.7	46.32	24230	0.696	1838.6	102.76	57.51	1.98	0.75	5.77	14.43	16.26
1.644	0.365	58.52	38.83	19.69	1472.0	46.46	24189	0.696	1576.6	87.95	51.83	1.98	0.74	5.77	12.88	14.89
2.114	0.375	63.35	41.44	21.91	1470.5	46.74	24108	0.696	1414.9	78.62	47.98	1.98	0.76	5.77	12.01	14.15
2.639	0.365	66.52	44.35	22.17	1468.9	47.05	24019	0.696	1394.8	77.18	47.31	1.98	0.78	5.77	11.95	14.11
2.879	0.360	66.82	45.68	21.14	1468.2	47.19	23978	0.696	1456.1	80.43	48.64	1.98	0.81	5.77	12.38	14.47
1.389	-0.375	55.64	37.41	18.22	1472.8	46.31	24233	0.696	1699.6	95.00	54.61	1.98	0.75	5.77	13.62	15.54
1.619	-0.360	58.98	38.69	20.29	1472.1	46.44	24193	0.696	1529.9	85.36	50.80	1.98	0.74	5.77	12.61	14.67
2.129	-0.365	64.85	41.52	23.32	1470.5	46.75	24105	0.696	1328.9	73.84	45.95	1.98	0.76	5.77	11.54	13.76
2.629	-0.385	67.78	44.30	23.49	1469.0	47.04	24020	0.696	1316.9	72.88	45.48	1.98	0.78	5.77	11.53	13.74
2.879	-0.385	68.18	45.68	22.50	1468.2	47.19	23978	0.696	1367.8	75.55	46.60	1.98	0.81	5.77	11.88	14.04

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 12
Date: 7 January 1992
Time: 11:17:48

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
271.96	29.84	284.86	53.06	19.31	0.01183	10.175	1475.8	84.24	12.22	8.18	1005	5.55	34.26	30.18

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	274.92	35.18
1.702	0.670	0.001	0.000	275.70	36.57
9.093	3.580	0.001	0.000	288.41	59.44
10.706	4.215	0.001	0.000	287.50	57.81

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	284.67	276.12	8.55	10.146	14.12	24234	0.696	11430	112.59	61.03	1.10	0.41	5.77	15.49	17.20
4.163	-0.025	287.05	276.92	10.13	10.141	14.17	24189	0.696	9670	95.05	54.59	1.10	0.41	5.77	13.60	15.52
5.408	-0.071	290.00	278.44	11.57	10.130	14.26	24105	0.696	8455	82.79	49.70	1.10	0.42	5.77	12.42	14.50
6.703	0.001	291.60	280.01	11.59	10.120	14.35	24018	0.696	8417	82.07	49.34	1.10	0.44	5.77	12.44	14.52
7.249	0.001	291.88	280.67	11.21	10.115	14.39	23982	0.696	8667	84.37	50.24	1.10	0.45	5.77	12.77	14.80
3.566	0.953	285.55	276.20	9.36	10.146	14.13	24230	0.696	10446	102.87	57.55	1.10	0.41	5.77	14.44	16.26
4.176	0.927	287.92	276.94	10.98	10.141	14.17	24189	0.696	8924	87.71	51.74	1.10	0.41	5.77	12.84	14.87
5.370	0.953	290.61	278.39	12.23	10.131	14.26	24108	0.696	8001	78.35	47.87	1.10	0.42	5.77	11.97	14.12
6.703	0.927	292.37	280.01	12.36	10.120	14.35	24018	0.696	7894	76.97	47.23	1.10	0.44	5.77	11.93	14.08
7.313	0.914	292.54	280.74	11.80	10.115	14.39	23978	0.696	8233	80.13	48.51	1.10	0.45	5.77	12.34	14.43
3.528	-0.953	286.30	276.15	10.15	10.146	14.12	24233	0.696	9628	94.83	54.55	1.10	0.41	5.77	13.59	15.52
4.112	-0.914	288.15	276.86	11.29	10.141	14.17	24193	0.696	8679	85.32	50.79	1.10	0.41	5.77	12.60	14.66
5.408	-0.927	291.41	278.44	12.97	10.130	14.26	24105	0.696	7539	73.81	45.94	1.10	0.42	5.77	11.53	13.75
6.678	-0.978	293.09	279.98	13.11	10.120	14.35	24020	0.696	7444	72.60	45.36	1.10	0.44	5.77	11.49	13.71
7.313	-0.978	293.29	280.74	12.54	10.115	14.39	23978	0.696	7742	75.35	46.51	1.10	0.45	5.77	11.85	14.02

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	52.72	37.33	15.39	1471.6	46.33	24234	0.696	2014.0	112.59	61.03	1.98	0.75	5.77	15.49	17.20
1.639	-0.010	57.01	38.77	18.24	1470.8	46.49	24189	0.696	1703.9	95.05	54.59	1.98	0.74	5.77	13.60	15.52
2.129	-0.028	62.32	41.50	20.82	1469.3	46.78	24105	0.696	1489.8	82.79	49.70	1.98	0.76	5.77	12.42	14.50
2.639	0.000	65.19	44.32	20.87	1467.7	47.08	24018	0.696	1483.1	82.07	49.34	1.98	0.78	5.77	12.44	14.52
2.854	0.000	65.70	45.51	20.19	1467.1	47.21	23982	0.696	1527.1	84.37	50.24	1.98	0.81	5.77	12.77	14.80
1.404	0.375	54.31	37.47	16.84	1471.5	46.35	24230	0.696	1840.6	102.87	57.55	1.98	0.75	5.77	14.44	16.26
1.644	0.365	58.56	38.80	19.76	1470.8	46.49	24189	0.696	1572.4	87.71	51.74	1.98	0.74	5.77	12.84	14.87
2.114	0.375	63.42	41.41	22.01	1469.3	46.77	24108	0.696	1409.8	78.35	47.87	1.98	0.76	5.77	11.97	14.12
2.639	0.365	66.58	44.32	22.25	1467.7	47.08	24018	0.696	1390.9	76.97	47.23	1.98	0.78	5.77	11.93	14.08
2.879	0.360	66.89	45.65	21.23	1467.0	47.22	23978	0.696	1450.7	80.13	48.51	1.98	0.81	5.77	12.34	14.43
1.389	-0.375	55.65	37.38	18.27	1471.5	46.34	24233	0.696	1696.5	94.83	54.55	1.98	0.75	5.77	13.59	15.52
1.619	-0.360	58.98	38.66	20.32	1470.8	46.48	24193	0.696	1529.2	85.32	50.79	1.98	0.74	5.77	12.60	14.66
2.129	-0.365	64.85	41.50	23.35	1469.3	46.78	24105	0.696	1328.4	73.81	45.94	1.98	0.76	5.77	11.53	13.75
2.629	-0.385	67.87	44.27	23.60	1467.8	47.07	24020	0.696	1311.6	72.60	45.36	1.98	0.78	5.77	11.49	13.71
2.879	-0.385	68.23	45.65	22.58	1467.0	47.22	23978	0.696	1364.1	75.35	46.51	1.98	0.81	5.77	11.85	14.02

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 13
Date: 7 January 1992
Time: 11:22:02

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.16	30.20	289.27	61.01	14.67	0.00898	10.184	1477.1	46.85	6.79	14.72	1014	4.23	34.57	30.45

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.46	37.94
1.702	0.670	0.001	0.000	277.43	39.68
9.093	3.580	0.001	0.000	293.79	69.13
10.706	4.215	0.001	0.000	292.72	67.21

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	288.74	277.68	11.06	10.168	10.76	18337	0.696	8910	87.40	51.58	1.10	0.44	5.77	12.35	14.44
4.163	-0.025	291.85	278.74	13.10	10.165	10.81	18292	0.696	7541	73.77	45.91	1.10	0.44	5.77	10.93	13.25
5.408	-0.071	295.66	280.75	14.91	10.159	10.89	18207	0.696	6616	64.38	41.68	1.10	0.47	5.77	10.09	12.57
6.703	0.001	297.69	282.84	14.86	10.153	10.97	18121	0.696	6623	64.11	41.49	1.10	0.48	5.77	10.15	12.61
7.249	0.001	298.05	283.71	14.34	10.150	11.01	18084	0.696	6834	66.00	42.32	1.10	0.50	5.77	10.42	12.83
3.566	0.953	289.70	277.78	11.92	10.167	10.77	18332	0.696	8267	81.08	49.03	1.10	0.44	5.77	11.68	13.88
4.176	0.927	292.69	278.77	13.93	10.165	10.81	18291	0.696	7093	69.38	43.99	1.10	0.44	5.77	10.49	12.89
5.370	0.953	296.20	280.69	15.51	10.159	10.88	18210	0.696	6360	61.91	40.54	1.10	0.47	5.77	9.85	12.37
6.703	0.927	298.44	282.84	15.61	10.153	10.97	18121	0.696	6306	61.03	40.06	1.10	0.48	5.77	9.84	12.37
7.313	0.914	298.67	283.82	14.86	10.150	11.01	18080	0.696	6591	63.63	41.24	1.10	0.50	5.77	10.19	12.64
3.528	-0.953	290.51	277.72	12.79	10.168	10.76	18335	0.696	7704	75.56	46.71	1.10	0.44	5.77	11.11	13.40
4.112	-0.914	292.97	278.66	14.31	10.165	10.80	18295	0.696	6904	67.55	43.18	1.10	0.44	5.77	10.31	12.74
5.408	-0.927	297.18	280.75	16.43	10.159	10.89	18207	0.696	6003	58.41	38.89	1.10	0.47	5.77	9.51	12.10
6.678	-0.978	299.25	282.80	16.46	10.153	10.97	18122	0.696	5980	57.89	38.58	1.10	0.48	5.77	9.54	12.12
7.313	-0.978	299.52	283.82	15.70	10.150	11.01	18080	0.696	6237	60.22	39.66	1.10	0.50	5.77	9.85	12.37

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	60.04	40.14	19.90	1474.7	35.31	18337	0.696	1569.9	87.40	51.58	1.98	0.80	5.77	12.35	14.44
1.639	-0.010	65.63	42.05	23.58	1474.3	35.45	18292	0.696	1328.7	73.77	45.91	1.98	0.80	5.77	10.93	13.25
2.129	-0.028	72.50	45.67	26.83	1473.4	35.72	18207	0.696	1165.7	64.38	41.68	1.98	0.84	5.77	10.09	12.57
2.639	0.000	76.16	49.42	26.74	1472.6	35.99	18121	0.696	1167.0	64.11	41.49	1.98	0.87	5.77	10.15	12.61
2.854	0.000	76.81	50.99	25.82	1472.2	36.11	18084	0.696	1204.2	66.00	42.32	1.98	0.89	5.77	10.42	12.83
1.404	0.375	61.78	40.32	21.46	1474.7	35.32	18332	0.696	1456.6	81.08	49.03	1.98	0.80	5.77	11.68	13.88
1.644	0.365	67.16	42.09	25.07	1474.3	35.45	18291	0.696	1249.8	69.38	43.99	1.98	0.80	5.77	10.49	12.89
2.114	0.375	73.47	45.56	27.91	1473.5	35.71	18210	0.696	1120.6	61.91	40.54	1.98	0.84	5.77	9.85	12.37
2.639	0.365	77.51	49.42	28.09	1472.6	35.99	18121	0.696	1111.1	61.03	40.06	1.98	0.87	5.77	9.84	12.37
2.879	0.360	77.93	51.18	26.75	1472.2	36.12	18080	0.696	1161.3	63.63	41.24	1.98	0.90	5.77	10.19	12.64
1.389	-0.375	63.23	40.21	23.02	1474.7	35.31	18335	0.696	1357.4	75.56	46.71	1.98	0.80	5.77	11.11	13.40
1.619	-0.360	67.66	41.91	25.75	1474.3	35.44	18295	0.696	1216.5	67.55	43.18	1.98	0.80	5.77	10.31	12.74
2.129	-0.365	75.24	45.67	29.57	1473.4	35.72	18207	0.696	1057.7	58.41	38.89	1.98	0.84	5.77	9.51	12.10
2.629	-0.385	78.97	49.34	29.62	1472.6	35.99	18122	0.696	1053.7	57.89	38.58	1.98	0.87	5.77	9.54	12.12
2.879	-0.385	79.44	51.18	28.27	1472.2	36.12	18080	0.696	1099.0	60.22	39.66	1.98	0.90	5.77	9.85	12.37

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 14
Date: 7 January 1992
Time: 11:22:28

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.15	30.18	289.29	61.03	14.66	0.00897	10.172	1475.4	46.85	6.79	14.72	1015	4.22	34.60	30.48

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.45	37.93
1.702	0.670	0.001	0.000	277.43	39.69
9.093	3.580	0.001	0.000	293.85	69.24
10.706	4.215	0.001	0.000	292.77	67.31

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	288.78	277.68	11.11	10.156	10.77	18323	0.696	8878	87.09	51.46	1.10	0.44	5.77	12.31	14.41
4.163	-0.025	291.88	278.74	13.14	10.153	10.81	18278	0.696	7526	73.63	45.85	1.10	0.44	5.77	10.91	13.23
5.408	-0.071	295.71	280.75	14.96	10.147	10.89	18194	0.696	6599	64.22	41.61	1.10	0.47	5.77	10.07	12.55
6.703	0.001	297.78	282.84	14.94	10.141	10.97	18107	0.696	6593	63.82	41.36	1.10	0.48	5.77	10.11	12.58
7.249	0.001	298.13	283.72	14.41	10.139	11.01	18071	0.696	6807	65.74	42.20	1.10	0.50	5.77	10.39	12.80
3.566	0.953	289.74	277.78	11.96	10.156	10.77	18319	0.696	8249	80.90	48.95	1.10	0.44	5.77	11.65	13.85
4.176	0.927	292.73	278.76	13.97	10.153	10.81	18277	0.696	7081	69.26	43.94	1.10	0.44	5.77	10.47	12.87
5.370	0.953	296.26	280.69	15.57	10.148	10.89	18196	0.696	6340	61.71	40.45	1.10	0.47	5.77	9.82	12.35
6.703	0.927	298.52	282.84	15.68	10.141	10.97	18107	0.696	6282	60.81	39.96	1.10	0.48	5.77	9.81	12.34
7.313	0.914	298.75	283.82	14.93	10.139	11.01	18066	0.696	6568	63.42	41.14	1.10	0.50	5.77	10.16	12.62
3.528	-0.953	290.59	277.72	12.88	10.156	10.77	18322	0.696	7659	75.12	46.53	1.10	0.44	5.77	11.06	13.35
4.112	-0.914	293.03	278.66	14.37	10.153	10.81	18282	0.696	6881	67.33	43.08	1.10	0.44	5.77	10.28	12.72
5.408	-0.927	297.24	280.75	16.48	10.147	10.89	18194	0.696	5989	58.28	38.83	1.10	0.47	5.77	9.49	12.09
6.678	-0.978	299.34	282.80	16.54	10.142	10.97	18109	0.696	5956	57.66	38.47	1.10	0.48	5.77	9.50	12.10
7.313	-0.978	299.60	283.82	15.78	10.139	11.01	18066	0.696	6214	60.00	39.55	1.10	0.50	5.77	9.82	12.35

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	60.12	40.13	19.99	1473.0	35.32	18323	0.696	1564.3	87.09	51.46	1.98	0.80	5.77	12.31	14.41
1.639	-0.010	65.70	42.05	23.65	1472.6	35.46	18278	0.696	1326.1	73.63	45.85	1.98	0.80	5.77	10.91	13.23
2.129	-0.028	72.59	45.67	26.93	1471.8	35.73	18194	0.696	1162.7	64.22	41.61	1.98	0.84	5.77	10.07	12.55
2.639	0.000	76.31	49.42	26.89	1470.9	36.00	18107	0.696	1161.7	63.82	41.36	1.98	0.87	5.77	10.11	12.58
2.854	0.000	76.95	51.00	25.94	1470.5	36.12	18071	0.696	1199.4	65.74	42.20	1.98	0.89	5.77	10.39	12.80
1.404	0.375	61.84	40.31	21.53	1473.0	35.33	18319	0.696	1453.5	80.90	48.95	1.98	0.80	5.77	11.65	13.85
1.644	0.365	67.22	42.08	25.14	1472.6	35.46	18277	0.696	1247.7	69.26	43.94	1.98	0.80	5.77	10.47	12.87
2.114	0.375	73.59	45.56	28.03	1471.8	35.72	18196	0.696	1117.1	61.71	40.45	1.98	0.84	5.77	9.82	12.35
2.639	0.365	77.65	49.42	28.22	1470.9	36.00	18107	0.696	1106.9	60.81	39.96	1.98	0.87	5.77	9.81	12.34
2.879	0.360	78.05	51.19	26.87	1470.5	36.13	18066	0.696	1157.3	63.42	41.14	1.98	0.90	5.77	10.16	12.62
1.389	-0.375	63.38	40.20	23.18	1473.0	35.32	18322	0.696	1349.5	75.12	46.53	1.98	0.80	5.77	11.06	13.35
1.619	-0.360	67.76	41.90	25.86	1472.6	35.45	18282	0.696	1212.4	67.33	43.08	1.98	0.80	5.77	10.28	12.72
2.129	-0.365	75.34	45.67	29.67	1471.8	35.73	18194	0.696	1055.3	58.28	38.83	1.98	0.84	5.77	9.49	12.09
2.629	-0.385	79.12	49.35	29.77	1470.9	36.00	18109	0.696	1049.4	57.66	38.47	1.98	0.87	5.77	9.50	12.10
2.879	-0.385	79.58	51.19	28.40	1470.5	36.13	18066	0.696	1094.9	60.00	39.55	1.98	0.90	5.77	9.82	12.35

Table 3.5 (continued)

Aluminum Heat Exchanger
Experiment: 5, Data Point: 15
Date: 7 January 1992
Time: 11:22:53

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
272.20	30.27	289.35	61.13	14.64	0.00897	10.160	1473.6	46.80	6.79	14.73	1015	4.22	34.60	30.48

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	276.47	37.96
1.702	0.670	0.001	0.000	277.44	39.71
9.093	3.580	0.001	0.000	293.88	69.30
10.706	4.215	0.001	0.000	292.81	67.37

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	288.82	277.73	11.09	10.144	10.77	18308	0.696	8890	87.20	51.50	1.10	0.44	5.77	12.32	14.42
4.163	-0.025	291.94	278.79	13.14	10.141	10.81	18263	0.696	7519	73.55	45.82	1.10	0.44	5.77	10.91	13.23
5.408	-0.071	295.76	280.80	14.96	10.135	10.90	18178	0.696	6596	64.19	41.59	1.10	0.47	5.77	10.07	12.55
6.703	0.001	297.83	282.89	14.93	10.129	10.98	18091	0.696	6592	63.80	41.35	1.10	0.48	5.77	10.12	12.58
7.249	0.001	298.17	283.77	14.40	10.127	11.02	18055	0.696	6809	65.76	42.21	1.10	0.50	5.77	10.39	12.81
3.566	0.953	289.76	277.83	11.93	10.144	10.77	18303	0.696	8266	81.06	49.02	1.10	0.44	5.77	11.67	13.87
4.176	0.927	292.76	278.82	13.95	10.141	10.81	18262	0.696	7086	69.31	43.96	1.10	0.44	5.77	10.48	12.88
5.370	0.953	296.31	280.74	15.56	10.136	10.89	18181	0.696	6341	61.71	40.45	1.10	0.47	5.77	9.82	12.35
6.703	0.927	298.57	282.89	15.67	10.129	10.98	18091	0.696	6281	60.79	39.95	1.10	0.48	5.77	9.82	12.34
7.313	0.914	298.79	283.87	14.91	10.127	11.02	18051	0.696	6571	63.44	41.15	1.10	0.50	5.77	10.17	12.62
3.528	-0.953	290.63	277.77	12.86	10.144	10.77	18306	0.696	7663	75.16	46.54	1.10	0.44	5.77	11.07	13.36
4.112	-0.914	293.04	278.71	14.33	10.141	10.81	18266	0.696	6897	67.48	43.15	1.10	0.44	5.77	10.30	12.73
5.408	-0.927	297.27	280.80	16.47	10.135	10.90	18178	0.696	5991	58.30	38.84	1.10	0.47	5.77	9.50	12.09
6.678	-0.978	299.37	282.85	16.51	10.129	10.98	18093	0.696	5962	57.71	38.49	1.10	0.48	5.77	9.51	12.11
7.313	-0.978	299.63	283.87	15.75	10.127	11.02	18051	0.696	6220	60.05	39.58	1.10	0.50	5.77	9.82	12.35

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	60.18	40.22	19.96	1471.3	35.34	18308	0.696	1566.4	87.20	51.50	1.98	0.80	5.77	12.32	14.42
1.639	-0.010	65.80	42.14	23.66	1470.8	35.48	18263	0.696	1324.8	73.55	45.82	1.98	0.80	5.77	10.91	13.23
2.129	-0.028	72.69	45.76	26.92	1470.0	35.75	18178	0.696	1162.2	64.19	41.59	1.98	0.84	5.77	10.07	12.55
2.639	0.000	76.40	49.52	26.88	1469.1	36.02	18091	0.696	1161.5	63.80	41.35	1.98	0.87	5.77	10.12	12.58
2.854	0.000	77.02	51.10	25.92	1468.8	36.14	18055	0.696	1199.7	65.76	42.21	1.98	0.89	5.77	10.39	12.81
1.404	0.375	61.88	40.40	21.47	1471.2	35.35	18303	0.696	1456.5	81.06	49.02	1.98	0.80	5.77	11.67	13.87
1.644	0.365	67.28	42.18	25.10	1470.8	35.48	18262	0.696	1248.6	69.31	43.96	1.98	0.80	5.77	10.48	12.88
2.114	0.375	73.66	45.65	28.01	1470.0	35.74	18181	0.696	1117.3	61.71	40.45	1.98	0.84	5.77	9.82	12.35
2.639	0.365	77.74	49.52	28.21	1469.1	36.02	18091	0.696	1106.7	60.79	39.95	1.98	0.87	5.77	9.82	12.34
2.879	0.360	78.13	51.29	26.84	1468.7	36.15	18051	0.696	1157.8	63.44	41.15	1.98	0.90	5.77	10.17	12.62
1.389	-0.375	63.45	40.29	23.16	1471.3	35.34	18306	0.696	1350.2	75.16	46.54	1.98	0.80	5.77	11.07	13.36
1.619	-0.360	67.78	41.99	25.79	1470.9	35.47	18266	0.696	1215.3	67.48	43.15	1.98	0.80	5.77	10.30	12.73
2.129	-0.365	75.41	45.76	29.64	1470.0	35.75	18178	0.696	1055.6	58.30	38.84	1.98	0.84	5.77	9.50	12.09
2.629	-0.385	79.17	49.45	29.73	1469.2	36.02	18093	0.696	1050.5	57.71	38.49	1.98	0.87	5.77	9.51	12.11
2.879	-0.385	79.64	51.29	28.36	1468.7	36.15	18051	0.696	1096.0	60.05	39.58	1.98	0.90	5.77	9.82	12.35

Table 3.6. Data tables for experiment 6

Aluminum Heat Exchanger
Summary Data Table for Experiment 6
Date: 9 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	P0 MPa	P0-P1 kPa	T0 K	T1 K	T1-T0 K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	11:34:24	996	33.96	19.38	10.24	89.72	280.79	293.52	12.74	10.99	14.66	23705	0.695	8815	84.37	49.97
2	11:34:49	991	33.79	19.40	10.24	89.69	280.71	293.38	12.67	11.02	14.66	23730	0.695	8753	83.80	49.75
3	11:35:15	995	33.92	19.40	10.25	89.65	280.60	293.30	12.71	11.00	14.65	23739	0.695	8794	84.21	49.91
4	11:40:48	1331	45.38	19.58	10.28	90.08	279.56	296.39	16.83	14.83	14.80	23907	0.695	8731	83.38	49.54
5	11:41:14	1334	45.48	19.60	10.28	90.07	279.46	296.33	16.87	14.84	14.80	23927	0.695	8747	83.55	49.61
6	11:41:39	1333	45.45	19.60	10.29	90.12	279.43	296.27	16.84	14.86	14.80	23933	0.695	8725	83.36	49.54
7	11:46:47	1662	56.66	19.01	10.31	84.42	279.28	300.93	21.65	19.18	14.42	23090	0.695	8427	80.04	48.10
8	11:47:12	1666	56.80	19.01	10.31	84.41	279.23	300.93	21.70	19.16	14.42	23094	0.695	8459	80.34	48.22
9	11:47:38	1666	56.80	19.01	10.31	84.40	279.19	300.90	21.70	19.13	14.41	23093	0.695	8470	80.46	48.27
10	11:52:46	2050	69.89	19.08	10.33	84.42	278.68	305.26	26.58	23.61	14.54	23082	0.695	8443	79.81	47.93
11	11:53:12	2053	69.99	19.09	10.34	84.37	278.66	305.27	26.62	23.60	14.54	23087	0.695	8459	79.96	47.99
12	11:53:38	2051	69.92	19.08	10.34	84.50	278.64	305.24	26.60	23.59	14.54	23085	0.695	8457	79.95	47.99
13	11:57:32	-1	-0.03	19.02	10.35	83.49	278.54	278.56	0.02	0.11	13.82	23722	0.696	0	0.00	0.00
14	11:57:57	2	0.07	19.01	10.35	83.45	278.51	278.56	0.05	0.11	13.81	23713	0.696	0	0.00	0.00
15	11:58:23	-3	-0.10	19.00	10.35	83.57	278.53	278.53	-0.01	0.08	13.81	23700	0.696	0	0.00	0.00

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 1
Date: 9 January 1992
Time: 11:34:24

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
280.79	45.73	293.52	68.66	19.38	0.01187	10.240	1485.2	89.72	13.01	7.68	996	5.63	33.96	29.91

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.57	50.74
1.702	0.670	0.001	0.000	284.34	52.13
9.093	3.580	0.001	0.000	296.74	74.45
10.706	4.215	0.001	0.000	295.90	72.93

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	293.01	284.89	8.11	10.209	14.52	23827	0.696	11931	114.86	61.31	1.10	0.41	5.77	16.17	17.82
4.163	-0.025	295.35	285.68	9.66	10.203	14.57	23785	0.696	10043	96.49	54.71	1.10	0.41	5.77	14.11	15.97
5.408	-0.071	298.17	287.18	10.99	10.192	14.66	23705	0.695	8815	84.37	49.97	1.10	0.42	5.77	12.89	14.91
6.703	0.001	299.77	288.73	11.04	10.181	14.75	23622	0.695	8760	83.51	49.56	1.10	0.43	5.77	12.90	14.91
7.249	0.001	300.06	289.38	10.67	10.176	14.79	23588	0.695	9021	85.87	50.47	1.10	0.45	5.77	13.24	15.21
3.566	0.953	293.90	284.97	8.94	10.208	14.53	23823	0.696	10836	104.30	57.61	1.10	0.41	5.77	14.98	16.75
4.176	0.927	296.13	285.70	10.43	10.203	14.57	23784	0.696	9303	89.37	52.00	1.10	0.41	5.77	13.34	15.30
5.370	0.953	298.78	287.13	11.64	10.192	14.66	23707	0.695	8321	79.65	48.06	1.10	0.42	5.77	12.40	14.48
6.703	0.927	300.52	288.73	11.79	10.181	14.75	23622	0.695	8202	78.19	47.40	1.10	0.43	5.77	12.34	14.43
7.313	0.914	300.68	289.46	11.22	10.175	14.80	23584	0.695	8571	81.57	48.75	1.10	0.45	5.77	12.79	14.82
3.528	-0.953	294.64	284.92	9.72	10.209	14.52	23826	0.696	9963	95.91	54.53	1.10	0.41	5.77	14.06	15.93
4.112	-0.914	296.42	285.62	10.80	10.204	14.57	23788	0.696	8985	86.34	50.82	1.10	0.41	5.77	13.02	15.02
5.408	-0.927	299.55	287.18	12.38	10.192	14.66	23705	0.695	7828	74.93	46.09	1.10	0.42	5.77	11.91	14.07
6.678	-0.978	301.19	288.70	12.49	10.181	14.75	23624	0.695	7740	73.79	45.55	1.10	0.43	5.77	11.88	14.04
7.313	-0.978	301.42	289.46	11.96	10.175	14.80	23584	0.695	8044	76.55	46.69	1.10	0.45	5.77	12.26	14.36

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	67.72	53.12	14.60	1480.7	47.65	23827	0.696	2102.2	114.86	61.31	1.98	0.74	5.77	16.17	17.82
1.639	-0.010	71.94	54.54	17.40	1479.8	47.80	23785	0.696	1769.6	96.49	54.71	1.98	0.74	5.77	14.11	15.97
2.129	-0.028	77.02	57.23	19.78	1478.2	48.09	23705	0.695	1553.2	84.37	49.97	1.98	0.76	5.77	12.89	14.91
2.639	0.000	79.89	60.03	19.86	1476.6	48.40	23622	0.695	1543.5	83.51	49.56	1.98	0.78	5.77	12.90	14.91
2.854	0.000	80.41	61.20	19.21	1475.9	48.52	23588	0.695	1589.5	85.87	50.47	1.98	0.80	5.77	13.24	15.21
1.404	0.375	69.34	53.26	16.08	1480.6	47.66	23823	0.696	1909.3	104.30	57.61	1.98	0.74	5.77	14.98	16.75
1.644	0.365	73.35	54.57	18.78	1479.8	47.80	23784	0.696	1639.2	89.37	52.00	1.98	0.74	5.77	13.34	15.30
2.114	0.375	78.11	57.15	20.96	1478.3	48.08	23707	0.695	1466.2	79.65	48.06	1.98	0.75	5.77	12.40	14.48
2.639	0.365	81.24	60.03	21.21	1476.6	48.40	23622	0.695	1445.2	78.19	47.40	1.98	0.78	5.77	12.34	14.43
2.879	0.360	81.54	61.34	20.20	1475.8	48.54	23584	0.695	1510.2	81.57	48.75	1.98	0.81	5.77	12.79	14.82
1.389	-0.375	70.66	53.17	17.49	1480.7	47.65	23826	0.696	1755.5	95.91	54.53	1.98	0.74	5.77	14.06	15.93
1.619	-0.360	73.87	54.44	19.44	1479.9	47.79	23788	0.696	1583.2	86.34	50.82	1.98	0.74	5.77	13.02	15.02
2.129	-0.365	79.51	57.23	22.28	1478.2	48.09	23705	0.695	1379.3	74.93	46.09	1.98	0.76	5.77	11.91	14.07
2.629	-0.385	82.46	59.97	22.48	1476.6	48.39	23624	0.695	1363.8	73.79	45.55	1.98	0.78	5.77	11.88	14.04
2.879	-0.385	82.86	61.34	21.53	1475.8	48.54	23584	0.695	1417.4	76.55	46.69	1.98	0.81	5.77	12.26	14.36

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 2
Date: 9 January 1992
Time: 11:34:49

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
280.71	45.60	293.38	68.40	19.40	0.01188	10.244	1485.7	89.69	13.01	7.69	991	5.66	33.79	29.76

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.48	50.58
1.702	0.670	0.001	0.000	284.25	51.96
9.093	3.580	0.001	0.000	296.66	74.30
10.706	4.215	0.001	0.000	295.79	72.73

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	292.92	284.80	8.13	10.213	14.52	23852	0.696	11856	114.16	61.08	1.10	0.41	5.77	16.16	17.81
4.163	-0.025	295.26	285.59	9.67	10.207	14.57	23809	0.696	9986	95.97	54.52	1.10	0.41	5.77	14.11	15.97
5.408	-0.071	298.09	287.07	11.02	10.196	14.66	23730	0.695	8753	83.80	49.75	1.10	0.42	5.77	12.88	14.90
6.703	0.001	299.68	288.61	11.07	10.184	14.75	23647	0.695	8695	82.92	49.33	1.10	0.43	5.77	12.88	14.90
7.249	0.001	299.96	289.26	10.70	10.180	14.79	23613	0.695	8962	85.33	50.26	1.10	0.44	5.77	13.23	15.21
3.566	0.953	293.82	284.87	8.94	10.212	14.53	23848	0.696	10777	103.75	57.42	1.10	0.41	5.77	14.98	16.75
4.176	0.927	296.06	285.60	10.46	10.207	14.57	23808	0.696	9236	88.75	51.76	1.10	0.41	5.77	13.33	15.29
5.370	0.953	298.68	287.03	11.66	10.196	14.66	23732	0.695	8274	79.22	47.89	1.10	0.42	5.77	12.40	14.48
6.703	0.927	300.42	288.61	11.80	10.184	14.75	23647	0.695	8151	77.74	47.22	1.10	0.43	5.77	12.34	14.43
7.313	0.914	300.59	289.34	11.25	10.179	14.80	23609	0.695	8512	81.03	48.54	1.10	0.45	5.77	12.78	14.81
3.528	-0.953	294.52	284.83	9.69	10.212	14.53	23850	0.696	9946	95.76	54.48	1.10	0.41	5.77	14.10	15.97
4.112	-0.914	296.35	285.52	10.82	10.207	14.57	23813	0.696	8926	85.79	50.60	1.10	0.41	5.77	13.02	15.01
5.408	-0.927	299.46	287.07	12.39	10.196	14.66	23730	0.695	7783	74.51	45.92	1.10	0.42	5.77	11.92	14.07
6.678	-0.978	301.08	288.58	12.50	10.185	14.75	23649	0.695	7698	73.42	45.40	1.10	0.43	5.77	11.89	14.05
7.313	-0.978	301.31	289.34	11.97	10.179	14.80	23609	0.695	7999	76.14	46.52	1.10	0.45	5.77	12.26	14.37

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	67.58	52.95	14.63	1481.2	47.65	23852	0.696	2089.0	114.16	61.08	1.98	0.74	5.77	16.16	17.81
1.639	-0.010	71.78	54.37	17.41	1480.4	47.81	23809	0.696	1759.5	95.97	54.52	1.98	0.74	5.77	14.11	15.97
2.129	-0.028	76.87	57.04	19.83	1478.8	48.10	23730	0.695	1542.3	83.80	49.75	1.98	0.75	5.77	12.88	14.90
2.639	0.000	79.74	59.82	19.92	1477.1	48.40	23647	0.695	1532.1	82.92	49.33	1.98	0.78	5.77	12.88	14.90
2.854	0.000	80.24	60.99	19.25	1476.4	48.53	23613	0.695	1579.1	85.33	50.26	1.98	0.80	5.77	13.23	15.21
1.404	0.375	69.18	53.08	16.10	1481.1	47.67	23848	0.696	1898.9	103.75	57.42	1.98	0.74	5.77	14.98	16.75
1.644	0.365	73.22	54.39	18.83	1480.4	47.81	23808	0.696	1627.4	88.75	51.76	1.98	0.74	5.77	13.33	15.29
2.114	0.375	77.94	56.96	20.98	1478.8	48.09	23732	0.695	1457.9	79.22	47.89	1.98	0.75	5.77	12.40	14.48
2.639	0.365	81.07	59.82	21.25	1477.1	48.40	23647	0.695	1436.2	77.74	47.22	1.98	0.78	5.77	12.34	14.43
2.879	0.360	81.38	61.12	20.25	1476.3	48.54	23609	0.695	1499.8	81.03	48.54	1.98	0.80	5.77	12.78	14.81
1.389	-0.375	70.44	53.00	17.44	1481.2	47.66	23850	0.696	1752.5	95.76	54.48	1.98	0.74	5.77	14.10	15.97
1.619	-0.360	73.73	54.26	19.48	1480.4	47.80	23813	0.696	1572.8	85.79	50.60	1.98	0.74	5.77	13.02	15.01
2.129	-0.365	79.34	57.04	22.30	1478.8	48.10	23730	0.695	1371.4	74.51	45.92	1.98	0.75	5.77	11.92	14.07
2.629	-0.385	82.26	59.76	22.50	1477.2	48.40	23649	0.695	1356.4	73.42	45.40	1.98	0.78	5.77	11.89	14.05
2.879	-0.385	82.67	61.12	21.55	1476.3	48.54	23609	0.695	1409.4	76.14	46.52	1.98	0.80	5.77	12.26	14.37

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 3
Date: 9 January 1992
Time: 11:35:15

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
280.60	45.38	293.30	68.26	19.40	0.01188	10.248	1486.4	89.65	13.00	7.69	995	5.64	33.92	29.88

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.37	50.37
1.702	0.670	0.001	0.000	284.14	51.77
9.093	3.580	0.001	0.000	296.53	74.07
10.706	4.215	0.001	0.000	295.66	72.50

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	292.80	284.69	8.10	10.217	14.52	23862	0.696	11928	114.89	61.34	1.10	0.41	5.77	16.19	17.83
4.163	-0.025	295.13	285.48	9.65	10.211	14.56	23819	0.696	10043	96.54	54.74	1.10	0.41	5.77	14.13	15.99
5.408	-0.071	297.98	286.97	11.00	10.200	14.65	23739	0.695	8794	84.21	49.91	1.10	0.42	5.77	12.89	14.90
6.703	0.001	299.57	288.52	11.05	10.189	14.74	23657	0.695	8741	83.38	49.52	1.10	0.43	5.77	12.89	14.91
7.249	0.001	299.85	289.17	10.67	10.184	14.78	23622	0.695	9010	85.80	50.45	1.10	0.45	5.77	13.25	15.22
3.566	0.953	293.70	284.77	8.93	10.217	14.52	23858	0.696	10825	104.24	57.60	1.10	0.41	5.77	14.99	16.75
4.176	0.927	295.95	285.50	10.45	10.211	14.56	23818	0.696	9279	89.19	51.94	1.10	0.41	5.77	13.34	15.29
5.370	0.953	298.58	286.93	11.66	10.201	14.65	23742	0.695	8302	79.51	48.01	1.10	0.42	5.77	12.39	14.48
6.703	0.927	300.31	288.52	11.79	10.189	14.74	23657	0.695	8190	78.12	47.38	1.10	0.43	5.77	12.34	14.43
7.313	0.914	300.48	289.25	11.23	10.184	14.79	23618	0.695	8557	81.48	48.72	1.10	0.45	5.77	12.79	14.82
3.528	-0.953	294.42	284.72	9.70	10.217	14.52	23860	0.696	9972	96.04	54.59	1.10	0.41	5.77	14.09	15.96
4.112	-0.914	296.22	285.42	10.80	10.212	14.56	23823	0.696	8977	86.31	50.81	1.10	0.41	5.77	13.03	15.03
5.408	-0.927	299.34	286.97	12.37	10.200	14.65	23739	0.695	7824	74.92	46.10	1.10	0.42	5.77	11.92	14.08
6.678	-0.978	300.96	288.49	12.46	10.189	14.74	23658	0.695	7746	73.90	45.61	1.10	0.43	5.77	11.90	14.06
7.313	-0.978	301.18	289.25	11.93	10.184	14.79	23618	0.695	8053	76.68	46.75	1.10	0.45	5.77	12.28	14.38

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	67.35	52.76	14.59	1481.9	47.63	23862	0.696	2101.7	114.89	61.34	1.98	0.74	5.77	16.19	17.83
1.639	-0.010	71.55	54.18	17.37	1481.0	47.78	23819	0.696	1769.6	96.54	54.74	1.98	0.74	5.77	14.13	15.99
2.129	-0.028	76.67	56.86	19.81	1479.4	48.07	23739	0.695	1549.5	84.21	49.91	1.98	0.76	5.77	12.89	14.90
2.639	0.000	79.53	59.65	19.88	1477.8	48.38	23657	0.695	1540.2	83.38	49.52	1.98	0.78	5.77	12.89	14.91
2.854	0.000	80.03	60.82	19.21	1477.1	48.50	23622	0.695	1587.6	85.80	50.45	1.98	0.80	5.77	13.25	15.22
1.404	0.375	68.98	52.89	16.08	1481.8	47.64	23858	0.696	1907.4	104.24	57.60	1.98	0.74	5.77	14.99	16.75
1.644	0.365	73.01	54.21	18.80	1481.0	47.78	23818	0.696	1635.0	89.19	51.94	1.98	0.74	5.77	13.34	15.29
2.114	0.375	77.76	56.78	20.98	1479.5	48.06	23742	0.695	1462.8	79.51	48.01	1.98	0.75	5.77	12.39	14.48
2.639	0.365	80.87	59.65	21.22	1477.8	48.38	23657	0.695	1443.1	78.12	47.38	1.98	0.78	5.77	12.34	14.43
2.879	0.360	81.17	60.96	20.21	1477.0	48.52	23618	0.695	1507.7	81.48	48.72	1.98	0.80	5.77	12.79	14.82
1.389	-0.375	70.26	52.81	17.45	1481.8	47.63	23860	0.696	1757.1	96.04	54.59	1.98	0.74	5.77	14.09	15.96
1.619	-0.360	73.50	54.07	19.43	1481.1	47.77	23823	0.696	1581.7	86.31	50.81	1.98	0.74	5.77	13.03	15.03
2.129	-0.365	79.12	56.86	22.26	1479.4	48.07	23739	0.695	1378.6	74.92	46.10	1.98	0.76	5.77	11.92	14.08
2.629	-0.385	82.03	59.60	22.44	1477.8	48.37	23658	0.695	1364.8	73.90	45.61	1.98	0.78	5.77	11.90	14.06
2.879	-0.385	82.44	60.96	21.48	1477.0	48.52	23618	0.695	1418.9	76.68	46.75	1.98	0.80	5.77	12.28	14.38

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 4
Date: 9 January 1992
Time: 11:40:48

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
279.56	43.51	296.39	73.81	19.58	0.01199	10.283	1491.4	90.08	13.07	7.65	1331	4.31	45.38	39.97

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.37	50.38
1.702	0.670	0.001	0.000	284.40	52.23
9.093	3.580	0.001	0.000	300.84	81.82
10.706	4.215	0.001	0.000	299.66	79.70

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	295.92	284.98	10.94	10.252	14.62	24071	0.696	11825	113.80	60.94	1.10	0.44	5.77	12.48	14.55
4.163	-0.025	299.02	286.03	12.99	10.246	14.68	24014	0.696	9980	95.79	54.43	1.10	0.44	5.77	11.02	13.32
5.408	-0.071	302.83	288.00	14.83	10.235	14.80	23907	0.695	8731	83.38	49.54	1.10	0.46	5.77	10.15	12.61
6.703	0.001	304.90	290.05	14.84	10.224	14.91	23797	0.695	8701	82.67	49.17	1.10	0.48	5.77	10.18	12.64
7.249	0.001	305.27	290.92	14.35	10.219	14.96	23751	0.695	8962	84.96	50.05	1.10	0.49	5.77	10.44	12.85
3.566	0.953	297.11	285.08	12.03	10.252	14.63	24065	0.696	10757	103.50	57.31	1.10	0.44	5.77	11.63	13.83
4.176	0.927	300.11	286.05	14.06	10.246	14.68	24012	0.696	9225	88.54	51.66	1.10	0.44	5.77	10.46	12.86
5.370	0.953	303.60	287.94	15.65	10.236	14.79	23910	0.695	8269	78.98	47.75	1.10	0.46	5.77	9.82	12.34
6.703	0.927	305.90	290.05	15.85	10.224	14.91	23797	0.695	8149	77.43	47.03	1.10	0.48	5.77	9.78	12.32
7.313	0.914	306.12	291.02	15.11	10.218	14.97	23746	0.695	8508	80.64	48.31	1.10	0.50	5.77	10.11	12.58
3.528	-0.953	298.05	285.02	13.03	10.252	14.63	24068	0.696	9926	95.51	54.37	1.10	0.44	5.77	11.00	13.30
4.112	-0.914	300.45	285.95	14.50	10.247	14.68	24018	0.696	8938	85.81	50.59	1.10	0.44	5.77	10.25	12.69
5.408	-0.927	304.65	288.00	16.65	10.235	14.80	23907	0.695	7774	74.24	45.77	1.10	0.46	5.77	9.47	12.07
6.678	-0.978	306.81	290.02	16.80	10.224	14.91	23799	0.695	7689	73.06	45.20	1.10	0.48	5.77	9.45	12.06
7.313	-0.978	307.09	291.02	16.07	10.218	14.97	23746	0.695	7998	75.81	46.32	1.10	0.50	5.77	9.74	12.28

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	72.97	53.28	19.68	1486.9	47.98	24071	0.696	2083.6	113.80	60.94	1.98	0.79	5.77	12.48	14.55
1.639	-0.010	78.55	55.17	23.39	1486.1	48.17	24014	0.696	1758.5	95.79	54.43	1.98	0.80	5.77	11.02	13.32
2.129	-0.028	85.40	58.72	26.69	1484.5	48.54	23907	0.695	1538.4	83.38	49.54	1.98	0.84	5.77	10.15	12.61
2.639	0.000	89.12	62.41	26.72	1482.8	48.93	23797	0.695	1533.1	82.67	49.17	1.98	0.86	5.77	10.18	12.64
2.854	0.000	89.80	63.96	25.84	1482.1	49.09	23751	0.695	1579.1	84.96	50.05	1.98	0.89	5.77	10.44	12.85
1.404	0.375	75.11	53.46	21.65	1486.9	47.99	24065	0.696	1895.4	103.50	57.31	1.98	0.79	5.77	11.63	13.83
1.644	0.365	80.50	55.20	25.30	1486.1	48.18	24012	0.696	1625.4	88.54	51.66	1.98	0.80	5.77	10.46	12.86
2.114	0.375	86.79	58.61	28.18	1484.5	48.53	23910	0.695	1457.0	78.98	47.75	1.98	0.83	5.77	9.82	12.34
2.639	0.365	90.93	62.41	28.52	1482.8	48.93	23797	0.695	1435.9	77.43	47.03	1.98	0.86	5.77	9.78	12.32
2.879	0.360	91.34	64.14	27.19	1482.0	49.11	23746	0.695	1499.1	80.64	48.31	1.98	0.89	5.77	10.11	12.58
1.389	-0.375	76.81	53.35	23.45	1486.9	47.98	24068	0.696	1749.0	95.51	54.37	1.98	0.79	5.77	11.00	13.30
1.619	-0.360	81.13	55.02	26.11	1486.2	48.16	24018	0.696	1574.9	85.81	50.59	1.98	0.79	5.77	10.25	12.69
2.129	-0.365	88.69	58.72	29.97	1484.5	48.54	23907	0.695	1369.8	74.24	45.77	1.98	0.84	5.77	9.47	12.07
2.629	-0.385	92.57	62.34	30.23	1482.9	48.92	23799	0.695	1354.8	73.06	45.20	1.98	0.86	5.77	9.45	12.06
2.879	-0.385	93.07	64.14	28.93	1482.0	49.11	23746	0.695	1409.2	75.81	46.32	1.98	0.89	5.77	9.74	12.28

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 5
Date: 9 January 1992
Time: 11:41:14

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
279.46	43.35	296.33	73.70	19.60	0.01200	10.285	1491.7	90.07	13.06	7.66	1334	4.30	45.48	40.06

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.34	50.32
1.702	0.670	0.001	0.000	284.35	52.14
9.093	3.580	0.001	0.000	300.80	81.75
10.706	4.215	0.001	0.000	299.61	79.61

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	295.85	284.90	10.95	10.254	14.63	24092	0.696	11842	113.99	61.01	1.10	0.44	5.77	12.46	14.54
4.163	-0.025	298.96	285.95	13.01	10.248	14.69	24034	0.696	9994	95.94	54.49	1.10	0.44	5.77	11.01	13.31
5.408	-0.071	302.77	287.93	14.84	10.237	14.80	23927	0.695	8747	83.55	49.61	1.10	0.46	5.77	10.14	12.61
6.703	0.001	304.86	289.98	14.87	10.225	14.92	23817	0.695	8707	82.74	49.20	1.10	0.48	5.77	10.17	12.63
7.249	0.001	305.22	290.85	14.38	10.221	14.97	23771	0.695	8971	85.07	50.09	1.10	0.49	5.77	10.42	12.83
3.566	0.953	297.05	285.00	12.05	10.253	14.63	24086	0.696	10764	103.58	57.35	1.10	0.44	5.77	11.61	13.82
4.176	0.927	300.06	285.97	14.09	10.248	14.69	24033	0.696	9225	88.56	51.67	1.10	0.44	5.77	10.44	12.84
5.370	0.953	303.58	287.87	15.71	10.237	14.80	23931	0.695	8263	78.94	47.74	1.10	0.46	5.77	9.79	12.33
6.703	0.927	305.84	289.98	15.86	10.225	14.92	23817	0.695	8166	77.60	47.11	1.10	0.48	5.77	9.77	12.31
7.313	0.914	306.09	290.95	15.14	10.220	14.97	23766	0.695	8513	80.70	48.34	1.10	0.50	5.77	10.09	12.57
3.528	-0.953	298.00	284.94	13.06	10.254	14.63	24089	0.696	9932	95.59	54.41	1.10	0.44	5.77	10.98	13.29
4.112	-0.914	300.41	285.87	14.54	10.248	14.68	24039	0.696	8942	85.86	50.61	1.10	0.44	5.77	10.23	12.67
5.408	-0.927	304.63	287.93	16.70	10.237	14.80	23927	0.695	7772	74.24	45.77	1.10	0.46	5.77	9.45	12.05
6.678	-0.978	306.76	289.94	16.82	10.226	14.92	23819	0.695	7700	73.18	45.25	1.10	0.48	5.77	9.44	12.05
7.313	-0.978	307.04	290.95	16.09	10.220	14.97	23766	0.695	8010	75.94	46.38	1.10	0.50	5.77	9.73	12.27

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	72.85	53.14	19.71	1487.2	47.98	24092	0.696	2086.6	113.99	61.01	1.98	0.79	5.77	12.46	14.54
1.639	-0.010	78.44	55.02	23.42	1486.3	48.18	24034	0.696	1760.9	95.94	54.49	1.98	0.80	5.77	11.01	13.31
2.129	-0.028	85.29	58.58	26.71	1484.7	48.56	23927	0.695	1541.2	83.55	49.61	1.98	0.84	5.77	10.14	12.61
2.639	0.000	89.05	62.28	26.77	1483.1	48.94	23817	0.695	1534.2	82.74	49.20	1.98	0.86	5.77	10.17	12.63
2.854	0.000	89.72	63.83	25.88	1482.4	49.11	23771	0.695	1580.7	85.07	50.09	1.98	0.89	5.77	10.42	12.83
1.404	0.375	75.01	53.31	21.70	1487.1	48.00	24086	0.696	1896.6	103.58	57.35	1.98	0.79	5.77	11.61	13.82
1.644	0.365	80.43	55.06	25.37	1486.3	48.19	24033	0.696	1625.4	88.56	51.67	1.98	0.80	5.77	10.44	12.84
2.114	0.375	86.75	58.47	28.28	1484.8	48.54	23931	0.695	1455.9	78.94	47.74	1.98	0.83	5.77	9.79	12.33
2.639	0.365	90.83	62.28	28.55	1483.1	48.94	23817	0.695	1438.8	77.60	47.11	1.98	0.86	5.77	9.77	12.31
2.879	0.360	91.27	64.02	27.25	1482.3	49.12	23766	0.695	1500.0	80.70	48.34	1.98	0.89	5.77	10.09	12.57
1.389	-0.375	76.71	53.21	23.50	1487.1	47.99	24089	0.696	1750.0	95.59	54.41	1.98	0.79	5.77	10.98	13.29
1.619	-0.360	81.05	54.88	26.17	1486.4	48.17	24039	0.696	1575.6	85.86	50.61	1.98	0.80	5.77	10.23	12.67
2.129	-0.365	88.64	58.58	30.06	1484.7	48.56	23927	0.695	1369.4	74.24	45.77	1.98	0.84	5.77	9.45	12.05
2.629	-0.385	92.49	62.21	30.28	1483.1	48.94	23819	0.695	1356.7	73.18	45.25	1.98	0.86	5.77	9.44	12.05
2.879	-0.385	92.98	64.02	28.96	1482.3	49.12	23766	0.695	1411.4	75.94	46.38	1.98	0.89	5.77	9.73	12.27

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 6
Date: 9 January 1992
Time: 11:41:39

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
279.43	43.29	296.27	73.60	19.60	0.01200	10.288	1492.1	90.12	13.07	7.65	1333	4.30	45.45	40.03

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.31	50.27
1.702	0.670	0.001	0.000	284.33	52.11
9.093	3.580	0.001	0.000	300.76	81.68
10.706	4.215	0.001	0.000	299.59	79.57

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	295.82	284.86	10.96	10.257	14.62	24097	0.696	11816	113.75	60.93	1.10	0.44	5.77	12.46	14.53
4.163	-0.025	298.94	285.91	13.03	10.251	14.68	24040	0.696	9968	95.70	54.40	1.10	0.44	5.77	11.00	13.31
5.408	-0.071	302.74	287.89	14.86	10.240	14.80	23933	0.695	8725	83.36	49.54	1.10	0.46	5.77	10.14	12.60
6.703	0.001	304.83	289.94	14.89	10.228	14.91	23823	0.695	8685	82.54	49.12	1.10	0.48	5.77	10.16	12.62
7.249	0.001	305.20	290.80	14.40	10.223	14.96	23777	0.695	8946	84.84	50.00	1.10	0.49	5.77	10.42	12.83
3.566	0.953	297.03	284.96	12.07	10.256	14.63	24092	0.696	10738	103.35	57.27	1.10	0.44	5.77	11.61	13.81
4.176	0.927	300.03	285.93	14.10	10.251	14.68	24039	0.696	9209	88.42	51.62	1.10	0.44	5.77	10.43	12.84
5.370	0.953	303.56	287.83	15.74	10.240	14.79	23936	0.695	8236	78.70	47.64	1.10	0.46	5.77	9.78	12.32
6.703	0.927	305.82	289.94	15.88	10.228	14.91	23823	0.695	8144	77.40	47.02	1.10	0.48	5.77	9.77	12.31
7.313	0.914	306.04	290.90	15.14	10.223	14.97	23772	0.695	8502	80.61	48.30	1.10	0.50	5.77	10.10	12.57
3.528	-0.953	297.98	284.90	13.07	10.256	14.63	24095	0.696	9905	95.35	54.32	1.10	0.44	5.77	10.97	13.28
4.112	-0.914	300.40	285.83	14.57	10.251	14.68	24044	0.696	8912	85.58	50.50	1.10	0.44	5.77	10.22	12.67
5.408	-0.927	304.58	287.89	16.70	10.240	14.80	23933	0.695	7762	74.15	45.74	1.10	0.46	5.77	9.45	12.06
6.678	-0.978	306.75	289.90	16.85	10.229	14.91	23825	0.695	7676	72.96	45.16	1.10	0.48	5.77	9.43	12.04
7.313	-0.978	307.02	290.90	16.12	10.223	14.97	23772	0.695	7987	75.73	46.29	1.10	0.50	5.77	9.72	12.27

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	72.79	53.07	19.73	1487.6	47.98	24097	0.696	2082.0	113.75	60.93	1.98	0.79	5.77	12.46	14.53
1.639	-0.010	78.40	54.95	23.45	1486.8	48.17	24040	0.696	1756.4	95.70	54.40	1.98	0.80	5.77	11.00	13.31
2.129	-0.028	85.25	58.51	26.74	1485.2	48.54	23933	0.695	1537.3	83.36	49.54	1.98	0.84	5.77	10.14	12.60
2.639	0.000	89.00	62.20	26.80	1483.5	48.93	23823	0.695	1530.3	82.54	49.12	1.98	0.86	5.77	10.16	12.62
2.854	0.000	89.67	63.75	25.92	1482.8	49.09	23777	0.695	1576.3	84.84	50.00	1.98	0.89	5.77	10.42	12.83
1.404	0.375	74.96	53.25	21.72	1487.5	47.99	24092	0.696	1892.0	103.35	57.27	1.98	0.79	5.77	11.61	13.81
1.644	0.365	80.36	54.99	25.38	1486.7	48.18	24039	0.696	1622.6	88.42	51.62	1.98	0.80	5.77	10.43	12.84
2.114	0.375	86.73	58.40	28.33	1485.2	48.53	23936	0.695	1451.2	78.70	47.64	1.98	0.83	5.77	9.78	12.32
2.639	0.365	90.78	62.20	28.58	1483.5	48.93	23823	0.695	1435.0	77.40	47.02	1.98	0.86	5.77	9.77	12.31
2.879	0.360	91.18	63.93	27.25	1482.7	49.11	23772	0.695	1498.1	80.61	48.30	1.98	0.89	5.77	10.10	12.57
1.389	-0.375	76.67	53.14	23.53	1487.6	47.98	24095	0.696	1745.3	95.35	54.32	1.98	0.79	5.77	10.97	13.28
1.619	-0.360	81.03	54.80	26.22	1486.8	48.16	24044	0.696	1570.3	85.58	50.50	1.98	0.79	5.77	10.22	12.67
2.129	-0.365	88.56	58.51	30.06	1485.2	48.54	23933	0.695	1367.7	74.15	45.74	1.98	0.84	5.77	9.45	12.06
2.629	-0.385	92.45	62.13	30.33	1483.5	48.92	23825	0.695	1352.5	72.96	45.16	1.98	0.86	5.77	9.43	12.04
2.879	-0.385	92.94	63.93	29.01	1482.7	49.11	23772	0.695	1407.3	75.73	46.29	1.98	0.89	5.77	9.72	12.27

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 7
Date: 9 January 1992
Time: 11:46:47

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
279.28	43.02	300.93	81.98	19.01	0.01164	10.312	1495.7	84.42	12.24	8.17	1662	3.41	56.66	49.91

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.29	52.04
1.702	0.670	0.001	0.000	285.60	54.40
9.093	3.580	0.001	0.000	306.74	92.45
10.706	4.215	0.001	0.000	305.23	89.73

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	300.38	286.26	14.12	10.283	14.21	23293	0.696	11437	109.70	59.45	1.10	0.48	5.77	10.17	12.63
4.163	-0.025	304.42	287.61	16.81	10.278	14.29	23223	0.695	9633	92.08	52.95	1.10	0.49	5.77	9.08	11.77
5.408	-0.071	309.33	290.15	19.18	10.267	14.42	23090	0.695	8427	80.04	48.10	1.10	0.52	5.77	8.46	11.30
6.703	0.001	312.01	292.78	19.23	10.257	14.56	22954	0.695	8390	79.16	47.64	1.10	0.54	5.77	8.49	11.32
7.249	0.001	312.48	293.89	18.59	10.252	14.62	22898	0.695	8642	81.31	48.47	1.10	0.56	5.77	8.69	11.47
3.566	0.953	301.90	286.39	15.51	10.283	14.22	23287	0.696	10417	99.88	55.93	1.10	0.48	5.77	9.54	12.13
4.176	0.927	305.79	287.64	18.15	10.278	14.29	23221	0.695	8920	85.26	50.30	1.10	0.49	5.77	8.67	11.45
5.370	0.953	310.33	290.07	20.26	10.268	14.42	23094	0.695	7980	75.81	46.36	1.10	0.52	5.77	8.21	11.11
6.703	0.927	313.25	292.78	20.47	10.257	14.56	22954	0.695	7881	74.36	45.65	1.10	0.54	5.77	8.20	11.10
7.313	0.914	313.55	294.02	19.53	10.252	14.63	22891	0.695	8220	77.32	46.84	1.10	0.56	5.77	8.45	11.29
3.528	-0.953	303.09	286.31	16.78	10.283	14.22	23291	0.696	9627	92.32	53.10	1.10	0.48	5.77	9.08	11.77
4.112	-0.914	306.21	287.50	18.70	10.278	14.28	23228	0.695	8657	82.78	49.32	1.10	0.49	5.77	8.52	11.34
5.408	-0.927	311.65	290.15	21.50	10.267	14.42	23090	0.695	7517	71.40	44.48	1.10	0.52	5.77	7.96	10.93
6.678	-0.978	314.39	292.73	21.66	10.257	14.56	22957	0.695	7449	70.29	43.91	1.10	0.54	5.77	7.96	10.93
7.313	-0.978	314.77	294.02	20.75	10.252	14.63	22891	0.695	7737	72.77	44.93	1.10	0.56	5.77	8.18	11.09

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	81.00	55.59	25.42	1491.5	46.63	23293	0.696	2015.2	109.70	59.45	1.98	0.86	5.77	10.17	12.63
1.639	-0.010	88.26	58.01	30.26	1490.7	46.87	23223	0.695	1697.3	92.08	52.95	1.98	0.88	5.77	9.08	11.77
2.129	-0.028	97.11	62.58	34.53	1489.2	47.32	23090	0.695	1484.8	80.04	48.10	1.98	0.94	5.77	8.46	11.30
2.639	0.000	101.93	67.32	34.61	1487.6	47.78	22954	0.695	1478.3	79.16	47.64	1.98	0.98	5.77	8.49	11.32
2.854	0.000	102.78	69.32	33.46	1486.9	47.98	22898	0.695	1522.7	81.31	48.47	1.98	1.00	5.77	8.69	11.47
1.404	0.375	83.73	55.82	27.92	1491.4	46.66	23287	0.696	1835.5	99.88	55.93	1.98	0.86	5.77	9.54	12.13
1.644	0.365	90.73	58.06	32.68	1490.6	46.87	23221	0.695	1571.7	85.26	50.30	1.98	0.88	5.77	8.67	11.45
2.114	0.375	98.90	62.44	36.47	1489.2	47.30	23094	0.695	1406.1	75.81	46.36	1.98	0.94	5.77	8.21	11.11
2.639	0.365	104.16	67.32	36.84	1487.6	47.78	22954	0.695	1388.6	74.36	45.65	1.98	0.98	5.77	8.20	11.10
2.879	0.360	104.70	69.55	35.15	1486.9	48.00	22891	0.695	1448.4	77.32	46.84	1.98	1.01	5.77	8.45	11.29
1.389	-0.375	85.88	55.68	30.20	1491.4	46.64	23291	0.696	1696.3	92.32	53.10	1.98	0.86	5.77	9.08	11.77
1.619	-0.360	91.48	57.82	33.67	1490.7	46.85	23228	0.695	1525.4	82.78	49.32	1.98	0.87	5.77	8.52	11.34
2.129	-0.365	101.29	62.58	38.71	1489.2	47.32	23090	0.695	1324.5	71.40	44.48	1.98	0.94	5.77	7.96	10.93
2.629	-0.385	106.21	67.23	38.98	1487.6	47.77	22957	0.695	1312.5	70.29	43.91	1.98	0.97	5.77	7.96	10.93
2.879	-0.385	106.90	69.55	37.35	1486.9	48.00	22891	0.695	1363.3	72.77	44.93	1.98	1.01	5.77	8.18	11.09

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 8
Date: 9 January 1992
Time: 11:47:12

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
279.23	42.93	300.93	81.99	19.01	0.01164	10.313	1495.8	84.41	12.24	8.17	1666	3.40	56.80	50.03

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.25	51.95
1.702	0.670	0.001	0.000	285.54	54.28
9.093	3.580	0.001	0.000	306.68	92.33
10.706	4.215	0.001	0.000	305.17	89.61

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	300.35	286.23	14.11	10.284	14.21	23298	0.696	11470	110.03	59.57	1.10	0.48	5.77	10.17	12.63
4.163	-0.025	304.37	287.58	16.79	10.279	14.28	23227	0.695	9670	92.45	53.10	1.10	0.49	5.77	9.08	11.77
5.408	-0.071	309.28	290.13	19.16	10.268	14.42	23094	0.695	8459	80.34	48.22	1.10	0.52	5.77	8.46	11.30
6.703	0.001	311.95	292.77	19.19	10.257	14.56	22958	0.695	8428	79.52	47.79	1.10	0.54	5.77	8.49	11.32
7.249	0.001	312.43	293.88	18.55	10.253	14.62	22901	0.695	8680	81.68	48.62	1.10	0.56	5.77	8.69	11.47
3.566	0.953	301.86	286.36	15.50	10.284	14.22	23291	0.696	10448	100.19	56.05	1.10	0.48	5.77	9.54	12.13
4.176	0.927	305.72	287.61	18.11	10.278	14.29	23226	0.695	8963	85.68	50.47	1.10	0.49	5.77	8.68	11.46
5.370	0.953	310.25	290.05	20.21	10.269	14.42	23098	0.695	8020	76.19	46.51	1.10	0.52	5.77	8.22	11.12
6.703	0.927	313.20	292.77	20.43	10.257	14.56	22958	0.695	7914	74.68	45.78	1.10	0.54	5.77	8.21	11.11
7.313	0.914	313.48	294.01	19.48	10.252	14.63	22895	0.695	8263	77.72	47.00	1.10	0.56	5.77	8.46	11.30
3.528	-0.953	303.02	286.28	16.73	10.284	14.22	23295	0.696	9676	92.81	53.29	1.10	0.48	5.77	9.09	11.78
4.112	-0.914	306.12	287.48	18.64	10.279	14.28	23233	0.695	8705	83.24	49.50	1.10	0.49	5.77	8.53	11.35
5.408	-0.927	311.57	290.13	21.45	10.268	14.42	23094	0.695	7556	71.77	44.64	1.10	0.52	5.77	7.97	10.93
6.678	-0.978	314.35	292.72	21.63	10.258	14.56	22961	0.695	7475	70.54	44.02	1.10	0.54	5.77	7.96	10.93
7.313	-0.978	314.68	294.01	20.67	10.252	14.63	22895	0.695	7784	73.22	45.12	1.10	0.56	5.77	8.19	11.10

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	80.93	55.53	25.41	1491.6	46.63	23298	0.696	2021.0	110.03	59.57	1.98	0.86	5.77	10.17	12.63
1.639	-0.010	88.17	57.96	30.21	1490.8	46.87	23227	0.695	1703.9	92.45	53.10	1.98	0.88	5.77	9.08	11.77
2.129	-0.028	97.02	62.54	34.49	1489.3	47.32	23094	0.695	1490.5	80.34	48.22	1.98	0.94	5.77	8.46	11.30
2.639	0.000	101.83	67.29	34.53	1487.7	47.78	22958	0.695	1485.0	79.52	47.79	1.98	0.98	5.77	8.49	11.32
2.854	0.000	102.69	69.29	33.40	1487.1	47.98	22901	0.695	1529.4	81.68	48.62	1.98	1.00	5.77	8.69	11.47
1.404	0.375	83.66	55.76	27.90	1491.5	46.65	23291	0.696	1840.9	100.19	56.05	1.98	0.86	5.77	9.54	12.13
1.644	0.365	90.60	58.00	32.60	1490.8	46.87	23226	0.695	1579.3	85.68	50.47	1.98	0.88	5.77	8.68	11.46
2.114	0.375	98.77	62.40	36.37	1489.3	47.30	23098	0.695	1413.1	76.19	46.51	1.98	0.94	5.77	8.22	11.12
2.639	0.365	104.07	67.29	36.77	1487.7	47.78	22958	0.695	1394.4	74.68	45.78	1.98	0.98	5.77	8.21	11.11
2.879	0.360	104.58	69.53	35.06	1487.0	48.00	22895	0.695	1455.9	77.72	47.00	1.98	1.01	5.77	8.46	11.30
1.389	-0.375	85.74	55.62	30.12	1491.5	46.64	23295	0.696	1704.9	92.81	53.29	1.98	0.86	5.77	9.09	11.78
1.619	-0.360	91.33	57.77	33.56	1490.8	46.85	23233	0.695	1533.8	83.24	49.50	1.98	0.87	5.77	8.53	11.35
2.129	-0.365	101.14	62.54	38.60	1489.3	47.32	23094	0.695	1331.4	71.77	44.64	1.98	0.94	5.77	7.97	10.93
2.629	-0.385	106.14	67.20	38.94	1487.7	47.77	22961	0.695	1317.1	70.54	44.02	1.98	0.98	5.77	7.96	10.93
2.879	-0.385	106.74	69.53	37.21	1487.0	48.00	22895	0.695	1371.5	73.22	45.12	1.98	1.01	5.77	8.19	11.10

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 9
Date: 9 January 1992
Time: 11:47:38

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
279.19	42.86	300.90	81.92	19.01	0.01164	10.315	1496.0	84.40	12.24	8.17	1666	3.40	56.80	50.03

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.20	51.87
1.702	0.670	0.001	0.000	285.48	54.18
9.093	3.580	0.001	0.000	306.64	92.26
10.706	4.215	0.001	0.000	305.12	89.53

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	300.29	286.19	14.10	10.286	14.21	23296	0.696	11486	110.19	59.63	1.10	0.48	5.77	10.18	12.64
4.163	-0.025	304.30	287.54	16.76	10.280	14.28	23225	0.695	9688	92.62	53.16	1.10	0.49	5.77	9.09	11.78
5.408	-0.071	309.22	290.09	19.13	10.270	14.41	23093	0.695	8470	80.46	48.27	1.10	0.52	5.77	8.47	11.31
6.703	0.001	311.92	292.73	19.18	10.259	14.56	22957	0.695	8429	79.54	47.80	1.10	0.54	5.77	8.49	11.32
7.249	0.001	312.38	293.84	18.54	10.255	14.62	22900	0.695	8689	81.76	48.65	1.10	0.56	5.77	8.70	11.48
3.566	0.953	301.80	286.32	15.48	10.285	14.21	23290	0.696	10464	100.35	56.11	1.10	0.48	5.77	9.55	12.14
4.176	0.927	305.68	287.57	18.12	10.280	14.28	23224	0.695	8961	85.66	50.46	1.10	0.49	5.77	8.68	11.46
5.370	0.953	310.23	290.01	20.22	10.270	14.41	23097	0.695	8015	76.15	46.50	1.10	0.52	5.77	8.21	11.11
6.703	0.927	313.15	292.73	20.42	10.259	14.56	22957	0.695	7917	74.71	45.80	1.10	0.54	5.77	8.21	11.11
7.313	0.914	313.45	293.97	19.48	10.254	14.62	22893	0.695	8261	77.71	47.00	1.10	0.56	5.77	8.46	11.30
3.528	-0.953	302.97	286.24	16.73	10.285	14.21	23294	0.696	9681	92.86	53.31	1.10	0.48	5.77	9.09	11.78
4.112	-0.914	306.07	287.44	18.63	10.281	14.27	23231	0.695	8711	83.30	49.53	1.10	0.49	5.77	8.53	11.35
5.408	-0.927	311.53	290.09	21.44	10.270	14.41	23093	0.695	7557	71.79	44.65	1.10	0.52	5.77	7.97	10.93
6.678	-0.978	314.31	292.68	21.63	10.259	14.55	22959	0.695	7477	70.56	44.03	1.10	0.54	5.77	7.96	10.93
7.313	-0.978	314.64	293.97	20.67	10.254	14.62	22893	0.695	7787	73.26	45.14	1.10	0.56	5.77	8.19	11.10

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	80.83	55.46	25.37	1491.8	46.61	23296	0.696	2023.8	110.19	59.63	1.98	0.86	5.77	10.18	12.64
1.639	-0.010	88.05	57.89	30.16	1491.0	46.85	23225	0.695	1707.0	92.62	53.16	1.98	0.88	5.77	9.09	11.78
2.129	-0.028	96.91	62.47	34.44	1489.5	47.29	23093	0.695	1492.4	80.46	48.27	1.98	0.94	5.77	8.47	11.31
2.639	0.000	101.76	67.23	34.53	1488.0	47.76	22957	0.695	1485.2	79.54	47.80	1.98	0.98	5.77	8.49	11.32
2.854	0.000	102.59	69.23	33.37	1487.3	47.96	22900	0.695	1531.0	81.76	48.65	1.98	1.00	5.77	8.70	11.48
1.404	0.375	83.55	55.69	27.86	1491.7	46.63	23290	0.696	1843.8	100.35	56.11	1.98	0.86	5.77	9.55	12.14
1.644	0.365	90.54	57.93	32.61	1491.0	46.85	23224	0.695	1578.9	85.66	50.46	1.98	0.88	5.77	8.68	11.46
2.114	0.375	98.73	62.33	36.40	1489.6	47.28	23097	0.695	1412.2	76.15	46.50	1.98	0.94	5.77	8.21	11.11
2.639	0.365	103.99	67.23	36.76	1488.0	47.76	22957	0.695	1395.0	74.71	45.80	1.98	0.98	5.77	8.21	11.11
2.879	0.360	104.53	69.46	35.07	1487.2	47.98	22893	0.695	1455.6	77.71	47.00	1.98	1.01	5.77	8.46	11.30
1.389	-0.375	85.66	55.55	30.11	1491.8	46.62	23294	0.696	1705.8	92.86	53.31	1.98	0.86	5.77	9.09	11.78
1.619	-0.360	91.24	57.70	33.54	1491.1	46.83	23231	0.695	1534.9	83.30	49.53	1.98	0.87	5.77	8.53	11.35
2.129	-0.365	101.07	62.47	38.60	1489.5	47.29	23093	0.695	1331.5	71.79	44.65	1.98	0.94	5.77	7.97	10.93
2.629	-0.385	106.07	67.14	38.93	1488.0	47.75	22959	0.695	1317.4	70.56	44.03	1.98	0.98	5.77	7.96	10.93
2.879	-0.385	106.66	69.46	37.20	1487.2	47.98	22893	0.695	1372.1	73.26	45.14	1.98	1.01	5.77	8.19	11.10

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 10
Date: 9 January 1992
Time: 11:52:46

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.68	41.93	305.26	89.78	19.08	0.01169	10.334	1498.8	84.42	12.24	8.17	2050	2.83	69.89	61.56

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.90	53.14
1.702	0.670	0.001	0.000	286.47	55.95
9.093	3.580	0.001	0.000	312.41	102.65
10.706	4.215	0.001	0.000	310.54	99.28

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	304.61	287.25	17.35	10.305	14.29	23331	0.695	11474	109.77	59.42	1.10	0.52	5.77	8.77	11.53
4.163	-0.025	309.55	288.90	20.65	10.300	14.38	23244	0.695	9671	92.13	52.91	1.10	0.54	5.77	7.93	10.90
5.408	-0.071	315.63	292.02	23.61	10.289	14.54	23082	0.695	8443	79.81	47.93	1.10	0.59	5.77	7.46	10.57
6.703	0.001	318.94	295.26	23.68	10.278	14.71	22916	0.695	8399	78.76	47.38	1.10	0.61	5.77	7.49	10.59
7.249	0.001	319.53	296.62	22.91	10.274	14.78	22847	0.695	8648	80.81	48.16	1.10	0.63	5.77	7.65	10.70
3.566	0.953	306.48	287.41	19.07	10.305	14.30	23322	0.695	10445	99.88	55.88	1.10	0.52	5.77	8.27	11.16
4.176	0.927	311.27	288.94	22.33	10.299	14.38	23242	0.695	8940	85.17	50.21	1.10	0.54	5.77	7.60	10.67
5.370	0.953	316.87	291.93	24.94	10.290	14.53	23087	0.695	7992	75.57	46.19	1.10	0.59	5.77	7.26	10.43
6.703	0.927	320.48	295.26	25.21	10.278	14.71	22916	0.695	7887	73.95	45.39	1.10	0.61	5.77	7.26	10.43
7.313	0.914	320.81	296.78	24.03	10.273	14.79	22839	0.695	8238	76.95	46.58	1.10	0.63	5.77	7.47	10.57
3.528	-0.953	307.92	287.31	20.61	10.305	14.29	23327	0.695	9663	92.43	53.10	1.10	0.52	5.77	7.91	10.89
4.112	-0.914	311.73	288.78	22.96	10.300	14.37	23250	0.695	8696	82.87	49.30	1.10	0.54	5.77	7.49	10.59
5.408	-0.927	318.46	292.02	26.44	10.289	14.54	23082	0.695	7539	71.27	44.36	1.10	0.59	5.77	7.07	10.30
6.678	-0.978	321.86	295.20	26.66	10.279	14.71	22919	0.695	7461	69.97	43.69	1.10	0.61	5.77	7.07	10.30
7.313	-0.978	322.27	296.78	25.49	10.273	14.79	22839	0.695	7764	72.53	44.73	1.10	0.63	5.77	7.26	10.43

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	88.60	57.37	31.24	1494.6	46.88	23331	0.695	2021.7	109.77	59.42	1.98	0.94	5.77	8.77	11.53
1.639	-0.010	97.50	60.34	37.16	1493.8	47.16	23244	0.695	1704.0	92.13	52.91	1.98	0.97	5.77	7.93	10.90
2.129	-0.028	108.45	65.95	42.49	1492.3	47.70	23082	0.695	1487.7	79.81	47.93	1.98	1.06	5.77	7.46	10.57
2.639	0.000	114.40	71.78	42.62	1490.8	48.26	22916	0.695	1479.9	78.76	47.38	1.98	1.10	5.77	7.49	10.59
2.854	0.000	115.46	74.23	41.23	1490.1	48.50	22847	0.695	1523.8	80.81	48.16	1.98	1.13	5.77	7.65	10.70
1.404	0.375	91.98	57.65	34.33	1494.5	46.91	23322	0.695	1840.4	99.88	55.88	1.98	0.94	5.77	8.27	11.16
1.644	0.365	100.59	60.40	40.20	1493.8	47.17	23242	0.695	1575.2	85.17	50.21	1.98	0.97	5.77	7.60	10.67
2.114	0.375	110.67	65.78	44.89	1492.4	47.69	23087	0.695	1408.2	75.57	46.19	1.98	1.06	5.77	7.26	10.43
2.639	0.365	117.17	71.78	45.39	1490.8	48.26	22916	0.695	1389.7	73.95	45.39	1.98	1.10	5.77	7.26	10.43
2.879	0.360	117.77	74.52	43.25	1490.0	48.53	22839	0.695	1451.5	76.95	46.58	1.98	1.14	5.77	7.47	10.57
1.389	-0.375	94.57	57.48	37.10	1494.6	46.89	23327	0.695	1702.6	92.43	53.10	1.98	0.94	5.77	7.91	10.89
1.619	-0.360	101.43	60.11	41.33	1493.9	47.14	23250	0.695	1532.2	82.87	49.30	1.98	0.97	5.77	7.49	10.59
2.129	-0.365	113.54	65.95	47.59	1492.3	47.70	23082	0.695	1328.4	71.27	44.36	1.98	1.06	5.77	7.07	10.30
2.629	-0.385	119.65	71.67	47.99	1490.8	48.25	22919	0.695	1314.6	69.97	43.69	1.98	1.10	5.77	7.07	10.30
2.879	-0.385	120.40	74.52	45.89	1490.0	48.53	22839	0.695	1368.0	72.53	44.73	1.98	1.14	5.77	7.26	10.43

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 11
Date: 9 January 1992
Time: 11:53:12

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.66	41.89	305.27	89.80	19.09	0.01169	10.335	1499.0	84.37	12.24	8.17	2053	2.83	69.99	61.65

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.88	53.09
1.702	0.670	0.001	0.000	286.45	55.92
9.093	3.580	0.001	0.000	312.39	102.61
10.706	4.215	0.001	0.000	310.52	99.25

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	304.60	287.24	17.35	10.306	14.29	23337	0.695	11493	109.96	59.49	1.10	0.52	5.77	8.77	11.53
4.163	-0.025	309.57	288.90	20.67	10.301	14.38	23250	0.695	9676	92.18	52.93	1.10	0.54	5.77	7.92	10.90
5.408	-0.071	315.62	292.02	23.60	10.290	14.54	23087	0.695	8459	79.96	47.99	1.10	0.59	5.77	7.46	10.57
6.703	0.001	318.89	295.26	23.63	10.279	14.71	22921	0.695	8429	79.03	47.49	1.10	0.61	5.77	7.49	10.59
7.249	0.001	319.48	296.62	22.85	10.275	14.78	22852	0.695	8683	81.14	48.29	1.10	0.63	5.77	7.66	10.71
3.566	0.953	306.47	287.40	19.07	10.305	14.30	23328	0.695	10465	100.08	55.95	1.10	0.52	5.77	8.28	11.16
4.176	0.927	311.25	288.93	22.32	10.300	14.38	23248	0.695	8961	85.37	50.29	1.10	0.54	5.77	7.60	10.67
5.370	0.953	316.83	291.92	24.90	10.291	14.54	23092	0.695	8018	75.81	46.29	1.10	0.59	5.77	7.26	10.43
6.703	0.927	320.43	295.26	25.17	10.279	14.71	22921	0.695	7915	74.22	45.50	1.10	0.61	5.77	7.26	10.43
7.313	0.914	320.80	296.78	24.01	10.274	14.79	22844	0.695	8257	77.13	46.65	1.10	0.63	5.77	7.47	10.58
3.528	-0.953	307.87	287.30	20.57	10.306	14.29	23333	0.695	9698	92.77	53.23	1.10	0.52	5.77	7.92	10.90
4.112	-0.914	311.70	288.77	22.93	10.301	14.37	23256	0.695	8722	83.13	49.40	1.10	0.54	5.77	7.49	10.59
5.408	-0.927	318.42	292.02	26.40	10.290	14.54	23087	0.695	7563	71.49	44.45	1.10	0.59	5.77	7.07	10.30
6.678	-0.978	321.82	295.20	26.62	10.280	14.71	22924	0.695	7484	70.18	43.78	1.10	0.61	5.77	7.08	10.30
7.313	-0.978	322.24	296.78	25.46	10.274	14.79	22844	0.695	7788	72.75	44.83	1.10	0.63	5.77	7.26	10.43

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	88.58	57.35	31.24	1494.8	46.89	23337	0.695	2025.1	109.96	59.49	1.98	0.94	5.77	8.77	11.53
1.639	-0.010	97.53	60.32	37.21	1494.0	47.17	23250	0.695	1704.9	92.18	52.93	1.98	0.97	5.77	7.92	10.90
2.129	-0.028	108.43	65.95	42.48	1492.5	47.71	23087	0.695	1490.5	79.96	47.99	1.98	1.07	5.77	7.46	10.57
2.639	0.000	114.32	71.78	42.54	1490.9	48.27	22921	0.695	1485.2	79.03	47.49	1.98	1.11	5.77	7.49	10.59
2.854	0.000	115.37	74.24	41.13	1490.3	48.51	22852	0.695	1529.9	81.14	48.29	1.98	1.13	5.77	7.66	10.71
1.404	0.375	91.95	57.63	34.32	1494.7	46.91	23328	0.695	1843.9	100.08	55.95	1.98	0.94	5.77	8.28	11.16
1.644	0.365	100.56	60.38	40.17	1494.0	47.17	23248	0.695	1578.9	85.37	50.29	1.98	0.97	5.77	7.60	10.67
2.114	0.375	110.60	65.78	44.82	1492.5	47.69	23092	0.695	1412.8	75.81	46.29	1.98	1.06	5.77	7.26	10.43
2.639	0.365	117.08	71.78	45.30	1490.9	48.27	22921	0.695	1394.6	74.22	45.50	1.98	1.11	5.77	7.26	10.43
2.879	0.360	117.74	74.52	43.22	1490.2	48.53	22844	0.695	1454.9	77.13	46.65	1.98	1.14	5.77	7.47	10.58
1.389	-0.375	94.48	57.46	37.02	1494.7	46.90	23333	0.695	1708.8	92.77	53.23	1.98	0.94	5.77	7.92	10.90
1.619	-0.360	101.36	60.09	41.27	1494.0	47.15	23256	0.695	1536.8	83.13	49.40	1.98	0.97	5.77	7.49	10.59
2.129	-0.365	113.46	65.95	47.51	1492.5	47.71	23087	0.695	1332.6	71.49	44.45	1.98	1.07	5.77	7.07	10.30
2.629	-0.385	119.59	71.67	47.92	1490.9	48.26	22924	0.695	1318.7	70.18	43.78	1.98	1.10	5.77	7.08	10.30
2.879	-0.385	120.34	74.52	45.82	1490.2	48.53	22844	0.695	1372.2	72.75	44.83	1.98	1.14	5.77	7.26	10.43

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 12
Date: 9 January 1992
Time: 11:53:38

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.64	41.87	305.24	89.75	19.08	0.01169	10.337	1499.2	84.50	12.26	8.16	2051	2.83	69.92	61.59

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	284.86	53.07
1.702	0.670	0.001	0.000	286.44	55.90
9.093	3.580	0.001	0.000	312.39	102.61
10.706	4.215	0.001	0.000	310.50	99.21

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	304.58	287.22	17.35	10.308	14.29	23334	0.696	11483	109.87	59.46	1.10	0.52	5.77	8.77	11.53
4.163	-0.025	309.50	288.88	20.62	10.302	14.37	23247	0.695	9689	92.31	52.98	1.10	0.54	5.77	7.93	10.91
5.408	-0.071	315.59	292.00	23.59	10.292	14.54	23085	0.695	8457	79.95	47.99	1.10	0.59	5.77	7.46	10.57
6.703	0.001	318.89	295.24	23.66	10.281	14.71	22919	0.695	8414	78.90	47.44	1.10	0.61	5.77	7.49	10.59
7.249	0.001	319.48	296.60	22.89	10.276	14.78	22850	0.695	8662	80.95	48.22	1.10	0.63	5.77	7.65	10.70
3.566	0.953	306.46	287.38	19.08	10.307	14.29	23326	0.695	10449	99.94	55.90	1.10	0.52	5.77	8.27	11.16
4.176	0.927	311.26	288.91	22.35	10.302	14.37	23245	0.695	8942	85.19	50.22	1.10	0.54	5.77	7.59	10.66
5.370	0.953	316.85	291.90	24.94	10.292	14.53	23090	0.695	7998	75.62	46.21	1.10	0.59	5.77	7.26	10.43
6.703	0.927	320.45	295.24	25.21	10.281	14.71	22919	0.695	7895	74.03	45.42	1.10	0.61	5.77	7.26	10.43
7.313	0.914	320.79	296.76	24.03	10.276	14.79	22842	0.695	8245	77.02	46.61	1.10	0.63	5.77	7.47	10.57
3.528	-0.953	307.90	287.29	20.61	10.307	14.29	23331	0.695	9670	92.50	53.13	1.10	0.52	5.77	7.91	10.89
4.112	-0.914	311.69	288.75	22.94	10.303	14.37	23254	0.695	8711	83.03	49.37	1.10	0.54	5.77	7.49	10.59
5.408	-0.927	318.39	292.00	26.39	10.292	14.54	23085	0.695	7559	71.46	44.44	1.10	0.59	5.77	7.08	10.30
6.678	-0.978	321.78	295.17	26.60	10.281	14.70	22922	0.695	7482	70.17	43.78	1.10	0.61	5.77	7.08	10.30
7.313	-0.978	322.21	296.76	25.45	10.276	14.79	22842	0.695	7785	72.72	44.81	1.10	0.63	5.77	7.26	10.43

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	88.55	57.31	31.24	1495.0	46.87	23334	0.696	2023.3	109.87	59.46	1.98	0.94	5.77	8.77	11.53
1.639	-0.010	97.41	60.29	37.12	1494.2	47.15	23247	0.695	1707.2	92.31	52.98	1.98	0.97	5.77	7.93	10.91
2.129	-0.028	108.37	65.91	42.46	1492.7	47.69	23085	0.695	1490.1	79.95	47.99	1.98	1.07	5.77	7.46	10.57
2.639	0.000	114.32	71.74	42.58	1491.1	48.25	22919	0.695	1482.5	78.90	47.44	1.98	1.10	5.77	7.49	10.59
2.854	0.000	115.38	74.19	41.19	1490.5	48.49	22850	0.695	1526.2	80.95	48.22	1.98	1.13	5.77	7.65	10.70
1.404	0.375	91.94	57.60	34.34	1494.9	46.90	23326	0.695	1841.1	99.94	55.90	1.98	0.94	5.77	8.27	11.16
1.644	0.365	100.57	60.35	40.23	1494.2	47.16	23245	0.695	1575.6	85.19	50.22	1.98	0.97	5.77	7.59	10.66
2.114	0.375	110.63	65.74	44.90	1492.7	47.68	23090	0.695	1409.2	75.62	46.21	1.98	1.06	5.77	7.26	10.43
2.639	0.365	117.12	71.74	45.38	1491.1	48.25	22919	0.695	1391.1	74.03	45.42	1.98	1.10	5.77	7.26	10.43
2.879	0.360	117.72	74.48	43.25	1490.4	48.52	22842	0.695	1452.8	77.02	46.61	1.98	1.14	5.77	7.47	10.57
1.389	-0.375	94.53	57.43	37.10	1495.0	46.88	23331	0.695	1703.9	92.50	53.13	1.98	0.94	5.77	7.91	10.89
1.619	-0.360	101.35	60.06	41.29	1494.3	47.13	23254	0.695	1534.9	83.03	49.37	1.98	0.97	5.77	7.49	10.59
2.129	-0.365	113.41	65.91	47.50	1492.7	47.69	23085	0.695	1331.9	71.46	44.44	1.98	1.07	5.77	7.08	10.30
2.629	-0.385	119.51	71.63	47.89	1491.2	48.24	22922	0.695	1318.3	70.17	43.78	1.98	1.10	5.77	7.08	10.30
2.879	-0.385	120.28	74.48	45.81	1490.4	48.52	22842	0.695	1371.7	72.72	44.81	1.98	1.14	5.77	7.26	10.43

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 13
Date: 9 January 1992
Time: 11:57:32

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.54	41.69	278.56	41.71	19.02	0.01165	10.350	1501.1	83.49	12.11	8.26	-1	0.00	-0.03	-0.03

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	278.68	41.93
1.702	0.670	0.001	0.000	278.54	41.69
9.093	3.580	0.001	0.000	278.67	41.93
10.706	4.215	0.001	0.000	278.60	41.79

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	278.45	278.54	-0.09	10.321	13.80	23721	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	278.53	278.54	-0.01	10.315	13.81	23722	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	278.66	278.55	0.11	10.305	13.82	23722	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	278.61	278.55	0.07	10.295	13.84	23723	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	278.58	278.55	0.03	10.290	13.84	23723	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	278.54	278.54	-0.00	10.320	13.80	23721	0.696	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	278.61	278.54	0.06	10.315	13.81	23722	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	278.61	278.55	0.06	10.305	13.82	23722	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	278.62	278.55	0.07	10.295	13.84	23723	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	278.61	278.55	0.06	10.290	13.84	23723	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	278.56	278.54	0.02	10.321	13.80	23721	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	278.54	278.54	-0.00	10.316	13.81	23722	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	278.64	278.55	0.09	10.305	13.82	23722	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	278.68	278.55	0.13	10.295	13.84	23723	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	278.55	278.55	-0.00	10.290	13.84	23723	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	41.53	41.69	-0.16	1496.9	45.28	23721	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	41.67	41.69	-0.02	1496.1	45.31	23722	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	41.89	41.69	0.20	1494.6	45.35	23722	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	41.82	41.70	0.12	1493.1	45.40	23723	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	41.76	41.70	0.06	1492.4	45.41	23723	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	41.68	41.69	-0.01	1496.8	45.29	23721	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	41.80	41.69	0.11	1496.1	45.31	23722	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	41.80	41.69	0.11	1494.7	45.35	23722	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	41.83	41.70	0.13	1493.1	45.40	23723	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	41.81	41.70	0.11	1492.4	45.42	23723	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	41.72	41.69	0.03	1496.9	45.29	23721	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	41.69	41.69	-0.01	1496.2	45.31	23722	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	41.86	41.69	0.17	1494.6	45.35	23722	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	41.94	41.70	0.24	1493.1	45.39	23723	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	41.70	41.70	-0.00	1492.4	45.42	23723	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 14
Date: 9 January 1992
Time: 11:57:57

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.51	41.63	278.56	41.72	19.01	0.01164	10.351	1501.3	83.45	12.10	8.26	2	0.00	0.07	0.06

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	278.65	41.88
1.702	0.670	0.001	0.000	278.53	41.66
9.093	3.580	0.001	0.000	278.64	41.86
10.706	4.215	0.001	0.000	278.57	41.74

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	278.44	278.52	-0.08	10.323	13.79	23712	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	278.52	278.52	-0.01	10.317	13.80	23712	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	278.64	278.53	0.11	10.307	13.81	23713	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	278.59	278.54	0.06	10.296	13.83	23713	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	278.57	278.54	0.03	10.292	13.83	23713	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	278.52	278.52	-0.01	10.322	13.80	23712	0.696	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	278.59	278.52	0.07	10.317	13.80	23712	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	278.59	278.53	0.06	10.307	13.81	23713	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	278.59	278.54	0.06	10.296	13.83	23713	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	278.58	278.54	0.04	10.291	13.83	23713	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	278.53	278.52	0.01	10.322	13.80	23712	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	278.52	278.52	-0.00	10.318	13.80	23712	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	278.62	278.53	0.09	10.307	13.81	23713	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	278.63	278.54	0.09	10.297	13.83	23713	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	278.51	278.54	-0.03	10.291	13.83	23713	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	41.51	41.65	-0.14	1497.2	45.26	23712	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	41.64	41.66	-0.01	1496.4	45.28	23712	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	41.87	41.67	0.20	1494.9	45.32	23713	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	41.78	41.68	0.10	1493.4	45.37	23713	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	41.74	41.68	0.06	1492.7	45.39	23713	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	41.64	41.65	-0.01	1497.1	45.26	23712	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	41.78	41.66	0.12	1496.4	45.28	23712	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	41.78	41.67	0.11	1495.0	45.32	23713	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	41.78	41.68	0.10	1493.4	45.37	23713	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	41.76	41.68	0.07	1492.6	45.39	23713	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	41.67	41.65	0.01	1497.1	45.26	23712	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	41.65	41.66	-0.01	1496.4	45.28	23712	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	41.83	41.67	0.16	1494.9	45.32	23713	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	41.84	41.68	0.16	1493.4	45.37	23713	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	41.63	41.68	-0.06	1492.6	45.39	23713	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.6 (continued)

Aluminum Heat Exchanger
Experiment: 6, Data Point: 15
Date: 9 January 1992
Time: 11:58:23

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
278.53	41.67	278.53	41.66	19.00	0.01164	10.353	1501.5	83.57	12.12	8.25	-3	0.00	-0.10	-0.09

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	278.62	41.83
1.702	0.670	0.001	0.000	278.50	41.62
9.093	3.580	0.001	0.000	278.60	41.79
10.706	4.215	0.001	0.000	278.54	41.68

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	278.42	278.53	-0.11	10.324	13.78	23699	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.163	-0.025	278.48	278.53	-0.05	10.318	13.79	23699	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.071	278.61	278.53	0.08	10.308	13.81	23700	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.001	278.57	278.53	0.04	10.297	13.82	23700	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.249	0.001	278.54	278.53	0.01	10.293	13.82	23701	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.566	0.953	278.49	278.53	-0.04	10.323	13.79	23699	0.696	0	0.00	0.00	1.10	0.37	5.77	0.00	0.00
4.176	0.927	278.55	278.53	0.02	10.318	13.79	23699	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.370	0.953	278.55	278.53	0.02	10.308	13.81	23700	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.703	0.927	278.56	278.53	0.04	10.297	13.82	23700	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	0.914	278.56	278.53	0.03	10.292	13.82	23701	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
3.528	-0.953	278.48	278.53	-0.04	10.324	13.79	23699	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00
4.112	-0.914	278.47	278.53	-0.06	10.319	13.79	23699	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
5.408	-0.927	278.56	278.53	0.04	10.308	13.81	23700	0.696	0	0.00	0.00	1.10	0.35	5.77	0.00	0.00
6.678	-0.978	278.59	278.53	0.07	10.298	13.82	23700	0.696	0	0.00	0.00	1.10	0.36	5.77	0.00	0.00
7.313	-0.978	278.48	278.53	-0.05	10.292	13.82	23701	0.696	0	0.00	0.00	1.10	0.38	5.77	0.00	0.00

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	41.47	41.66	-0.19	1497.3	45.23	23699	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.639	-0.010	41.58	41.66	-0.09	1496.5	45.25	23699	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.129	-0.028	41.80	41.66	0.14	1495.1	45.29	23700	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.000	41.73	41.66	0.07	1493.5	45.33	23700	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.854	0.000	41.68	41.66	0.02	1492.9	45.35	23701	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.404	0.375	41.59	41.66	-0.07	1497.3	45.23	23699	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.644	0.365	41.70	41.66	0.04	1496.5	45.25	23699	0.696	0.0	0.00	0.00	1.98	0.65	5.77	0.00	0.00
2.114	0.375	41.69	41.66	0.03	1495.1	45.29	23700	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.639	0.365	41.72	41.66	0.06	1493.5	45.33	23700	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	0.360	41.71	41.66	0.06	1492.8	45.36	23701	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00
1.389	-0.375	41.58	41.66	-0.08	1497.3	45.23	23699	0.696	0.0	0.00	0.00	1.98	0.67	5.77	0.00	0.00
1.619	-0.360	41.56	41.66	-0.10	1496.6	45.25	23699	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.129	-0.365	41.73	41.66	0.07	1495.1	45.29	23700	0.696	0.0	0.00	0.00	1.98	0.64	5.77	0.00	0.00
2.629	-0.385	41.78	41.66	0.12	1493.5	45.33	23700	0.696	0.0	0.00	0.00	1.98	0.66	5.77	0.00	0.00
2.879	-0.385	41.57	41.66	-0.09	1492.8	45.36	23701	0.696	0.0	0.00	0.00	1.98	0.68	5.77	0.00	0.00

Table 3.7. Data tables for experiment 7

Aluminum Heat Exchanger
Summary Data Table for Experiment 7
Date: 10 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	P0 MPa	P0-P1 kPa	T0 K	T1 K	T1-T0 K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	14:13:36	1730	58.98	19.68	10.32	105.31	284.72	306.49	21.78	19.11	15.21	23609	0.695	8807	82.50	48.88
2	14:14:01	1734	59.12	19.69	10.32	105.14	284.66	306.48	21.81	19.16	15.22	23627	0.695	8804	82.48	48.87
3	14:14:27	1733	59.08	19.69	10.32	105.26	284.68	306.46	21.79	19.12	15.22	23626	0.695	8811	82.55	48.90
4	14:18:25	1746	59.53	16.30	10.35	70.83	284.68	311.18	26.50	23.03	12.64	19454	0.695	7372	68.65	43.02
5	14:18:50	1746	59.53	16.30	10.35	70.78	284.72	311.21	26.49	22.98	12.64	19457	0.695	7390	68.81	43.09
6	14:19:16	1745	59.49	16.30	10.35	70.80	284.72	311.20	26.48	23.05	12.64	19456	0.695	7362	68.56	42.99
7	14:22:51	1754	59.80	13.16	10.37	45.52	285.04	317.99	32.95	28.16	10.30	15587	0.695	6056	55.91	37.13
8	14:23:17	1752	59.73	13.17	10.37	45.55	285.14	318.05	32.90	28.19	10.30	15589	0.695	6044	55.79	37.07
9	14:23:43	1755	59.83	13.17	10.37	45.61	285.22	318.18	32.96	28.18	10.31	15588	0.695	6057	55.90	37.12
10	14:28:46	1764	60.14	10.45	10.38	28.35	285.78	327.51	41.72	34.74	8.29	12241	0.694	4937	45.05	31.62
11	14:29:11	1765	60.17	10.45	10.38	28.28	285.79	327.55	41.76	34.78	8.29	12239	0.694	4935	45.03	31.61
12	14:29:36	1769	60.31	10.45	10.38	28.34	285.80	327.64	41.84	34.78	8.29	12241	0.694	4945	45.11	31.65
13	14:33:56	1766	60.21	7.14	10.40	12.49	286.53	347.70	61.17	48.20	5.84	8179	0.693	3563	31.76	24.11
14	14:34:21	1764	60.14	7.13	10.40	12.50	286.66	347.79	61.13	48.22	5.83	8169	0.693	3556	31.69	24.07
15	14:34:47	1764	60.14	7.13	10.40	12.47	286.74	347.86	61.12	48.23	5.84	8172	0.693	3556	31.69	24.07
16	14:38:46	1761	60.04	19.55	10.37	104.79	285.05	307.35	22.30	19.43	15.08	23427	0.695	8814	82.44	48.83
17	14:39:12	1765	60.17	19.57	10.37	104.66	284.68	307.00	22.32	19.50	15.07	23468	0.695	8801	82.38	48.82
18	14:39:37	1767	60.24	19.57	10.37	104.58	284.37	306.73	22.36	19.56	15.05	23480	0.695	8788	82.33	48.81

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 1
Date: 10 January 1992
Time: 14:13:36

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.72	52.80	306.49	92.00	19.68	0.01205	10.316	1496.2	105.31	15.27	6.55	1730	3.39	58.98	51.95

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.47	61.37
1.702	0.670	0.001	0.000	290.80	63.74
9.093	3.580	0.001	0.000	312.25	102.37
10.706	4.215	0.001	0.000	310.69	99.55

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	305.77	291.74	14.03	10.280	14.99	23815	0.695	11982	113.35	60.42	1.10	0.48	5.77	10.21	12.66
4.163	-0.025	309.84	293.09	16.74	10.273	15.07	23743	0.695	10069	94.93	53.78	1.10	0.49	5.77	9.10	11.78
5.408	-0.071	314.76	295.65	19.11	10.260	15.21	23609	0.695	8807	82.50	48.88	1.10	0.52	5.77	8.48	11.31
6.703	0.001	317.48	298.30	19.18	10.246	15.36	23471	0.695	8754	81.47	48.36	1.10	0.54	5.77	8.49	11.32
7.249	0.001	318.00	299.42	18.59	10.241	15.43	23413	0.695	8999	83.52	49.13	1.10	0.56	5.77	8.68	11.47
3.566	0.953	307.42	291.87	15.55	10.279	15.00	23808	0.695	10817	102.29	56.53	1.10	0.48	5.77	9.52	12.11
4.176	0.927	311.33	293.12	18.21	10.273	15.07	23742	0.695	9258	87.27	50.86	1.10	0.49	5.77	8.65	11.44
5.370	0.953	315.90	295.57	20.33	10.260	15.21	23613	0.695	8277	77.55	46.87	1.10	0.52	5.77	8.19	11.09
6.703	0.927	318.88	298.30	20.58	10.246	15.36	23471	0.695	8159	75.94	46.11	1.10	0.54	5.77	8.17	11.08
7.313	0.914	319.18	299.55	19.63	10.240	15.44	23407	0.695	8515	79.00	47.32	1.10	0.56	5.77	8.42	11.27
3.528	-0.953	308.61	291.79	16.82	10.279	14.99	23812	0.695	9995	94.53	53.69	1.10	0.48	5.77	9.06	11.75
4.112	-0.914	311.72	292.99	18.73	10.273	15.06	23749	0.695	8999	84.86	49.92	1.10	0.49	5.77	8.51	11.33
5.408	-0.927	317.20	295.65	21.55	10.260	15.21	23609	0.695	7809	73.15	45.03	1.10	0.52	5.77	7.95	10.92
6.678	-0.978	320.03	298.25	21.78	10.247	15.36	23474	0.695	7710	71.76	44.35	1.10	0.54	5.77	7.93	10.91
7.313	-0.978	320.41	299.55	20.86	10.240	15.44	23407	0.695	8012	74.34	45.40	1.10	0.56	5.77	8.15	11.07

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	90.70	65.44	25.26	1490.9	49.18	23815	0.695	2111.2	113.35	60.42	1.98	0.86	5.77	10.21	12.66
1.639	-0.010	98.02	67.88	30.14	1489.9	49.44	23743	0.695	1774.2	94.93	53.78	1.98	0.88	5.77	9.10	11.78
2.129	-0.028	106.88	72.48	34.40	1488.1	49.91	23609	0.695	1551.8	82.50	48.88	1.98	0.94	5.77	8.48	11.31
2.639	0.000	111.78	77.26	34.53	1486.1	50.41	23471	0.695	1542.5	81.47	48.36	1.98	0.98	5.77	8.49	11.32
2.854	0.000	112.72	79.26	33.46	1485.3	50.62	23413	0.695	1585.6	83.52	49.13	1.98	1.00	5.77	8.68	11.47
1.404	0.375	93.67	65.68	27.99	1490.8	49.21	23808	0.695	1906.0	102.29	56.53	1.98	0.86	5.77	9.52	12.11
1.644	0.365	100.71	67.93	32.78	1489.9	49.44	23742	0.695	1631.3	87.27	50.86	1.98	0.88	5.77	8.65	11.44
2.114	0.375	108.94	72.34	36.60	1488.1	49.90	23613	0.695	1458.4	77.55	46.87	1.98	0.94	5.77	8.19	11.09
2.639	0.365	114.30	77.26	37.04	1486.1	50.41	23471	0.695	1437.6	75.94	46.11	1.98	0.98	5.77	8.17	11.08
2.879	0.360	114.83	79.50	35.33	1485.2	50.64	23407	0.695	1500.3	79.00	47.32	1.98	1.01	5.77	8.42	11.27
1.389	-0.375	95.82	65.54	30.28	1490.9	49.19	23812	0.695	1761.1	94.53	53.69	1.98	0.86	5.77	9.06	11.75
1.619	-0.360	101.41	67.69	33.72	1490.0	49.42	23749	0.695	1585.6	84.86	49.92	1.98	0.88	5.77	8.51	11.33
2.129	-0.365	111.27	72.48	38.79	1488.1	49.91	23609	0.695	1375.9	73.15	45.03	1.98	0.94	5.77	7.95	10.92
2.629	-0.385	116.37	77.16	39.20	1486.2	50.40	23474	0.695	1358.5	71.76	44.35	1.98	0.98	5.77	7.93	10.91
2.879	-0.385	117.04	79.50	37.55	1485.2	50.64	23407	0.695	1411.7	74.34	45.40	1.98	1.01	5.77	8.15	11.07

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 2
Date: 10 January 1992
Time: 14:14:01

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.66	52.71	306.48	91.97	19.69	0.01206	10.318	1496.6	105.14	15.25	6.56	1734	3.39	59.12	52.07

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.45	61.33
1.702	0.670	0.001	0.000	290.79	63.74
9.093	3.580	0.001	0.000	312.24	102.35
10.706	4.215	0.001	0.000	310.70	99.57

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	305.77	291.70	14.07	10.282	15.00	23834	0.695	11980	113.34	60.41	1.10	0.48	5.77	10.19	12.65
4.163	-0.025	309.83	293.05	16.77	10.275	15.07	23762	0.695	10076	95.00	53.81	1.10	0.49	5.77	9.09	11.77
5.408	-0.071	314.77	295.61	19.16	10.262	15.22	23627	0.695	8804	82.48	48.87	1.10	0.52	5.77	8.46	11.30
6.703	0.001	317.50	298.27	19.23	10.249	15.37	23489	0.695	8753	81.46	48.36	1.10	0.54	5.77	8.48	11.31
7.249	0.001	318.01	299.39	18.62	10.243	15.43	23431	0.695	9003	83.56	49.15	1.10	0.56	5.77	8.67	11.46
3.566	0.953	307.43	291.83	15.60	10.282	15.00	23827	0.695	10805	102.18	56.50	1.10	0.48	5.77	9.50	12.10
4.176	0.927	311.36	293.08	18.28	10.275	15.07	23761	0.695	9245	87.16	50.82	1.10	0.49	5.77	8.63	11.42
5.370	0.953	315.93	295.54	20.39	10.263	15.21	23631	0.695	8273	77.53	46.87	1.10	0.52	5.77	8.17	11.08
6.703	0.927	318.91	298.27	20.64	10.249	15.37	23489	0.695	8153	75.88	46.08	1.10	0.54	5.77	8.16	11.07
7.313	0.914	319.20	299.52	19.68	10.243	15.44	23425	0.695	8513	78.99	47.31	1.10	0.56	5.77	8.41	11.26
3.528	-0.953	308.60	291.75	16.85	10.282	15.00	23831	0.695	10001	94.60	53.72	1.10	0.48	5.77	9.05	11.74
4.112	-0.914	311.75	292.95	18.80	10.276	15.07	23768	0.695	8988	84.77	49.89	1.10	0.49	5.77	8.49	11.32
5.408	-0.927	317.23	295.61	21.61	10.262	15.22	23627	0.695	7804	73.12	45.02	1.10	0.52	5.77	7.93	10.91
6.678	-0.978	320.05	298.22	21.83	10.249	15.37	23492	0.695	7710	71.76	44.35	1.10	0.54	5.77	7.92	10.90
7.313	-0.978	320.44	299.52	20.92	10.243	15.44	23425	0.695	8008	74.30	45.38	1.10	0.56	5.77	8.14	11.06

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	90.69	65.37	25.32	1491.3	49.20	23834	0.695	2110.9	113.34	60.41	1.98	0.86	5.77	10.19	12.65
1.639	-0.010	98.00	67.81	30.19	1490.3	49.45	23762	0.695	1775.4	95.00	53.81	1.98	0.88	5.77	9.09	11.77
2.129	-0.028	106.91	72.42	34.49	1488.4	49.93	23627	0.695	1551.3	82.48	48.87	1.98	0.94	5.77	8.46	11.30
2.639	0.000	111.81	77.20	34.61	1486.5	50.43	23489	0.695	1542.3	81.46	48.36	1.98	0.98	5.77	8.48	11.31
2.854	0.000	112.73	79.21	33.52	1485.7	50.64	23431	0.695	1586.3	83.56	49.15	1.98	1.01	5.77	8.67	11.46
1.404	0.375	93.69	65.60	28.09	1491.2	49.23	23827	0.695	1903.8	102.18	56.50	1.98	0.86	5.77	9.50	12.10
1.644	0.365	100.76	67.86	32.90	1490.3	49.46	23761	0.695	1629.0	87.16	50.82	1.98	0.88	5.77	8.63	11.42
2.114	0.375	108.98	72.28	36.70	1488.5	49.91	23631	0.695	1457.7	77.53	46.87	1.98	0.94	5.77	8.17	11.08
2.639	0.365	114.36	77.20	37.16	1486.5	50.43	23489	0.695	1436.6	75.88	46.08	1.98	0.98	5.77	8.16	11.07
2.879	0.360	114.87	79.44	35.42	1485.6	50.66	23425	0.695	1500.0	78.99	47.31	1.98	1.01	5.77	8.41	11.26
1.389	-0.375	95.80	65.46	30.34	1491.3	49.21	23831	0.695	1762.2	94.60	53.72	1.98	0.86	5.77	9.05	11.74
1.619	-0.360	101.46	67.62	33.84	1490.4	49.43	23768	0.695	1583.7	84.77	49.89	1.98	0.88	5.77	8.49	11.32
2.129	-0.365	111.32	72.42	38.91	1488.4	49.93	23627	0.695	1375.1	73.12	45.02	1.98	0.94	5.77	7.93	10.91
2.629	-0.385	116.41	77.11	39.30	1486.5	50.42	23492	0.695	1358.5	71.76	44.35	1.98	0.98	5.77	7.92	10.90
2.879	-0.385	117.10	79.44	37.66	1485.6	50.66	23425	0.695	1411.0	74.30	45.38	1.98	1.01	5.77	8.14	11.06

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 3
Date: 10 January 1992
Time: 14:14:27

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.68	52.73	306.46	91.95	19.69	0.01206	10.321	1496.9	105.26	15.27	6.55	1733	3.39	59.08	52.04

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.43	61.28
1.702	0.670	0.001	0.000	290.75	63.67
9.093	3.580	0.001	0.000	312.19	102.26
10.706	4.215	0.001	0.000	310.65	99.48

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	305.74	291.70	14.04	10.285	14.99	23832	0.695	11993	113.45	60.45	1.10	0.48	5.77	10.21	12.66
4.163	-0.025	309.81	293.06	16.75	10.278	15.07	23760	0.695	10074	94.98	53.80	1.10	0.49	5.77	9.09	11.78
5.408	-0.071	314.74	295.61	19.12	10.265	15.22	23626	0.695	8811	82.55	48.90	1.10	0.52	5.77	8.47	11.31
6.703	0.001	317.47	298.27	19.20	10.251	15.37	23488	0.695	8757	81.50	48.37	1.10	0.54	5.77	8.49	11.32
7.249	0.001	317.98	299.39	18.59	10.246	15.43	23430	0.695	9007	83.60	49.16	1.10	0.56	5.77	8.68	11.46
3.566	0.953	307.39	291.83	15.55	10.284	15.00	23825	0.695	10828	102.40	56.58	1.10	0.48	5.77	9.52	12.11
4.176	0.927	311.30	293.08	18.22	10.278	15.07	23759	0.695	9264	87.34	50.89	1.10	0.49	5.77	8.64	11.44
5.370	0.953	315.86	295.54	20.32	10.265	15.21	23630	0.695	8292	77.70	46.94	1.10	0.52	5.77	8.19	11.10
6.703	0.927	318.83	298.27	20.56	10.251	15.37	23488	0.695	8178	76.11	46.18	1.10	0.54	5.77	8.18	11.09
7.313	0.914	319.13	299.52	19.61	10.245	15.44	23423	0.695	8533	79.18	47.39	1.10	0.56	5.77	8.43	11.27
3.528	-0.953	308.53	291.76	16.77	10.284	14.99	23830	0.695	10037	94.94	53.84	1.10	0.48	5.77	9.07	11.76
4.112	-0.914	311.66	292.95	18.70	10.278	15.06	23766	0.695	9024	85.10	50.02	1.10	0.49	5.77	8.51	11.34
5.408	-0.927	317.14	295.61	21.53	10.265	15.22	23626	0.695	7826	73.32	45.11	1.10	0.52	5.77	7.95	10.92
6.678	-0.978	319.97	298.22	21.75	10.252	15.36	23490	0.695	7731	71.96	44.44	1.10	0.54	5.77	7.94	10.91
7.313	-0.978	320.36	299.52	20.85	10.245	15.44	23423	0.695	8026	74.47	45.45	1.10	0.56	5.77	8.15	11.07

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	90.64	65.38	25.26	1491.7	49.19	23832	0.695	2113.2	113.45	60.45	1.98	0.86	5.77	10.21	12.66
1.639	-0.010	97.98	67.82	30.16	1490.7	49.44	23760	0.695	1775.0	94.98	53.80	1.98	0.88	5.77	9.09	11.78
2.129	-0.028	106.84	72.42	34.42	1488.8	49.92	23626	0.695	1552.5	82.55	48.90	1.98	0.94	5.77	8.47	11.31
2.639	0.000	111.76	77.20	34.56	1486.9	50.41	23488	0.695	1543.0	81.50	48.37	1.98	0.98	5.77	8.49	11.32
2.854	0.000	112.67	79.21	33.47	1486.0	50.62	23430	0.695	1587.0	83.60	49.16	1.98	1.00	5.77	8.68	11.46
1.404	0.375	93.61	65.61	28.00	1491.6	49.21	23825	0.695	1907.9	102.40	56.58	1.98	0.86	5.77	9.52	12.11
1.644	0.365	100.66	67.86	32.80	1490.6	49.44	23759	0.695	1632.3	87.34	50.89	1.98	0.88	5.77	8.64	11.44
2.114	0.375	108.86	72.28	36.58	1488.9	49.90	23630	0.695	1461.1	77.70	46.94	1.98	0.94	5.77	8.19	11.10
2.639	0.365	114.20	77.20	37.00	1486.9	50.41	23488	0.695	1441.0	76.11	46.18	1.98	0.98	5.77	8.18	11.09
2.879	0.360	114.74	79.44	35.30	1485.9	50.65	23423	0.695	1503.5	79.18	47.39	1.98	1.01	5.77	8.43	11.27
1.389	-0.375	95.66	65.47	30.19	1491.6	49.20	23830	0.695	1768.5	94.94	53.84	1.98	0.86	5.77	9.07	11.76
1.619	-0.360	101.29	67.63	33.67	1490.7	49.42	23766	0.695	1590.0	85.10	50.02	1.98	0.88	5.77	8.51	11.34
2.129	-0.365	111.17	72.42	38.75	1488.8	49.92	23626	0.695	1378.9	73.32	45.11	1.98	0.94	5.77	7.95	10.92
2.629	-0.385	116.25	77.10	39.15	1486.9	50.40	23490	0.695	1362.2	71.96	44.44	1.98	0.98	5.77	7.94	10.91
2.879	-0.385	116.97	79.44	37.53	1485.9	50.65	23423	0.695	1414.2	74.47	45.45	1.98	1.01	5.77	8.15	11.07

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 4
Date: 10 January 1992
Time: 14:18:25

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.68	52.74	311.18	100.43	16.30	0.00998	10.348	1500.8	70.83	10.27	9.73	1746	2.84	59.53	52.43

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	290.87	63.88
1.702	0.670	0.001	0.000	292.42	66.67
9.093	3.580	0.001	0.000	318.09	112.87
10.706	4.215	0.001	0.000	316.35	109.75

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	310.16	293.23	16.93	10.324	12.43	19660	0.695	10016	94.38	53.57	1.10	0.52	5.77	8.91	11.64
4.163	-0.025	315.05	294.88	20.17	10.319	12.50	19588	0.695	8431	79.12	47.54	1.10	0.54	5.77	8.03	10.98
5.408	-0.071	321.01	297.98	23.03	10.310	12.64	19454	0.695	7372	68.65	43.02	1.10	0.59	5.77	7.56	10.64
6.703	0.001	324.26	301.21	23.05	10.301	12.78	19318	0.695	7348	67.90	42.60	1.10	0.61	5.77	7.59	10.66
7.249	0.001	324.83	302.57	22.27	10.297	12.84	19263	0.694	7577	69.80	43.38	1.10	0.63	5.77	7.77	10.79
3.566	0.953	311.89	293.39	18.50	10.323	12.44	19654	0.695	9169	86.36	50.49	1.10	0.52	5.77	8.43	11.27
4.176	0.927	316.56	294.91	21.65	10.319	12.51	19587	0.695	7853	73.69	45.29	1.10	0.54	5.77	7.72	10.76
5.370	0.953	322.09	297.89	24.20	10.311	12.64	19458	0.695	7016	65.35	41.57	1.10	0.59	5.77	7.37	10.50
6.703	0.927	325.64	301.21	24.43	10.301	12.78	19318	0.695	6933	64.07	40.91	1.10	0.61	5.77	7.37	10.51
7.313	0.914	325.97	302.73	23.25	10.297	12.85	19257	0.694	7252	66.79	42.07	1.10	0.63	5.77	7.60	10.67
3.528	-0.953	313.18	293.29	19.89	10.323	12.43	19658	0.695	8527	80.34	48.10	1.10	0.52	5.77	8.07	11.01
4.112	-0.914	316.99	294.75	22.25	10.319	12.50	19594	0.695	7643	71.75	44.47	1.10	0.54	5.77	7.61	10.68
5.408	-0.927	323.57	297.98	25.59	10.310	12.64	19454	0.695	6634	61.78	39.96	1.10	0.59	5.77	7.18	10.37
6.678	-0.978	326.89	301.15	25.74	10.301	12.78	19321	0.695	6581	60.83	39.44	1.10	0.61	5.77	7.19	10.38
7.313	-0.978	327.32	302.73	24.60	10.297	12.85	19257	0.694	6854	63.12	40.44	1.10	0.63	5.77	7.38	10.52

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	98.60	68.12	30.48	1497.3	40.78	19660	0.695	1764.8	94.38	53.57	1.98	0.94	5.77	8.91	11.64
1.639	-0.010	107.39	71.09	36.31	1496.6	41.02	19588	0.695	1485.5	79.12	47.54	1.98	0.97	5.77	8.03	10.98
2.129	-0.028	118.14	76.68	41.45	1495.4	41.47	19454	0.695	1298.9	68.65	43.02	1.98	1.06	5.77	7.56	10.64
2.639	0.000	123.99	82.49	41.49	1494.1	41.94	19318	0.695	1294.7	67.90	42.60	1.98	1.10	5.77	7.59	10.66
2.854	0.000	125.01	84.93	40.08	1493.5	42.14	19263	0.694	1335.1	69.80	43.38	1.98	1.13	5.77	7.77	10.79
1.404	0.375	101.71	68.41	33.31	1497.2	40.80	19654	0.695	1615.6	86.36	50.49	1.98	0.94	5.77	8.43	11.27
1.644	0.365	110.12	71.15	38.97	1496.6	41.03	19587	0.695	1383.7	73.69	45.29	1.98	0.97	5.77	7.72	10.76
2.114	0.375	120.07	76.51	43.56	1495.4	41.46	19458	0.695	1236.2	65.35	41.57	1.98	1.06	5.77	7.37	10.50
2.639	0.365	126.47	82.49	43.98	1494.1	41.94	19318	0.695	1221.6	64.07	40.91	1.98	1.10	5.77	7.37	10.51
2.879	0.360	127.06	85.22	41.84	1493.4	42.16	19257	0.694	1277.8	66.79	42.07	1.98	1.13	5.77	7.60	10.67
1.389	-0.375	104.04	68.24	35.80	1497.3	40.79	19658	0.695	1502.5	80.34	48.10	1.98	0.94	5.77	8.07	11.01
1.619	-0.360	110.90	70.86	40.04	1496.7	41.00	19594	0.695	1346.7	71.75	44.47	1.98	0.96	5.77	7.61	10.68
2.129	-0.365	122.75	76.68	46.06	1495.4	41.47	19454	0.695	1168.9	61.78	39.96	1.98	1.06	5.77	7.18	10.37
2.629	-0.385	128.71	82.38	46.33	1494.1	41.93	19321	0.695	1159.6	60.83	39.44	1.98	1.10	5.77	7.19	10.38
2.879	-0.385	129.50	85.22	44.27	1493.4	42.16	19257	0.694	1207.7	63.12	40.44	1.98	1.13	5.77	7.38	10.52

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 5
Date: 10 January 1992
Time: 14:18:50

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.72	52.81	311.21	100.50	16.30	0.00998	10.349	1501.0	70.78	10.27	9.74	1746	2.84	59.53	52.43

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	290.91	63.96
1.702	0.670	0.001	0.000	292.45	66.73
9.093	3.580	0.001	0.000	318.12	112.92
10.706	4.215	0.001	0.000	316.37	109.79

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	310.16	293.27	16.89	10.325	12.43	19663	0.695	10039	94.59	53.64	1.10	0.52	5.77	8.92	11.65
4.163	-0.025	315.05	294.91	20.14	10.320	12.51	19591	0.695	8444	79.24	47.59	1.10	0.54	5.77	8.04	10.99
5.408	-0.071	321.00	298.02	22.98	10.312	12.64	19457	0.695	7390	68.81	43.09	1.10	0.59	5.77	7.57	10.64
6.703	0.001	324.23	301.25	22.98	10.303	12.79	19321	0.695	7373	68.12	42.69	1.10	0.61	5.77	7.60	10.67
7.249	0.001	324.82	302.61	22.22	10.299	12.85	19266	0.694	7594	69.96	43.45	1.10	0.63	5.77	7.77	10.79
3.566	0.953	311.91	293.42	18.48	10.325	12.44	19656	0.695	9180	86.46	50.53	1.10	0.52	5.77	8.43	11.28
4.176	0.927	316.59	294.95	21.64	10.320	12.51	19590	0.695	7858	73.73	45.30	1.10	0.54	5.77	7.73	10.76
5.370	0.953	322.10	297.93	24.17	10.312	12.64	19461	0.695	7024	65.42	41.61	1.10	0.59	5.77	7.37	10.51
6.703	0.927	325.63	301.25	24.38	10.303	12.79	19321	0.695	6948	64.20	40.96	1.10	0.61	5.77	7.38	10.51
7.313	0.914	325.99	302.76	23.23	10.298	12.85	19259	0.694	7259	66.85	42.09	1.10	0.63	5.77	7.60	10.67
3.528	-0.953	313.21	293.33	19.88	10.325	12.44	19660	0.695	8533	80.39	48.12	1.10	0.52	5.77	8.08	11.01
4.112	-0.914	317.02	294.79	22.24	10.321	12.50	19597	0.695	7647	71.78	44.48	1.10	0.54	5.77	7.61	10.68
5.408	-0.927	323.60	298.02	25.58	10.312	12.64	19457	0.695	6637	61.80	39.97	1.10	0.59	5.77	7.18	10.37
6.678	-0.978	326.92	301.19	25.74	10.303	12.78	19323	0.695	6582	60.83	39.44	1.10	0.61	5.77	7.19	10.38
7.313	-0.978	327.36	302.76	24.60	10.298	12.85	19259	0.694	6854	63.12	40.44	1.10	0.63	5.77	7.38	10.51

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	98.60	68.19	30.41	1497.5	40.79	19663	0.695	1768.9	94.59	53.64	1.98	0.94	5.77	8.92	11.65
1.639	-0.010	107.41	71.16	36.25	1496.8	41.03	19591	0.695	1487.8	79.24	47.59	1.98	0.97	5.77	8.04	10.99
2.129	-0.028	118.11	76.75	41.36	1495.6	41.48	19457	0.695	1302.1	68.81	43.09	1.98	1.06	5.77	7.57	10.64
2.639	0.000	123.92	82.56	41.36	1494.3	41.95	19321	0.695	1299.1	68.12	42.69	1.98	1.10	5.77	7.60	10.67
2.854	0.000	124.99	85.00	39.99	1493.7	42.15	19266	0.694	1338.1	69.96	43.45	1.98	1.13	5.77	7.77	10.79
1.404	0.375	101.74	68.47	33.27	1497.4	40.81	19656	0.695	1617.5	86.46	50.53	1.98	0.94	5.77	8.43	11.28
1.644	0.365	110.17	71.21	38.96	1496.8	41.03	19590	0.695	1384.6	73.73	45.30	1.98	0.97	5.77	7.73	10.76
2.114	0.375	120.09	76.58	43.51	1495.6	41.47	19461	0.695	1237.6	65.42	41.61	1.98	1.06	5.77	7.37	10.51
2.639	0.365	126.45	82.56	43.89	1494.3	41.95	19321	0.695	1224.2	64.20	40.96	1.98	1.10	5.77	7.38	10.51
2.879	0.360	127.09	85.29	41.81	1493.7	42.17	19259	0.694	1279.0	66.85	42.09	1.98	1.13	5.77	7.60	10.67
1.389	-0.375	104.09	68.30	35.78	1497.5	40.80	19660	0.695	1503.5	80.39	48.12	1.98	0.94	5.77	8.08	11.01
1.619	-0.360	110.96	70.93	40.03	1496.9	41.01	19597	0.695	1347.4	71.78	44.48	1.98	0.96	5.77	7.61	10.68
2.129	-0.365	122.80	76.75	46.05	1495.6	41.48	19457	0.695	1169.4	61.80	39.97	1.98	1.06	5.77	7.18	10.37
2.629	-0.385	128.78	82.45	46.33	1494.3	41.94	19323	0.695	1159.7	60.83	39.44	1.98	1.10	5.77	7.19	10.38
2.879	-0.385	129.56	85.29	44.28	1493.7	42.17	19259	0.694	1207.7	63.12	40.44	1.98	1.13	5.77	7.38	10.51

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 6
Date: 10 January 1992
Time: 14:19:16

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.72	52.81	311.20	100.47	16.30	0.00998	10.350	1501.2	70.80	10.27	9.74	1745	2.84	59.49	52.40

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	290.93	63.99
1.702	0.670	0.001	0.000	292.47	66.77
9.093	3.580	0.001	0.000	318.20	113.08
10.706	4.215	0.001	0.000	316.45	109.92

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	310.21	293.26	16.95	10.326	12.43	19663	0.695	10001	94.24	53.51	1.10	0.52	5.77	8.91	11.64
4.163	-0.025	315.10	294.91	20.19	10.321	12.50	19591	0.695	8417	78.99	47.49	1.10	0.54	5.77	8.03	10.98
5.408	-0.071	321.06	298.02	23.05	10.313	12.64	19456	0.695	7362	68.56	42.99	1.10	0.59	5.77	7.55	10.64
6.703	0.001	324.32	301.24	23.08	10.304	12.78	19321	0.695	7335	67.78	42.54	1.10	0.61	5.77	7.59	10.66
7.249	0.001	324.90	302.60	22.31	10.300	12.84	19265	0.694	7559	69.63	43.30	1.10	0.63	5.77	7.76	10.78
3.566	0.953	311.95	293.42	18.53	10.326	12.44	19656	0.695	9152	86.20	50.43	1.10	0.52	5.77	8.42	11.27
4.176	0.927	316.64	294.94	21.70	10.321	12.51	19589	0.695	7833	73.50	45.21	1.10	0.54	5.77	7.72	10.75
5.370	0.953	322.18	297.92	24.26	10.313	12.64	19460	0.695	6994	65.15	41.49	1.10	0.59	5.77	7.36	10.50
6.703	0.927	325.73	301.24	24.49	10.304	12.78	19321	0.695	6913	63.87	40.81	1.10	0.61	5.77	7.36	10.50
7.313	0.914	326.08	302.75	23.33	10.300	12.85	19259	0.694	7223	66.51	41.94	1.10	0.63	5.77	7.58	10.66
3.528	-0.953	313.27	293.33	19.95	10.326	12.43	19660	0.695	8497	80.05	47.98	1.10	0.52	5.77	8.06	11.00
4.112	-0.914	317.11	294.78	22.33	10.322	12.50	19596	0.695	7611	71.44	44.33	1.10	0.54	5.77	7.60	10.67
5.408	-0.927	323.70	298.02	25.69	10.313	12.64	19456	0.695	6605	61.51	39.84	1.10	0.59	5.77	7.17	10.36
6.678	-0.978	327.02	301.18	25.85	10.304	12.78	19323	0.695	6550	60.53	39.30	1.10	0.61	5.77	7.18	10.37
7.313	-0.978	327.48	302.75	24.73	10.300	12.85	19259	0.694	6813	62.74	40.27	1.10	0.63	5.77	7.36	10.50

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	98.69	68.19	30.50	1497.7	40.78	19663	0.695	1762.2	94.24	53.51	1.98	0.94	5.77	8.91	11.64
1.639	-0.010	107.49	71.15	36.34	1497.0	41.02	19591	0.695	1483.1	78.99	47.49	1.98	0.97	5.77	8.03	10.98
2.129	-0.028	118.22	76.74	41.48	1495.7	41.48	19456	0.695	1297.2	68.56	42.99	1.98	1.06	5.77	7.55	10.64
2.639	0.000	124.08	82.54	41.54	1494.4	41.94	19321	0.695	1292.4	67.78	42.54	1.98	1.10	5.77	7.59	10.66
2.854	0.000	125.14	84.98	40.15	1493.9	42.14	19265	0.694	1331.9	69.63	43.30	1.98	1.13	5.77	7.76	10.78
1.404	0.375	101.82	68.47	33.35	1497.6	40.81	19656	0.695	1612.6	86.20	50.43	1.98	0.94	5.77	8.42	11.27
1.644	0.365	110.26	71.21	39.05	1497.0	41.03	19589	0.695	1380.2	73.50	45.21	1.98	0.97	5.77	7.72	10.75
2.114	0.375	120.23	76.57	43.66	1495.8	41.46	19460	0.695	1232.3	65.15	41.49	1.98	1.06	5.77	7.36	10.50
2.639	0.365	126.62	82.54	44.08	1494.4	41.94	19321	0.695	1218.1	63.87	40.81	1.98	1.10	5.77	7.36	10.50
2.879	0.360	127.26	85.27	41.99	1493.8	42.16	19259	0.694	1272.7	66.51	41.94	1.98	1.13	5.77	7.58	10.66
1.389	-0.375	104.21	68.30	35.91	1497.6	40.79	19660	0.695	1497.2	80.05	47.98	1.98	0.94	5.77	8.06	11.00
1.619	-0.360	111.11	70.92	40.19	1497.1	41.00	19596	0.695	1341.1	71.44	44.33	1.98	0.96	5.77	7.60	10.67
2.129	-0.365	122.97	76.74	46.23	1495.7	41.48	19456	0.695	1163.8	61.51	39.84	1.98	1.06	5.77	7.17	10.36
2.629	-0.385	128.96	82.43	46.52	1494.5	41.93	19323	0.695	1154.1	60.53	39.30	1.98	1.10	5.77	7.18	10.37
2.879	-0.385	129.78	85.27	44.51	1493.8	42.16	19259	0.694	1200.5	62.74	40.27	1.98	1.13	5.77	7.36	10.50

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 7
Date: 10 January 1992
Time: 14:22:51

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
285.04	53.38	317.99	112.69	13.16	0.00806	10.367	1503.6	45.52	6.60	15.15	1754	2.36	59.80	52.67

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	293.23	68.13
1.702	0.670	0.001	0.000	295.09	71.47
9.093	3.580	0.001	0.000	326.47	127.96
10.706	4.215	0.001	0.000	324.50	124.42

Insulated-Side Temperatures and Calculated Data:
SI Units:

													---------Uncertainties---------			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	316.43	295.67	20.76	10.351	10.09	15790	0.695	8208	76.87	46.59	1.10	0.58	5.77	7.83	10.83
4.163	-0.025	322.43	297.72	24.71	10.348	10.16	15718	0.695	6914	64.43	41.17	1.10	0.61	5.77	7.15	10.35
5.408	-0.071	329.75	301.58	28.16	10.343	10.30	15587	0.695	6056	55.91	37.13	1.10	0.69	5.77	6.81	10.12
6.703	0.001	333.74	305.60	28.15	10.337	10.43	15456	0.694	6046	55.31	36.75	1.10	0.71	5.77	6.85	10.15
7.249	0.001	334.41	307.28	27.13	10.334	10.49	15401	0.694	6249	56.95	37.48	1.10	0.73	5.77	7.01	10.25
3.566	0.953	318.25	295.86	22.39	10.351	10.10	15783	0.695	7613	71.27	44.23	1.10	0.59	5.77	7.50	10.60
4.176	0.927	323.93	297.76	26.17	10.348	10.17	15717	0.695	6527	60.81	39.52	1.10	0.61	5.77	6.95	10.22
5.370	0.953	330.73	301.46	29.27	10.343	10.29	15591	0.695	5828	53.82	36.13	1.10	0.68	5.77	6.69	10.04
6.703	0.927	335.07	305.60	29.48	10.337	10.43	15456	0.694	5774	52.82	35.55	1.10	0.71	5.77	6.71	10.05
7.313	0.914	335.50	307.48	28.02	10.334	10.50	15395	0.694	6045	55.07	36.59	1.10	0.73	5.77	6.91	10.19
3.528	-0.953	319.70	295.75	23.95	10.351	10.10	15787	0.695	7115	66.63	42.21	1.10	0.58	5.77	7.23	10.41
4.112	-0.914	324.39	297.56	26.83	10.348	10.16	15724	0.695	6367	59.35	38.85	1.10	0.61	5.77	6.87	10.16
5.408	-0.927	332.46	301.58	30.88	10.343	10.30	15587	0.695	5524	51.00	34.75	1.10	0.69	5.77	6.54	9.94
6.678	-0.978	336.45	305.52	30.93	10.337	10.43	15458	0.694	5502	50.35	34.34	1.10	0.71	5.77	6.57	9.96
7.313	-0.978	336.99	307.48	29.51	10.334	10.50	15395	0.694	5740	52.29	35.25	1.10	0.73	5.77	6.75	10.08

English Units:

													---------Uncertainties---------			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	109.88	72.51	37.37	1501.3	33.12	15790	0.695	1446.2	76.87	46.59	1.98	1.05	5.77	7.83	10.83
1.639	-0.010	120.68	76.20	44.48	1500.9	33.35	15718	0.695	1218.2	64.43	41.17	1.98	1.10	5.77	7.15	10.35
2.129	-0.028	133.86	83.16	50.70	1500.1	33.78	15587	0.695	1067.1	55.91	37.13	1.98	1.23	5.77	6.81	10.12
2.639	0.000	141.05	90.38	50.67	1499.2	34.23	15456	0.694	1065.3	55.31	36.75	1.98	1.28	5.77	6.85	10.15
2.854	0.000	142.25	93.42	48.83	1498.9	34.42	15401	0.694	1101.1	56.95	37.48	1.98	1.32	5.77	7.01	10.25
1.404	0.375	113.17	72.87	40.30	1501.3	33.14	15783	0.695	1341.4	71.27	44.23	1.98	1.06	5.77	7.50	10.60
1.644	0.365	123.39	76.28	47.11	1500.9	33.35	15717	0.695	1150.1	60.81	39.52	1.98	1.11	5.77	6.95	10.22
2.114	0.375	135.63	82.95	52.68	1500.1	33.77	15591	0.695	1026.9	53.82	36.13	1.98	1.23	5.77	6.69	10.04
2.639	0.365	143.44	90.38	53.06	1499.2	34.23	15456	0.694	1017.4	52.82	35.55	1.98	1.28	5.77	6.71	10.05
2.879	0.360	144.21	93.77	50.43	1498.8	34.44	15395	0.694	1065.1	55.07	36.59	1.98	1.32	5.77	6.91	10.19
1.389	-0.375	115.76	72.65	43.11	1501.3	33.12	15787	0.695	1253.7	66.63	42.21	1.98	1.05	5.77	7.23	10.41
1.619	-0.360	124.22	75.92	48.30	1500.9	33.33	15724	0.695	1121.9	59.35	38.85	1.98	1.10	5.77	6.87	10.16
2.129	-0.365	138.74	83.16	55.58	1500.1	33.78	15587	0.695	973.3	51.00	34.75	1.98	1.23	5.77	6.54	9.94
2.629	-0.385	145.92	90.24	55.68	1499.3	34.22	15458	0.694	969.5	50.35	34.34	1.98	1.28	5.77	6.57	9.96
2.879	-0.385	146.89	93.77	53.12	1498.8	34.44	15395	0.694	1011.4	52.29	35.25	1.98	1.32	5.77	6.75	10.08

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 8
Date: 10 January 1992
Time: 14:23:17

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
285.14	53.57	318.05	112.80	13.17	0.00806	10.367	1503.6	45.55	6.61	15.14	1752	2.36	59.73	52.61

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	293.32	68.29
1.702	0.670	0.001	0.000	295.18	71.63
9.093	3.580	0.001	0.000	326.59	128.18
10.706	4.215	0.001	0.000	324.61	124.61

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	316.52	295.76	20.76	10.351	10.10	15792	0.695	8199	76.77	46.54	1.10	0.58	5.77	7.83	10.83
4.163	-0.025	322.52	297.81	24.72	10.348	10.17	15720	0.695	6904	64.32	41.12	1.10	0.61	5.77	7.15	10.35
5.408	-0.071	329.86	301.67	28.19	10.343	10.30	15589	0.695	6044	55.79	37.07	1.10	0.69	5.77	6.81	10.12
6.703	0.001	333.84	305.67	28.17	10.337	10.44	15458	0.694	6035	55.20	36.69	1.10	0.71	5.77	6.85	10.15
7.249	0.001	334.51	307.36	27.15	10.334	10.50	15404	0.694	6236	56.82	37.42	1.10	0.73	5.77	7.00	10.25
3.566	0.953	318.34	295.96	22.39	10.351	10.11	15785	0.695	7606	71.18	44.18	1.10	0.59	5.77	7.50	10.60
4.176	0.927	324.04	297.85	26.19	10.348	10.17	15719	0.695	6516	60.70	39.47	1.10	0.61	5.77	6.95	10.21
5.370	0.953	330.85	301.55	29.30	10.343	10.30	15593	0.695	5815	53.69	36.06	1.10	0.68	5.77	6.69	10.04
6.703	0.927	335.19	305.67	29.52	10.337	10.44	15458	0.694	5759	52.68	35.48	1.10	0.71	5.77	6.71	10.05
7.313	0.914	335.63	307.55	28.08	10.334	10.50	15398	0.694	6026	54.89	36.50	1.10	0.73	5.77	6.90	10.18
3.528	-0.953	319.80	295.84	23.97	10.351	10.10	15789	0.695	7102	66.49	42.15	1.10	0.58	5.77	7.23	10.41
4.112	-0.914	324.52	297.65	26.87	10.348	10.16	15726	0.695	6352	59.19	38.78	1.10	0.61	5.77	6.86	10.16
5.408	-0.927	332.59	301.67	30.93	10.343	10.30	15589	0.695	5509	50.85	34.67	1.10	0.69	5.77	6.54	9.94
6.678	-0.978	336.58	305.60	30.99	10.337	10.44	15461	0.694	5486	50.19	34.26	1.10	0.71	5.77	6.57	9.96
7.313	-0.978	337.13	307.55	29.58	10.334	10.50	15398	0.694	5721	52.10	35.16	1.10	0.73	5.77	6.74	10.07

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	110.04	72.68	37.36	1501.3	33.14	15792	0.695	1444.7	76.77	46.54	1.98	1.05	5.77	7.83	10.83
1.639	-0.010	120.86	76.36	44.49	1500.9	33.37	15720	0.695	1216.5	64.32	41.12	1.98	1.10	5.77	7.15	10.35
2.129	-0.028	134.05	83.31	50.74	1500.1	33.80	15589	0.695	1065.0	55.79	37.07	1.98	1.23	5.77	6.81	10.12
2.639	0.000	141.23	90.53	50.70	1499.2	34.25	15458	0.694	1063.4	55.20	36.69	1.98	1.28	5.77	6.85	10.15
2.854	0.000	142.43	93.56	48.88	1498.9	34.44	15404	0.694	1098.8	56.82	37.42	1.98	1.31	5.77	7.00	10.25
1.404	0.375	113.33	73.03	40.29	1501.3	33.16	15785	0.695	1340.2	71.18	44.18	1.98	1.05	5.77	7.50	10.60
1.644	0.365	123.58	76.44	47.14	1500.9	33.37	15719	0.695	1148.1	60.70	39.47	1.98	1.10	5.77	6.95	10.21
2.114	0.375	135.84	83.10	52.74	1500.1	33.79	15593	0.695	1024.6	53.69	36.06	1.98	1.23	5.77	6.69	10.04
2.639	0.365	143.66	90.53	53.13	1499.2	34.25	15458	0.694	1014.7	52.68	35.48	1.98	1.28	5.77	6.71	10.05
2.879	0.360	144.45	93.91	50.54	1498.8	34.46	15398	0.694	1061.8	54.89	36.50	1.98	1.32	5.77	6.90	10.18
1.389	-0.375	115.96	72.82	43.14	1501.3	33.15	15789	0.695	1251.4	66.49	42.15	1.98	1.05	5.77	7.23	10.41
1.619	-0.360	124.44	76.08	48.36	1500.9	33.35	15726	0.695	1119.2	59.19	38.78	1.98	1.10	5.77	6.86	10.16
2.129	-0.365	138.98	83.31	55.67	1500.1	33.80	15589	0.695	970.7	50.85	34.67	1.98	1.23	5.77	6.54	9.94
2.629	-0.385	146.16	90.39	55.77	1499.3	34.24	15461	0.694	966.6	50.19	34.26	1.98	1.28	5.77	6.57	9.96
2.879	-0.385	147.15	93.91	53.24	1498.8	34.46	15398	0.694	1008.0	52.10	35.16	1.98	1.32	5.77	6.74	10.07

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 9
Date: 10 January 1992
Time: 14:23:43

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
285.22	53.72	318.18	113.04	13.17	0.00806	10.368	1503.8	45.61	6.62	15.12	1755	2.36	59.83	52.70

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	293.40	68.42
1.702	0.670	0.001	0.000	295.24	71.75
9.093	3.580	0.001	0.000	326.68	128.34
10.706	4.215	0.001	0.000	324.70	124.77

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	316.60	295.86	20.74	10.352	10.10	15790	0.695	8218	76.93	46.60	1.10	0.58	5.77	7.83	10.83
4.163	-0.025	322.62	297.91	24.72	10.349	10.17	15719	0.695	6917	64.42	41.16	1.10	0.61	5.77	7.15	10.35
5.408	-0.071	329.95	301.77	28.18	10.344	10.31	15588	0.695	6057	55.90	37.12	1.10	0.69	5.77	6.81	10.12
6.703	0.001	333.94	305.79	28.16	10.338	10.44	15457	0.694	6048	55.31	36.75	1.10	0.71	5.77	6.85	10.15
7.249	0.001	334.61	307.47	27.14	10.335	10.50	15402	0.694	6250	56.94	37.48	1.10	0.73	5.77	7.01	10.25
3.566	0.953	318.44	296.05	22.38	10.352	10.11	15784	0.695	7621	71.30	44.23	1.10	0.59	5.77	7.50	10.60
4.176	0.927	324.13	297.95	26.18	10.349	10.18	15718	0.695	6529	60.81	39.52	1.10	0.61	5.77	6.95	10.22
5.370	0.953	330.95	301.65	29.29	10.344	10.30	15592	0.695	5827	53.79	36.11	1.10	0.68	5.77	6.69	10.04
6.703	0.927	335.29	305.79	29.50	10.338	10.44	15457	0.694	5772	52.78	35.53	1.10	0.71	5.77	6.71	10.05
7.313	0.914	335.72	307.67	28.05	10.335	10.51	15396	0.694	6043	55.03	36.57	1.10	0.73	5.77	6.90	10.18
3.528	-0.953	319.91	295.93	23.97	10.352	10.11	15788	0.695	7113	66.57	42.18	1.10	0.58	5.77	7.23	10.41
4.112	-0.914	324.62	297.75	26.87	10.350	10.17	15724	0.695	6362	59.27	38.81	1.10	0.61	5.77	6.86	10.16
5.408	-0.927	332.70	301.77	30.92	10.344	10.31	15588	0.695	5520	50.94	34.71	1.10	0.69	5.77	6.54	9.94
6.678	-0.978	336.67	305.71	30.96	10.338	10.44	15459	0.694	5500	50.31	34.32	1.10	0.71	5.77	6.57	9.96
7.313	-0.978	337.22	307.67	29.55	10.335	10.51	15396	0.694	5736	52.23	35.22	1.10	0.73	5.77	6.74	10.07

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	110.20	72.85	37.34	1501.5	33.15	15790	0.695	1448.0	76.93	46.60	1.98	1.05	5.77	7.83	10.83
1.639	-0.010	121.04	76.54	44.49	1501.0	33.38	15719	0.695	1218.8	64.42	41.16	1.98	1.10	5.77	7.15	10.35
2.129	-0.028	134.22	83.50	50.72	1500.2	33.82	15588	0.695	1067.2	55.90	37.12	1.98	1.23	5.77	6.81	10.12
2.639	0.000	141.41	90.73	50.68	1499.4	34.26	15457	0.694	1065.7	55.31	36.75	1.98	1.28	5.77	6.85	10.15
2.854	0.000	142.61	93.76	48.85	1499.0	34.45	15402	0.694	1101.3	56.94	37.48	1.98	1.32	5.77	7.01	10.25
1.404	0.375	113.50	73.21	40.29	1501.4	33.17	15784	0.695	1342.8	71.30	44.23	1.98	1.06	5.77	7.50	10.60
1.644	0.365	123.75	76.62	47.13	1501.0	33.39	15718	0.695	1150.4	60.81	39.52	1.98	1.11	5.77	6.95	10.22
2.114	0.375	136.02	83.29	52.73	1500.3	33.80	15592	0.695	1026.7	53.79	36.11	1.98	1.23	5.77	6.69	10.04
2.639	0.365	143.83	90.73	53.11	1499.4	34.26	15457	0.694	1017.0	52.78	35.53	1.98	1.28	5.77	6.71	10.05
2.879	0.360	144.60	94.12	50.48	1499.0	34.47	15396	0.694	1064.8	55.03	36.57	1.98	1.32	5.77	6.90	10.18
1.389	-0.375	116.15	72.99	43.15	1501.5	33.16	15788	0.695	1253.3	66.57	42.18	1.98	1.05	5.77	7.23	10.41
1.619	-0.360	124.63	76.26	48.37	1501.1	33.36	15724	0.695	1121.0	59.27	38.81	1.98	1.10	5.77	6.86	10.16
2.129	-0.365	139.16	83.50	55.66	1500.2	33.82	15588	0.695	972.6	50.94	34.71	1.98	1.23	5.77	6.54	9.94
2.629	-0.385	146.32	90.59	55.74	1499.4	34.25	15459	0.694	969.1	50.31	34.32	1.98	1.28	5.77	6.57	9.96
2.879	-0.385	147.30	94.12	53.19	1499.0	34.47	15396	0.694	1010.7	52.23	35.22	1.98	1.32	5.77	6.74	10.07

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 10
Date: 10 January 1992
Time: 14:28:46

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
285.78	54.72	327.51	129.82	10.45	0.00640	10.384	1506.1	28.35	4.11	24.32	1764	1.96	60.14	52.97

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	296.68	74.34
1.702	0.670	0.001	0.000	298.89	78.31
9.093	3.580	0.001	0.000	337.91	148.54
10.706	4.215	0.001	0.000	335.66	144.50

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	324.85	299.24	25.60	10.374	8.09	12436	0.695	6691	62.11	40.08	1.10	0.68	5.77	7.00	10.25
4.163	-0.025	332.30	301.84	30.46	10.373	8.16	12367	0.695	5641	52.04	35.25	1.10	0.72	5.77	6.49	9.91
5.408	-0.071	341.47	306.73	34.74	10.369	8.29	12241	0.694	4937	45.05	31.62	1.10	0.82	5.77	6.26	9.76
6.703	0.001	346.46	311.81	34.64	10.366	8.42	12112	0.694	4940	44.56	31.27	1.10	0.86	5.77	6.30	9.79
7.249	0.001	347.25	313.95	33.30	10.364	8.48	12058	0.694	5118	45.95	31.95	1.10	0.88	5.77	6.45	9.88
3.566	0.953	326.74	299.49	27.25	10.374	8.10	12429	0.695	6291	58.36	38.34	1.10	0.68	5.77	6.79	10.11
4.176	0.927	333.75	301.89	31.86	10.373	8.16	12366	0.695	5392	49.75	34.12	1.10	0.72	5.77	6.37	9.83
5.370	0.953	342.31	306.58	35.73	10.369	8.28	12244	0.694	4801	43.82	30.98	1.10	0.82	5.77	6.18	9.71
6.703	0.927	347.73	311.81	35.91	10.366	8.42	12112	0.694	4765	42.98	30.45	1.10	0.86	5.77	6.21	9.73
7.313	0.914	348.29	314.20	34.09	10.364	8.48	12052	0.694	4997	44.84	31.38	1.10	0.88	5.77	6.39	9.84
3.528	-0.953	328.39	299.34	29.05	10.374	8.09	12434	0.695	5899	54.74	36.62	1.10	0.68	5.77	6.59	9.97
4.112	-0.914	334.25	301.64	32.61	10.373	8.15	12373	0.695	5267	48.62	33.55	1.10	0.72	5.77	6.30	9.78
5.408	-0.927	344.33	306.73	37.60	10.369	8.29	12241	0.694	4561	41.62	29.81	1.10	0.82	5.77	6.07	9.64
6.678	-0.978	349.21	311.72	37.49	10.366	8.42	12114	0.694	4565	41.19	29.50	1.10	0.85	5.77	6.11	9.66
7.313	-0.978	349.92	314.20	35.72	10.364	8.48	12052	0.694	4768	42.79	30.31	1.10	0.88	5.77	6.27	9.76

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	125.04	78.95	46.09	1504.7	26.54	12436	0.695	1179.0	62.11	40.08	1.98	1.22	5.77	7.00	10.25
1.639	-0.010	138.44	83.62	54.82	1504.4	26.77	12367	0.695	993.9	52.04	35.25	1.98	1.30	5.77	6.49	9.91
2.129	-0.028	154.96	92.43	62.53	1503.9	27.19	12241	0.694	869.9	45.05	31.62	1.98	1.48	5.77	6.26	9.76
2.639	0.000	163.93	101.58	62.36	1503.4	27.63	12112	0.694	870.4	44.56	31.27	1.98	1.54	5.77	6.30	9.79
2.854	0.000	165.36	105.42	59.94	1503.2	27.82	12058	0.694	901.8	45.95	31.95	1.98	1.58	5.77	6.45	9.88
1.404	0.375	128.44	79.40	49.04	1504.7	26.56	12429	0.695	1108.5	58.36	38.34	1.98	1.23	5.77	6.79	10.11
1.644	0.365	141.06	83.71	57.35	1504.4	26.77	12366	0.695	950.1	49.75	34.12	1.98	1.30	5.77	6.37	9.83
2.114	0.375	156.47	92.16	64.31	1503.9	27.18	12244	0.694	845.9	43.82	30.98	1.98	1.48	5.77	6.18	9.71
2.639	0.365	166.22	101.58	64.65	1503.4	27.63	12112	0.694	839.6	42.98	30.45	1.98	1.54	5.77	6.21	9.73
2.879	0.360	167.22	105.87	61.35	1503.1	27.84	12052	0.694	880.5	44.84	31.38	1.98	1.59	5.77	6.39	9.84
1.389	-0.375	131.41	79.13	52.28	1504.7	26.55	12434	0.695	1039.4	54.74	36.62	1.98	1.23	5.77	6.59	9.97
1.619	-0.360	141.97	83.26	58.71	1504.4	26.75	12373	0.695	928.0	48.62	33.55	1.98	1.30	5.77	6.30	9.78
2.129	-0.365	160.11	92.43	67.68	1503.9	27.19	12241	0.694	803.6	41.62	29.81	1.98	1.48	5.77	6.07	9.64
2.629	-0.385	168.89	101.40	67.49	1503.4	27.62	12114	0.694	804.4	41.19	29.50	1.98	1.54	5.77	6.11	9.66
2.879	-0.385	170.17	105.87	64.30	1503.1	27.84	12052	0.694	840.1	42.79	30.31	1.98	1.59	5.77	6.27	9.76

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 11
Date: 10 January 1992
Time: 14:29:11

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
285.79	54.73	327.55	129.90	10.45	0.00640	10.384	1506.1	28.28	4.10	24.38	1765	1.96	60.17	53.00

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	296.73	74.42
1.702	0.670	0.001	0.000	298.94	78.41
9.093	3.580	0.001	0.000	337.99	148.70
10.706	4.215	0.001	0.000	335.74	144.64

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	324.89	299.26	25.63	10.374	8.09	12435	0.695	6689	62.09	40.07	1.10	0.68	5.77	7.00	10.25
4.163	-0.025	332.35	301.86	30.49	10.372	8.16	12366	0.695	5640	52.03	35.25	1.10	0.72	5.77	6.49	9.91
5.408	-0.071	341.54	306.76	34.78	10.369	8.29	12239	0.694	4935	45.03	31.61	1.10	0.82	5.77	6.25	9.75
6.703	0.001	346.54	311.84	34.70	10.365	8.42	12110	0.694	4936	44.53	31.26	1.10	0.86	5.77	6.30	9.78
7.249	0.001	347.33	313.98	33.35	10.364	8.48	12057	0.694	5115	45.92	31.94	1.10	0.88	5.77	6.44	9.88
3.566	0.953	326.79	299.51	27.28	10.374	8.10	12428	0.695	6288	58.33	38.32	1.10	0.68	5.77	6.79	10.10
4.176	0.927	333.84	301.91	31.93	10.372	8.16	12365	0.695	5386	49.68	34.08	1.10	0.73	5.77	6.36	9.82
5.370	0.953	342.40	306.61	35.79	10.369	8.28	12243	0.694	4796	43.78	30.96	1.10	0.82	5.77	6.18	9.71
6.703	0.927	347.82	311.84	35.98	10.365	8.42	12110	0.694	4760	42.94	30.43	1.10	0.86	5.77	6.21	9.73
7.313	0.914	348.36	314.23	34.13	10.364	8.49	12051	0.694	4994	44.81	31.36	1.10	0.88	5.77	6.39	9.84
3.528	-0.953	328.45	299.36	29.09	10.374	8.09	12432	0.695	5896	54.71	36.61	1.10	0.68	5.77	6.58	9.97
4.112	-0.914	334.33	301.66	32.68	10.373	8.15	12371	0.695	5262	48.56	33.52	1.10	0.72	5.77	6.29	9.78
5.408	-0.927	344.43	306.76	37.67	10.369	8.29	12239	0.694	4557	41.58	29.79	1.10	0.82	5.77	6.07	9.64
6.678	-0.978	349.30	311.74	37.56	10.365	8.42	12113	0.694	4561	41.15	29.47	1.10	0.86	5.77	6.11	9.66
7.313	-0.978	350.00	314.23	35.77	10.364	8.49	12051	0.694	4765	42.76	30.29	1.10	0.88	5.77	6.26	9.76

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	125.12	78.99	46.14	1504.7	26.54	12435	0.695	1178.6	62.09	40.07	1.98	1.22	5.77	7.00	10.25
1.639	-0.010	138.53	83.66	54.88	1504.4	26.77	12366	0.695	993.8	52.03	35.25	1.98	1.30	5.77	6.49	9.91
2.129	-0.028	155.08	92.47	62.61	1503.9	27.19	12239	0.694	869.5	45.03	31.61	1.98	1.48	5.77	6.25	9.75
2.639	0.000	164.09	101.63	62.46	1503.4	27.63	12110	0.694	869.7	44.53	31.26	1.98	1.54	5.77	6.30	9.78
2.854	0.000	165.51	105.48	60.04	1503.1	27.82	12057	0.694	901.3	45.92	31.94	1.98	1.58	5.77	6.44	9.88
1.404	0.375	128.54	79.43	49.11	1504.6	26.56	12428	0.695	1107.9	58.33	38.32	1.98	1.23	5.77	6.79	10.10
1.644	0.365	141.22	83.75	57.47	1504.4	26.77	12365	0.695	949.0	49.68	34.08	1.98	1.31	5.77	6.36	9.82
2.114	0.375	156.63	92.21	64.42	1503.9	27.18	12243	0.694	845.1	43.78	30.96	1.98	1.48	5.77	6.18	9.71
2.639	0.365	166.40	101.63	64.77	1503.4	27.63	12110	0.694	838.7	42.94	30.43	1.98	1.54	5.77	6.21	9.73
2.879	0.360	167.37	105.93	61.44	1503.1	27.84	12051	0.694	879.9	44.81	31.36	1.98	1.59	5.77	6.39	9.84
1.389	-0.375	131.52	79.16	52.36	1504.6	26.55	12432	0.695	1038.9	54.71	36.61	1.98	1.23	5.77	6.58	9.97
1.619	-0.360	142.11	83.30	58.82	1504.4	26.75	12371	0.695	927.2	48.56	33.52	1.98	1.30	5.77	6.29	9.78
2.129	-0.365	160.28	92.47	67.81	1503.9	27.19	12239	0.694	802.9	41.58	29.79	1.98	1.48	5.77	6.07	9.64
2.629	-0.385	169.05	101.45	67.60	1503.4	27.62	12113	0.694	803.6	41.15	29.47	1.98	1.54	5.77	6.11	9.66
2.879	-0.385	170.32	105.93	64.39	1503.1	27.84	12051	0.694	839.6	42.76	30.29	1.98	1.59	5.77	6.26	9.76

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 12
Date: 10 January 1992
Time: 14:29:36

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
285.80	54.76	327.64	130.06	10.45	0.00640	10.384	1506.1	28.34	4.11	24.33	1769	1.96	60.31	53.12

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	296.77	74.49
1.702	0.670	0.001	0.000	298.97	78.45
9.093	3.580	0.001	0.000	338.04	148.77
10.706	4.215	0.001	0.000	335.79	144.73

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	324.92	299.30	25.62	10.374	8.09	12437	0.695	6707	62.24	40.13	1.10	0.68	5.77	7.00	10.25
4.163	-0.025	332.38	301.90	30.48	10.373	8.16	12368	0.695	5653	52.14	35.30	1.10	0.73	5.77	6.49	9.91
5.408	-0.071	341.59	306.81	34.78	10.369	8.29	12241	0.694	4945	45.11	31.65	1.10	0.82	5.77	6.25	9.75
6.703	0.001	346.60	311.90	34.69	10.366	8.43	12112	0.694	4947	44.62	31.30	1.10	0.86	5.77	6.30	9.79
7.249	0.001	347.38	314.05	33.34	10.364	8.48	12058	0.694	5128	46.03	31.99	1.10	0.88	5.77	6.44	9.88
3.566	0.953	326.84	299.55	27.29	10.374	8.10	12430	0.695	6299	58.43	38.37	1.10	0.69	5.77	6.79	10.10
4.176	0.927	333.88	301.95	31.92	10.373	8.16	12367	0.695	5397	49.78	34.13	1.10	0.73	5.77	6.36	9.82
5.370	0.953	342.44	306.66	35.78	10.369	8.29	12245	0.694	4808	43.88	31.01	1.10	0.82	5.77	6.18	9.71
6.703	0.927	347.87	311.90	35.96	10.366	8.43	12112	0.694	4772	43.04	30.48	1.10	0.86	5.77	6.21	9.73
7.313	0.914	348.40	314.30	34.11	10.364	8.49	12052	0.694	5009	44.93	31.42	1.10	0.88	5.77	6.39	9.84
3.528	-0.953	328.51	299.40	29.11	10.374	8.10	12434	0.695	5904	54.78	36.64	1.10	0.68	5.77	6.58	9.97
4.112	-0.914	334.39	301.70	32.69	10.373	8.16	12373	0.695	5271	48.64	33.56	1.10	0.72	5.77	6.29	9.78
5.408	-0.927	344.46	306.81	37.65	10.369	8.29	12241	0.694	4568	41.67	29.83	1.10	0.82	5.77	6.07	9.64
6.678	-0.978	349.35	311.81	37.55	10.366	8.42	12114	0.694	4572	41.24	29.52	1.10	0.86	5.77	6.11	9.66
7.313	-0.978	350.05	314.30	35.76	10.364	8.49	12052	0.694	4777	42.86	30.34	1.10	0.88	5.77	6.27	9.76

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	125.17	79.06	46.11	1504.7	26.55	12437	0.695	1181.8	62.24	40.13	1.98	1.23	5.77	7.00	10.25
1.639	-0.010	138.60	83.74	54.86	1504.4	26.78	12368	0.695	996.1	52.14	35.30	1.98	1.31	5.77	6.49	9.91
2.129	-0.028	155.18	92.57	62.61	1503.9	27.20	12241	0.694	871.3	45.11	31.65	1.98	1.48	5.77	6.25	9.75
2.639	0.000	164.19	101.74	62.45	1503.4	27.64	12112	0.694	871.7	44.62	31.30	1.98	1.54	5.77	6.30	9.79
2.854	0.000	165.60	105.59	60.01	1503.2	27.83	12058	0.694	903.6	46.03	31.99	1.98	1.58	5.77	6.44	9.88
1.404	0.375	128.62	79.50	49.12	1504.7	26.57	12430	0.695	1109.9	58.43	38.37	1.98	1.23	5.77	6.79	10.10
1.644	0.365	141.29	83.83	57.46	1504.4	26.78	12367	0.695	951.0	49.78	34.13	1.98	1.31	5.77	6.36	9.82
2.114	0.375	156.70	92.30	64.40	1503.9	27.19	12245	0.694	847.2	43.88	31.01	1.98	1.48	5.77	6.18	9.71
2.639	0.365	166.47	101.74	64.74	1503.4	27.64	12112	0.694	840.8	43.04	30.48	1.98	1.54	5.77	6.21	9.73
2.879	0.360	167.43	106.04	61.39	1503.1	27.85	12052	0.694	882.6	44.93	31.42	1.98	1.59	5.77	6.39	9.84
1.389	-0.375	131.63	79.23	52.39	1504.7	26.56	12434	0.695	1040.3	54.78	36.64	1.98	1.23	5.77	6.58	9.97
1.619	-0.360	142.21	83.37	58.84	1504.4	26.76	12373	0.695	928.8	48.64	33.56	1.98	1.30	5.77	6.29	9.78
2.129	-0.365	160.35	92.57	67.78	1503.9	27.20	12241	0.694	804.9	41.67	29.83	1.98	1.48	5.77	6.07	9.64
2.629	-0.385	169.14	101.56	67.58	1503.4	27.64	12114	0.694	805.6	41.24	29.52	1.98	1.54	5.77	6.11	9.66
2.879	-0.385	170.41	106.04	64.36	1503.1	27.85	12052	0.694	841.7	42.86	30.34	1.98	1.59	5.77	6.27	9.76

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 13
Date: 10 January 1992
Time: 14:33:56

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
286.53	56.07	347.70	166.17	7.14	0.00437	10.396	1507.8	12.49	1.81	55.22	1766	1.53	60.21	53.03

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	303.92	87.36
1.702	0.670	0.001	0.000	306.91	92.75
9.093	3.580	0.001	0.000	361.97	191.86
10.706	4.215	0.001	0.000	359.32	187.09

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	341.87	306.27	35.60	10.392	5.64	8367	0.694	4819	44.01	31.09	1.10	0.91	5.77	6.17	9.70
4.163	-0.025	352.33	310.07	42.26	10.391	5.71	8301	0.694	4071	36.87	27.15	1.10	0.99	5.77	5.84	9.50
5.408	-0.071	365.44	317.25	48.20	10.389	5.84	8179	0.693	3563	31.76	24.11	1.10	1.15	5.77	5.73	9.43
6.703	0.001	372.70	324.70	48.00	10.388	5.97	8056	0.693	3569	31.30	23.75	1.10	1.19	5.77	5.78	9.46
7.249	0.001	373.77	327.83	45.94	10.387	6.02	8005	0.693	3715	32.35	24.33	1.10	1.22	5.77	5.91	9.54
3.566	0.953	343.98	306.63	37.35	10.392	5.65	8360	0.694	4595	41.94	29.98	1.10	0.92	5.77	6.06	9.63
4.176	0.927	353.73	310.15	43.58	10.391	5.71	8299	0.694	3947	35.74	26.51	1.10	0.99	5.77	5.78	9.46
5.370	0.953	366.05	317.03	49.02	10.389	5.83	8182	0.693	3504	31.24	23.80	1.10	1.14	5.77	5.69	9.41
6.703	0.927	373.86	324.70	49.16	10.388	5.97	8056	0.693	3485	30.56	23.31	1.10	1.19	5.77	5.74	9.43
7.313	0.914	374.66	328.19	46.47	10.387	6.03	7999	0.693	3670	31.94	24.09	1.10	1.23	5.77	5.90	9.53
3.528	-0.953	345.91	306.41	39.50	10.392	5.64	8364	0.694	4344	39.66	28.75	1.10	0.92	5.77	5.93	9.55
4.112	-0.914	354.23	309.78	44.45	10.391	5.70	8306	0.694	3869	35.06	26.12	1.10	0.98	5.77	5.74	9.43
5.408	-0.927	368.56	317.25	51.31	10.389	5.84	8179	0.693	3347	29.83	22.96	1.10	1.15	5.77	5.62	9.36
6.678	-0.978	375.41	324.55	50.86	10.388	5.96	8058	0.693	3369	29.56	22.72	1.10	1.19	5.77	5.67	9.39
7.313	-0.978	376.54	328.19	48.34	10.387	6.03	7999	0.693	3528	30.70	23.36	1.10	1.23	5.77	5.81	9.48

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	155.68	91.60	64.08	1507.2	18.50	8367	0.694	849.1	44.01	31.09	1.98	1.64	5.77	6.17	9.70
1.639	-0.010	174.50	98.44	76.06	1507.1	18.73	8301	0.694	717.3	36.87	27.15	1.98	1.77	5.77	5.84	9.50
2.129	-0.028	198.11	111.36	86.75	1506.9	19.14	8179	0.693	627.8	31.76	24.11	1.98	2.06	5.77	5.73	9.43
2.639	0.000	211.17	124.76	86.40	1506.6	19.58	8056	0.693	628.9	31.30	23.75	1.98	2.15	5.77	5.78	9.46
2.854	0.000	213.10	130.40	82.70	1506.5	19.76	8005	0.693	654.6	32.35	24.33	1.98	2.20	5.77	5.91	9.54
1.404	0.375	159.47	92.25	67.22	1507.2	18.53	8360	0.694	809.6	41.94	29.98	1.98	1.65	5.77	6.06	9.63
1.644	0.365	177.02	98.58	78.44	1507.1	18.73	8299	0.694	695.5	35.74	26.51	1.98	1.78	5.77	5.78	9.46
2.114	0.375	199.19	110.96	88.23	1506.9	19.13	8182	0.693	617.4	31.24	23.80	1.98	2.05	5.77	5.69	9.41
2.639	0.365	213.26	124.76	88.50	1506.6	19.58	8056	0.693	614.1	30.56	23.31	1.98	2.15	5.77	5.74	9.43
2.879	0.360	214.70	131.06	83.64	1506.5	19.78	7999	0.693	646.7	31.94	24.09	1.98	2.21	5.77	5.90	9.53
1.389	-0.375	162.96	91.86	71.10	1507.2	18.51	8364	0.694	765.4	39.66	28.75	1.98	1.65	5.77	5.93	9.55
1.619	-0.360	177.93	97.91	80.02	1507.1	18.71	8306	0.694	681.7	35.06	26.12	1.98	1.76	5.77	5.74	9.43
2.129	-0.365	203.72	111.36	92.36	1506.9	19.14	8179	0.693	589.7	29.83	22.96	1.98	2.06	5.77	5.62	9.36
2.629	-0.385	216.05	124.51	91.54	1506.6	19.57	8058	0.693	593.6	29.56	22.72	1.98	2.14	5.77	5.67	9.39
2.879	-0.385	218.08	131.06	87.02	1506.5	19.78	7999	0.693	621.6	30.70	23.36	1.98	2.21	5.77	5.81	9.48

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 14
Date: 10 January 1992
Time: 14:34:21

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
286.66	56.31	347.79	166.34	7.13	0.00437	10.396	1507.8	12.50	1.81	55.16	1764	1.53	60.14	52.97

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	304.04	87.58
1.702	0.670	0.001	0.000	307.02	92.96
9.093	3.580	0.001	0.000	362.11	192.10
10.706	4.215	0.001	0.000	359.44	187.30

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	342.01	306.39	35.62	10.391	5.64	8357	0.694	4809	43.91	31.03	1.10	0.91	5.77	6.17	9.70
4.163	-0.025	352.45	310.19	42.26	10.391	5.70	8291	0.694	4064	36.80	27.11	1.10	0.99	5.77	5.84	9.50
5.408	-0.071	365.58	317.36	48.22	10.389	5.83	8169	0.693	3556	31.69	24.07	1.10	1.15	5.77	5.73	9.43
6.703	0.001	372.83	324.80	48.03	10.388	5.96	8047	0.693	3562	31.23	23.71	1.10	1.19	5.77	5.78	9.46
7.249	0.001	373.91	327.93	45.98	10.387	6.02	7996	0.693	3706	32.27	24.28	1.10	1.22	5.77	5.91	9.54
3.566	0.953	344.08	306.75	37.33	10.391	5.64	8351	0.694	4590	41.88	29.95	1.10	0.92	5.77	6.06	9.63
4.176	0.927	353.85	310.26	43.58	10.391	5.71	8290	0.694	3941	35.67	26.47	1.10	0.99	5.77	5.78	9.46
5.370	0.953	366.17	317.14	49.03	10.389	5.83	8173	0.693	3498	31.18	23.77	1.10	1.14	5.77	5.69	9.41
6.703	0.927	373.98	324.80	49.18	10.388	5.96	8047	0.693	3479	30.50	23.28	1.10	1.19	5.77	5.74	9.43
7.313	0.914	374.79	328.30	46.50	10.387	6.03	7990	0.693	3662	31.87	24.05	1.10	1.23	5.77	5.89	9.53
3.528	-0.953	346.03	306.53	39.50	10.391	5.64	8355	0.694	4337	39.59	28.71	1.10	0.91	5.77	5.93	9.55
4.112	-0.914	354.31	309.89	44.42	10.391	5.70	8296	0.694	3867	35.03	26.11	1.10	0.98	5.77	5.74	9.43
5.408	-0.927	368.67	317.36	51.32	10.389	5.83	8169	0.693	3341	29.78	22.93	1.10	1.15	5.77	5.62	9.36
6.678	-0.978	375.53	324.66	50.87	10.388	5.96	8049	0.693	3363	29.50	22.68	1.10	1.19	5.77	5.67	9.39
7.313	-0.978	376.66	328.30	48.36	10.387	6.03	7990	0.693	3521	30.64	23.32	1.10	1.23	5.77	5.81	9.48

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	155.92	91.81	64.11	1507.2	18.49	8357	0.694	847.3	43.91	31.03	1.98	1.64	5.77	6.17	9.70
1.639	-0.010	174.72	98.65	76.07	1507.0	18.72	8291	0.694	716.1	36.80	27.11	1.98	1.77	5.77	5.84	9.50
2.129	-0.028	198.35	111.55	86.80	1506.8	19.13	8169	0.693	626.6	31.69	24.07	1.98	2.06	5.77	5.73	9.43
2.639	0.000	211.40	124.96	86.45	1506.6	19.57	8047	0.693	627.6	31.23	23.71	1.98	2.14	5.77	5.78	9.46
2.854	0.000	213.35	130.59	82.76	1506.5	19.75	7996	0.693	653.0	32.27	24.28	1.98	2.20	5.77	5.91	9.54
1.404	0.375	159.66	92.46	67.20	1507.1	18.52	8351	0.694	808.8	41.88	29.95	1.98	1.65	5.77	6.06	9.63
1.644	0.365	177.23	98.78	78.45	1507.0	18.72	8290	0.694	694.4	35.67	26.47	1.98	1.78	5.77	5.78	9.46
2.114	0.375	199.41	111.16	88.25	1506.8	19.12	8173	0.693	616.3	31.18	23.77	1.98	2.05	5.77	5.69	9.41
2.639	0.365	213.48	124.96	88.53	1506.6	19.57	8047	0.693	613.0	30.50	23.28	1.98	2.14	5.77	5.74	9.43
2.879	0.360	214.94	131.24	83.69	1506.5	19.77	7990	0.693	645.2	31.87	24.05	1.98	2.21	5.77	5.89	9.53
1.389	-0.375	163.16	92.07	71.10	1507.2	18.50	8355	0.694	764.2	39.59	28.71	1.98	1.65	5.77	5.93	9.55
1.619	-0.360	178.07	98.12	79.95	1507.1	18.70	8296	0.694	681.4	35.03	26.11	1.98	1.76	5.77	5.74	9.43
2.129	-0.365	203.92	111.55	92.37	1506.8	19.13	8169	0.693	588.7	29.78	22.93	1.98	2.06	5.77	5.62	9.36
2.629	-0.385	216.27	124.70	91.57	1506.6	19.56	8049	0.693	592.6	29.50	22.68	1.98	2.14	5.77	5.67	9.39
2.879	-0.385	218.29	131.24	87.05	1506.5	19.77	7990	0.693	620.4	30.64	23.32	1.98	2.21	5.77	5.81	9.48

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 15
Date: 10 January 1992
Time: 14:34:47

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
286.74	56.45	347.86	166.47	7.13	0.00437	10.396	1507.8	12.47	1.81	55.31	1764	1.53	60.14	52.97

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	304.10	87.69
1.702	0.670	0.001	0.000	307.08	93.06
9.093	3.580	0.001	0.000	362.22	192.31
10.706	4.215	0.001	0.000	359.55	187.50

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	342.08	306.46	35.62	10.392	5.64	8360	0.694	4810	43.92	31.04	1.10	0.91	5.77	6.17	9.70
4.163	-0.025	352.52	310.27	42.26	10.391	5.71	8294	0.694	4066	36.80	27.11	1.10	0.99	5.77	5.84	9.50
5.408	-0.071	365.66	317.43	48.23	10.389	5.84	8172	0.693	3556	31.69	24.07	1.10	1.15	5.77	5.73	9.43
6.703	0.001	372.92	324.88	48.04	10.388	5.97	8049	0.693	3563	31.23	23.71	1.10	1.19	5.77	5.78	9.46
7.249	0.001	374.00	328.01	45.99	10.387	6.02	7999	0.693	3706	32.27	24.28	1.10	1.22	5.77	5.91	9.54
3.566	0.953	344.17	306.83	37.34	10.392	5.65	8353	0.694	4591	41.88	29.95	1.10	0.92	5.77	6.06	9.63
4.176	0.927	353.93	310.34	43.59	10.391	5.71	8292	0.694	3941	35.67	26.47	1.10	0.99	5.77	5.78	9.46
5.370	0.953	366.24	317.21	49.02	10.389	5.83	8176	0.693	3499	31.19	23.77	1.10	1.14	5.77	5.69	9.41
6.703	0.927	374.07	324.88	49.19	10.388	5.97	8049	0.693	3479	30.50	23.28	1.10	1.19	5.77	5.74	9.43
7.313	0.914	374.89	328.37	46.52	10.387	6.03	7993	0.693	3661	31.85	24.03	1.10	1.23	5.77	5.89	9.53
3.528	-0.953	346.15	306.61	39.54	10.392	5.64	8357	0.694	4334	39.56	28.69	1.10	0.91	5.77	5.92	9.55
4.112	-0.914	354.45	309.97	44.48	10.391	5.70	8299	0.694	3862	34.98	26.08	1.10	0.98	5.77	5.73	9.43
5.408	-0.927	368.79	317.43	51.36	10.389	5.84	8172	0.693	3340	29.75	22.90	1.10	1.15	5.77	5.61	9.36
6.678	-0.978	375.64	324.73	50.91	10.388	5.97	8052	0.693	3362	29.48	22.66	1.10	1.19	5.77	5.67	9.39
7.313	-0.978	376.77	328.37	48.40	10.387	6.03	7993	0.693	3520	30.62	23.31	1.10	1.23	5.77	5.81	9.48

English Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	156.06	91.95	64.11	1507.2	18.51	8360	0.694	847.5	43.92	31.04	1.98	1.64	5.77	6.17	9.70
1.639	-0.010	174.85	98.79	76.06	1507.1	18.73	8294	0.694	716.4	36.80	27.11	1.98	1.77	5.77	5.84	9.50
2.129	-0.028	198.51	111.69	86.81	1506.9	19.15	8172	0.693	626.6	31.69	24.07	1.98	2.06	5.77	5.73	9.43
2.639	0.000	211.56	125.09	86.47	1506.6	19.58	8049	0.693	627.8	31.23	23.71	1.98	2.14	5.77	5.78	9.46
2.854	0.000	213.50	130.72	82.78	1506.5	19.76	7999	0.693	653.0	32.27	24.28	1.98	2.20	5.77	5.91	9.54
1.404	0.375	159.81	92.60	67.21	1507.2	18.53	8353	0.694	808.9	41.88	29.95	1.98	1.65	5.77	6.06	9.63
1.644	0.365	177.39	98.92	78.46	1507.1	18.73	8292	0.694	694.4	35.67	26.47	1.98	1.78	5.77	5.78	9.46
2.114	0.375	199.54	111.30	88.24	1506.9	19.13	8176	0.693	616.5	31.19	23.77	1.98	2.05	5.77	5.69	9.41
2.639	0.365	213.64	125.09	88.55	1506.6	19.58	8049	0.693	613.0	30.50	23.28	1.98	2.14	5.77	5.74	9.43
2.879	0.360	215.12	131.38	83.74	1506.5	19.78	7993	0.693	645.1	31.85	24.03	1.98	2.21	5.77	5.89	9.53
1.389	-0.375	163.38	92.21	71.17	1507.2	18.52	8357	0.694	763.7	39.56	28.69	1.98	1.65	5.77	5.92	9.55
1.619	-0.360	178.33	98.26	80.07	1507.1	18.71	8299	0.694	680.5	34.98	26.08	1.98	1.76	5.77	5.73	9.43
2.129	-0.365	204.14	111.69	92.45	1506.9	19.15	8172	0.693	588.5	29.75	22.90	1.98	2.06	5.77	5.61	9.36
2.629	-0.385	216.47	124.83	91.63	1506.6	19.57	8052	0.693	592.4	29.48	22.66	1.98	2.14	5.77	5.67	9.39
2.879	-0.385	218.49	131.38	87.11	1506.5	19.78	7993	0.693	620.2	30.62	23.31	1.98	2.21	5.77	5.81	9.48

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 16
Date: 10 January 1992
Time: 14:38:46

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
285.05	53.40	307.35	93.54	19.55	0.01197	10.367	1503.7	104.79	15.20	6.58	1761	3.32	60.04	52.88

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.90	62.13
1.702	0.670	0.001	0.000	291.04	64.19
9.093	3.580	0.001	0.000	313.08	103.86
10.706	4.215	0.001	0.000	311.35	100.74

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	306.36	292.24	14.11	10.331	14.85	23636	0.695	12123	114.52	60.78	1.10	0.48	5.77	10.16	12.62
4.163	-0.025	310.52	293.63	16.90	10.324	14.93	23564	0.695	10155	95.60	54.00	1.10	0.49	5.77	9.03	11.73
5.408	-0.071	315.68	296.24	19.43	10.312	15.08	23427	0.695	8814	82.44	48.83	1.10	0.53	5.77	8.38	11.24
6.703	0.001	318.35	298.96	19.39	10.298	15.23	23287	0.695	8814	81.88	48.50	1.10	0.55	5.77	8.43	11.27
7.249	0.001	318.87	300.10	18.76	10.293	15.29	23229	0.695	9072	84.05	49.31	1.10	0.57	5.77	8.62	11.42
3.566	0.953	307.98	292.38	15.60	10.331	14.86	23630	0.695	10973	103.62	56.98	1.10	0.48	5.77	9.49	12.09
4.176	0.927	312.04	293.66	18.38	10.324	14.93	23562	0.695	9334	87.86	51.06	1.10	0.49	5.77	8.58	11.39
5.370	0.953	316.70	296.17	20.53	10.312	15.07	23431	0.695	8344	78.05	47.05	1.10	0.53	5.77	8.13	11.05
6.703	0.927	319.67	298.96	20.71	10.298	15.23	23287	0.695	8252	76.66	46.38	1.10	0.55	5.77	8.13	11.05
7.313	0.914	319.99	300.24	19.75	10.292	15.30	23223	0.695	8612	79.76	47.60	1.10	0.57	5.77	8.38	11.23
3.528	-0.953	309.13	292.30	16.83	10.331	14.85	23634	0.695	10168	96.04	54.23	1.10	0.48	5.77	9.04	11.73
4.112	-0.914	312.32	293.52	18.80	10.325	14.92	23569	0.695	9128	85.95	50.32	1.10	0.49	5.77	8.47	11.30
5.408	-0.927	318.03	296.24	21.79	10.312	15.08	23427	0.695	7862	73.54	45.18	1.10	0.53	5.77	7.88	10.87
6.678	-0.978	320.90	298.91	21.99	10.298	15.23	23290	0.695	7774	72.23	44.53	1.10	0.55	5.77	7.88	10.87
7.313	-0.978	321.19	300.24	20.95	10.292	15.30	23223	0.695	8119	75.19	45.73	1.10	0.57	5.77	8.11	11.04

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	91.76	66.35	25.41	1498.4	48.73	23636	0.695	2136.1	114.52	60.78	1.98	0.87	5.77	10.16	12.62
1.639	-0.010	99.26	68.84	30.41	1497.4	48.98	23564	0.695	1789.3	95.60	54.00	1.98	0.89	5.77	9.03	11.73
2.129	-0.028	108.53	73.55	34.98	1495.6	49.46	23427	0.695	1553.0	82.44	48.83	1.98	0.96	5.77	8.38	11.24
2.639	0.000	113.35	78.44	34.91	1493.6	49.96	23287	0.695	1553.0	81.88	48.50	1.98	0.99	5.77	8.43	11.27
2.854	0.000	114.27	80.50	33.77	1492.8	50.17	23229	0.695	1598.5	84.05	49.31	1.98	1.02	5.77	8.62	11.42
1.404	0.375	94.67	66.59	28.08	1498.3	48.75	23630	0.695	1933.4	103.62	56.98	1.98	0.87	5.77	9.49	12.09
1.644	0.365	101.98	68.89	33.09	1497.4	48.99	23562	0.695	1644.7	87.86	51.06	1.98	0.89	5.77	8.58	11.39
2.114	0.375	110.36	73.41	36.95	1495.6	49.45	23431	0.695	1470.2	78.05	47.05	1.98	0.95	5.77	8.13	11.05
2.639	0.365	115.72	78.44	37.28	1493.6	49.96	23287	0.695	1454.0	76.66	46.38	1.98	0.99	5.77	8.13	11.05
2.879	0.360	116.29	80.74	35.56	1492.7	50.20	23223	0.695	1517.4	79.76	47.60	1.98	1.02	5.77	8.38	11.23
1.389	-0.375	96.74	66.44	30.30	1498.4	48.74	23634	0.695	1791.6	96.04	54.23	1.98	0.87	5.77	9.04	11.73
1.619	-0.360	102.48	68.65	33.83	1497.5	48.96	23569	0.695	1608.4	85.95	50.32	1.98	0.89	5.77	8.47	11.30
2.129	-0.365	112.77	73.55	39.21	1495.6	49.46	23427	0.695	1385.3	73.54	45.18	1.98	0.96	5.77	7.88	10.87
2.629	-0.385	117.92	78.35	39.57	1493.7	49.95	23290	0.695	1369.8	72.23	44.53	1.98	0.99	5.77	7.88	10.87
2.879	-0.385	118.45	80.74	37.71	1492.7	50.20	23223	0.695	1430.6	75.19	45.73	1.98	1.02	5.77	8.11	11.04

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 17
Date: 10 January 1992
Time: 14:39:12

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.68	52.74	307.00	92.92	19.57	0.01198	10.368	1503.7	104.66	15.18	6.59	1765	3.32	60.17	53.00

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.60	61.59
1.702	0.670	0.001	0.000	290.74	63.64
9.093	3.580	0.001	0.000	312.78	103.31
10.706	4.215	0.001	0.000	311.07	100.24

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	306.08	291.88	14.20	10.332	14.85	23678	0.695	12077	114.19	60.69	1.10	0.48	5.77	10.11	12.58
4.163	-0.025	310.24	293.27	16.97	10.325	14.93	23605	0.695	10130	95.45	53.96	1.10	0.49	5.77	9.00	11.71
5.408	-0.071	315.39	295.89	19.50	10.312	15.07	23468	0.695	8801	82.38	48.82	1.10	0.53	5.77	8.36	11.22
6.703	0.001	318.07	298.61	19.46	10.299	15.23	23327	0.695	8800	81.83	48.49	1.10	0.55	5.77	8.41	11.26
7.249	0.001	318.57	299.75	18.82	10.293	15.29	23269	0.695	9061	84.01	49.31	1.10	0.57	5.77	8.61	11.41
3.566	0.953	307.70	292.01	15.69	10.331	14.85	23671	0.695	10934	103.35	56.91	1.10	0.48	5.77	9.45	12.06
4.176	0.927	311.76	293.30	18.46	10.325	14.93	23603	0.695	9311	87.73	51.03	1.10	0.49	5.77	8.56	11.37
5.370	0.953	316.42	295.81	20.61	10.313	15.07	23472	0.695	8325	77.95	47.03	1.10	0.53	5.77	8.11	11.04
6.703	0.927	319.40	298.61	20.80	10.299	15.23	23327	0.695	8233	76.56	46.35	1.10	0.55	5.77	8.11	11.03
7.313	0.914	319.71	299.88	19.83	10.293	15.30	23262	0.695	8594	79.66	47.57	1.10	0.57	5.77	8.36	11.22
3.528	-0.953	308.83	291.93	16.90	10.332	14.85	23675	0.695	10145	95.91	54.20	1.10	0.48	5.77	9.01	11.72
4.112	-0.914	312.03	293.16	18.87	10.326	14.92	23610	0.695	9109	85.86	50.31	1.10	0.49	5.77	8.45	11.29
5.408	-0.927	317.75	295.89	21.86	10.312	15.07	23468	0.695	7849	73.48	45.17	1.10	0.53	5.77	7.87	10.86
6.678	-0.978	320.62	298.55	22.06	10.299	15.22	23330	0.695	7762	72.18	44.52	1.10	0.55	5.77	7.86	10.86
7.313	-0.978	320.92	299.88	21.04	10.293	15.30	23262	0.695	8101	75.09	45.70	1.10	0.57	5.77	8.09	11.03

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	91.25	65.70	25.55	1498.5	48.71	23678	0.695	2128.0	114.19	60.69	1.98	0.87	5.77	10.11	12.58
1.639	-0.010	98.74	68.19	30.55	1497.5	48.97	23605	0.695	1784.9	95.45	53.96	1.98	0.89	5.77	9.00	11.71
2.129	-0.028	108.01	72.91	35.10	1495.7	49.45	23468	0.695	1550.7	82.38	48.82	1.98	0.96	5.77	8.36	11.22
2.639	0.000	112.83	77.80	35.02	1493.7	49.95	23327	0.695	1550.6	81.83	48.49	1.98	0.99	5.77	8.41	11.26
2.854	0.000	113.74	79.86	33.88	1492.9	50.16	23269	0.695	1596.5	84.01	49.31	1.98	1.02	5.77	8.61	11.41
1.404	0.375	94.17	65.94	28.23	1498.4	48.74	23671	0.695	1926.6	103.35	56.91	1.98	0.87	5.77	9.45	12.06
1.644	0.365	101.48	68.24	33.23	1497.5	48.97	23603	0.695	1640.6	87.73	51.03	1.98	0.89	5.77	8.56	11.37
2.114	0.375	109.87	72.76	37.11	1495.7	49.43	23472	0.695	1466.9	77.95	47.03	1.98	0.95	5.77	8.11	11.04
2.639	0.365	115.24	77.80	37.43	1493.7	49.95	23327	0.695	1450.7	76.56	46.35	1.98	0.99	5.77	8.11	11.03
2.879	0.360	115.80	80.10	35.70	1492.8	50.19	23262	0.695	1514.3	79.66	47.57	1.98	1.02	5.77	8.36	11.22
1.389	-0.375	96.21	65.79	30.42	1498.5	48.72	23675	0.695	1787.5	95.91	54.20	1.98	0.87	5.77	9.01	11.72
1.619	-0.360	101.97	68.00	33.96	1497.6	48.95	23610	0.695	1605.0	85.86	50.31	1.98	0.89	5.77	8.45	11.29
2.129	-0.365	112.26	72.91	39.35	1495.7	49.45	23468	0.695	1383.0	73.48	45.17	1.98	0.96	5.77	7.87	10.86
2.629	-0.385	117.42	77.71	39.71	1493.8	49.94	23330	0.695	1367.7	72.18	44.52	1.98	0.99	5.77	7.86	10.86
2.879	-0.385	117.97	80.10	37.87	1492.8	50.19	23262	0.695	1427.4	75.09	45.70	1.98	1.02	5.77	8.09	11.03

Table 3.7 (continued)

Aluminum Heat Exchanger
Experiment: 7, Data Point: 18
Date: 10 January 1992
Time: 14:39:37

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
284.37	52.18	306.73	92.42	19.57	0.01198	10.369	1503.9	104.58	15.17	6.59	1767	3.31	60.24	53.06

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	289.35	61.13
1.702	0.670	0.001	0.000	290.49	63.20
9.093	3.580	0.001	0.000	312.54	102.88
10.706	4.215	0.001	0.000	310.83	99.80

Insulated-Side Temperatures and Calculated Data:
SI Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	305.83	291.58	14.25	10.333	14.83	23690	0.695	12048	114.00	60.64	1.10	0.48	5.77	10.09	12.56
4.163	-0.025	309.99	292.97	17.02	10.326	14.91	23617	0.695	10117	95.40	53.96	1.10	0.49	5.77	8.99	11.70
5.408	-0.071	315.15	295.60	19.56	10.313	15.05	23480	0.695	8788	82.33	48.81	1.10	0.53	5.77	8.35	11.21
6.703	0.001	317.83	298.32	19.52	10.300	15.21	23339	0.695	8787	81.76	48.47	1.10	0.55	5.77	8.39	11.25
7.249	0.001	318.36	299.46	18.90	10.294	15.27	23280	0.695	9037	83.86	49.26	1.10	0.57	5.77	8.58	11.39
3.566	0.953	307.47	291.71	15.76	10.332	14.84	23683	0.695	10902	103.12	56.84	1.10	0.48	5.77	9.42	12.04
4.176	0.927	311.52	293.00	18.52	10.326	14.91	23615	0.695	9296	87.65	51.01	1.10	0.49	5.77	8.54	11.36
5.370	0.953	316.18	295.52	20.67	10.314	15.05	23484	0.695	8316	77.92	47.03	1.10	0.53	5.77	8.10	11.03
6.703	0.927	319.19	298.32	20.87	10.300	15.21	23339	0.695	8217	76.46	46.32	1.10	0.55	5.77	8.09	11.02
7.313	0.914	319.50	299.60	19.91	10.294	15.28	23273	0.695	8575	79.54	47.53	1.10	0.57	5.77	8.34	11.21
3.528	-0.953	308.62	291.64	16.98	10.332	14.83	23687	0.695	10110	95.65	54.11	1.10	0.48	5.77	8.98	11.69
4.112	-0.914	311.80	292.86	18.94	10.326	14.90	23622	0.695	9091	85.74	50.27	1.10	0.49	5.77	8.43	11.28
5.408	-0.927	317.52	295.60	21.93	10.313	15.05	23480	0.695	7837	73.42	45.15	1.10	0.53	5.77	7.85	10.85
6.678	-0.978	320.40	298.27	22.14	10.300	15.20	23341	0.695	7747	72.10	44.50	1.10	0.55	5.77	7.85	10.84
7.313	-0.978	320.70	299.60	21.10	10.294	15.28	23273	0.695	8088	75.02	45.68	1.10	0.57	5.77	8.08	11.01

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	90.81	65.16	25.65	1498.6	48.65	23690	0.695	2122.9	114.00	60.64	1.98	0.87	5.77	10.09	12.56
1.639	-0.010	98.29	67.66	30.63	1497.7	48.91	23617	0.695	1782.6	95.40	53.96	1.98	0.89	5.77	8.99	11.70
2.129	-0.028	107.59	72.38	35.20	1495.8	49.39	23480	0.695	1548.4	82.33	48.81	1.98	0.96	5.77	8.35	11.21
2.639	0.000	112.41	77.29	35.13	1493.9	49.89	23339	0.695	1548.3	81.76	48.47	1.98	0.99	5.77	8.39	11.25
2.854	0.000	113.37	79.35	34.02	1493.0	50.10	23280	0.695	1592.3	83.86	49.26	1.98	1.02	5.77	8.58	11.39
1.404	0.375	93.76	65.40	28.36	1498.5	48.68	23683	0.695	1920.9	103.12	56.84	1.98	0.87	5.77	9.42	12.04
1.644	0.365	101.05	67.71	33.34	1497.6	48.91	23615	0.695	1638.0	87.65	51.01	1.98	0.89	5.77	8.54	11.36
2.114	0.375	109.44	72.24	37.20	1495.9	49.37	23484	0.695	1465.3	77.92	47.03	1.98	0.96	5.77	8.10	11.03
2.639	0.365	114.85	77.29	37.56	1493.9	49.89	23339	0.695	1447.8	76.46	46.32	1.98	0.99	5.77	8.09	11.02
2.879	0.360	115.42	79.59	35.83	1493.0	50.13	23273	0.695	1510.9	79.54	47.53	1.98	1.02	5.77	8.34	11.21
1.389	-0.375	95.83	65.26	30.57	1498.6	48.66	23687	0.695	1781.4	95.65	54.11	1.98	0.87	5.77	8.98	11.69
1.619	-0.360	101.55	67.47	34.08	1497.7	48.89	23622	0.695	1601.8	85.74	50.27	1.98	0.89	5.77	8.43	11.28
2.129	-0.365	111.86	72.38	39.47	1495.8	49.39	23480	0.695	1380.9	73.42	45.15	1.98	0.96	5.77	7.85	10.85
2.629	-0.385	117.04	77.19	39.84	1493.9	49.88	23341	0.695	1365.0	72.10	44.50	1.98	0.99	5.77	7.85	10.84
2.879	-0.385	117.57	79.59	37.99	1493.0	50.13	23273	0.695	1425.1	75.02	45.68	1.98	1.02	5.77	8.08	11.01

Table 3.8. Data tables for experiment 8

Aluminum Heat Exchanger
Summary Data Table for Experiment 8
Date: 13 January 1992

Data Pt.	Time	Qt W	Qt/An W/cm²	M kg/h	P0 MPa	P0-P1 kPa	T0 K	T1 K	T1-T0 K	Tw-Tf K	V m/s	Re	Pr	h W/(m²·K)	Nu	Nuw
1	14:26:11	1066	36.34	19.43	10.31	97.00	276.90	290.50	13.59	11.78	14.44	23950	0.696	8801	84.97	50.35
2	14:26:37	1065	36.31	19.43	10.31	97.09	276.74	290.32	13.58	11.80	14.42	23959	0.696	8775	84.76	50.27
3	14:27:02	1065	36.31	19.44	10.32	97.09	276.59	290.16	13.57	11.83	14.42	23977	0.696	8755	84.60	50.22
4	14:32:17	2236	76.23	19.49	10.32	97.64	276.09	304.48	28.39	25.30	14.79	23660	0.695	8594	81.58	48.72
5	14:32:43	2239	76.33	19.47	10.31	97.48	276.01	304.48	28.47	25.40	14.79	23644	0.695	8573	81.39	48.64
6	14:33:08	2241	76.40	19.45	10.29	97.21	275.96	304.48	28.53	25.45	14.79	23617	0.695	8565	81.32	48.61
7	14:40:13	2572	87.69	19.73	9.47	108.64	275.67	307.98	32.31	28.87	16.34	23911	0.694	8664	82.07	48.88
8	14:40:38	2575	87.79	19.74	9.47	108.67	275.57	307.89	32.32	29.04	16.35	23936	0.694	8622	81.69	48.73
9	14:41:04	2580	87.96	19.75	9.47	108.75	275.50	307.88	32.38	28.95	16.35	23942	0.694	8666	82.12	48.91

Tw-Tf, V, Re, Pr, h, Nu, and Nuw evaluated at Y/W=0 and X/L=0.5.

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 1
Date: 13 January 1992
Time: 14:26:11

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.90	38.74	290.50	63.20	19.43	0.01190	10.310	1495.4	97.00	14.07	7.11	1066	5.28	36.34	32.01

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	279.77	43.90
1.702	0.670	0.001	0.000	280.58	45.36
9.093	3.580	0.001	0.000	293.84	69.22
10.706	4.215	0.001	0.000	292.87	67.47

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	289.95	281.29	8.66	10.277	14.29	24084	0.696	11961	116.21	61.98	1.10	0.42	5.77	15.25	16.99
4.163	-0.025	292.46	282.13	10.33	10.271	14.34	24037	0.696	10051	97.44	55.24	1.10	0.42	5.77	13.31	15.27
5.408	-0.071	295.51	283.73	11.78	10.259	14.44	23950	0.696	8801	84.97	50.35	1.10	0.43	5.77	12.17	14.29
6.703	0.001	297.19	285.38	11.81	10.246	14.53	23861	0.696	8760	84.22	49.98	1.10	0.44	5.77	12.19	14.30
7.249	0.001	297.47	286.08	11.39	10.241	14.58	23823	0.696	9043	86.78	50.97	1.10	0.46	5.77	12.53	14.60
3.566	0.953	290.93	281.37	9.56	10.276	14.30	24079	0.696	10835	105.25	58.14	1.10	0.42	5.77	14.11	15.97
4.176	0.927	293.35	282.15	11.20	10.270	14.34	24036	0.696	9268	89.84	52.34	1.10	0.42	5.77	12.56	14.62
5.370	0.953	296.15	283.68	12.48	10.259	14.43	23953	0.696	8310	80.24	48.44	1.10	0.43	5.77	11.71	13.90
6.703	0.927	297.98	285.38	12.60	10.246	14.53	23861	0.696	8207	78.90	47.82	1.10	0.44	5.77	11.67	13.87
7.313	0.914	298.16	286.16	12.01	10.240	14.58	23819	0.696	8576	82.29	49.17	1.10	0.46	5.77	12.10	14.23
3.528	-0.953	291.68	281.32	10.36	10.277	14.30	24082	0.696	9999	97.14	55.16	1.10	0.42	5.77	13.30	15.26
4.112	-0.914	293.59	282.07	11.52	10.271	14.34	24041	0.696	9013	87.39	51.38	1.10	0.42	5.77	12.32	14.42
5.408	-0.927	296.97	283.73	13.24	10.259	14.44	23950	0.696	7827	75.57	46.49	1.10	0.43	5.77	11.27	13.53
6.678	-0.978	298.71	285.35	13.36	10.247	14.53	23862	0.696	7745	74.47	45.96	1.10	0.44	5.77	11.25	13.51
7.313	-0.978	298.92	286.16	12.76	10.240	14.58	23819	0.696	8066	77.40	47.17	1.10	0.46	5.77	11.62	13.82

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	62.21	46.63	15.59	1490.5	46.89	24084	0.696	2107.5	116.21	61.98	1.98	0.75	5.77	15.25	16.99
1.639	-0.010	66.75	48.15	18.60	1489.6	47.06	24037	0.696	1771.0	97.44	55.24	1.98	0.75	5.77	13.31	15.27
2.129	-0.028	72.22	51.02	21.20	1487.9	47.36	23950	0.696	1550.7	84.97	50.35	1.98	0.77	5.77	12.17	14.29
2.639	0.000	75.25	54.00	21.26	1486.1	47.69	23861	0.696	1543.5	84.22	49.98	1.98	0.80	5.77	12.19	14.30
2.854	0.000	75.76	55.25	20.51	1485.3	47.82	23823	0.696	1593.4	86.78	50.97	1.98	0.82	5.77	12.53	14.60
1.404	0.375	63.99	46.77	17.22	1490.4	46.91	24079	0.696	1909.1	105.25	58.14	1.98	0.75	5.77	14.11	15.97
1.644	0.365	68.35	48.18	20.17	1489.6	47.06	24036	0.696	1633.0	89.84	52.34	1.98	0.75	5.77	12.56	14.62
2.114	0.375	73.39	50.93	22.46	1487.9	47.36	23953	0.696	1464.2	80.24	48.44	1.98	0.77	5.77	11.71	13.90
2.639	0.365	76.68	54.00	22.69	1486.1	47.69	23861	0.696	1446.1	78.90	47.82	1.98	0.80	5.77	11.67	13.87
2.879	0.360	77.01	55.40	21.61	1485.3	47.84	23819	0.696	1511.1	82.29	49.17	1.98	0.82	5.77	12.10	14.23
1.389	-0.375	65.33	46.68	18.65	1490.5	46.90	24082	0.696	1761.8	97.14	55.16	1.98	0.75	5.77	13.30	15.26
1.619	-0.360	68.77	48.03	20.74	1489.7	47.04	24041	0.696	1588.1	87.39	51.38	1.98	0.75	5.77	12.32	14.42
2.129	-0.365	74.86	51.02	23.84	1487.9	47.36	23950	0.696	1379.1	75.57	46.49	1.98	0.77	5.77	11.27	13.53
2.629	-0.385	77.98	53.94	24.04	1486.1	47.68	23862	0.696	1364.7	74.47	45.96	1.98	0.80	5.77	11.25	13.51
2.879	-0.385	78.37	55.40	22.98	1485.3	47.84	23819	0.696	1421.2	77.40	47.17	1.98	0.82	5.77	11.62	13.82

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 2
Date: 13 January 1992
Time: 14:26:37

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.74	38.44	290.32	62.88	19.43	0.01190	10.314	1495.9	97.09	14.08	7.10	1065	5.29	36.31	31.98

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	279.65	43.67
1.702	0.670	0.001	0.000	280.44	45.10
9.093	3.580	0.001	0.000	293.70	68.97
10.706	4.215	0.001	0.000	292.73	67.22

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	289.78	281.12	8.67	10.281	14.28	24092	0.696	11938	116.03	61.93	1.10	0.42	5.77	15.24	16.98
4.163	-0.025	292.31	281.96	10.35	10.274	14.33	24046	0.696	10020	97.18	55.15	1.10	0.42	5.77	13.29	15.26
5.408	-0.071	295.36	283.55	11.80	10.263	14.42	23959	0.696	8775	84.76	50.27	1.10	0.43	5.77	12.16	14.28
6.703	0.001	297.04	285.21	11.83	10.250	14.52	23869	0.696	8736	84.03	49.91	1.10	0.44	5.77	12.18	14.30
7.249	0.001	297.32	285.90	11.42	10.245	14.56	23832	0.696	9012	86.53	50.88	1.10	0.46	5.77	12.51	14.58
3.566	0.953	290.77	281.20	9.57	10.280	14.28	24088	0.696	10813	105.08	58.08	1.10	0.42	5.77	14.10	15.97
4.176	0.927	293.19	281.98	11.21	10.274	14.33	24045	0.696	9250	89.71	52.30	1.10	0.42	5.77	12.56	14.62
5.370	0.953	296.01	283.51	12.50	10.263	14.42	23962	0.696	8284	80.03	48.36	1.10	0.43	5.77	11.70	13.89
6.703	0.927	297.83	285.21	12.62	10.250	14.52	23869	0.696	8185	78.73	47.76	1.10	0.44	5.77	11.66	13.86
7.313	0.914	298.00	285.98	12.02	10.244	14.57	23827	0.696	8558	82.16	49.13	1.10	0.46	5.77	12.09	14.22
3.528	-0.953	291.50	281.15	10.35	10.280	14.28	24090	0.696	9993	97.12	55.16	1.10	0.42	5.77	13.30	15.26
4.112	-0.914	293.44	281.90	11.54	10.275	14.32	24049	0.696	8985	87.15	51.29	1.10	0.42	5.77	12.31	14.40
5.408	-0.927	296.82	283.55	13.27	10.263	14.42	23959	0.696	7806	75.39	46.42	1.10	0.43	5.77	11.26	13.52
6.678	-0.978	298.57	285.18	13.39	10.250	14.52	23871	0.696	7716	74.22	45.86	1.10	0.44	5.77	11.23	13.50
7.313	-0.978	298.76	285.98	12.78	10.244	14.57	23827	0.696	8047	77.25	47.11	1.10	0.46	5.77	11.61	13.81

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	61.92	46.32	15.60	1491.1	46.85	24092	0.696	2103.5	116.03	61.93	1.98	0.75	5.77	15.24	16.98
1.639	-0.010	66.48	47.84	18.64	1490.2	47.01	24046	0.696	1765.5	97.18	55.15	1.98	0.75	5.77	13.29	15.26
2.129	-0.028	71.95	50.71	21.24	1488.5	47.32	23959	0.696	1546.2	84.76	50.27	1.98	0.77	5.77	12.16	14.28
2.639	0.000	74.97	53.69	21.29	1486.7	47.64	23869	0.696	1539.3	84.03	49.91	1.98	0.80	5.77	12.18	14.30
2.854	0.000	75.49	54.94	20.55	1485.9	47.78	23832	0.696	1587.9	86.53	50.88	1.98	0.82	5.77	12.51	14.58
1.404	0.375	63.70	46.47	17.23	1491.0	46.86	24088	0.696	1905.3	105.08	58.08	1.98	0.75	5.77	14.10	15.97
1.644	0.365	68.06	47.87	20.18	1490.2	47.01	24045	0.696	1629.8	89.71	52.30	1.98	0.75	5.77	12.56	14.62
2.114	0.375	73.12	50.62	22.50	1488.5	47.31	23962	0.696	1459.6	80.03	48.36	1.98	0.77	5.77	11.70	13.89
2.639	0.365	76.41	53.69	22.72	1486.7	47.64	23869	0.696	1442.2	78.73	47.76	1.98	0.80	5.77	11.66	13.86
2.879	0.360	76.71	55.08	21.63	1485.8	47.79	23827	0.696	1507.9	82.16	49.13	1.98	0.82	5.77	12.09	14.22
1.389	-0.375	65.02	46.38	18.64	1491.1	46.85	24090	0.696	1760.8	97.12	55.16	1.98	0.75	5.77	13.30	15.26
1.619	-0.360	68.50	47.72	20.78	1490.3	47.00	24049	0.696	1583.2	87.15	51.29	1.98	0.75	5.77	12.31	14.40
2.129	-0.365	74.59	50.71	23.88	1488.5	47.32	23959	0.696	1375.4	75.39	46.42	1.98	0.77	5.77	11.26	13.52
2.629	-0.385	77.73	53.63	24.11	1486.7	47.63	23871	0.696	1359.6	74.22	45.86	1.98	0.80	5.77	11.23	13.50
2.879	-0.385	78.09	55.08	23.00	1485.8	47.79	23827	0.696	1417.9	77.25	47.11	1.98	0.82	5.77	11.61	13.81

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 3
Date: 13 January 1992
Time: 14:27:02

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.59	38.17	290.16	62.61	19.44	0.01190	10.317	1496.4	97.09	14.08	7.10	1065	5.29	36.31	31.98

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	279.53	43.47
1.702	0.670	0.001	0.000	280.35	44.94
9.093	3.580	0.001	0.000	293.59	68.78
10.706	4.215	0.001	0.000	292.63	67.04

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	289.67	280.96	8.70	10.284	14.27	24111	0.696	11890	115.61	61.79	1.10	0.42	5.77	15.19	16.93
4.163	-0.025	292.18	281.81	10.37	10.278	14.32	24064	0.696	10004	97.06	55.11	1.10	0.42	5.77	13.28	15.24
5.408	-0.071	295.23	283.40	11.83	10.266	14.42	23977	0.696	8755	84.60	50.22	1.10	0.43	5.77	12.14	14.26
6.703	0.001	296.90	285.05	11.85	10.253	14.52	23888	0.696	8723	83.93	49.88	1.10	0.44	5.77	12.16	14.28
7.249	0.001	297.20	285.75	11.45	10.248	14.56	23850	0.696	8990	86.35	50.81	1.10	0.46	5.77	12.49	14.56
3.566	0.953	290.67	281.05	9.62	10.283	14.28	24106	0.696	10762	104.62	57.93	1.10	0.42	5.77	14.05	15.92
4.176	0.927	293.09	281.83	11.26	10.277	14.32	24063	0.696	9212	89.37	52.17	1.10	0.42	5.77	12.52	14.59
5.370	0.953	295.89	283.35	12.53	10.266	14.41	23980	0.696	8265	79.87	48.30	1.10	0.43	5.77	11.68	13.87
6.703	0.927	297.73	285.05	12.68	10.253	14.52	23888	0.696	8153	78.45	47.65	1.10	0.44	5.77	11.63	13.83
7.313	0.914	297.88	285.83	12.05	10.247	14.56	23846	0.696	8536	81.97	49.06	1.10	0.46	5.77	12.07	14.20
3.528	-0.953	291.41	281.00	10.41	10.284	14.28	24109	0.696	9942	96.66	55.00	1.10	0.42	5.77	13.25	15.22
4.112	-0.914	293.34	281.74	11.60	10.278	14.32	24068	0.696	8944	86.79	51.16	1.10	0.42	5.77	12.27	14.37
5.408	-0.927	296.73	283.40	13.33	10.266	14.42	23977	0.696	7772	75.10	46.30	1.10	0.43	5.77	11.23	13.50
6.678	-0.978	298.46	285.02	13.44	10.253	14.51	23889	0.696	7691	74.01	45.78	1.10	0.44	5.77	11.21	13.48
7.313	-0.978	298.67	285.83	12.84	10.247	14.56	23846	0.696	8012	76.94	46.99	1.10	0.46	5.77	11.58	13.79

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	61.71	46.05	15.67	1491.5	46.83	24111	0.696	2095.0	115.61	61.79	1.98	0.75	5.77	15.19	16.93
1.639	-0.010	66.24	47.57	18.67	1490.6	46.99	24064	0.696	1762.7	97.06	55.11	1.98	0.75	5.77	13.28	15.24
2.129	-0.028	71.73	50.43	21.30	1488.9	47.30	23977	0.696	1542.6	84.60	50.22	1.98	0.77	5.77	12.14	14.26
2.639	0.000	74.74	53.41	21.33	1487.1	47.62	23888	0.696	1537.0	83.93	49.88	1.98	0.80	5.77	12.16	14.28
2.854	0.000	75.27	54.66	20.61	1486.4	47.76	23850	0.696	1584.0	86.35	50.81	1.98	0.82	5.77	12.49	14.56
1.404	0.375	63.51	46.19	17.31	1491.5	46.85	24106	0.696	1896.3	104.62	57.93	1.98	0.75	5.77	14.05	15.92
1.644	0.365	67.87	47.60	20.27	1490.6	47.00	24063	0.696	1623.2	89.37	52.17	1.98	0.75	5.77	12.52	14.59
2.114	0.375	72.91	50.35	22.56	1489.0	47.29	23980	0.696	1456.3	79.87	48.30	1.98	0.77	5.77	11.68	13.87
2.639	0.365	76.23	53.41	22.82	1487.1	47.62	23888	0.696	1436.6	78.45	47.65	1.98	0.80	5.77	11.63	13.83
2.879	0.360	76.50	54.81	21.69	1486.3	47.78	23846	0.696	1504.0	81.97	49.06	1.98	0.82	5.77	12.07	14.20
1.389	-0.375	64.84	46.11	18.74	1491.5	46.84	24109	0.696	1751.8	96.66	55.00	1.98	0.75	5.77	13.25	15.22
1.619	-0.360	68.33	47.45	20.88	1490.7	46.98	24068	0.696	1575.9	86.79	51.16	1.98	0.75	5.77	12.27	14.37
2.129	-0.365	74.42	50.43	23.99	1488.9	47.30	23977	0.696	1369.4	75.10	46.30	1.98	0.77	5.77	11.23	13.50
2.629	-0.385	77.54	53.35	24.19	1487.1	47.62	23889	0.696	1355.2	74.01	45.78	1.98	0.80	5.77	11.21	13.48
2.879	-0.385	77.92	54.81	23.11	1486.3	47.78	23846	0.696	1411.7	76.94	46.99	1.98	0.82	5.77	11.58	13.79

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 4
Date: 13 January 1992
Time: 14:32:17

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.09	37.28	304.48	88.38	19.49	0.01193	10.322	1497.1	97.64	14.16	7.06	2236	2.67	76.23	67.14

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	282.50	48.81
1.702	0.670	0.001	0.000	284.23	51.93
9.093	3.580	0.001	0.000	312.02	101.94
10.706	4.215	0.001	0.000	309.98	98.28

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	303.90	285.25	18.65	10.289	14.52	23934	0.696	11646	111.99	60.30	1.10	0.54	5.77	8.37	11.23
4.163	-0.025	309.20	287.02	22.18	10.282	14.61	23839	0.695	9818	94.00	53.71	1.10	0.56	5.77	7.60	10.67
5.408	-0.071	315.64	290.35	25.30	10.270	14.79	23660	0.695	8594	81.58	48.72	1.10	0.62	5.77	7.19	10.38
6.703	0.001	319.18	293.80	25.38	10.258	14.98	23478	0.695	8547	80.44	48.12	1.10	0.64	5.77	7.21	10.40
7.249	0.001	319.80	295.26	24.54	10.253	15.06	23402	0.695	8803	82.55	48.91	1.10	0.66	5.77	7.37	10.50
3.566	0.953	305.94	285.42	20.52	10.288	14.52	23925	0.696	10588	101.77	56.67	1.10	0.54	5.77	7.90	10.89
4.176	0.927	311.06	287.05	24.01	10.282	14.61	23837	0.695	9068	86.81	50.94	1.10	0.56	5.77	7.29	10.45
5.370	0.953	317.04	290.24	26.80	10.271	14.78	23666	0.695	8113	77.03	46.86	1.10	0.62	5.77	6.99	10.25
6.703	0.927	320.89	293.80	27.08	10.258	14.98	23478	0.695	8009	75.38	46.04	1.10	0.64	5.77	7.00	10.25
7.313	0.914	321.25	295.43	25.82	10.252	15.07	23394	0.695	8360	78.36	47.21	1.10	0.66	5.77	7.19	10.38
3.528	-0.953	307.48	285.32	22.16	10.288	14.52	23931	0.696	9802	94.24	53.88	1.10	0.54	5.77	7.58	10.65
4.112	-0.914	311.58	286.88	24.71	10.283	14.60	23846	0.696	8814	84.41	49.99	1.10	0.56	5.77	7.19	10.38
5.408	-0.927	318.78	290.35	28.43	10.270	14.79	23660	0.695	7646	72.58	44.98	1.10	0.62	5.77	6.82	10.13
6.678	-0.978	322.42	293.74	28.68	10.258	14.98	23482	0.695	7563	71.19	44.27	1.10	0.64	5.77	6.82	10.13
7.313	-0.978	322.91	295.43	27.48	10.252	15.07	23394	0.695	7857	73.65	45.26	1.10	0.66	5.77	6.99	10.24

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	87.33	53.76	33.57	1492.2	47.62	23934	0.696	2052.0	111.99	60.30	1.98	0.97	5.77	8.37	11.23
1.639	-0.010	96.86	56.94	39.92	1491.3	47.93	23839	0.695	1729.9	94.00	53.71	1.98	1.01	5.77	7.60	10.67
2.129	-0.028	108.47	62.93	45.53	1489.6	48.53	23660	0.695	1514.3	81.58	48.72	1.98	1.11	5.77	7.19	10.38
2.639	0.000	114.84	69.16	45.68	1487.8	49.14	23478	0.695	1506.0	80.44	48.12	1.98	1.15	5.77	7.21	10.40
2.854	0.000	115.95	71.78	44.18	1487.0	49.40	23402	0.695	1551.1	82.55	48.91	1.98	1.18	5.77	7.37	10.50
1.404	0.375	91.00	54.06	36.94	1492.2	47.65	23925	0.696	1865.6	101.77	56.67	1.98	0.97	5.77	7.90	10.89
1.644	0.365	100.23	57.00	43.23	1491.3	47.94	23837	0.695	1597.8	86.81	50.94	1.98	1.01	5.77	7.29	10.45
2.114	0.375	110.99	62.75	48.24	1489.6	48.51	23666	0.695	1429.5	77.03	46.86	1.98	1.11	5.77	6.99	10.25
2.639	0.365	117.91	69.16	48.75	1487.8	49.14	23478	0.695	1411.2	75.38	46.04	1.98	1.15	5.77	7.00	10.25
2.879	0.360	118.57	72.08	46.48	1486.9	49.43	23394	0.695	1473.0	78.36	47.21	1.98	1.19	5.77	7.19	10.38
1.389	-0.375	93.77	53.88	39.89	1492.2	47.63	23931	0.696	1727.1	94.24	53.88	1.98	0.97	5.77	7.58	10.65
1.619	-0.360	101.16	56.69	44.47	1491.4	47.91	23846	0.696	1553.0	84.41	49.99	1.98	1.00	5.77	7.19	10.38
2.129	-0.365	114.11	62.93	51.18	1489.6	48.53	23660	0.695	1347.2	72.58	44.98	1.98	1.11	5.77	6.82	10.13
2.629	-0.385	120.67	69.04	51.63	1487.8	49.13	23482	0.695	1332.6	71.19	44.27	1.98	1.15	5.77	6.82	10.13
2.879	-0.385	121.54	72.08	49.46	1486.9	49.43	23394	0.695	1384.4	73.65	45.26	1.98	1.19	5.77	6.99	10.24

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 5
Date: 13 January 1992
Time: 14:32:43

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
276.01	37.14	304.48	88.38	19.47	0.01192	10.311	1495.4	97.48	14.14	7.07	2239	2.67	76.33	67.23

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	282.47	48.76
1.702	0.670	0.001	0.000	284.23	51.93
9.093	3.580	0.001	0.000	312.07	102.05
10.706	4.215	0.001	0.000	310.03	98.36

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	303.92	285.20	18.73	10.277	14.52	23919	0.696	11617	111.73	60.22	1.10	0.54	5.77	8.34	11.21
4.163	-0.025	309.24	286.96	22.27	10.271	14.61	23823	0.695	9795	93.78	53.63	1.10	0.56	5.77	7.58	10.65
5.408	-0.071	315.71	290.30	25.40	10.259	14.79	23644	0.695	8573	81.39	48.64	1.10	0.62	5.77	7.17	10.37
6.703	0.001	319.25	293.77	25.48	10.246	14.98	23462	0.695	8528	80.26	48.05	1.10	0.64	5.77	7.20	10.39
7.249	0.001	319.89	295.23	24.66	10.241	15.06	23386	0.695	8777	82.31	48.82	1.10	0.66	5.77	7.35	10.49
3.566	0.953	305.97	285.36	20.61	10.276	14.52	23909	0.696	10562	101.54	56.59	1.10	0.54	5.77	7.89	10.87
4.176	0.927	311.12	287.00	24.12	10.270	14.61	23821	0.695	9044	86.59	50.85	1.10	0.56	5.77	7.27	10.44
5.370	0.953	317.11	290.20	26.91	10.259	14.79	23650	0.695	8093	76.85	46.78	1.10	0.62	5.77	6.98	10.24
6.703	0.927	320.97	293.77	27.20	10.246	14.98	23462	0.695	7990	75.20	45.96	1.10	0.64	5.77	6.98	10.24
7.313	0.914	321.33	295.40	25.93	10.240	15.07	23377	0.695	8339	78.17	47.13	1.10	0.66	5.77	7.18	10.37
3.528	-0.953	307.55	285.26	22.28	10.277	14.52	23915	0.696	9764	93.90	53.76	1.10	0.54	5.77	7.55	10.63
4.112	-0.914	311.65	286.83	24.83	10.271	14.60	23830	0.695	8786	84.15	49.89	1.10	0.56	5.77	7.17	10.37
5.408	-0.927	318.85	290.30	28.55	10.259	14.79	23644	0.695	7629	72.43	44.92	1.10	0.62	5.77	6.80	10.12
6.678	-0.978	322.52	293.70	28.82	10.246	14.98	23465	0.695	7540	70.98	44.18	1.10	0.64	5.77	6.81	10.12
7.313	-0.978	323.01	295.40	27.61	10.240	15.07	23377	0.695	7832	73.41	45.15	1.10	0.66	5.77	6.97	10.23

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	87.37	53.66	33.71	1490.5	47.62	23919	0.696	2046.9	111.73	60.22	1.98	0.97	5.77	8.34	11.21
1.639	-0.010	96.94	56.85	40.09	1489.6	47.94	23823	0.695	1725.9	93.78	53.63	1.98	1.01	5.77	7.58	10.65
2.129	-0.028	108.59	62.86	45.73	1487.9	48.53	23644	0.695	1510.6	81.39	48.64	1.98	1.11	5.77	7.17	10.37
2.639	0.000	114.97	69.10	45.87	1486.1	49.15	23462	0.695	1502.6	80.26	48.05	1.98	1.16	5.77	7.20	10.39
2.854	0.000	116.11	71.72	44.38	1485.3	49.41	23386	0.695	1546.5	82.31	48.82	1.98	1.19	5.77	7.35	10.49
1.404	0.375	91.06	53.97	37.09	1490.5	47.65	23909	0.696	1861.0	101.54	56.59	1.98	0.97	5.77	7.89	10.87
1.644	0.365	100.33	56.91	43.42	1489.6	47.94	23821	0.695	1593.6	86.59	50.85	1.98	1.01	5.77	7.27	10.44
2.114	0.375	111.12	62.68	48.44	1487.9	48.51	23650	0.695	1426.0	76.85	46.78	1.98	1.11	5.77	6.98	10.24
2.639	0.365	118.05	69.10	48.95	1486.1	49.15	23462	0.695	1407.8	75.20	45.96	1.98	1.16	5.77	6.98	10.24
2.879	0.360	118.71	72.03	46.68	1485.2	49.44	23377	0.695	1469.3	78.17	47.13	1.98	1.19	5.77	7.18	10.37
1.389	-0.375	93.89	53.78	40.11	1490.5	47.63	23915	0.696	1720.4	93.90	53.76	1.98	0.97	5.77	7.55	10.63
1.619	-0.360	101.29	56.60	44.69	1489.7	47.91	23830	0.695	1548.1	84.15	49.89	1.98	1.00	5.77	7.17	10.37
2.129	-0.365	114.24	62.86	51.38	1487.9	48.53	23644	0.695	1344.2	72.43	44.92	1.98	1.11	5.77	6.80	10.12
2.629	-0.385	120.86	68.98	51.88	1486.1	49.14	23465	0.695	1328.5	70.98	44.18	1.98	1.15	5.77	6.81	10.12
2.879	-0.385	121.74	72.03	49.71	1485.2	49.44	23377	0.695	1380.0	73.41	45.15	1.98	1.19	5.77	6.97	10.23

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 6
Date: 13 January 1992
Time: 14:33:08

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
275.96	37.03	304.48	88.38	19.45	0.01191	10.295	1493.1	97.21	14.10	7.09	2241	2.66	76.40	67.29

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	282.41	48.65
1.702	0.670	0.001	0.000	284.17	51.81
9.093	3.580	0.001	0.000	312.08	102.05
10.706	4.215	0.001	0.000	310.03	98.37

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	303.91	285.16	18.75	10.261	14.52	23891	0.696	11610	111.68	60.20	1.10	0.54	5.77	8.34	11.20
4.163	-0.025	309.22	286.93	22.29	10.255	14.61	23796	0.695	9797	93.82	53.65	1.10	0.56	5.77	7.58	10.65
5.408	-0.071	315.73	290.28	25.45	10.243	14.79	23617	0.695	8565	81.32	48.61	1.10	0.62	5.77	7.17	10.36
6.703	0.001	319.26	293.75	25.51	10.231	14.98	23434	0.695	8525	80.24	48.04	1.10	0.64	5.77	7.19	10.38
7.249	0.001	319.89	295.21	24.67	10.225	15.06	23358	0.695	8779	82.33	48.83	1.10	0.66	5.77	7.35	10.49
3.566	0.953	305.95	285.33	20.63	10.261	14.52	23882	0.696	10560	101.54	56.59	1.10	0.54	5.77	7.88	10.87
4.176	0.927	311.11	286.96	24.14	10.255	14.61	23794	0.695	9043	86.58	50.85	1.10	0.56	5.77	7.27	10.44
5.370	0.953	317.12	290.17	26.95	10.243	14.79	23622	0.695	8090	76.83	46.78	1.10	0.62	5.77	6.98	10.23
6.703	0.927	320.97	293.75	27.22	10.231	14.98	23434	0.695	7990	75.21	45.97	1.10	0.64	5.77	6.98	10.24
7.313	0.914	321.33	295.38	25.94	10.225	15.07	23349	0.695	8343	78.22	47.16	1.10	0.66	5.77	7.17	10.37
3.528	-0.953	307.49	285.22	22.27	10.261	14.52	23888	0.696	9780	94.06	53.82	1.10	0.54	5.77	7.55	10.64
4.112	-0.914	311.63	286.79	24.84	10.255	14.60	23803	0.695	8790	84.20	49.91	1.10	0.56	5.77	7.17	10.36
5.408	-0.927	318.85	290.28	28.57	10.243	14.79	23617	0.695	7629	72.44	44.92	1.10	0.62	5.77	6.80	10.11
6.678	-0.978	322.52	293.68	28.84	10.231	14.98	23437	0.695	7542	71.01	44.19	1.10	0.64	5.77	6.80	10.12
7.313	-0.978	323.01	295.38	27.62	10.225	15.07	23349	0.695	7836	73.46	45.18	1.10	0.66	5.77	6.97	10.23

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	87.35	53.59	33.76	1488.3	47.62	23891	0.696	2045.7	111.68	60.20	1.98	0.97	5.77	8.34	11.20
1.639	-0.010	96.90	56.79	40.11	1487.4	47.94	23796	0.695	1726.2	93.82	53.65	1.98	1.01	5.77	7.58	10.65
2.129	-0.028	108.62	62.81	45.81	1485.6	48.54	23617	0.695	1509.2	81.32	48.61	1.98	1.12	5.77	7.17	10.36
2.639	0.000	114.99	69.07	45.92	1483.8	49.15	23434	0.695	1502.1	80.24	48.04	1.98	1.16	5.77	7.19	10.38
2.854	0.000	116.11	71.69	44.41	1483.1	49.42	23358	0.695	1546.9	82.33	48.83	1.98	1.19	5.77	7.35	10.49
1.404	0.375	91.03	53.90	37.13	1488.2	47.65	23882	0.696	1860.7	101.54	56.59	1.98	0.97	5.77	7.88	10.87
1.644	0.365	100.31	56.85	43.46	1487.3	47.95	23794	0.695	1593.4	86.58	50.85	1.98	1.01	5.77	7.27	10.44
2.114	0.375	111.13	62.63	48.50	1485.7	48.52	23622	0.695	1425.5	76.83	46.78	1.98	1.11	5.77	6.98	10.23
2.639	0.365	118.06	69.07	48.99	1483.8	49.15	23434	0.695	1407.8	75.21	45.97	1.98	1.16	5.77	6.98	10.24
2.879	0.360	118.70	72.00	46.70	1483.0	49.44	23349	0.695	1470.0	78.22	47.16	1.98	1.19	5.77	7.17	10.37
1.389	-0.375	93.80	53.72	40.08	1488.2	47.64	23888	0.696	1723.2	94.06	53.82	1.98	0.97	5.77	7.55	10.64
1.619	-0.360	101.25	56.54	44.71	1487.4	47.92	23803	0.695	1548.8	84.20	49.91	1.98	1.01	5.77	7.17	10.36
2.129	-0.365	114.24	62.81	51.43	1485.6	48.54	23617	0.695	1344.2	72.44	44.92	1.98	1.12	5.77	6.80	10.11
2.629	-0.385	120.85	68.94	51.91	1483.9	49.14	23437	0.695	1328.9	71.01	44.19	1.98	1.16	5.77	6.80	10.12
2.879	-0.385	121.72	72.00	49.72	1483.0	49.44	23349	0.695	1380.7	73.46	45.18	1.98	1.19	5.77	6.97	10.23

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 7
Date: 13 January 1992
Time: 14:40:13

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
275.67	36.52	307.98	94.68	19.73	0.01208	9.469	1373.4	108.64	15.76	6.35	2572	2.40	87.69	77.23

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.02	49.76
1.702	0.670	0.001	0.000	284.95	53.23
9.093	3.580	0.001	0.000	316.57	110.15
10.706	4.215	0.001	0.000	314.21	105.90

Insulated-Side Temperatures and Calculated Data:
SI Units:

											---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	307.33	286.09	21.24	9.432	15.99	24227	0.695	11764	113.09	60.68	1.10	0.58	5.77	7.72	10.76
4.163	-0.025	313.37	288.10	25.27	9.425	16.11	24117	0.695	9916	94.83	54.00	1.10	0.61	5.77	7.07	10.30
5.408	-0.071	320.76	291.89	28.87	9.411	16.34	23911	0.694	8664	82.07	48.88	1.10	0.68	5.77	6.74	10.07
6.703	0.001	324.74	295.83	28.91	9.398	16.58	23700	0.694	8632	80.96	48.28	1.10	0.70	5.77	6.77	10.09
7.249	0.001	325.45	297.48	27.97	9.392	16.68	23613	0.694	8889	83.02	49.03	1.10	0.72	5.77	6.91	10.19
3.566	0.953	309.64	286.28	23.35	9.431	16.00	24217	0.695	10705	102.86	57.06	1.10	0.58	5.77	7.33	10.48
4.176	0.927	315.52	288.14	27.38	9.425	16.11	24115	0.695	9151	87.51	51.20	1.10	0.61	5.77	6.81	10.12
5.370	0.953	322.33	291.78	30.55	9.412	16.33	23917	0.694	8188	77.58	47.05	1.10	0.67	5.77	6.57	9.96
6.703	0.927	326.66	295.83	30.83	9.398	16.58	23700	0.694	8096	75.93	46.22	1.10	0.70	5.77	6.59	9.97
7.313	0.914	327.07	297.68	29.40	9.391	16.69	23603	0.694	8450	78.89	47.37	1.10	0.72	5.77	6.76	10.09
3.528	-0.953	311.40	286.17	25.23	9.432	16.00	24223	0.695	9905	95.20	54.24	1.10	0.58	5.77	7.05	10.28
4.112	-0.914	316.08	287.95	28.13	9.425	16.10	24125	0.695	8906	85.21	50.30	1.10	0.60	5.77	6.73	10.06
5.408	-0.927	324.30	291.89	32.41	9.411	16.34	23911	0.694	7717	73.10	45.17	1.10	0.68	5.77	6.42	9.86
6.678	-0.978	328.46	295.75	32.71	9.398	16.57	23704	0.694	7631	71.58	44.39	1.10	0.70	5.77	6.43	9.87
7.313	-0.978	328.97	297.68	31.29	9.391	16.69	23603	0.694	7939	74.11	45.39	1.10	0.72	5.77	6.58	9.97

English Units:

												---------Uncertainties---------				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	93.51	55.28	38.23	1368.0	52.47	24227	0.695	2072.8	113.09	60.68	1.98	1.04	5.77	7.72	10.76
1.639	-0.010	104.38	58.90	45.48	1366.9	52.86	24117	0.695	1747.2	94.83	54.00	1.98	1.09	5.77	7.07	10.30
2.129	-0.028	117.69	65.72	51.97	1365.0	53.61	23911	0.694	1526.6	82.07	48.88	1.98	1.22	5.77	6.74	10.07
2.639	0.000	124.85	72.81	52.04	1363.0	54.39	23700	0.694	1521.0	80.96	48.28	1.98	1.26	5.77	6.77	10.09
2.854	0.000	126.12	75.78	50.34	1362.2	54.72	23613	0.694	1566.2	83.02	49.03	1.98	1.30	5.77	6.91	10.19
1.404	0.375	97.66	55.62	42.03	1367.9	52.51	24217	0.695	1886.2	102.86	57.06	1.98	1.04	5.77	7.33	10.48
1.644	0.365	108.25	58.97	49.28	1366.9	52.87	24115	0.695	1612.4	87.51	51.20	1.98	1.09	5.77	6.81	10.12
2.114	0.375	120.50	65.51	54.99	1365.1	53.59	23917	0.694	1442.7	77.58	47.05	1.98	1.21	5.77	6.57	9.96
2.639	0.365	128.30	72.81	55.49	1363.0	54.39	23700	0.694	1426.5	75.93	46.22	1.98	1.26	5.77	6.59	9.97
2.879	0.360	129.05	76.13	52.91	1362.1	54.76	23603	0.694	1488.9	78.89	47.37	1.98	1.30	5.77	6.76	10.09
1.389	-0.375	100.83	55.41	45.42	1367.9	52.48	24223	0.695	1745.3	95.20	54.24	1.98	1.04	5.77	7.05	10.28
1.619	-0.360	109.25	58.61	50.64	1367.0	52.83	24125	0.695	1569.2	85.21	50.30	1.98	1.09	5.77	6.73	10.06
2.129	-0.365	124.06	65.72	58.34	1365.0	53.61	23911	0.694	1359.7	73.10	45.17	1.98	1.22	5.77	6.42	9.86
2.629	-0.385	131.55	72.67	58.88	1363.0	54.37	23704	0.694	1344.6	71.58	44.39	1.98	1.26	5.77	6.43	9.87
2.879	-0.385	132.45	76.13	56.32	1362.1	54.76	23603	0.694	1398.9	74.11	45.39	1.98	1.30	5.77	6.58	9.97

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 8
Date: 13 January 1992
Time: 14:40:38

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
275.57	36.34	307.89	94.52	19.74	0.01209	9.469	1373.4	108.67	15.76	6.34	2575	2.40	87.79	77.32

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	283.01	49.73
1.702	0.670	0.001	0.000	284.97	53.26
9.093	3.580	0.001	0.000	316.63	110.24
10.706	4.215	0.001	0.000	314.27	105.99

Insulated-Side Temperatures and Calculated Data:
SI Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	307.35	286.00	21.35	9.432	16.00	24253	0.695	11715	112.65	60.53	1.10	0.58	5.77	7.70	10.74
4.163	-0.025	313.41	288.01	25.40	9.425	16.12	24142	0.695	9875	94.47	53.88	1.10	0.61	5.77	7.06	10.29
5.408	-0.071	320.84	291.80	29.04	9.412	16.35	23936	0.694	8622	81.69	48.73	1.10	0.68	5.77	6.72	10.06
6.703	0.001	324.82	295.74	29.08	9.398	16.59	23725	0.694	8592	80.60	48.13	1.10	0.70	5.77	6.75	10.08
7.249	0.001	325.53	297.39	28.13	9.392	16.69	23638	0.694	8846	82.64	48.89	1.10	0.72	5.77	6.89	10.17
3.566	0.953	309.68	286.19	23.49	9.431	16.01	24243	0.695	10652	102.37	56.88	1.10	0.58	5.77	7.31	10.46
4.176	0.927	315.58	288.05	27.54	9.425	16.12	24140	0.695	9108	87.12	51.05	1.10	0.61	5.77	6.79	10.11
5.370	0.953	322.41	291.68	30.73	9.412	16.34	23942	0.694	8150	77.24	46.92	1.10	0.67	5.77	6.56	9.95
6.703	0.927	326.75	295.74	31.01	9.398	16.59	23725	0.694	8057	75.59	46.08	1.10	0.70	5.77	6.57	9.96
7.313	0.914	327.14	297.59	29.55	9.391	16.70	23628	0.694	8414	78.57	47.24	1.10	0.72	5.77	6.74	10.08
3.528	-0.953	311.48	286.07	25.40	9.432	16.00	24249	0.695	9849	94.69	54.05	1.10	0.58	5.77	7.03	10.27
4.112	-0.914	316.16	287.85	28.30	9.425	16.11	24151	0.695	8861	84.80	50.14	1.10	0.60	5.77	6.71	10.05
5.408	-0.927	324.40	291.80	32.60	9.412	16.35	23936	0.694	7682	72.78	45.04	1.10	0.68	5.77	6.41	9.86
6.678	-0.978	328.55	295.66	32.89	9.398	16.58	23729	0.694	7597	71.28	44.26	1.10	0.70	5.77	6.42	9.86
7.313	-0.978	329.05	297.59	31.47	9.391	16.70	23628	0.694	7902	73.79	45.26	1.10	0.72	5.77	6.57	9.96

English Units:

													Uncertainties			
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	93.54	55.11	38.44	1368.0	52.49	24253	0.695	2064.2	112.65	60.53	1.98	1.04	5.77	7.70	10.74
1.639	-0.010	104.44	58.72	45.72	1367.0	52.89	24142	0.695	1740.0	94.47	53.88	1.98	1.09	5.77	7.06	10.29
2.129	-0.028	117.83	65.55	52.28	1365.0	53.64	23936	0.694	1519.2	81.69	48.73	1.98	1.22	5.77	6.72	10.06
2.639	0.000	124.98	72.64	52.34	1363.0	54.42	23725	0.694	1513.9	80.60	48.13	1.98	1.26	5.77	6.75	10.08
2.854	0.000	126.26	75.62	50.64	1362.2	54.75	23638	0.694	1558.7	82.64	48.89	1.98	1.30	5.77	6.89	10.17
1.404	0.375	97.74	55.45	42.29	1367.9	52.53	24243	0.695	1876.9	102.37	56.88	1.98	1.04	5.77	7.31	10.46
1.644	0.365	108.36	58.80	49.57	1366.9	52.90	24140	0.695	1604.8	87.12	51.05	1.98	1.09	5.77	6.79	10.11
2.114	0.375	120.65	65.34	55.31	1365.1	53.61	23942	0.694	1436.0	77.24	46.92	1.98	1.21	5.77	6.56	9.95
2.639	0.365	128.46	72.64	55.82	1363.0	54.42	23725	0.694	1419.6	75.59	46.08	1.98	1.26	5.77	6.57	9.96
2.879	0.360	129.17	75.97	53.20	1362.1	54.79	23628	0.694	1482.5	78.57	47.24	1.98	1.30	5.77	6.74	10.08
1.389	-0.375	100.97	55.24	45.72	1367.9	52.51	24249	0.695	1735.4	94.69	54.05	1.98	1.04	5.77	7.03	10.27
1.619	-0.360	109.39	58.45	50.95	1367.0	52.86	24151	0.695	1561.3	84.80	50.14	1.98	1.09	5.77	6.71	10.05
2.129	-0.365	124.23	65.55	58.68	1365.0	53.64	23936	0.694	1353.6	72.78	45.04	1.98	1.22	5.77	6.41	9.86
2.629	-0.385	131.71	72.50	59.20	1363.1	54.40	23729	0.694	1338.6	71.28	44.26	1.98	1.26	5.77	6.42	9.86
2.879	-0.385	132.61	75.97	56.64	1362.1	54.79	23628	0.694	1392.3	73.79	45.26	1.98	1.30	5.77	6.57	9.96

Table 3.8 (continued)

Aluminum Heat Exchanger
Experiment: 8, Data Point: 9
Date: 13 January 1992
Time: 14:41:04

T0		T1		M		P0		P0-P1		Wdp	Qt	Wqt	Qt/An	
K	°F	K	°F	kg/h	lb/s	MPa	psi	kPa	psi	%	W	%	W/cm²	Btu/(s·ft²)
275.50	36.21	307.88	94.50	19.75	0.01209	9.470	1373.6	108.75	15.77	6.34	2580	2.39	87.96	77.47

Manifold Temperatures:

X		Y		Tw	
cm	in	cm	in	K	°F
0.114	0.045	0.001	0.000	282.98	49.68
1.702	0.670	0.001	0.000	284.93	53.18
9.093	3.580	0.001	0.000	316.49	110.00
10.706	4.215	0.001	0.000	314.15	105.79

Insulated-Side Temperatures and Calculated Data:
SI Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
cm	cm	K	K	K	MPa	m/s			W/(m²·K)			K	K	%	%	%
3.503	0.001	307.28	285.95	21.33	9.433	16.00	24260	0.695	11748	112.98	60.65	1.10	0.58	5.77	7.70	10.74
4.163	-0.025	313.31	287.96	25.35	9.426	16.12	24149	0.695	9913	94.85	54.02	1.10	0.61	5.77	7.06	10.29
5.408	-0.071	320.71	291.76	28.95	9.412	16.35	23942	0.694	8666	82.12	48.91	1.10	0.68	5.77	6.73	10.07
6.703	0.001	324.68	295.70	28.98	9.399	16.59	23731	0.694	8640	81.06	48.32	1.10	0.70	5.77	6.76	10.09
7.249	0.001	325.38	297.36	28.02	9.393	16.69	23643	0.694	8899	83.14	49.09	1.10	0.72	5.77	6.90	10.18
3.566	0.953	309.57	286.14	23.43	9.432	16.01	24249	0.695	10701	102.86	57.06	1.10	0.58	5.77	7.32	10.47
4.176	0.927	315.45	288.00	27.45	9.426	16.12	24146	0.695	9156	87.59	51.23	1.10	0.61	5.77	6.80	10.12
5.370	0.953	322.24	291.64	30.60	9.413	16.34	23948	0.694	8199	77.71	47.11	1.10	0.68	5.77	6.57	9.96
6.703	0.927	326.58	295.70	30.87	9.399	16.59	23731	0.694	8109	76.08	46.29	1.10	0.70	5.77	6.58	9.97
7.313	0.914	326.99	297.55	29.44	9.392	16.70	23633	0.694	8464	79.04	47.43	1.10	0.72	5.77	6.75	10.08
3.528	-0.953	311.36	286.02	25.34	9.433	16.00	24255	0.695	9894	95.13	54.22	1.10	0.58	5.77	7.03	10.27
4.112	-0.914	316.03	287.80	28.23	9.426	16.11	24157	0.695	8903	85.21	50.30	1.10	0.60	5.77	6.71	10.06
5.408	-0.927	324.24	291.76	32.48	9.412	16.35	23942	0.694	7724	73.19	45.21	1.10	0.68	5.77	6.42	9.86
6.678	-0.978	328.38	295.63	32.75	9.399	16.58	23735	0.694	7644	71.73	44.45	1.10	0.70	5.77	6.43	9.87
7.313	-0.978	328.89	297.55	31.33	9.392	16.70	23633	0.694	7952	74.27	45.46	1.10	0.72	5.77	6.58	9.97

English Units:

												Uncertainties				
X	Y	Tw	Tf	Tw-Tf	P	V	RE	PR	h	NU	NUw	Wtw	Wtf	Wre	Wh	Wnu
in	in	°F	°F	°F	psi	ft/s			Btu/(hr·ft²·°F)			°F	°F	%	%	%
1.379	0.000	93.42	55.01	38.40	1368.1	52.49	24260	0.695	2070.0	112.98	60.65	1.98	1.04	5.77	7.70	10.74
1.639	-0.010	104.27	58.64	45.63	1367.1	52.88	24149	0.695	1746.7	94.85	54.02	1.98	1.09	5.77	7.06	10.29
2.129	-0.028	117.59	65.48	52.11	1365.2	53.63	23942	0.694	1526.9	82.12	48.91	1.98	1.22	5.77	6.73	10.07
2.639	0.000	124.73	72.58	52.16	1363.1	54.42	23731	0.694	1522.4	81.06	48.32	1.98	1.27	5.77	6.76	10.09
2.854	0.000	126.00	75.56	50.43	1362.3	54.74	23643	0.694	1568.0	83.14	49.09	1.98	1.30	5.77	6.90	10.18
1.404	0.375	97.54	55.36	42.18	1368.0	52.53	24249	0.695	1885.5	102.86	57.06	1.98	1.05	5.77	7.32	10.47
1.644	0.365	108.12	58.71	49.41	1367.1	52.89	24146	0.695	1613.3	87.59	51.23	1.98	1.09	5.77	6.80	10.12
2.114	0.375	120.35	65.27	55.09	1365.2	53.61	23948	0.694	1444.7	77.71	47.11	1.98	1.22	5.77	6.57	9.96
2.639	0.365	128.15	72.58	55.57	1363.1	54.42	23731	0.694	1428.8	76.08	46.29	1.98	1.27	5.77	6.58	9.97
2.879	0.360	128.90	75.91	52.99	1362.2	54.78	23633	0.694	1491.4	79.04	47.43	1.98	1.30	5.77	6.75	10.08
1.389	-0.375	100.76	55.15	45.60	1368.1	52.50	24255	0.695	1743.3	95.13	54.22	1.98	1.04	5.77	7.03	10.27
1.619	-0.360	109.16	58.36	50.81	1367.2	52.85	24157	0.695	1568.7	85.21	50.30	1.98	1.09	5.77	6.71	10.06
2.129	-0.365	123.94	65.48	58.47	1365.2	53.63	23942	0.694	1361.0	73.19	45.21	1.98	1.22	5.77	6.42	9.86
2.629	-0.385	131.39	72.44	58.95	1363.2	54.40	23735	0.694	1346.9	71.73	44.45	1.98	1.26	5.77	6.43	9.87
2.879	-0.385	132.31	75.91	56.40	1362.2	54.78	23633	0.694	1401.1	74.27	45.46	1.98	1.30	5.77	6.58	9.97

Table 4. Uncertainties in data analysis parameters and calculated quantities

Uncertainty Parameter	Major Source of Uncertainty	Magnitude of Uncertainty	Estimated or Calculated
Location of Temperature Probe	Measurement	1 mm	Estimated
Channel Flow Rate	Channel Uniformity, Manifold Uniformity	2 percent	Estimated
Fluid Temperature	Inlet and Outlet Temperature, Flow Rate, Furnace Calibration	0.37-1.23 K	Calculated
Gas Enthalpy Rise	Inlet and Outlet Temperature	1.5-14.2 percent	Calculated
Heat Transfer Coefficient	Wall and Fluid Temperature	5.6-43.2 percent	Calculated
Nusselt Number	Wall and Fluid Temperature	9.4-43.8 percent	Calculated
Reynolds Number	Fluid Viscosity	5.8 percent	Calculated

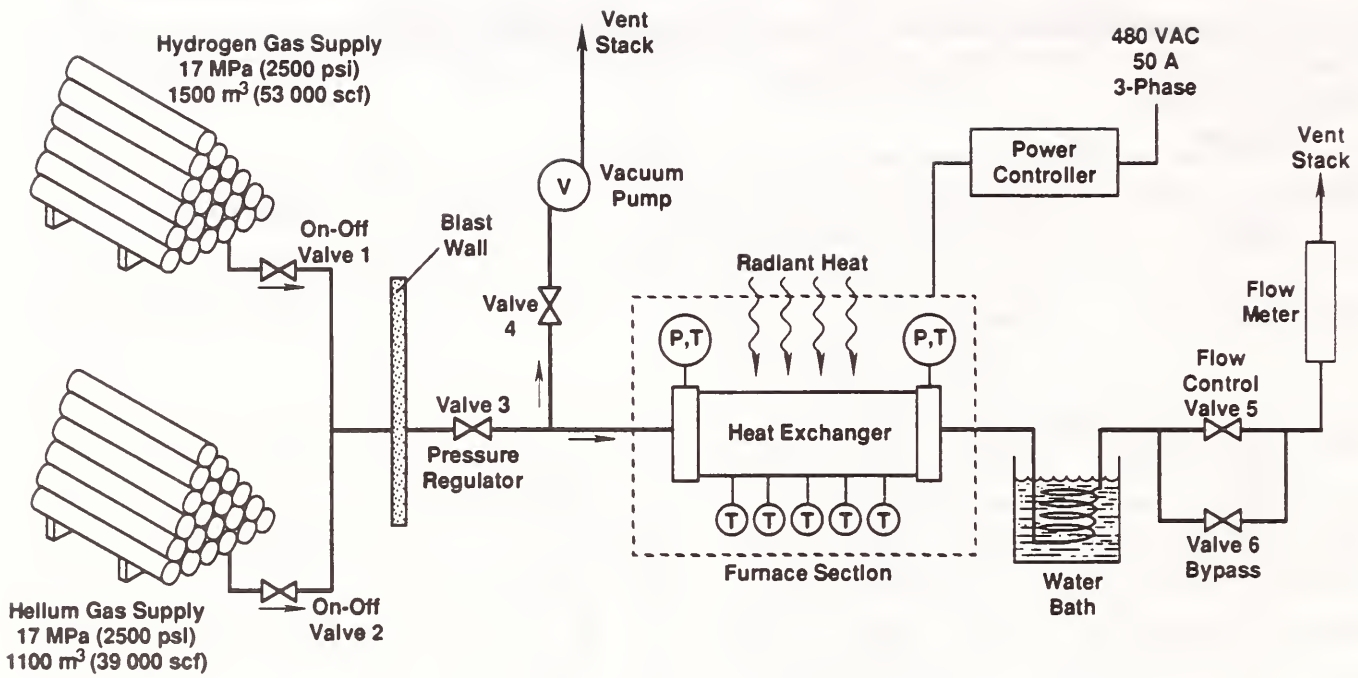


Figure 1. Hydrogen flow apparatus.

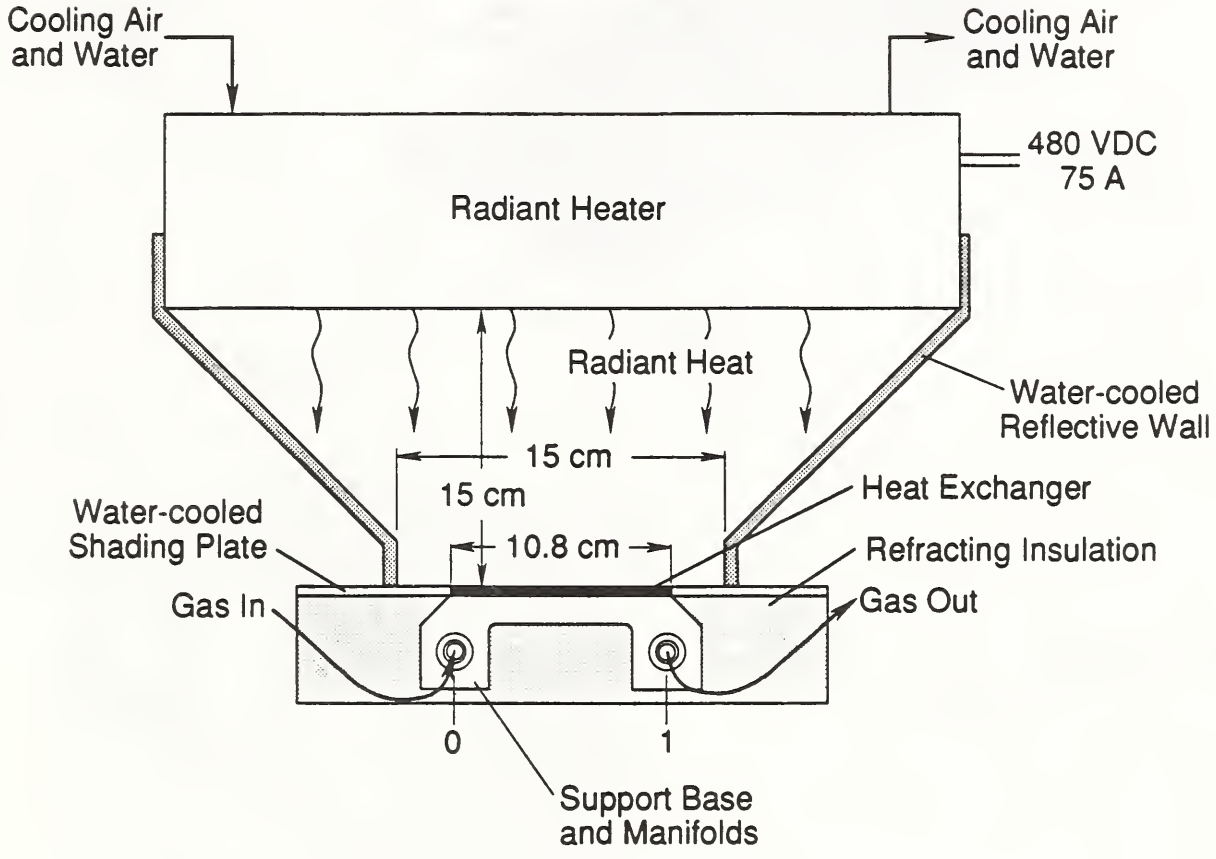


Figure 2. Furnace, showing location of shading plate, heat exchanger, inlet gas temperature and pressure (0), and outlet gas temperature and pressure (1).

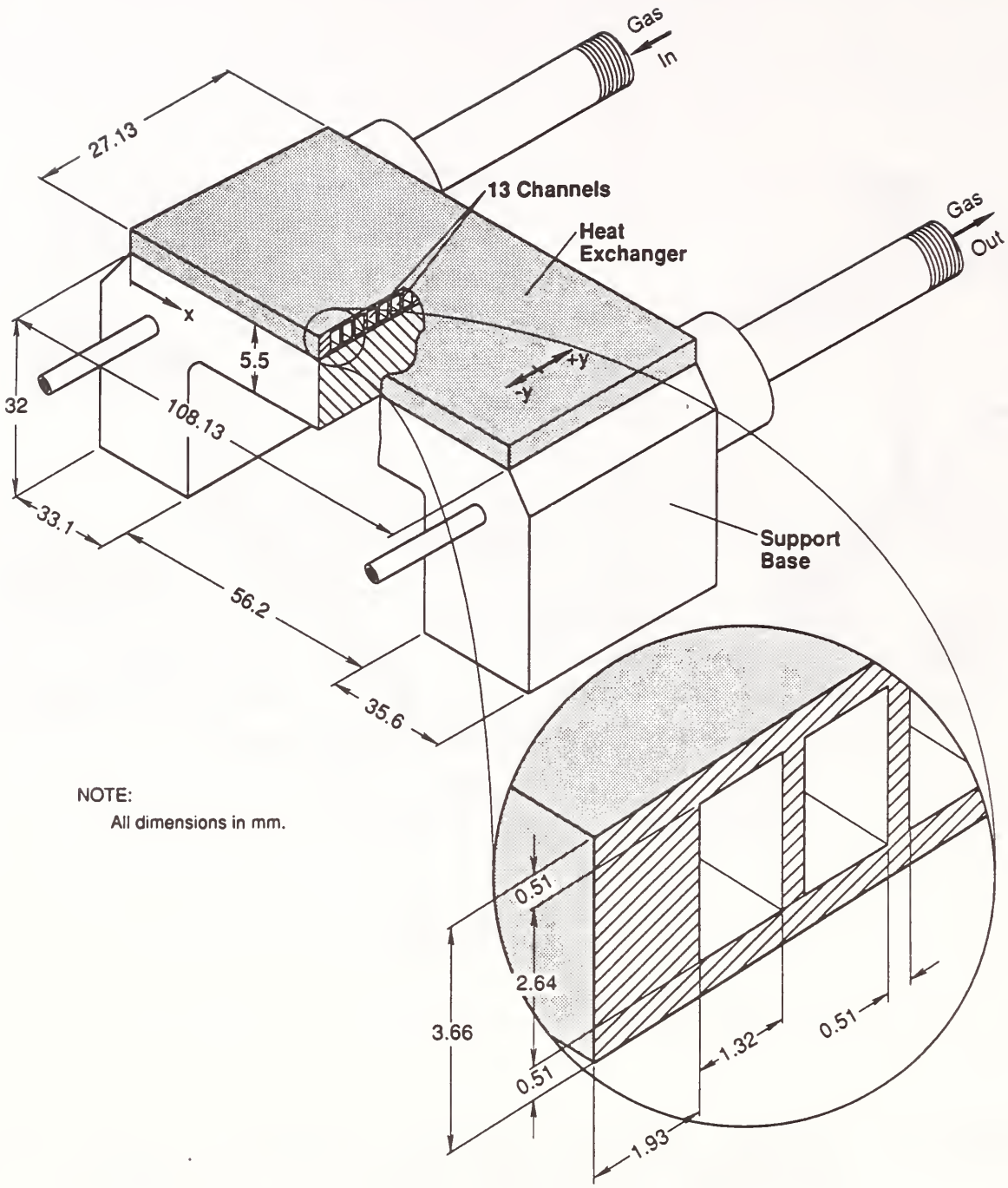
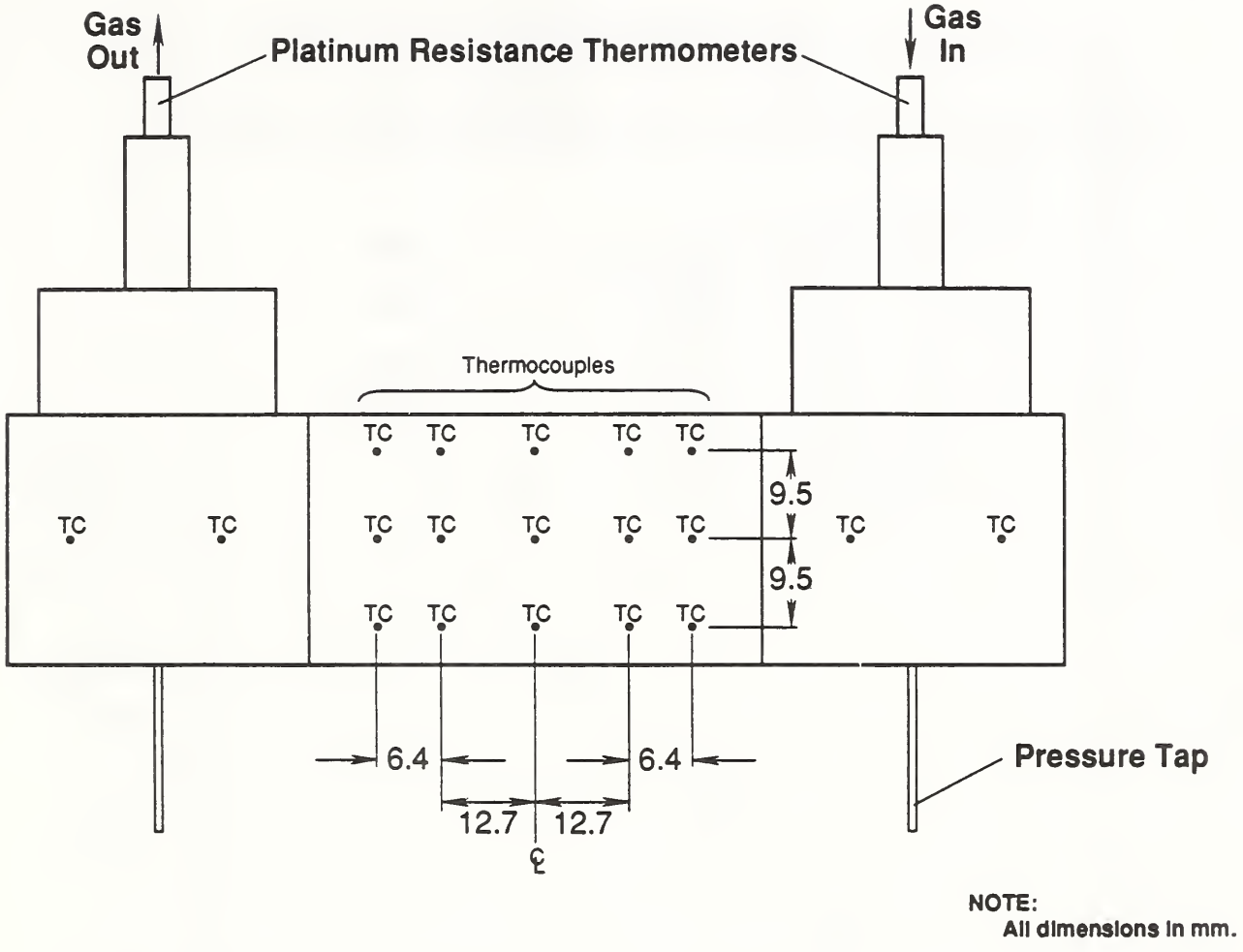


Figure 3. Aluminum heat exchanger.



Underside View of Support Base

Figure 4. Underside view of support base and heat exchanger showing locations of thermocouples.

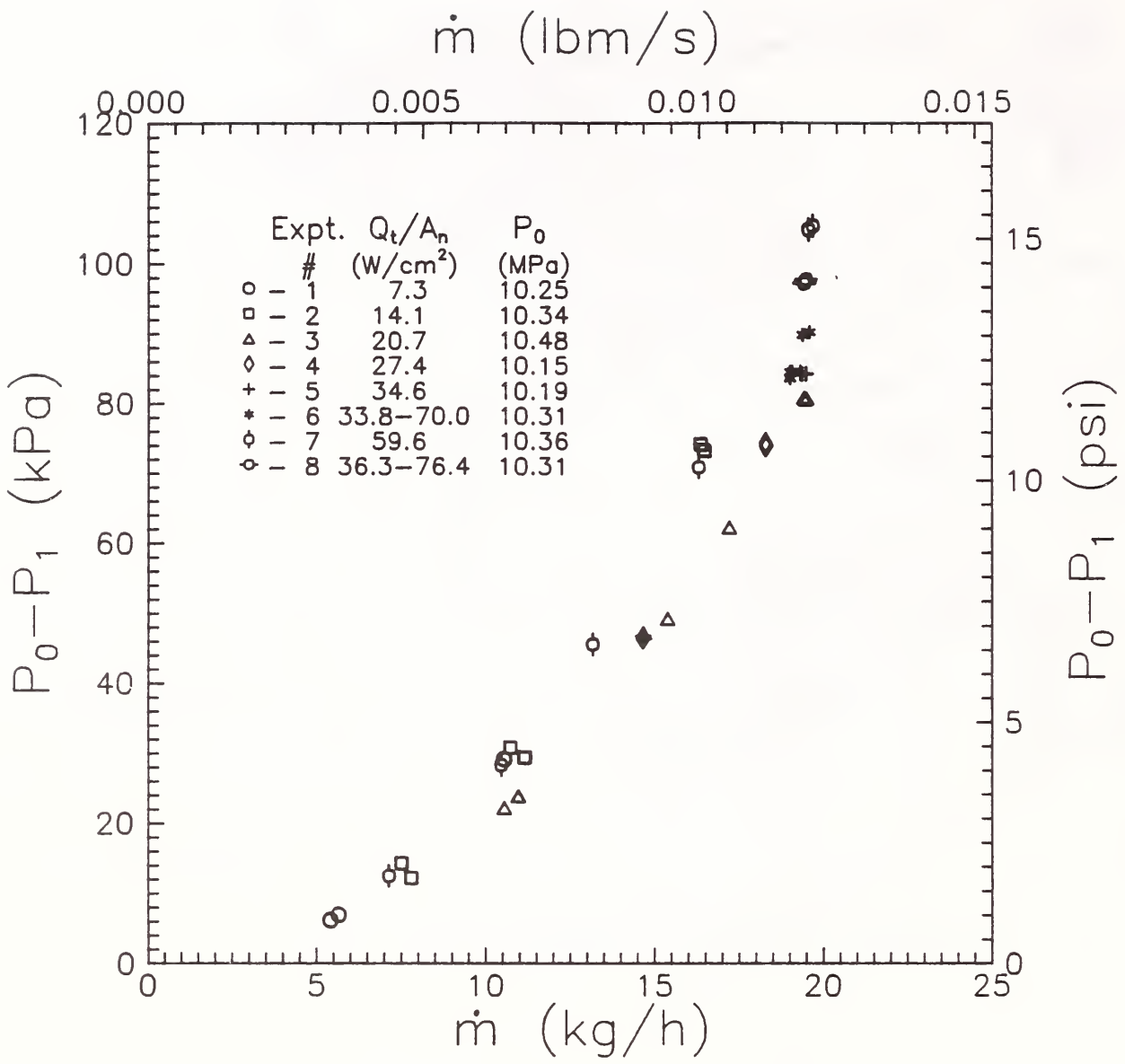


Figure 5. Pressure drop (P_0-P_1) across heat exchanger as a function of flow rate ($\dot{m}$).

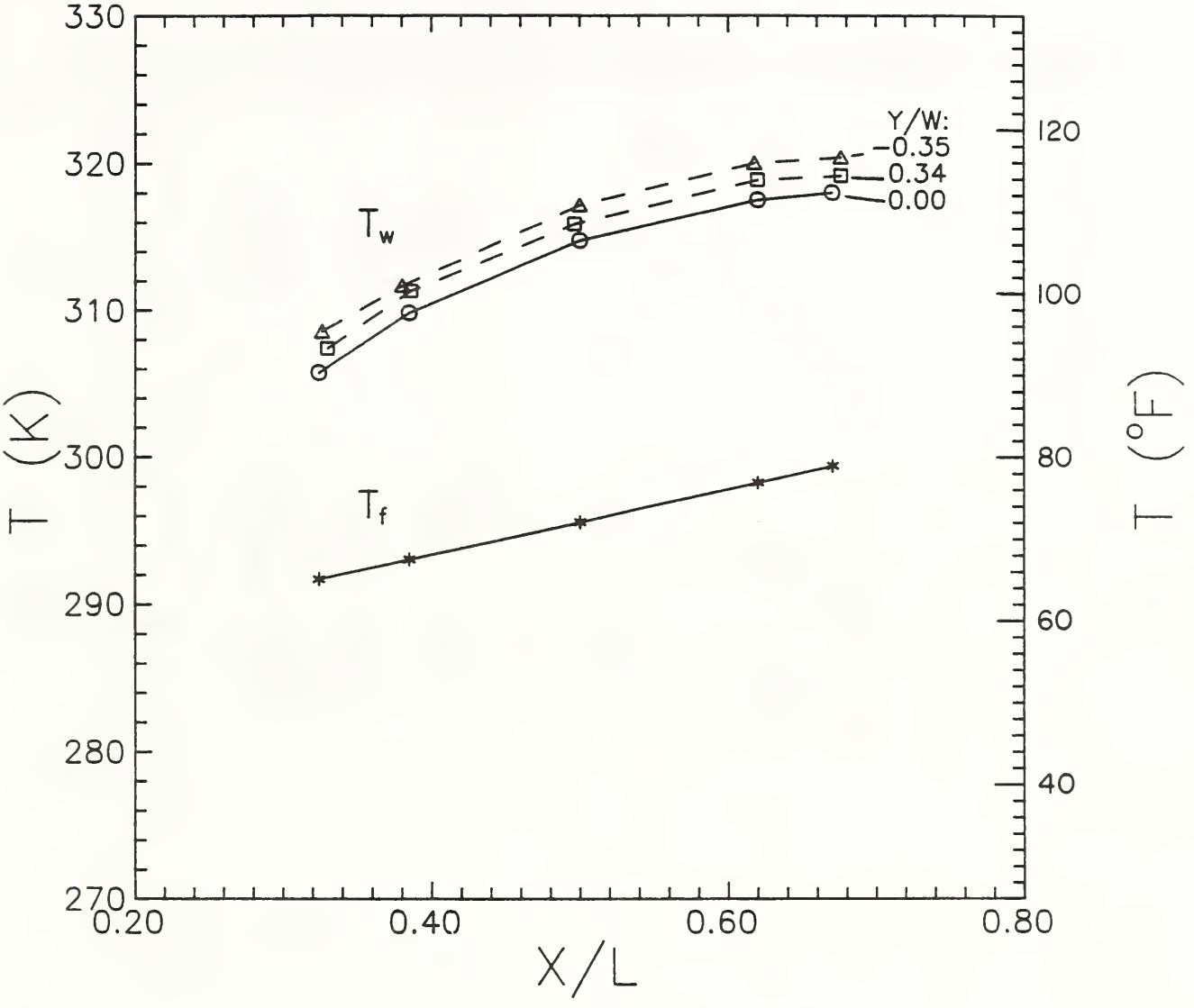


Figure 6. Wall (T_w) and gas (T_f) temperatures as a function of scaled position (x/L); experiment 7, 19.7 kg/h flow rate.

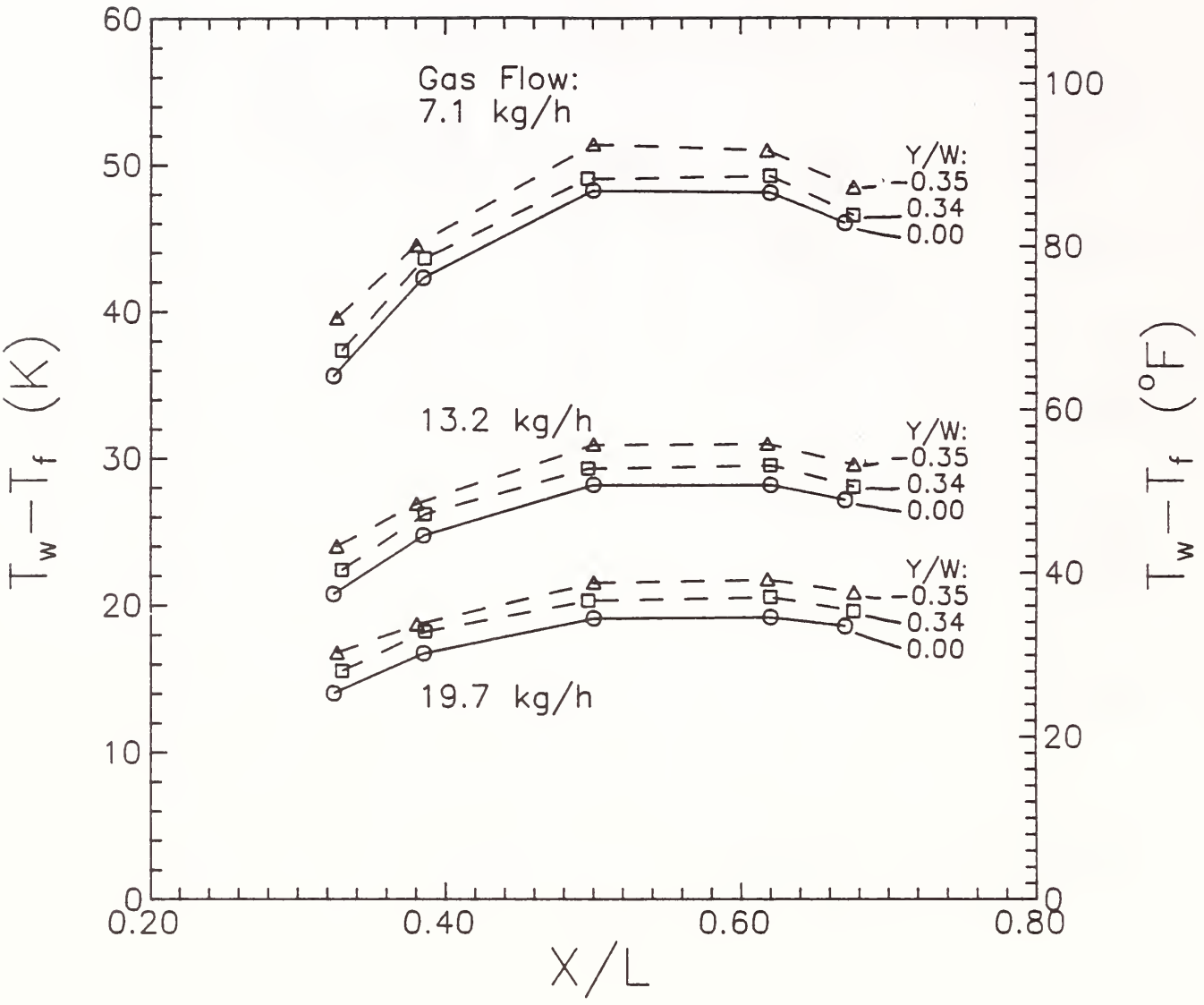


Figure 7. Wall-to-gas temperature difference (T_w-T_f) as a function of scaled position (x/L); experiment 7, flow rates of 7.1, 13.2, and 19.7 kg/h.

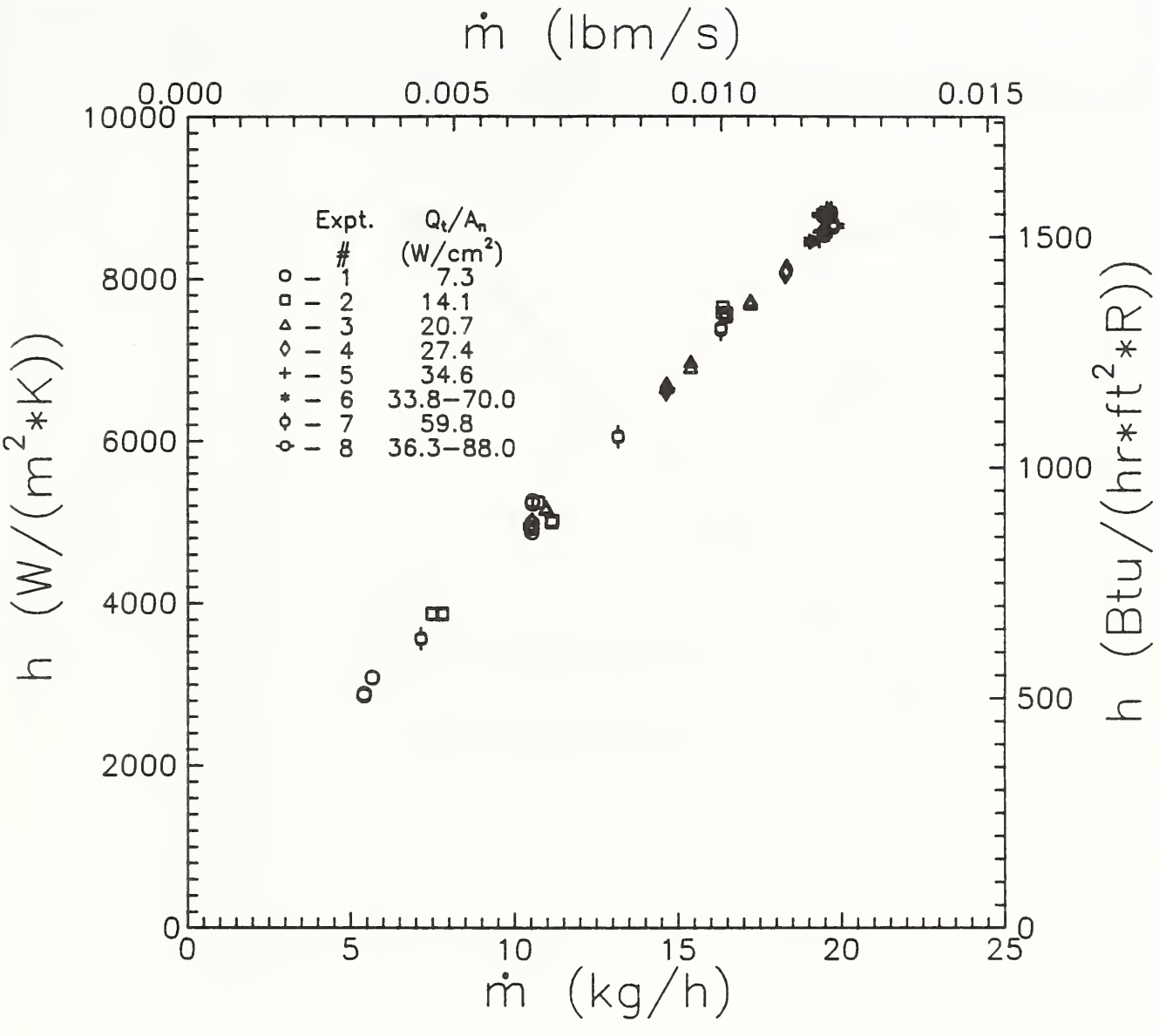


Figure 8. Heat transfer coefficient (h) as a function of flow rate ($\dot{m}$) for all experiments at scaled positions x/L = 0.5 and y/W = 0.

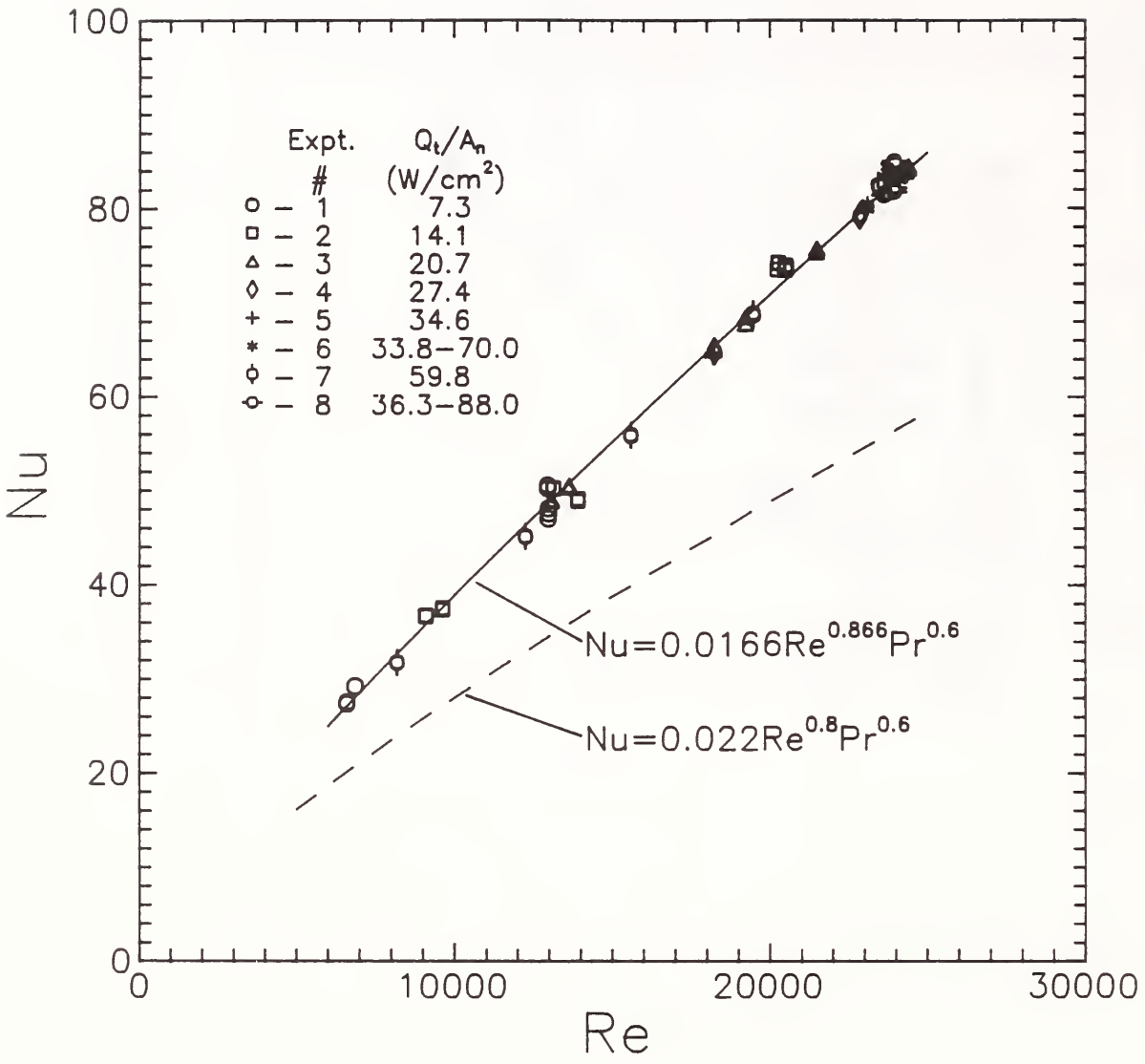


Figure 9. Nusselt number (Nu) as a function of Reynolds number (Re) for all experiments at scaled positions x/L = 0.5 and y/W = 0. The solid line is the correlation of my data; the dashed line is the correlation of Rohsenow and Hartnett [1973].

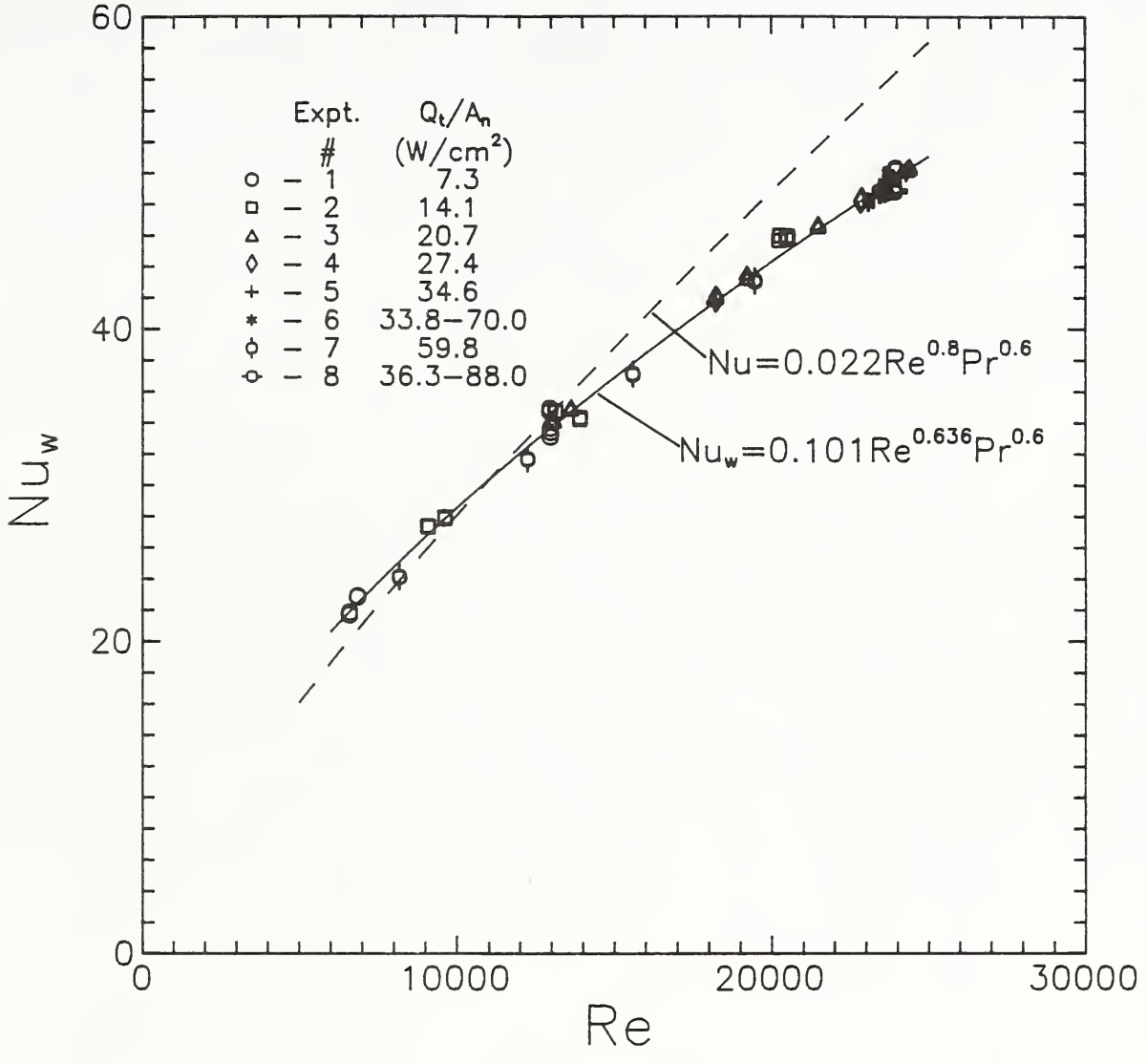


Figure 10. Wall Nusselt number (Nu_w) as a function of Reynolds number (Re) for all experiments at scaled positions x/L = 0.5 and y/W = 0. The solid line is the correlation of my data; the dashed line is the correlation of Rohsenow and Hartnett [1973].

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