ORNL-5852
Dist. Category UC-66d

ORNL--5852

DE82 015126

Contract No. W-7405-eng-26

Engineering Technology Division*

FIELD TESTS OF 2- AND 40-TUBE CONDENSERS AT THE EAST MESA GEOTHERMAL TEST SITE

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Date Published - May 1982

*Work sponsored by the Energy Division

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operated by
UNION CARBIDE CORPORATION
for the
Department of Energy

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A	Heat transfer area
c	Specific heat at constant pressure
D	Diameter
h	Heat transfer coefficient
k	Thermal conductivity
$\dot{m}$	Mass flow rate
p	Shell pressure
P	Perimeter
Pr	Prandtl number
Q	Heat load
R	Resistance to heat flow
Re	Reynolds number
T	Temperature
μ	Viscosity

Subscripts

avg	Average
comp	Composite
h	Hydraulic
in	Inlet
ins wall	Inside tube wall
out	Outlet
s	Shell-side
sat iso	Saturation isobutane
sf	Shell-side fouling
t	Tube-side
tf	Tube-side fouling
w	Water, water-side
wall	Tube wall

ACKNOWLEDGMENTS

The work reported here was part of a general program at Oak Ridge National Laboratory (ORNL) concerning power plant heat rejection undertaken for the U.S. Department of Energy (DOE), Division of Geothermal Energy. Clifton McFarland served as program manager for DOE and J. W. Michel (Energy Division) as program manager for ORNL.

Other organizations who cooperated in this effort included the following: DSS Engineers, Incorporated; Westec Services, Incorporated; Barber-Nichols Engineering Company; and Lawrence Berkeley Laboratory.

The ORNL personnel who assisted the authors during the field tests were C. V. Hardin, R. L. Linkous, and G. S. Mailen.

Detailed designs for test equipment were produced by ORNL Engineering. Fabrication functions were performed by ORNL Plant and Equipment and Y-12 Maintenance personnel. Gas sample analyses were conducted by the ORNL Analytical Chemistry Division. Assistance in preparing the manuscript for publication was provided by the Engineering Technology Division Word Processing Center and Publications Office. The authors are grateful to all who contributed in any way to this project.

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ABSTRACT

Two water-cooled isobutane condensers, one with 2 tubes and one with 40 tubes, were subjected to field tests at the East Mesa Geothermal Test Site to assess relative heat transfer performance in both surface evaporator and direct-contact evaporator modes. The five groups of tests established that field performance was below earlier laboratory-determined levels and that direct-contact evaporator mode performance was poorer than that for the surface evaporator mode. In all test situations, fluted condenser tubes performed better than smooth condenser tubes. Cooling water quality had no significant effect on performance, but brine preflash in the direct-contact mode did promote some relative performance improvement.

Important implications of these results for binary geothermal power plants are that (1) working-fluid-side impurities can significantly degrade heat transfer performance of the power plant condensers and (2) provisions for minimizing such impurities may be required.

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1. INTRODUCTION

Previous studies have indicated the significant role that heat exchangers play in determining the economic feasibility of geothermal binary-cycle power plants.[1] This importance is related to two primary characteristics of such plants: (1) the relatively high rate of heat transfer required per unit of electrical power output and (2) the relatively poor heat transfer properties of candidate binary-cycle fluids. These factors point toward a requirement for comparatively large versions of conventional heat exchangers, which, in the aggregate, can represent a major fraction of total plant capital investment.

Recognition of these relationships led to a program at Oak Ridge National Laboratory (ORNL) funded by the U.S. Department of Energy (DOE), Division of Geothermal Energy, to develop improved heat exchangers for application to the geothermal binary-cycle situation. Emphasis to date has centered on the heat rejection end of the cycle with particular attention given to advanced surface condensers.

Single-tube laboratory experiments have been conducted to evaluate the performance of a wide range of condenser tube geometries, orientations, and materials. Test results showed consistent high performance achieved by a class of fluted condenser tubes operated in the vertical orientation.[2,3]

Based on these encouraging results with single tubes in the laboratory situation, the subsequent condenser development plan included (1) verification of tube bundle performance under laboratory conditions, (2) examination of material/fabrication/cost trade-offs for field application, (3) field testing of the resulting design with a surface evaporator, (4) assessment of application to a field direct-contact evaporator situation, and (5) field testing of a unit designed for operation with a direct-contact evaporator if deemed appropriate by the assessment. Because of budget and schedule constraints, the plan was compressed to "piggyback" and mesh with independent equipment tests being conducted by DSS Engineers, Incorporated, and Barber-Nichols Engineering Company involving a direct-contact evaporator, turbine, brine preflash unit, and direct-contact condenser at various times at the East Mesa Geothermal Test Site. Although this situation did not permit attainment of the orderly development sequence outlined previously, much field operating experience was gained, and several important experimental conclusions were reached during the various groups of tests. If the work reported here contributes to the realization of improved heat exchangers for broadening world energy options, it will have served its purpose well.

2. EQUIPMENT AND FACILITIES

The condenser field tests involved equipment and facilities under the control of several organizations. This section describes the most important components in some detail and classifies their various configurations into convenient test groupings.

2.1 The DSS Apparatus

The DSS experimental loop provided for the continuous circulation, contact, and separation of geothermal brine and isobutane.[4,5] Heat from the brine was transferred to the isobutane in a direct-contact evaporator or a surface evaporator, depending on the chosen mode of operation. Other major components of the DSS apparatus included a hot well, brine and isobutane pumps, a separator, and a service condenser.

Isobutane liquid was pumped from the hot well to the evaporator, where it was vaporized with heat from the brine. The vapor was then expanded, condensed, and returned to the hot well to complete the cycle.

Hot brine was pumped from the geothermal supply manifold to the evaporator, where heat was removed to vaporize isobutane. The spent brine passed through the test pad manifold to the holding pond.

Cooling water obtained from the cooling tower basin was pumped through the test pad manifold into the service condenser. After absorbing heat from the condensing isobutane, the cooling water returned to the manifold and fed spray nozzles in the top section of the cooling tower.

2.1.1 Direct-contact evaporator

The DSS direct-contact evaporator consisted of a single column with an inside diameter of 152 mm (6.0 in.) and an overall height of about 4.0 m (13 ft). The distance between the isobutane distributor at the bottom of the column and the brine distributor at the top was 3.5 m (10.3 ft).

Isobutane liquid was introduced near the bottom of the column through a plate containing 390 drilled holes, each 1.52 mm (0.060 in.) in diameter. Brine was introduced through a perforated distribution ring near

the top of the column. Isobutane vapor leaving the top of the column passed through a knit stainless steel wire-mesh demister pad 152 mm (6.0 in.) deep that was intended to minimize carryover of either liquid isobutane or brine.

Numerous connections were provided on the shell of the column for vents, drains, and instrumentation including three thermowells, one pressure gauge connection, two manometer taps, and four high-pressure windows (or "bulls-eyes") for viewing the dispersion.

2.1.2 Surface evaporator

For operation in the non-direct-contact mode, a surface heat exchanger in a "hairpin" configuration was used to transfer heat from the brine to the isobutane. This single-pass tube-in-tube unit performed with brine inside the inner tube and isobutane in the annulus.

2.1.3 Service condenser

Isobutane vapor, after expanding through a turbine, valve, or dummy nozzle, was condensed on the shell side of a conventional shell-and-tube heat exchanger by cooling water flowing through a single pass of tubes. The unit was installed in a counterflow arrangement with its longitudinal axis tilted 20° from the horizontal. The inlet for isobutane vapor was at the upper end of the exchanger, and the outlet for the condensate was at the lower end. The total heat transfer area for this brass and cast-iron service condenser was 11.15 m^2 (120 ft^2).

2.1.4 Hot well

The hot well served as a receiver for the isobutane condensate from which the isobutane evaporator feed pump took suction. The vessel, 1.8 m (6 ft) long and 260 mm (10.6 in.) in diameter, was installed with its longitudinal axis tilted slightly from the horizontal to facilitate flow to the pump suction line. As operating conditions changed, the amounts of liquid isobutane in various parts of the apparatus changed, and the hot well provided the liquid inventory to cope with both these changes and losses through leakage.

2.1.5 Pumps

The isobutane was circulated by a four-cylinder (John Bean Model T-04102) outside-packed plunger pump rated at 6.3 x 10^{-4} m^3/s (10 gpm) capacity. The brine pump was an outside-packed triplex plunger type (John Bean Model M-0910) with a rated capacity of 4.4 x 10^{-4} m^3/s (7 gpm).

2.2 The ORNL Two-Tube Condenser

The ORNL two-tube condenser was originally envisioned as an easy-to-install versatile apparatus to obtain side-by-side vertical condenser tube data in a stable field-test environment. It later came to be used as a reliable tool in evaluating the effects of various operating parameters on condenser performance. These requirements were met using a relatively simple shell-and-tube configuration modified to take advantage of experience gained in previous laboratory experiments with single-tube condensers.

For the test at East Mesa, vapor feed to the ORNL two-tube condenser was provided by either the DSS direct-contact evaporator or the DSS surface evaporator. The product condensate from the ORNL two-tube condenser drained to the DSS hot well. Cooling water supply and return connections were made to the test pad manifold piping.

2.2.1 Shell and heads

The shell of the two-tube condenser (Fig. 2.1) was fabricated from 6-in. sched-40 stainless steel pipe. Shell penetrations were provided in the upper section for pressure and temperature sensors, in the middle section for two view ports and one liquid-level port, and in the lower section for the vapor inlet.

The two heads were fabricated from 6-in. 150-lb stainless steel blind flanges and were mated to the 6-in. 150-lb weld neck flanges that comprised the top and bottom ends of the shell. Each head contained two 25.4-mm (1.00-in.) holes with Buna-N O-ring seals to accommodate two test tubes on 76.2-mm (3.00-in.) centers. A port for venting the shell of the condenser was provided in the top head. Two additional penetrations in the bottom head allowed for condensate drainage and a second liquid-level port.

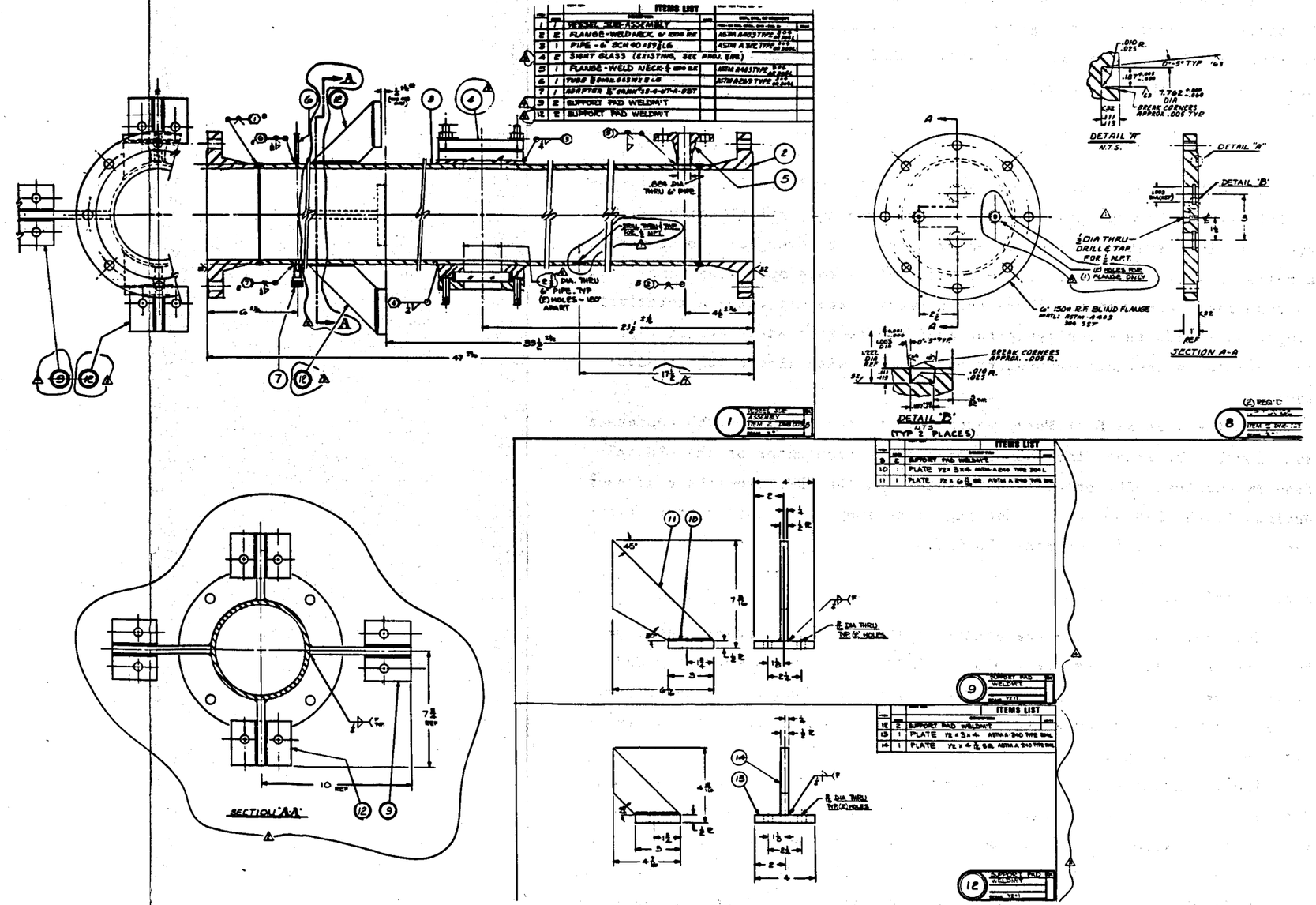

Fig. 2.1. The ORNL two-tube condenser – shell and heads drawing.

When assembled as shown in Fig. 2.2, the shell and head combination gave a total available vertical condensing length of 1.194 m (47.0 in.).

2.2.2 Tube installation

Because the heads on the two-tube condenser were designed to seal smooth 25.4-mm-diam (1.00-in.) tubes, fluted tubes were prepared for testing by welding a smooth adapter sleeve to each test tube end (Fig. 2.3). During installation, the top head was removed, and the test tubes were inserted downward into the shell until the bottom sleeves slipped through the O-ring seals in the bottom head. The top head was then slipped over the top sleeves and bolted to the shell flange to complete the shell-side sealing operation. Next, inlet and outlet cooling water connections were made to the protruding sleeves at the bottom and top heads, respectively. Finally, a 19.0- or 12.7-mm-diam (0.75- or 0.50-in.), full-length solid rod insert was centered and sealed inside the tube in each channel to achieve the desired water-side conditions (Appendix D).

2.2.3 Test tubes

Eleven tubes of eight distinct types were tested in the ORNL two-tube condenser during this investigation. Two specimens each of tube types A, F, and F-3 and one each of the five other types were employed in the studies. Letter designations and physical characteristics of the various tube types are given in Table 2.1. Photographs of samples of the test tubes are presented in Fig. 2.4.

Tube types A, W, X, Y, and Z were smooth tubes, while tube types F, F-3, and L had outside flutes. Details of the F and L cross sections are illustrated in Fig. 2.5. All tubes were made of aluminum except types W (copper), X (brass), and Z (nickel).

Tube type F-3 was a variation of tube type F created by attaching three rubber skirts to the outside tube wall. Each 0.79-mm-thick (1/32-in.) neoprene skirt was placed in a slot 3.18 mm wide by 0.10 mm deep (0.125 in. by 0.004 in.) machined into a type F fluted tube. The three skirts divided the tube into four equal lengths and aided condensate drainage from the outside tube surface.

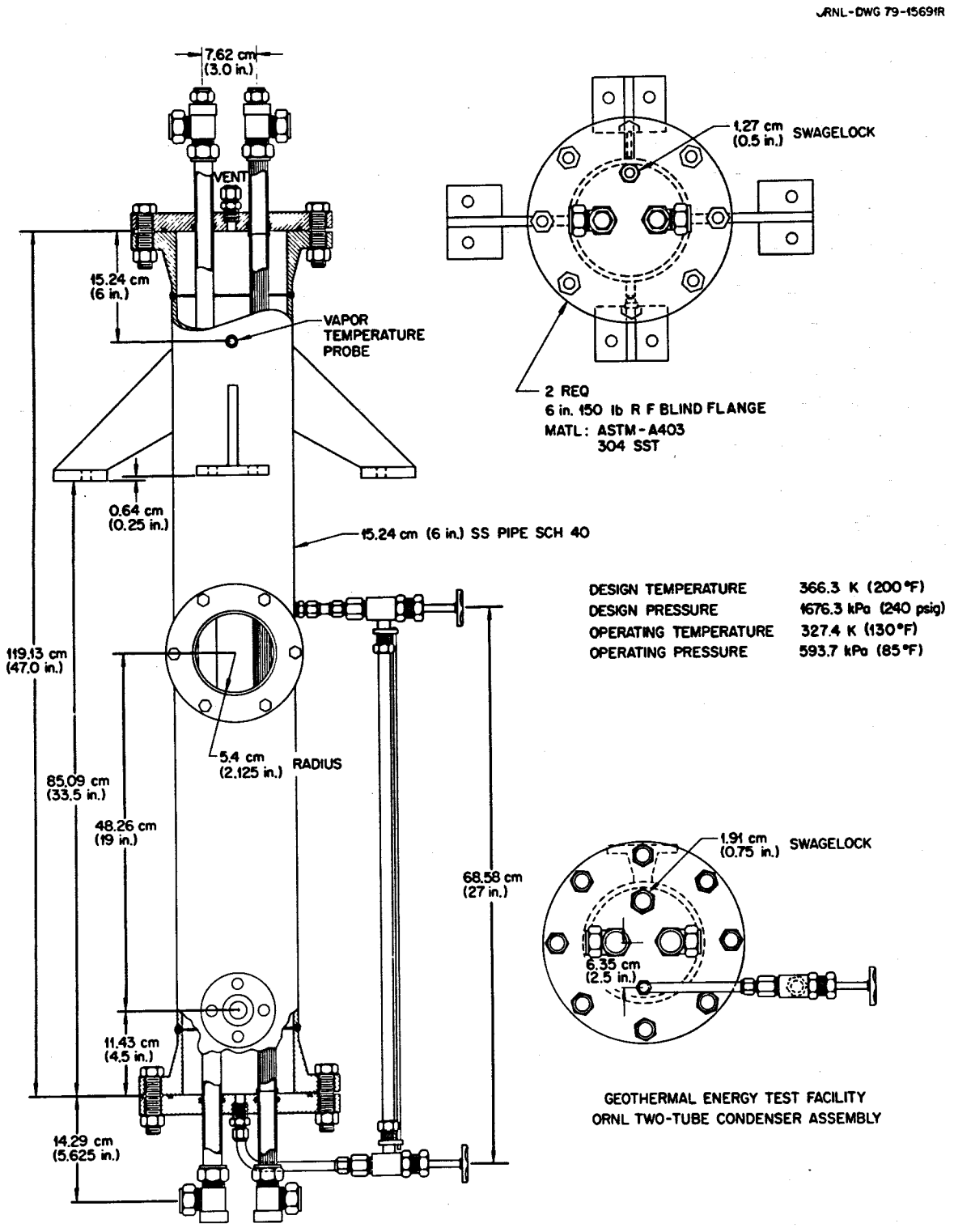

Fig. 2.2. The ORNL two-tube condenser – assembly drawing.

ORNL–PHOTO 4506–75

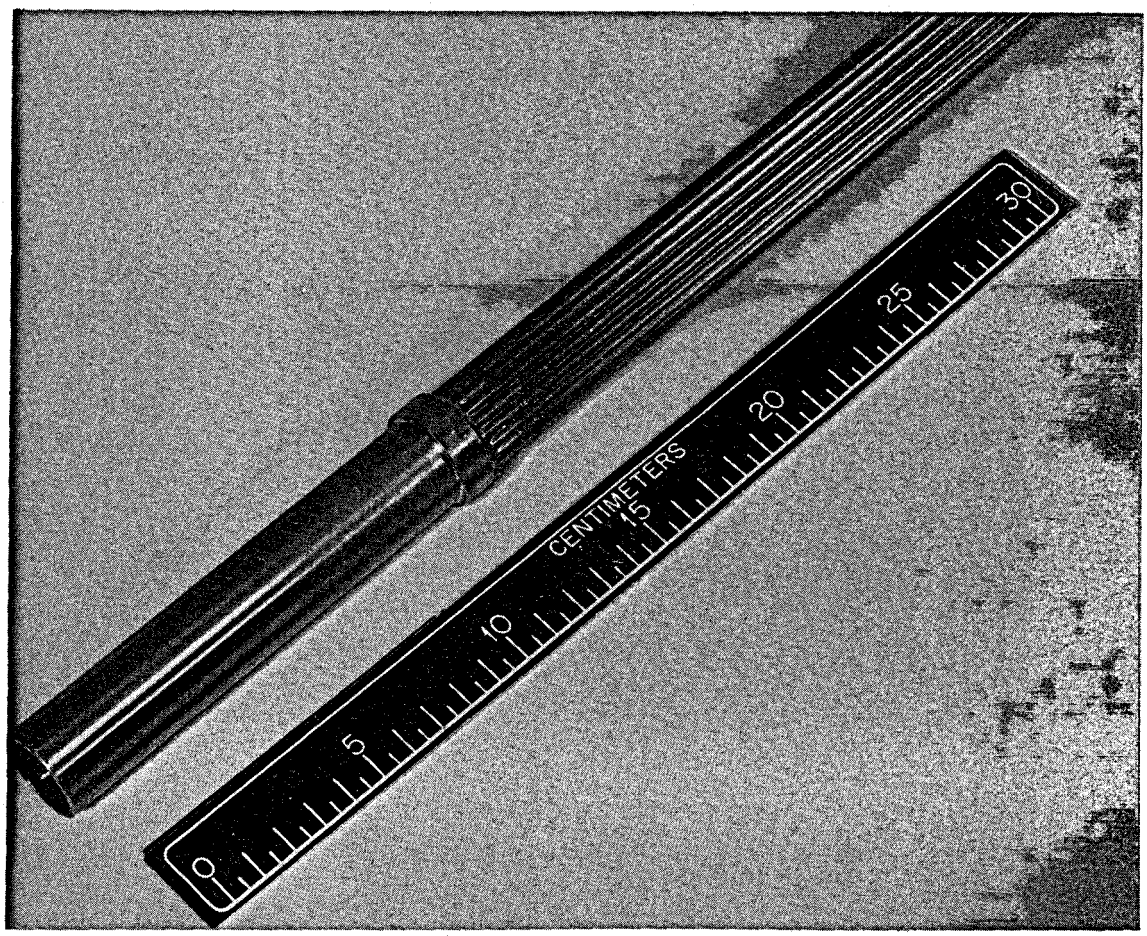

Fig. 2.3. Sleeve adapter installed on sample fluted tube.

Table 2.1. Characteristics of test tubes
[nominal 2.5-cm (1-in.) OD, 1.2 m (4 ft) long]

Tube	Description	Material	Surface area [m² (ft²)]		Number of flutes	
			Inside	Outside	External	Internal
A	Smooth	Aluminum 6061-T6	0.08287 (0.892)	0.09523 (1.025)	0	0
F[a]	Single-fluted	Aluminum 6063	0.08110 (0.873)	0.09643 (1.038)	48	0
L[a]	Single-fluted	Aluminum 6061	0.08018 (0.863)	0.13973 (1.504)	60	0
W	Smooth	Copper ASTM B-75	0.08287 (0.892)	0.09523 (1.025)	0	0
X	Smooth	Brass alloy 330 (ASTM B251-67)	0.08287 (0.892)	0.09523 (1.025)	0	0
Y	Smooth	Aluminum 2024-T3	0.08287 (0.892)	0.09523 (1.025)	0	0
Z	Smooth	Nickel ASTM B-161	0.08287 (0.892)	0.09523 (1.025)	0	0

[a]Areas based on 1.17-m (46-in.) tube lengths. All other tubes were of 1.19-m (47-in.) lengths.

ORNL–PHOTO 8880–81

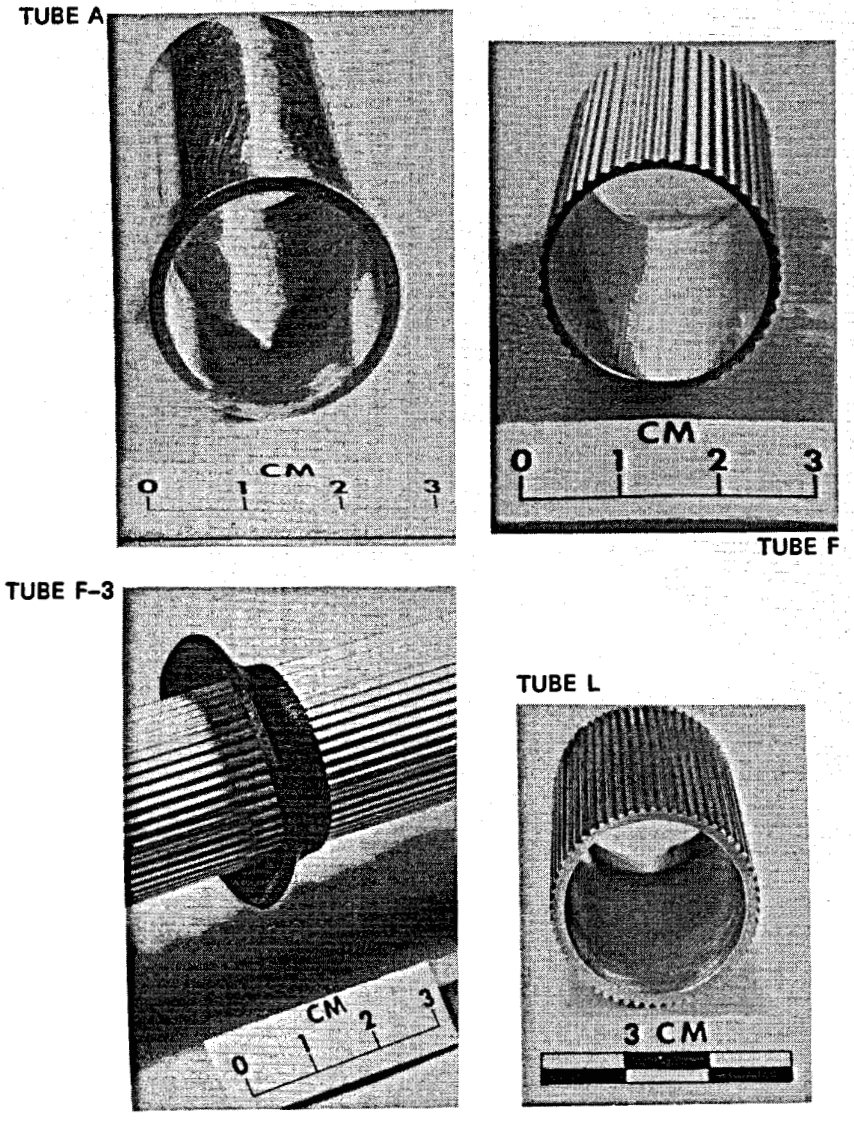

Fig. 2.4. Sample sections – tube types A, F, F-3, and L.

The external perimeter of each fluted tube was measured as the length of thin tape forced to conform closely and completely around the outside surface of the tube. The external surface areas in Table 2.1 apply to the tubes after preparation for testing. The areas of the smooth tubes were based on a 1.194-m (47.0-in.) length – the total length available within the condenser shell. [Comparable length was 1.219 m (48.0 in.) for the

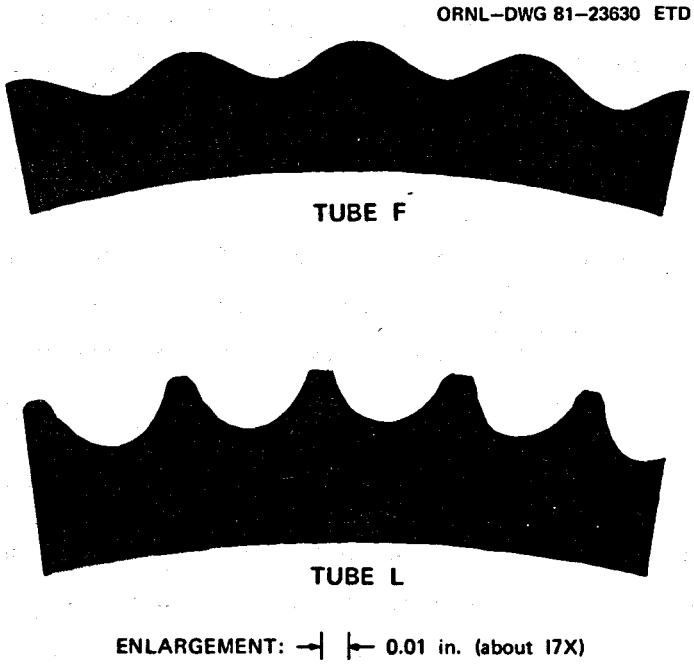

Fig. 2.5. Enlarged cross sections – tube types F and L.

single-tube condenser used in laboratory tests in Refs. 2 and 3.] However, the areas of the fluted tubes are based on 1.168-m (46.0-in.) effective length to account for the 12.7-mm (0.50-in.) adapter sleeve and installation clearance on each end of the fluted tubes.

2.3 The ORNL 40-Tube Condenser

The ORNL 40-tube condenser was a first attempt at incorporating into a practical bundle configuration the apparent advantages found during tests of individual vertical fluted condenser tubes. The resulting shell-and-tube heat exchanger was sized specifically for operation with the DSS apparatus. A U-tube configuration with four water-side passes and four vapor-side baffles was chosen. The water inlet and outlet, vapor inlet, and condensate outlet were all located near the bottom of the condenser in this design.

2.3.1 Shell and water head

The shell of the ORNL 40-tube condenser was fabricated from 12-in. sched-40 stainless steel pipe with a 12-in. sched-40 stainless steel pipe

cap welded to the top end and a 12-in. 150-lb stainless steel weld-neck flange welded to the bottom end (Fig. 2.6). Various penetrations in the shell provided for vapor entry, venting, bundle viewing, and monitoring of pressure, temperature, and liquid-level conditions on the isobutane side of the condenser.

The water head was made by welding a 12-in. 150-lb aluminum weld-neck flange to an aluminum disk. Penetrations in the disk accommodated cooling water supply and return connections as well as a condensate drainage line.

2.3.2 Tube bundle

The type F tube bundle was of a U-bend configuration with four-pass water-side flow. Construction of the bundle required 15 tubes bent to form the outside rows of the bundle plus 10 more tubes bent and welded (to avoid minimum radius bends) to form the inner rows. The "40-tube" count denotes the number of vertical fluted tube lengths rather than the actual number of separate pieces involved in the construction. All tube ends were welded to the aluminum tube sheet (Fig. 2.7).

Four rubber sheets attached by Pliobond adhesive to each fluted tube were arranged along the bundle length to aid with condensate drainage, to act as baffles for guiding the vapor flow on its shell-side passes, and to reduce the potential for tube vibrations. The resulting arrangement was, in some sense, comparable with that achieved with tube type F-3 in the ORNL two-tube condenser. In addition, two shrouds (or longitudinal baffles) served as vapor flow guides to minimize bypassing of the bundle core.

The total installed outside heat transfer area of the tube bundle was calculated to be 4.487 m^2 (48.3 ft^2). Photographs of the tube bundle are presented in Figs. 2.8 and 2.9.

Condenser assembly was accomplished by mating the bundle tube sheet to the shell flange, which, in turn, was bolted to the water head (Fig. 2.10). Two Buna-N gaskets – one between the shell and the tube sheet and the other between the tube sheet and the water head – were used to prevent isobutane or cooling water leakage to the surroundings.

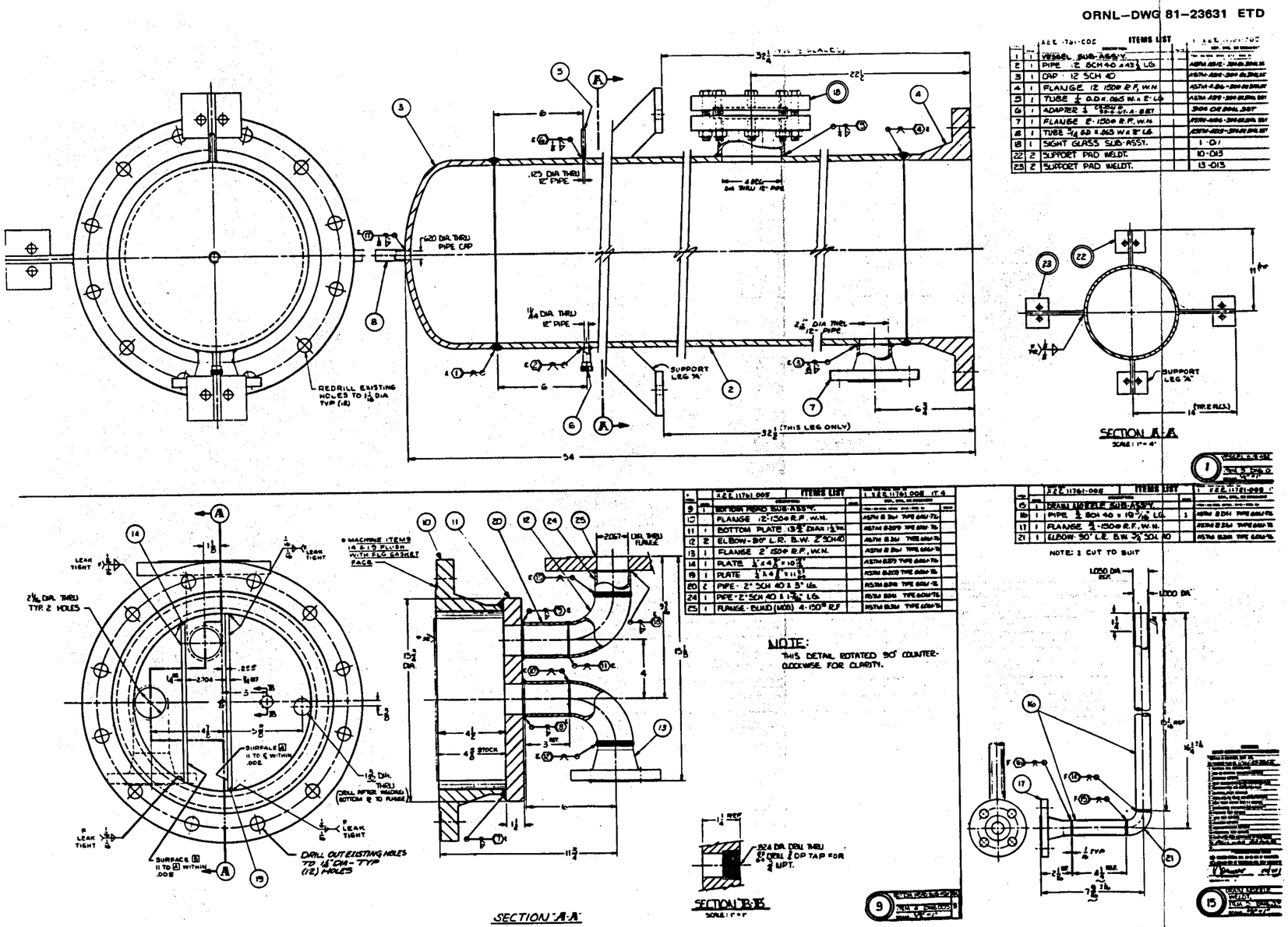

Fig. 2.6. The ORNL 40-tube condenser — shell and head drawing.

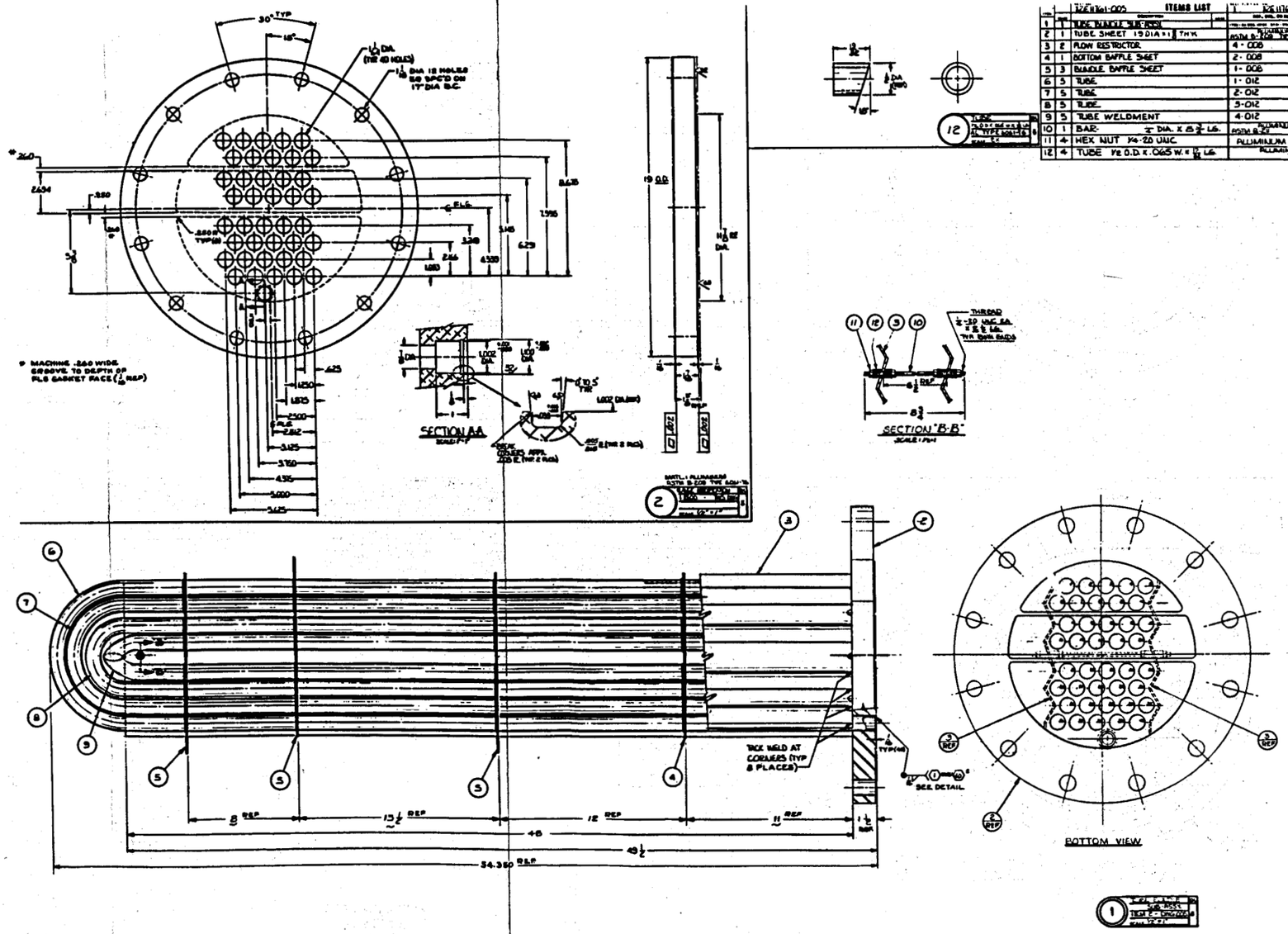

Fig. 2.7. The ORNL 40-tube condenser – tube bundle drawing.

ORNL–PHOTO 1340–78

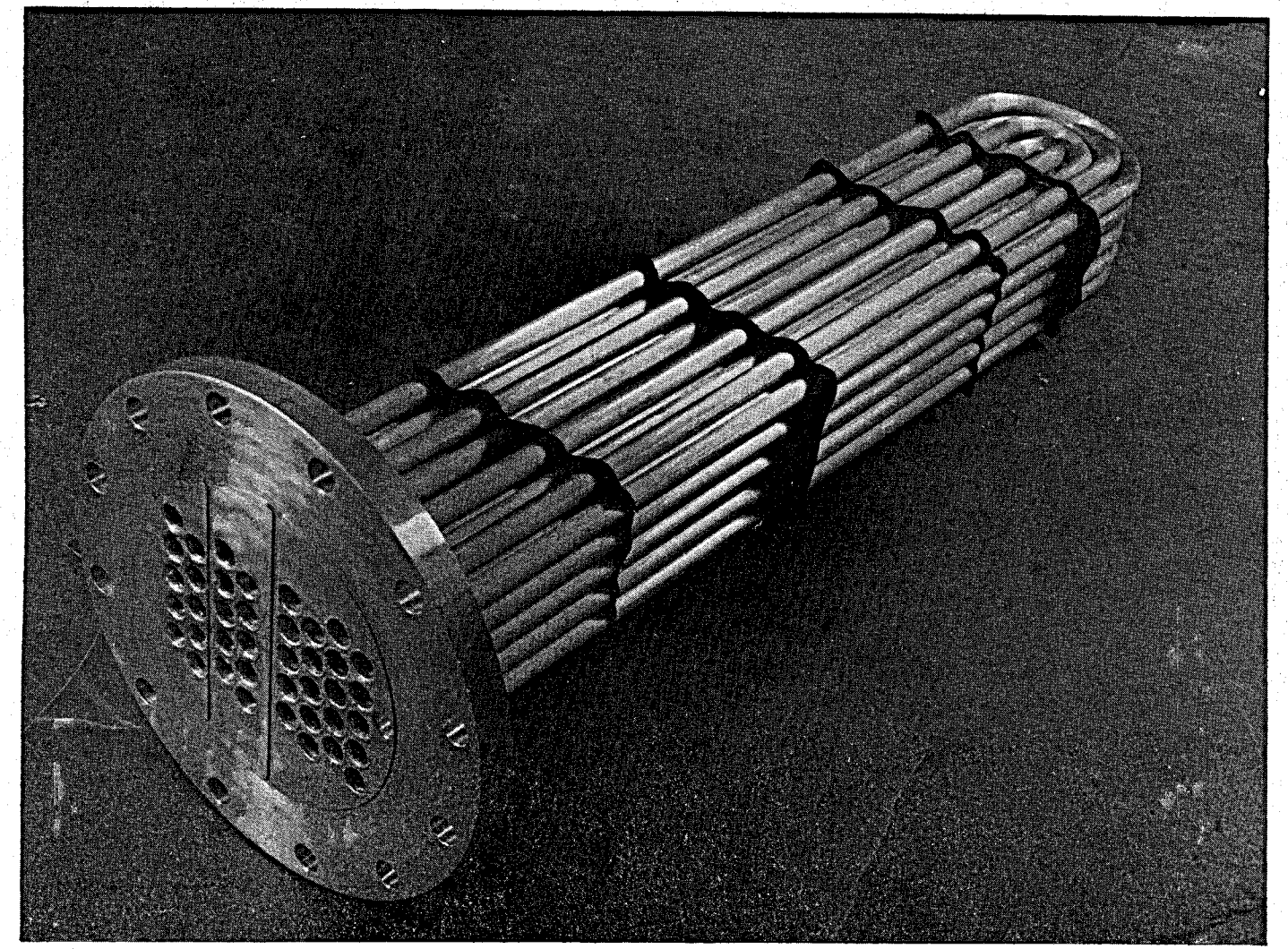

Fig. 2.8. The ORNL 40-tube condenser – tube bundle photo.

ORNL–PHOTO 1479–78

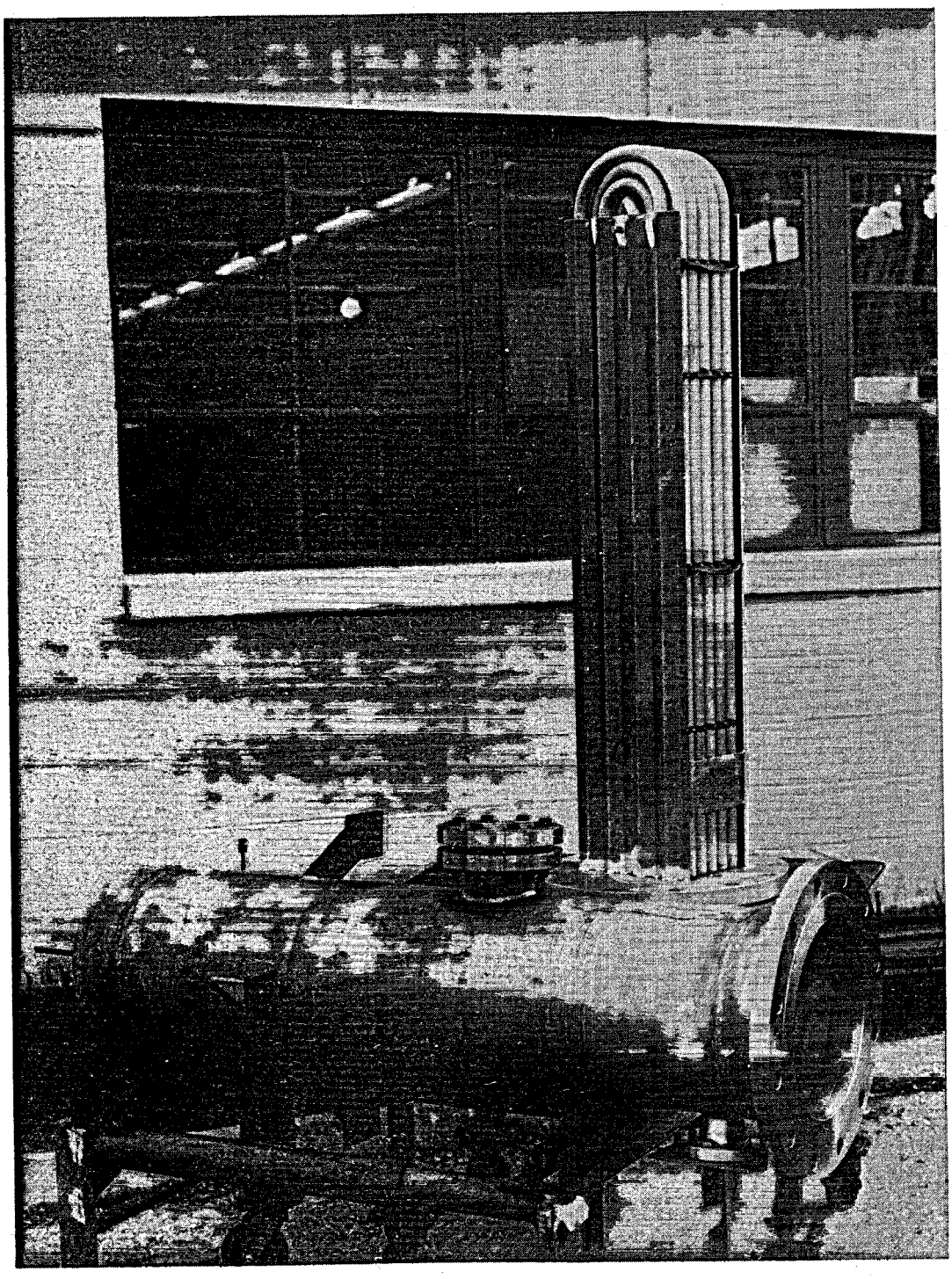

Fig. 2.9. The ORNL 40-tube condenser – tube bundle with shell.

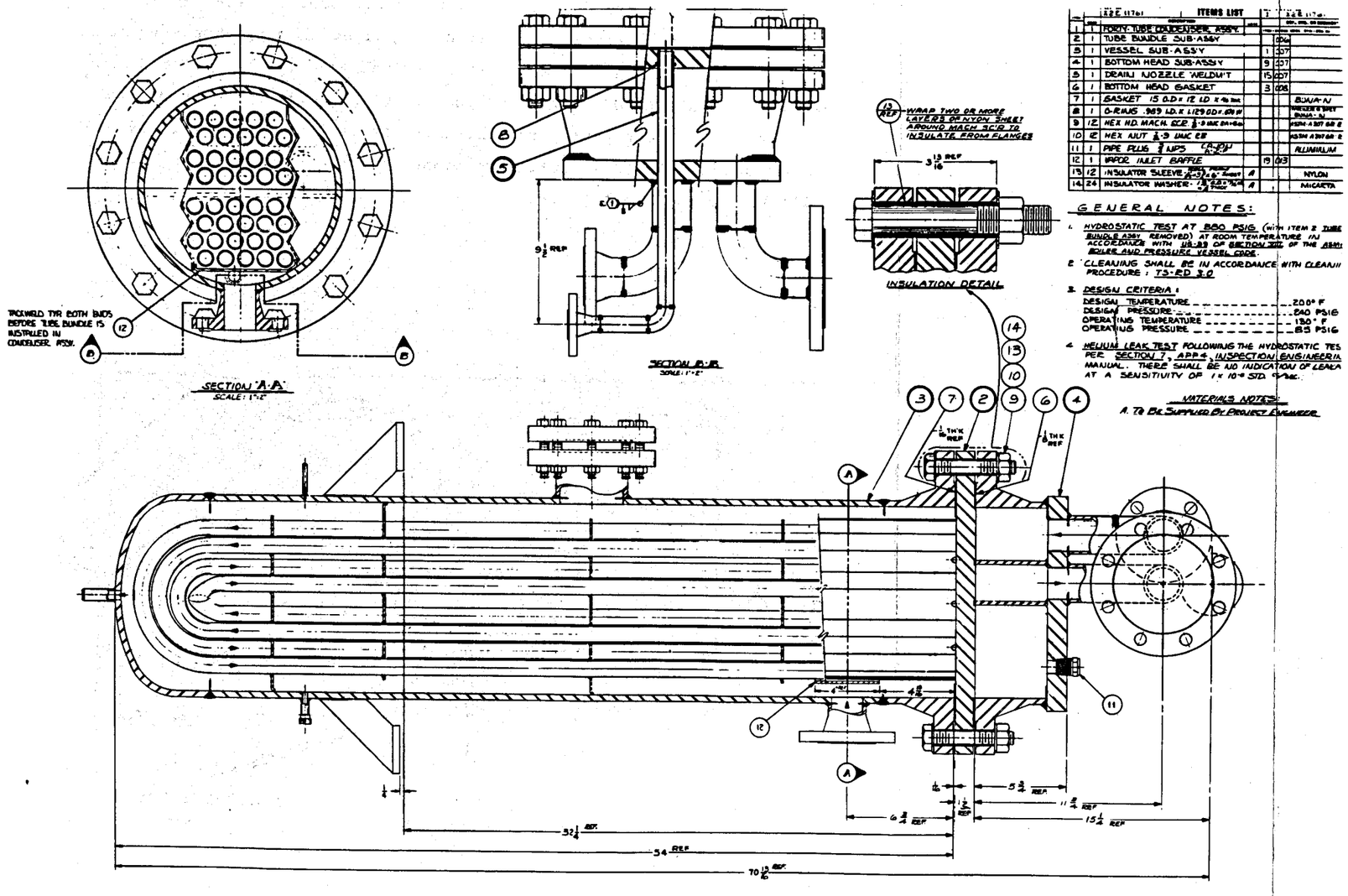

Fig. 2.10. The ORNL 40-tube condenser – assembly drawing.

2.4 East Mesa Geothermal Test Site

The East Mesa Geothermal Test Site, located near Holtville, California (Fig. 2.11), and operated for DOE by Westec Services, Incorporated, provided test pad space, geothermal brine and cooling water access, utilities, and various support services during the ORNL experiments described in this report. Figure 2.12 gives a general view of the test pad area with both ORNL and DSS equipment in place. The primary brine source well was Mesa 6-2, which gave gauge pressures at the supply manifold of 0.931 to 1.048 MPa (135 to 152 psi) and temperatures of 422 to 439 K (300 to 330°F) over this test period.

ORNL–DWG 78–10168

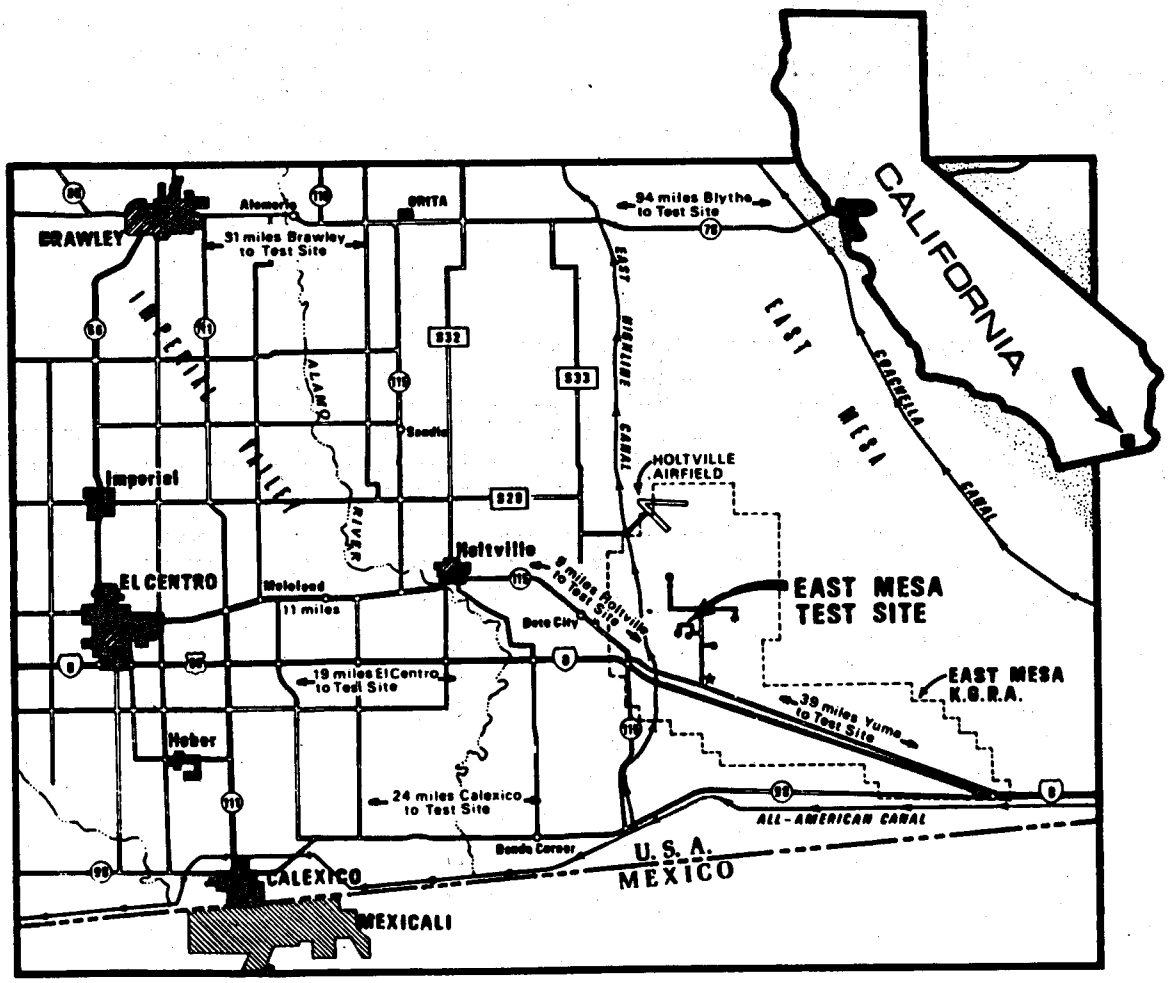

Fig. 2.11. Map of East Mesa Geothermal Test Site and surrounding area.

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1. INTRODUCTION

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ORNL–PHOTO 7031–79

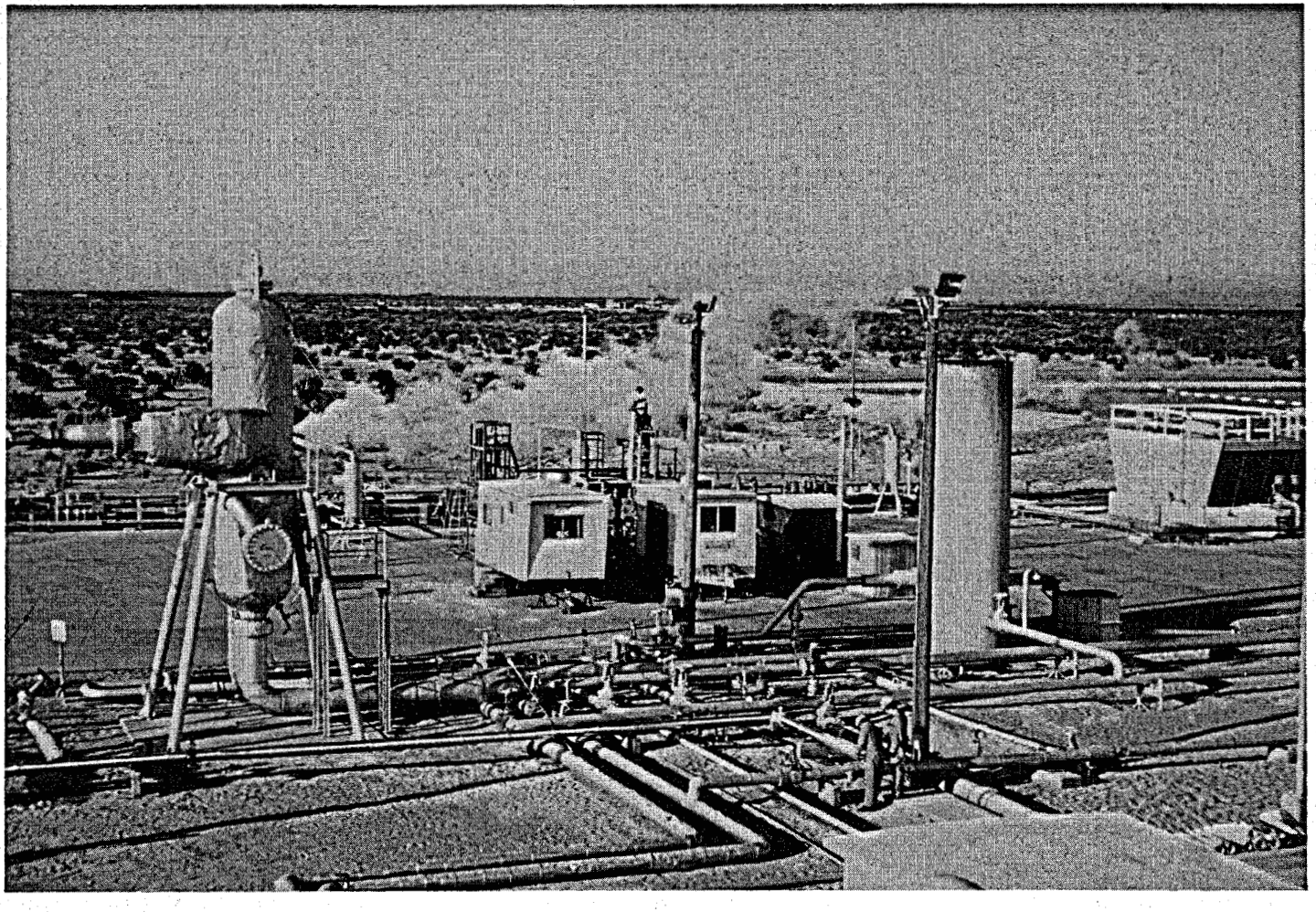

Fig. 2.12. Test pad at East Mesa Geothermal Test Site with ORNL and DSS equipment in place.

2.5 Equipment Configurations

The ORNL condenser tests at East Mesa were conducted in five separate groups. These five groups have been further broken down into ten categories based on time period, test condenser, and service evaporator (Table 2.2) to facilitate description of the various equipment configurations.

Conducted in March and April 1978, the Group I tests involved use of the two-tube condenser as installed on the upper deck of the DSS rig (Fig. 2.13). Connections and operating conditions were dictated by the requirements of the Barber-Nichols turbine "endurance tests" scheduled during this period.[4,6] Both surface and direct-contact evaporator modes were used in this initial field-test effort.

The 40-tube condenser was first installed during the Group II tests of May and June 1978. An angle iron (steel) frame was provided to mount the condenser on the test pad beside the DSS rig (Fig. 2.14). A small trailer was also added to accommodate instrumentation and other experimental equipment.

Preparation for the Group III tests of August and September 1978, included significant modifications to both experimental condensers including liquid-level indicators, larger condensate return lines, and separate frame mounting (Fig. 2.15). Several additional shell penetrations in the 40-tube condenser were used for temperature monitoring. Two large glass view ports were welded to the two-tube unit to allow observation of the tube surfaces. A condensate temperature monitor was added to the two-tube instrument package. An attempt was also made to evacuate the combined ORNL-DSS apparatus and to fill it with high-purity isobutane.

For the Group IV tests conducted in October and November 1978, only the 40-tube unit was operated and only the direct-contact evaporator mode was used. Operating conditions were dictated by the requirements of the Barber-Nichols preflash unit experiments scheduled during this period.[5,7]

The final series of tests reported here was Group V. A demineralized water loop was installed to aid in establishing water-side fouling effects on the two-tube condenser. Experiments were limited to the surface evaporator mode during these runs. The relevant equipment arrangement is illustrated in Fig. 2.16.

Table 2.2. The ORNL East Mesa condenser test outline

Group	Test dates		Condenser type	Evaporator type	Comments
	Beginning	Ending			
I					
A	3/12/78	3/26/78	2-tube	Surface	Barber-Nichols turbine "endurance runs;" 2-tube condenser installed on upper deck of DSS rig
B	3/27/78	4/06/78	2-tube	Direct-contact	
II					
A	5/31/78	6/28/78	40-tube	Surface	40-tube condenser in separate frame; trailer with thermocouple recorder, voltmeters, heater controls, and voltage regulator installed
B	6/28/78	6/29/78	40-tube	Direct-contact	
III					
A	8/22/78	9/19/78	40-tube	Surface	Pumpdown and high-purity isobutane fill; both condensers with liquid-level indicators, larger condensate lines, and separate frame mounting; sampling capability; 40-tube – additional shell temperature monitors; 2-tube – two view ports, bigger condensate drain, condensate temperature monitor
B	9/19/78	9/24/78	2-tube	Surface	
C	9/25/78	9/26/78	40-tube	Direct-contact	
D	9/27/78	9/28/78	2-tube	Direct-contact	
IV	10/31/78	11/09/78	40-tube	Direct-contact	Barber-Nichols preflash unit tests
V	3/20/79	3/29/79	2-tube	Surface	Water-side fouling tests; demineralized water loop installed

ORNL–PHOTO 6565–78

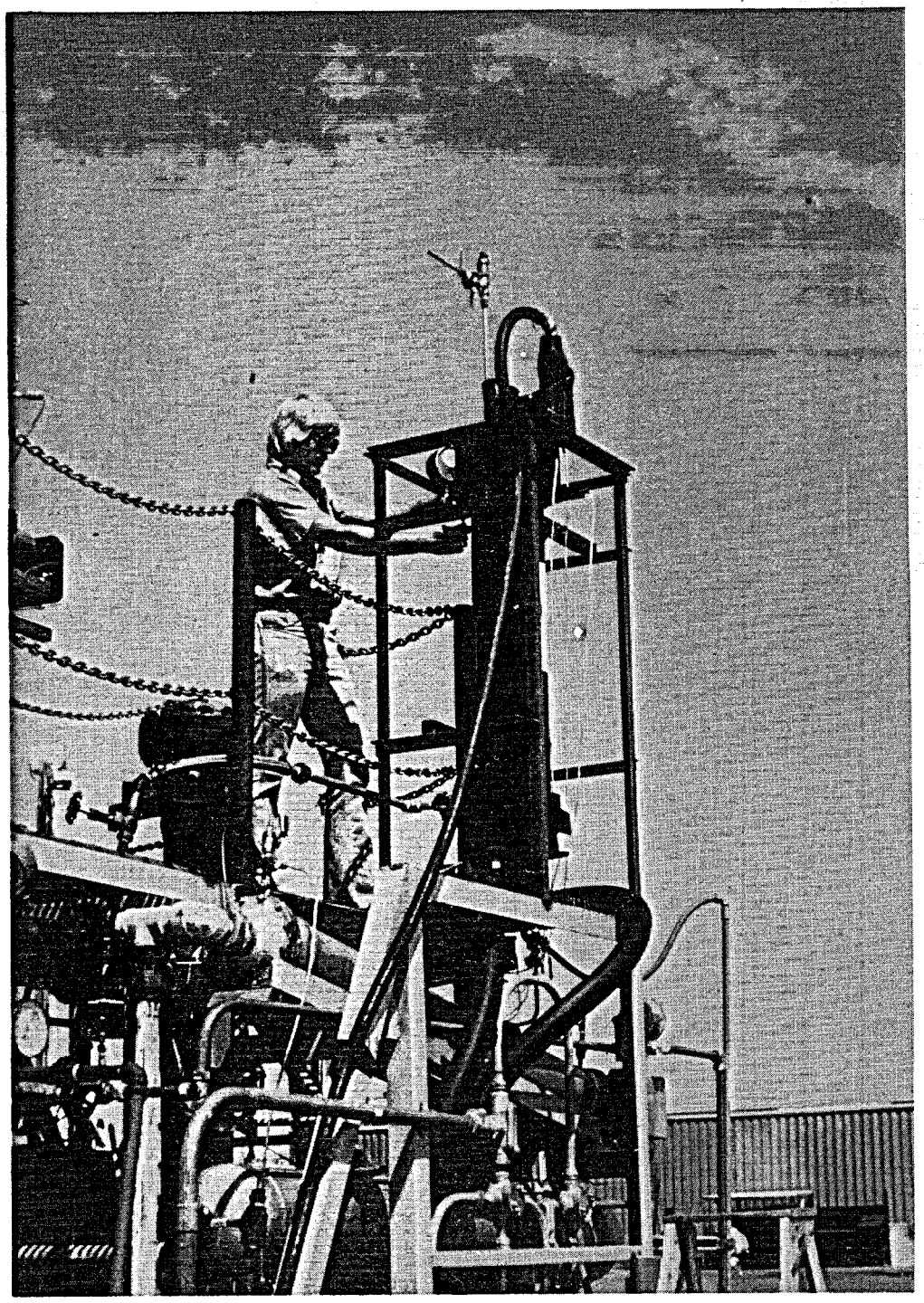

Fig. 2.13. The ORNL two-tube condenser installed for Group I tests.

ORNL–PHOTO 7386–78

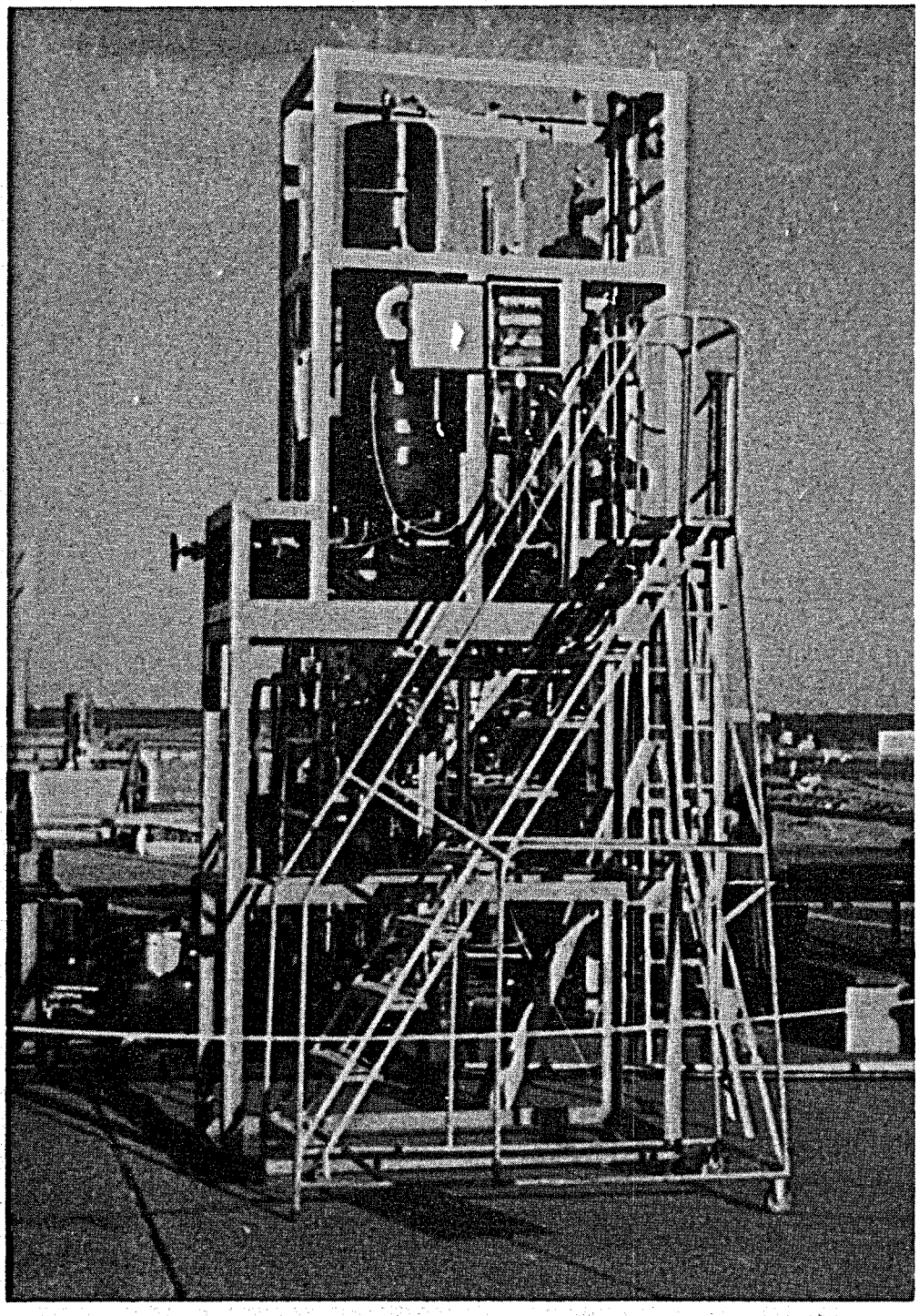

Fig. 2.14. The ORNL 40-tube condenser installed for Group II tests.

ORNL–PHOTO 7635–79

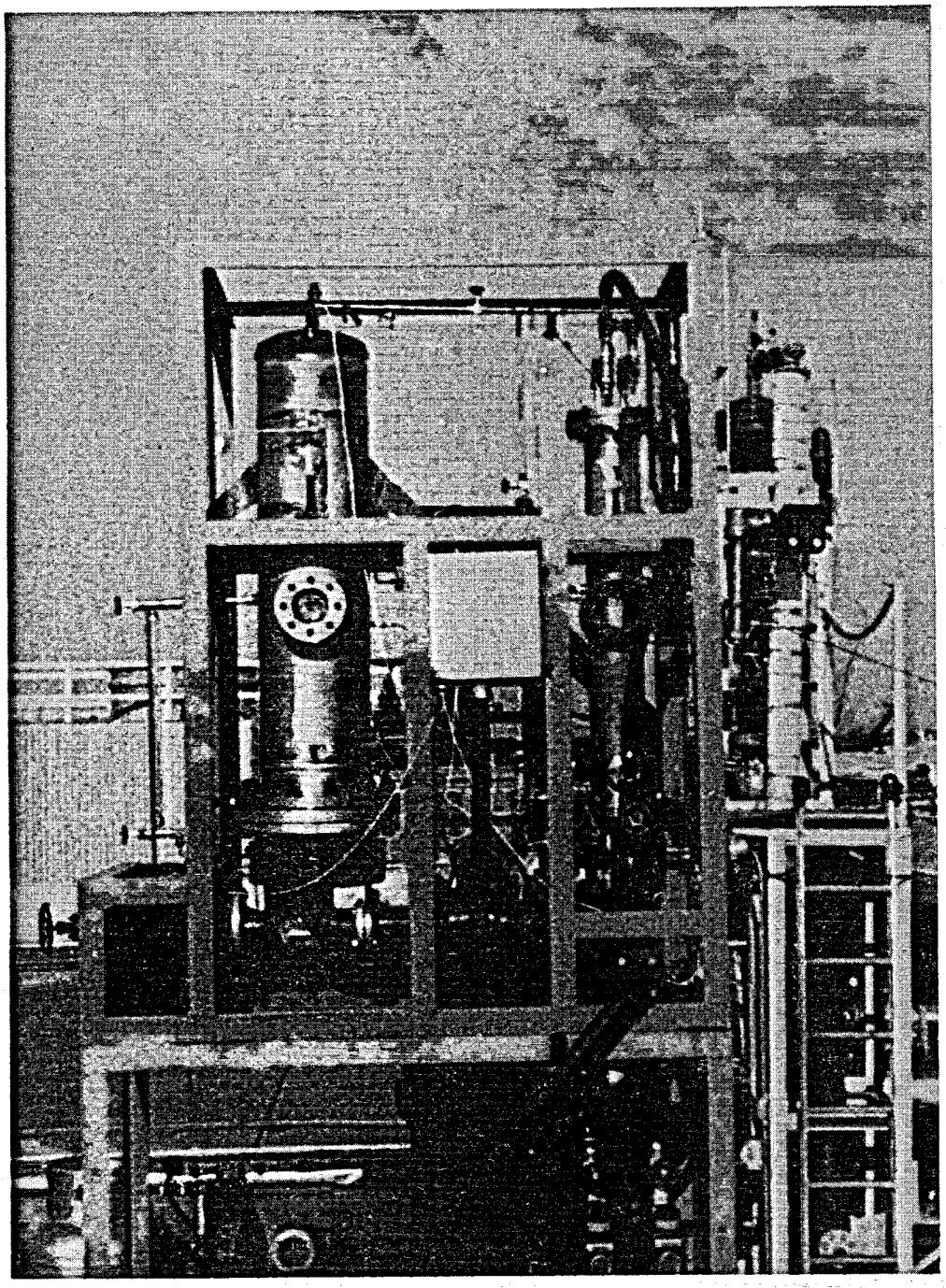

Fig. 2.15. The ORNL 2- and 40-tube condensers installed for Group III tests.

ORNL–PHOTO 7552–79

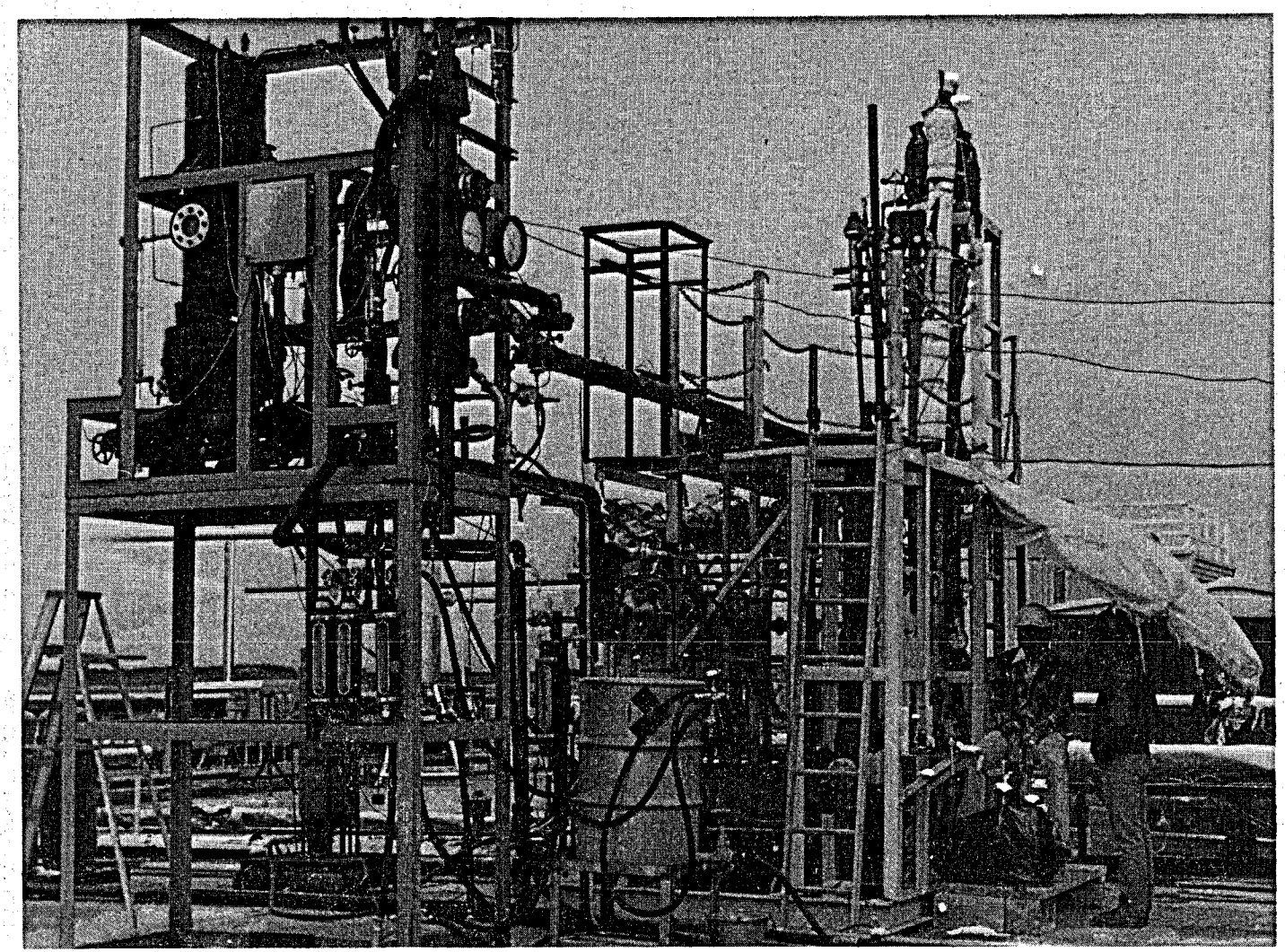

Fig. 2.16. The ORNL two-tube condenser installed for Group V tests.

3. INSTRUMENTATION AND SAMPLING

Measurements were taken during the tests to determine the heat transfer performance of the ORNL condensers under various sets of specified conditions. Primary measurements established operating heat loads and temperature differences associated directly with evaluation of condenser performance. Secondary measurements verified steady-state conditions, proper equipment operation, instrument consistency, and safe operating conditions. Measurement techniques varied somewhat among test groups depending on respective requirements and goals. A comprehensive flow and instrument schematic is presented in Fig. 3.1.

3.1 The DSS Apparatus

Most measurements taken from the DSS apparatus were of secondary importance in the ORNL condenser tests. Temperature indications from iron-constantan thermocouples were transmitted to a multichannel recorder for control, comparison, and steady-state assessment. Bimetal thermometers were used for other temperature measurements. Of most interest were inlet and outlet brine and isobutane temperatures associated with the active evaporator unit.

Rotameters served as flow indicators for both brine and isobutane in the DSS apparatus. Pressure gauges installed in various locations provided control and monitoring capabilities. Loop isobutane inventory was monitored by a liquid-level indicator located on the hot well. Additional details concerning DSS apparatus instrumentation are given in Refs. 4 and 5.

3.2 The ORNL Two-Tube Condenser

The ORNL two-tube condenser was instrumented to acquire side-by-side vertical condenser tube data sufficient to permit various heat transfer performance comparisons. Fluid temperatures, pressures, and flows were the primary measurements used to determine such performance. Secondary or control equipment included an electrical apparatus for water heater

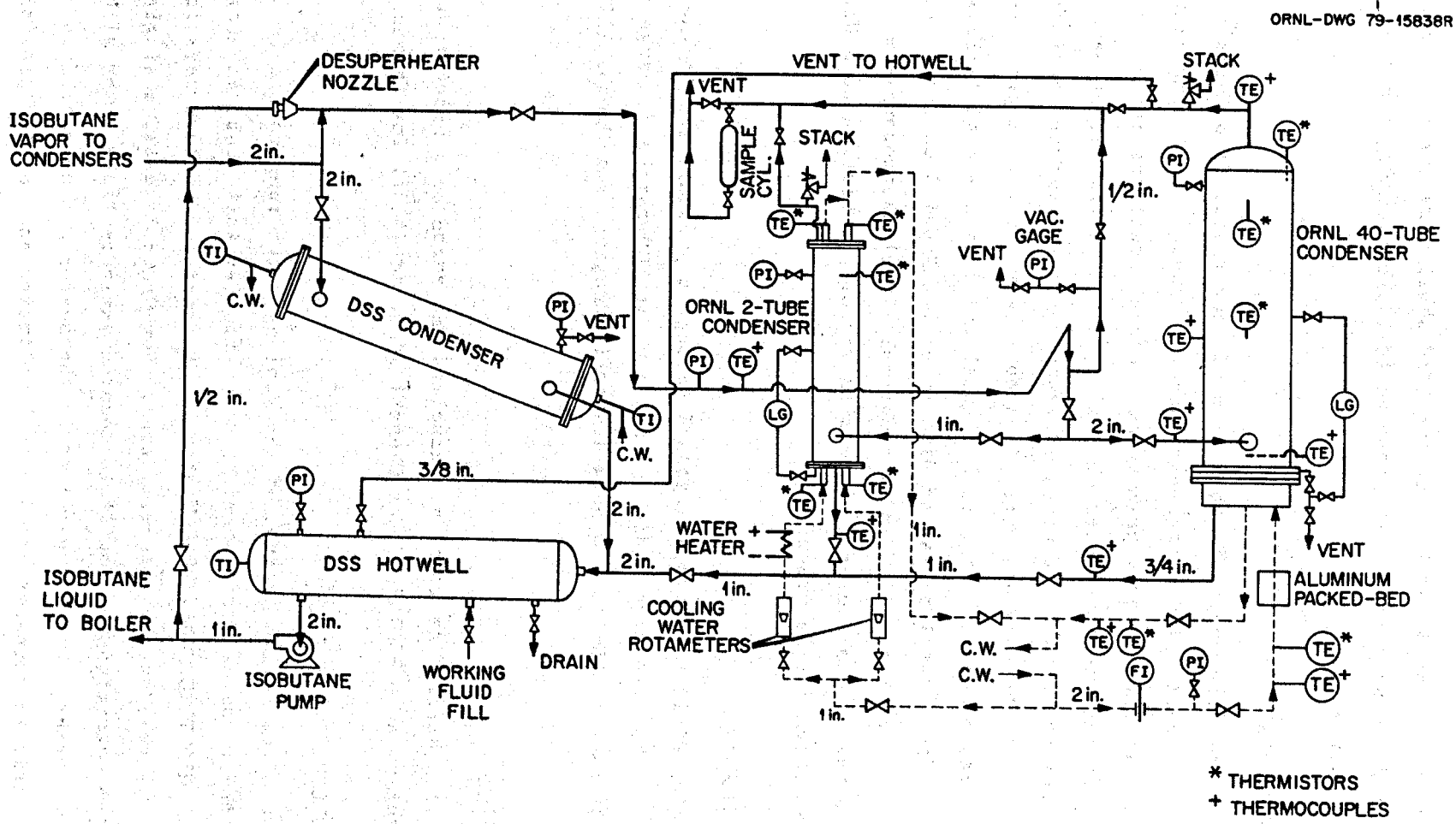

Fig. 3.1. Flow and instrumentation diagram for ORNL condensers at East Mesa.

control, a shell liquid-level indicator, and shell view ports. Instrumentation varied somewhat from test group to test group during the two-tube condenser experiments.

3.2.1 Temperature

Throughout each group of two-tube condenser tests, five thermistors (Thermometrics Part S-10-4-wire) were used as temperature measurement elements. Four of these served primary measurement functions at the inlet and outlet of each cooling water channel. The fifth thermistor penetrated the condenser shell wall and provided vapor-space temperature monitoring capability. All thermistors were wired to a switch box that permitted individual resistance readouts on a digital multimeter – Hewlett-Packard Model 3465A for Group I tests and Data Precision Model 3500 for Groups III and V tests. For Groups III and V a Chromel-Alumel thermocouple was installed in the condensate drain line with readout connection to a Honeywell-Brown thermocouple recorder.

3.2.2 Pressure

Working-fluid pressure was sensed through a pressure tap in the upper shell wall. The pressure indicator was a 0- to 100-psig U.S. gauge for Group I tests and a 0- to 160-psig Ashcroft Duragauge for Groups III and V tests.

3.2.3 Flow

Cooling water flow to each channel was measured by a Fischer and Porter rotameter – W3-1036/3 for Channel I and X4-4300/7 for Channel II.

3.2.4 Support

To achieve active control of the cooling water temperature in one tube channel, one or two (depending on particular test requirements) Watlow L7 NX5 772D 240-V 2000-W electrical immersion heaters were installed upstream of the Channel I tube. For Group I tests, a single 2-kW heater was connected to a manifold-mounted variable transformer with integral voltmeter. For Group III tests the heater was connected to a panel-mounted variable transformer with both voltmeter and ammeter provisions.

The Group V tests required installation of an additional Group III heater system.

An Ernst Model 3010 liquid-level indicator and two Jacoby-Tarbox Style 200 Size 6 view ports were installed on the condenser shell for Groups III and V tests to facilitate condensate observations.

Another group of instruments was installed in conjunction with the demineralized water loop used in the Group V tests. This setup is described in Sect. 6.1.3.

3.3 The ORNL 40-Tube Condenser

Instruments associated with the ORNL 40-tube condenser were intended to acquire vertical tube bundle condenser data for heat transfer performance evaluation. As with the two-tube condenser, fluid temperature, pressures, and flows were the primary measurements used to determine such performance. Secondary equipment included a shell liquid-level indicator and a shell view port.

3.3.1 Temperature

Two thermistors (Thermometrics Part S-10-4-wire) were used for primary measurement (inlet and outlet cooling water temperatures) during all ORNL 40-tube condenser tests. A third thermistor penetrated the condenser shell wall and provided single-point temperature monitoring capability in the vapor space. Two additional thermistors were installed in the vapor space for the Groups III and IV tests to give a more complete temperature profile. All thermistors were wired to a switch box that permitted individual resistance readouts on a digital multimeter — Data Precision Model 3500 for all ORNL 40-tube condenser tests.

For the Group II tests five thermocouples were employed as secondary monitoring instruments — two as checks on cooling water inlet and outlet temperatures, two as indicators of working-fluid temperatures at vapor supply and condensate return locations, and one as a vapor-space temperature indicator in the condenser shell. Two additional vapor-space thermocouples were installed for the Groups III and IV tests to give a more complete temperature profile. All thermocouples were connected to a Honeywell-Brown recorder for readout purposes.

3.3.2 Pressure

Working-fluid pressure was sensed through a pressure tap in the upper shell wall. The pressure indicator was a 0- to 200-psig Heise gauge (Model H-19178). Auxiliary pressure gauges were used to monitor vacuum level (during loop pumpdowns), vapor feed pressure, and cooling water pressure.

3.3.3 Flow

A thin-plate sharp-edged concentric orifice of 39.4-mm bore (1.55-in.) with flange pressure taps was used to measure cooling water flow to the ORNL 40-tube condenser. Pressure differential readout was on a Meriam Model 1020 D/P indicator (0–150 in. of water) for Group II tests. For Groups III and IV tests this unit was replaced by a Barton Instrument indicator (0–400 in. of water).

3.3.4 Support

The view port was located about midway up the shell wall to provide for condensate observation. A Jacoby-Tarbox liquid-level indicator was installed to monitor condensate buildup in the shell during Groups III and IV tests.

3.4 Sampling

Eight working-fluid samples were collected in ORNL 1000-ml stainless steel sample cylinders (Whitey 304-HDF4-1000 with Whitey SS 3NBS4 valves) during Group II-B (1), Group IV (2), and Group V (5) tests. In each case the sample cylinder was initially pumped down to a vacuum of 95–98 kPa (28–29 in. of mercury). Then the sample cylinder was installed in the sampling line, and the line was purged for 1–2 min. Next, the sample was collected using residual vacuum, allowing about 5 min for equilibration before closing the sample cylinder valve.

The Groups II-B and IV samples were taken from the 40-tube condenser vent line. The Group V samples were taken from three different locations – the two-tube condenser vent line, the two-tube condenser vapor-feed line, and the Linde supply cylinder.

Groups II-B and IV samples were analyzed by Westec personnel using the test-site laboratory gas chromatograph. Group V samples were analyzed by the Westec test-site laboratory and the ORNL Analytical Chemistry Division, using both gas chromatograph and mass spectrometer techniques.

Other samples were taken at various apparatus locations by DSS and Barber-Nichols personnel to provide more complete system characterization. These additional samples were analyzed by Westec personnel at the test site. A discussion of the various sample analyses is presented in Appendix G.

4. OPERATING PROCEDURES

Although general procedures for operating the field-test equipment were developed as part of the preliminary test plan, circumstances often required considerable adaptation and even major revision of these procedures during actual experimentation. Normal operating sequences were as follows.

1. Assure availability of required site utilities and services.
2. Bring basic DSS apparatus up to nominal steady-state conditions.
3. Bring auxiliary and test equipment (including ORNL 2-tube or 40-tube condenser) on-line.
4. Vary system operating points as required to meet test requirements within imposed constraints.

Only one test condenser was in operation at any given time. Details of specific operating procedures are given in the following subsections.

4.1 The DSS Apparatus

Because the DSS unit was generally capable of operating alone and because reliable condenser tests required proper operation of its components, standard operating procedure called for checkout and steady-state operation of this unit before either ORNL condenser was put on-line.

For experiments in the surface evaporator mode, after turning on cooling water to the DSS condenser, the operator opened a valve to introduce hot brine fed by wellhead pressure into the tube side of the evaporator. The evaporator feed pump was then activated to initiate isobutane flow on the shell side. Valves on the brine and isobutane feed lines were then used to bring the unit to steady-state conditions at the nominal operating point.

In the direct-contact evaporator mode, after turning on the cooling water to the DSS condenser, the operator opened a valve to feed hot brine at wellhead pressure into the top of the direct-contact evaporator column. When the brine reached the desired level in the column, the evaporator feed pump was activated to inject liquid isobutane at the bottom of the column. Then the brine feed pump was started to meet the increased head

requirement, and brine and isobutane feed valves were used to attain nominal steady-state conditions.

Additional information concerning operating procedures with the DSS apparatus is given in Refs. 4 and 5.

4.2 The ORNL Two-Tube Condenser

With the DSS apparatus already running, the vapor inlet valve to the ORNL two-tube condenser was slowly opened, gradually pressurizing the condenser shell. Then a valve on the condensate drain line, connecting the bottom flange of the condenser shell to the DSS hot well, was opened. When pressure equilibrium was achieved, cooling water control valves were opened to provide the desired flow in each of the two condenser tube channels. The valve on the vent line connected to the top shell flange was then opened several times to purge any contaminant gases trapped in the shell during the start-up procedure.

When steady-state conditions (as judged by pressure and temperature monitors) were reached, raw data were recorded. Primary data included the following:

1. inlet and outlet water temperature – Channels I and II (thermistors),
2. water flow rate – Channels I and II, and
3. shell pressure.

Secondary data included the following:

1. shell temperature (thermistor);
2. condensate temperature (thermocouple, Groups III and V);
3. heater voltage (see the following paragraph);
4. heater current (Groups III and V, see the following paragraph);
5. various temperature, pressure, and flow readings associated with the DSS apparatus;
6. condenser liquid-level and view port observations (Groups III and V); and
7. local weather observations.

In most cases, Channels I and II were filled by condenser tubes with distinctly different characteristics. The primary mode chosen for these

side-by-side comparisons used equal average water-side temperatures. To implement experimentally the basis for such comparisons, the decision was made to install an electrical heater in the water inlet to Channel I and to relegate the poorer performer of each pair of tubes to this channel. Since, for a given water flow and water inlet temperature, the poorer tube would have a smaller water-temperature rise (and thus lower average water temperature), heater power could be used to raise the Channel-I inlet water temperature to match the average water temperature experienced by the (better) tube in Channel II. A Hewlett-Packard Model 97 programmable calculator was used for rough on-site data reduction during the experiments to facilitate the required iterative heater adjustments.

After heater adjustment and data entry, the operator increased (or decreased) the cooling water flow to the DSS condenser to decrease (or increase) the vapor pressure in the ORNL two-tube condenser and, thereby, to lower (or raise) the operating-point heat load accommodated by each test tube. Variations in vapor superheat at the inlet to the ORNL two-tube condenser were accomplished during the Groups III and V tests by adjustments to a valve in the line leading to the desuperheater nozzle on the DSS apparatus. These procedures were repeated until the operating ranges of interest for the test tube pair were covered.

Subject to the requirements of each test sequence, tubes were precleaned by two separate means. The first method, used for both inside and outside surfaces, involved rubbing with an acetone-soaked rag. The second, used only for stubborn internal deposits, involved steel brushing of the tube surface.

4.3 The ORNL 40-Tube Condenser

As with the ORNL two-tube condenser, the DSS apparatus was initially brought to a nominal steady-state operating point. However, the subsequent procedure required to bring the ORNL 40-tube condenser on-line was extremely tedious.

With the DSS apparatus already operating, the vapor inlet valve to the ORNL 40-tube condenser was opened slightly, gradually pressurizing the condenser shell. When pressure equilibrium was achieved, the valve on

the condensate drain line connecting the bottom of the condenser shell to the DSS hot well was opened. Next, the cooling water control valve was opened very slightly, and the combined DSS-ORNL system was allowed to settle out at a new steady-state condition. Then, on the ORNL 40-tube condenser, the vapor inlet valve opening was increased slightly, and the cooling water control valve opening was increased very slightly. Next, the valve on the vapor inlet to the DSS condenser was closed slightly, and the system was again allowed to come to its new steady-state operating point. These last few steps were repeated in small increments until the ORNL 40-tube condenser was operating at steady state with its specified cooling water flow.

Note that failure to follow the very gradual process outlined here resulted in system instabilities characterized by condensate backup into the ORNL 40-tube condenser and loss of flow in the DSS evaporator feed pump. Stable operation of the ORNL 40-tube condenser with the DSS condenser completely valved out of the system was not achieved during any of the tests.

At steady state the valve on the vent line connected to the top of the condenser shell was opened several times to purge contaminant gases trapped in the shell during start-up. Additional venting was performed as required to meet particular experimental objectives.

When steady-state conditions were again reached, raw data were recorded. Primary data included the following:

1. inlet and outlet water temperature (thermistors),
2. water flow rate, and
3. shell pressure.

Secondary data included the following:

1. shell temperatures (thermistors);
2. shell temperatures (thermocouples);
3. water temperatures (thermocouples);
4. condensate return temperature;
5. vapor-feed temperature;

6. various temperature, pressure, and flow readings associated with the DSS apparatus;
7. condenser view port observations;
8. condenser liquid-level observations (Groups III and IV); and
9. local weather observations.

As a consequence of the difficulties enumerated previously, realization of any particular operating point on demand was impossible. Variations (e.g., in heat load or inlet vapor superheat) were therefore accomplished mainly by letting the system "float" very slowly, influenced by uncontrolled external variations such as cooling water temperature or ambient conditions. This lack of system control severely limited the operating range covered in the tests.

The tube bundle was cleaned before each group of tests. The outside surface of the bundle was cleaned by flushing with water and rubbing off obvious deposits. Of course, the effectiveness of this procedure was restricted by limited access to the tubes near the bundle center. Internal tube cleaning was accomplished by lowering the water box away from the shell and tube-sheet flanges and then passing a tubular steel brush up inside the straight section of each tube.

5. DATA REDUCTION

Partial reduction of the data from the condenser tests was carried out in the field using a Hewlett-Packard Model 97 programmable calculator to give the rough guidance required to cover the desired test range during each test group. After the completion of each test group, a more detailed and complete data reduction was carried out using computer programs developed specifically to facilitate test-to-test performance comparisons (see Appendixes A and B).

Raw data were converted using instrument calibrations to give the fundamental quantities (temperatures, pressures, flow rates) required for further manipulation. These fundamental quantities were then combined with fluid property values to put the results in forms (heat loads, heat fluxes, temperature differences, or heat transfer coefficients) amenable to performance comparisons.

For the results presented in Sect. 6, the primary variables used for condenser performance comparisons are heat load or heat flux and composite temperature difference. Better performance implies a higher heat load or heat flux for a given composite temperature difference or lower composite temperature difference for a given heat load or heat flux. Condenser heat load is determined from water-side measurements using the relation

$$Q = \dot{m}_w c_w \left(T_{w_{out}} - T_{w_{in}} \right) , \tag{5.1}$$

where the symbols are defined in the List of Symbols near the beginning of this report. The corresponding heat flux, based on shell-side (outside) heat transfer area A_s is then

$$\frac{Q}{A_s} = \frac{\dot{m}_w c_w \left(T_{w_{out}} - T_{w_{in}} \right)}{A_s} . \tag{5.2}$$

The appropriate (overall) working fluid-to-water temperature difference

is taken to be

$$T_{sat\ iso} - T_{w_{avg}} = T_{sat\ iso}\,(p) - \frac{\left(T_{w_{in}} + T_{w_{out}}\right)}{2}\ , \qquad (5.3)$$

where $T_{sat\ iso}$ is the pure isobutane saturation temperature associated with the measured shell pressure as deduced from American Society of Heating, Refrigeration, and Air-Conditioning Engineers values for isobutane (R-600a) in Ref. 8, and $T_{w_{avg}}$ is the arithmetic mean of the inlet and outlet water temperatures. Such an overall difference can be considered the sum of a number of individual differences associated with various potential resistances to heat flow. For example, the expression

$$T_{sat\ iso} - T_{w_{avg}} = Q\left(\underbrace{\frac{1}{h_s A_s} + R_{sf}}_{\text{shell-side}} + \underbrace{R_{wall}}_{\text{tube-wall}} + \underbrace{R_{tf} + \frac{1}{h_t A_t}}_{\text{tube-side}}\right) \qquad (5.4)$$

indicates a logical separation of the overall into shell- and tube-side film resistances, fouling resistances, and tube-wall metal resistance. Since, for the situation of interest here, the tube-side film resistance [last term in Eq. (5.4)] was (1) dependent only on the tube-side flow situation and fluid (water) properties, (2) estimable from existing correlations, (3) generally small relative to the overall resistance, and (4) variable from test situation to test situation, it was advisable to emphasize a data presentation method that eliminated in a reasonable manner the tube-side film resistance from primary consideration. For comparison purposes, we have expressed the temperature difference result in the form of a "composite temperature difference," ΔT_{comp} where

$$\Delta T_{comp} = Q\left(\frac{1}{h_s A_s} + R_{sf} + R_{wall} + R_{tf}\right)\ , \qquad (5.5)$$

or

$$\Delta T_{comp} = \left(T_{sat\ iso} - T_{w_{avg}}\right) - \frac{Q}{h_t A_t}\ , \qquad (5.6)$$

and

$$\Delta T_{comp} = T_{sat\ iso} - T_{ins\ wall}\ , \tag{5.7}$$

where $T_{ins\ wall}$, the "inside wall temperature," can be conceptualized as the temperature corresponding to the surface (fouling deposit or, in the no water-side fouling case, metal tube wall) in direct contact with the cooling water.

In the laboratory situation of previous experiments,[2,3] the Wilson-plot method[9] was employed to accomplish this objective. However, because this method requires the maintenance of a constant heat load during operation at changing water flow rates, and since such control was not attainable in the field situation, an alternative method was employed. For the present field data, the Dittus-Boelter correlation[10] was used to estimate water-side film coefficients as

$$h_t = 0.023 \frac{k_w}{D_h} Re_w^{0.8} Pr_w^{0.4}\ , \tag{5.8}$$

where

$$Re_w = \frac{4 \dot{m}_w}{\mu_w P_w} \tag{5.9}$$

and

$$Pr_w = \frac{\mu_w c_w}{k_w} \tag{5.10}$$

with water properties evaluated at $T_{w_{avg}}$. Trial comparisons between the two methods using laboratory data showed good agreement, as indicated in Appendix D.

Estimated overall accuracies associated with the reduced field data are, for the 2-tube condenser, $\pm$3% heat load and $\pm$0.56 K (1.0°F) composite temperature difference, and for the 40-tube condenser, $\pm$5% heat load and

±0.83 K (±1.5°F) composite temperature difference. Data reduction examples and detailed data listings for all test groups are given in Appendixes A and B.

6. TEST RESULTS

In view of the rather complex and variable nature of the equipment, procedures, and instrumentation associated with both the 2- and 40-tube condenser tests, as well as the large amount of test data taken, the following sections attempt to distill the most consistent and important results into a relatively concise summary. Individual discussions are arranged by condenser (primary division) and by test group (secondary division). Detailed data listings (A, B, and C) and subsidiary assessments (D, E, F, G, H, and I) are relegated to appendixes. General operating parameter ranges are summarized in Table 6.1. As in any nonideal experimental situation, certain subjective judgments and interpretations of objective information were required to determine when systems, components, and instruments were operating in the required manner. Within this framework, important conclusions concerning the effects of significant operating variables on condenser performance are developed from the relevant test data groups.

Table 6.1. Operating parameter ranges for East Mesa condenser tests

Parameter	Range
Shell pressure, kPa (psia)	345–896 (50–130)
Isobutane saturation temperature, K (°F)	297.6–334.8 (76–143)
Average water temperature, K (°F)	286.5–302.6 (56–85)
Heat flux (based on outside area), W/m² [Btu/(h·ft²)]	2,800–35,900 (900–11,400)
Composite heat transfer coefficient (based on outside area), W/(m²·K) [Btu/h·ft²·°F)]	110–2,330 (20–410)
Composite temperature difference, K (°F)	7.2–41.0 (13–73)

6.1 ORNL Two-Tube Condenser

As outlined in Sect. 2.5, the versatile ORNL two-tube condenser was employed during three of the five groups of field experiments. Group I results gave preliminary information concerning condenser tube performance

in the field, but schedule and operating constraints did not allow resolution of several uncertainties in the data. Group III results confirmed and extended the basic trends of Group I data using improved monitoring and system control capabilities. Group V tests clarified the mechanisms responsible for performance tendencies observed during the earlier tests.

6.1.1 Group I

During the Group I tests, the ORNL two-tube condenser "floated" with the DSS apparatus as the various operating requirements for the Barber-Nichols turbine endurance runs were met.[6] Because the two-tube condenser was to be used for side-by-side tube comparisons, initial tests were conducted with identical smooth tubes (A) in both sides to verify channel similarity. After this successful checkout phase, fluted tubes F and F-3 (skirted) were installed and operated in both surface evaporator and direct-contact evaporator modes. Typical data (Fig. 6.1) led to preliminary conclusions that (1) field performance was poorer than the previous laboratory levels and (2) direct-contact evaporator mode performance was poorer than that associated with the surface evaporator mode. Specific performance relationships, expressed as composite condensing temperature differences at a heat load of 2050 W (7000 Btu/h) were 5.00 K (9.0°F), 10.28 K (18.5°F), and 18.33 K (33.0°F) for the laboratory, field-surface evaporator, and field-direct-contact evaporator situations, respectively (Fig. 6.1).

Group I results were regarded as preliminary for the following reasons:

1. uncontrolled, floating nature of hookup to the DSS and Barber-Nichols equipment,
2. highly transient system characteristics,
3. uncertain working-fluid composition,
4. limited schedule, and
5. limited monitoring capability – specifically, no condenser-shell liquid-level or condensate temperature indicators.

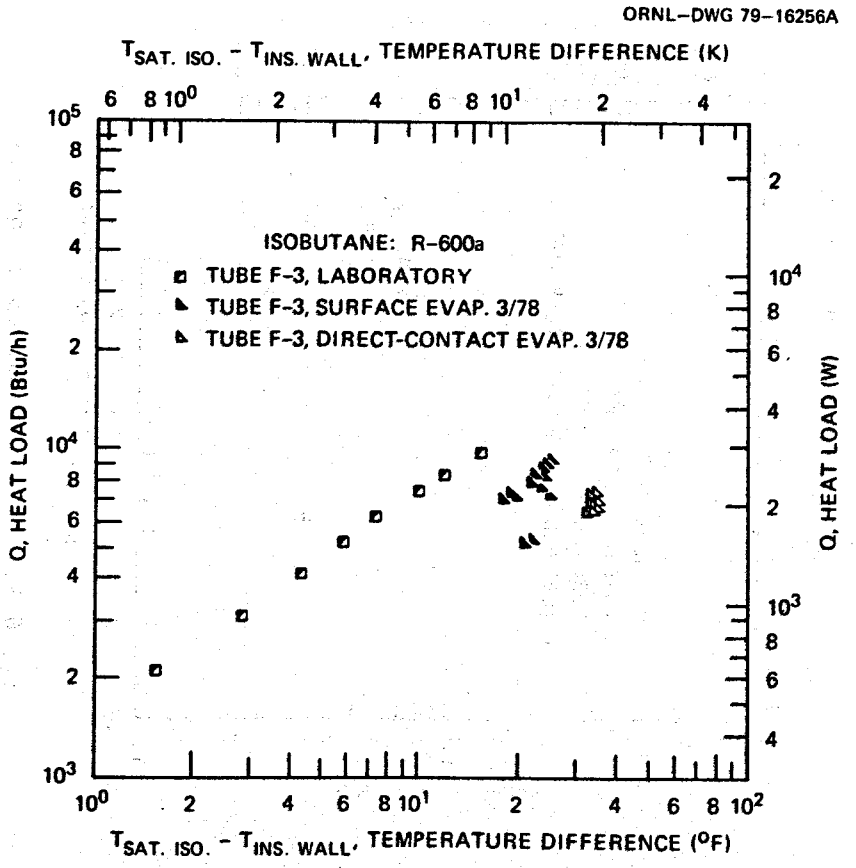

Fig. 6.1. The ORNL two-tube condenser – Group I test results, tube F-3.

6.1.2 Group III

To verify and extend the tentative results of Group I tests, Group III tests were planned to provide improved control of the DSS system and improved monitoring of the two-tube condenser as detailed in Sect. 2.5.

Typical data (Figs. 6.2–6.4) confirmed the preliminary conclusions from the Group I tests. Replots in Figs. 6.5 and 6.6 of data from Figs. 6.2 and 6.4 show that, although smooth tube performance was less sensitive to the lab-field transition than that of fluted tubes, fluted tubes still demonstrated their clear superiority under field conditions in both modes. In particular, Fig. 6.5 surface evaporator mode data indicate that at a composite condensing temperature difference of 15.56 K (28.0°F), the heat-load capacity of tube A was about 1170 W (4000 Btu/h), while that of tube F-3 was 2720 W (9300 Btu/h). Related direct-contact evaporator mode data

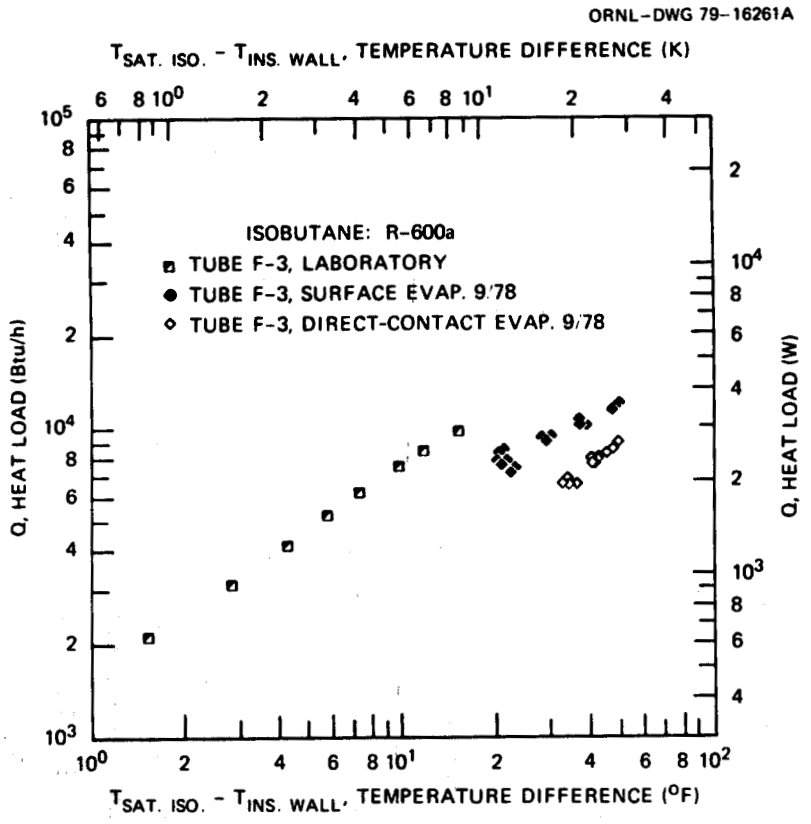

Fig. 6.2. The ORNL two-tube condenser - Group III test results, tube F-3.

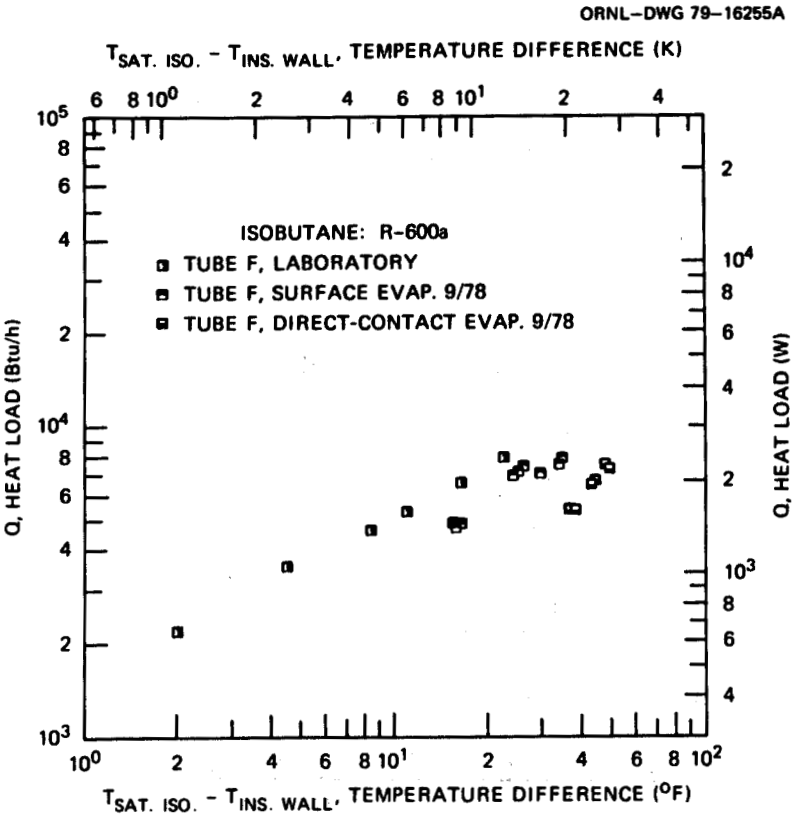

Fig. 6.3. The ORNL two-tube condenser - Group III test results, tube F.

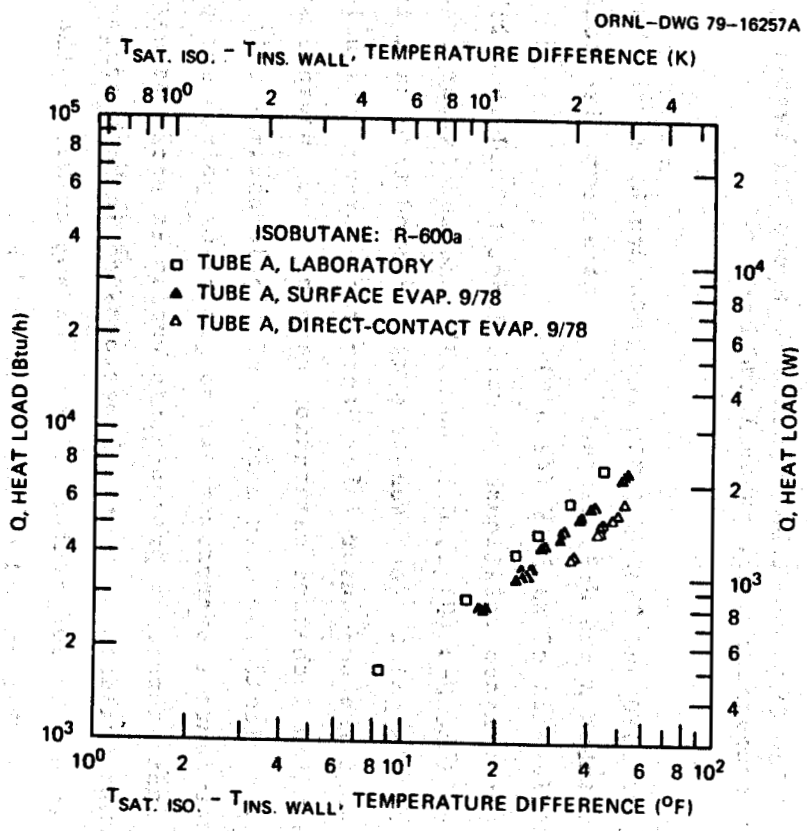

Fig. 6.4. The ORNL two-tube condenser – Group III test results, tube A.

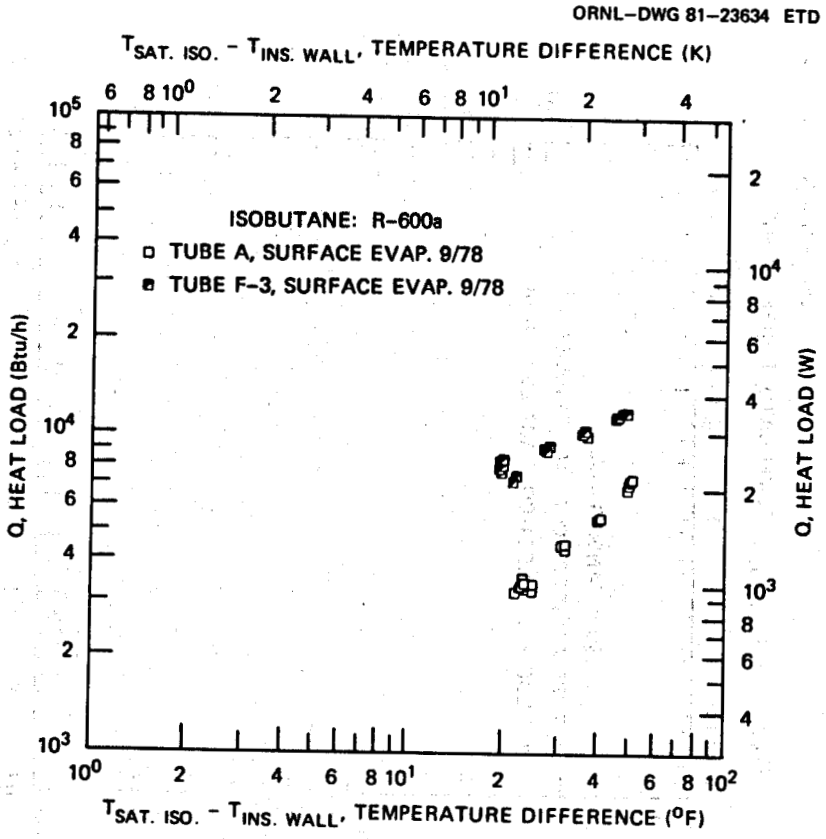

Fig. 6.5. The ORNL two-tube condenser – Group III test results, surface evaporator mode, tubes A and F-3.

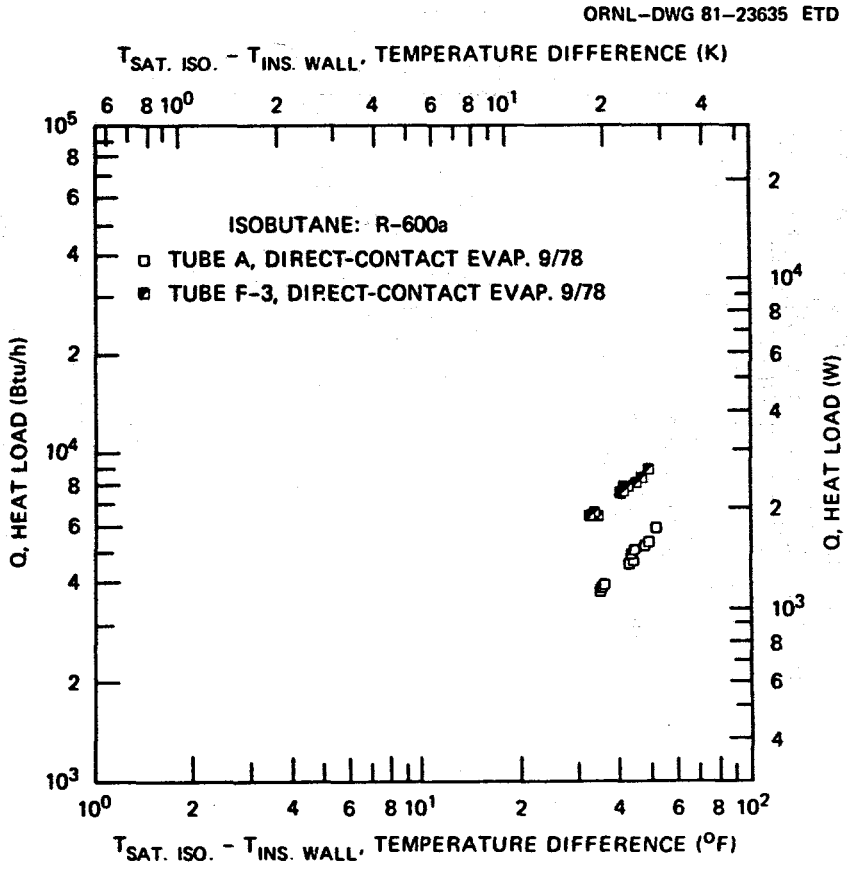

Fig. 6.6. The ORNL two-tube condenser – Group III test results, direct-contact evaporator mode, tubes A and F-3.

in Fig. 6.6 give 1380 and 2340 W (4700 and 8000 Btu/h) as the heat-load capacities for tubes A and F-3, respectively, at a composite condensing temperature difference of 23.33 K (42.0°F).

Similar performance relationships were demonstrated when tube L was substituted for tube F-3 (Figs. 6.7 and 6.8). In the latter figure, the lowest group of six points for each tube was derived from data taken during a period when the condenser inlet vapor temperature fell below the pressure-determined isobutane saturation temperature. Because such circumstances may indicate the introduction of liquid-phase working fluid from the direct-contact evaporator, these groups of points are probably not reliable indicators of representative condenser performance for either tube. The remaining data show tube L performance in both surface evaporator and direct-contact evaporator modes to be approximately the same as that for tube F-3 when judged on the basis used here.

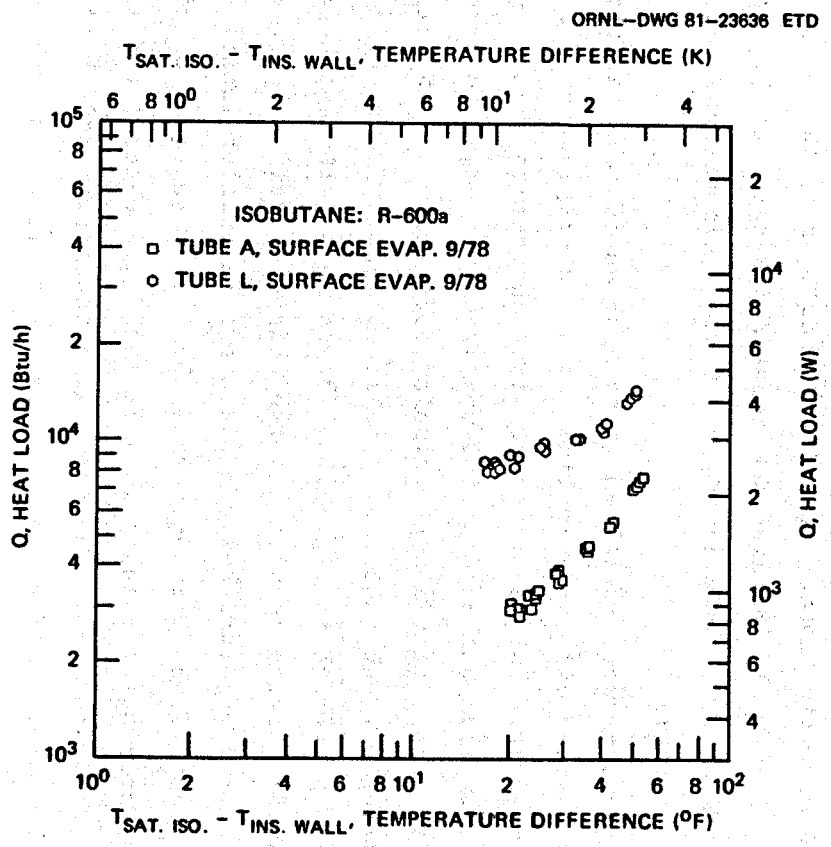

Fig. 6.7. The ORNL two-tube condenser – Group III test results, surface evaporator mode, tubes A and L.

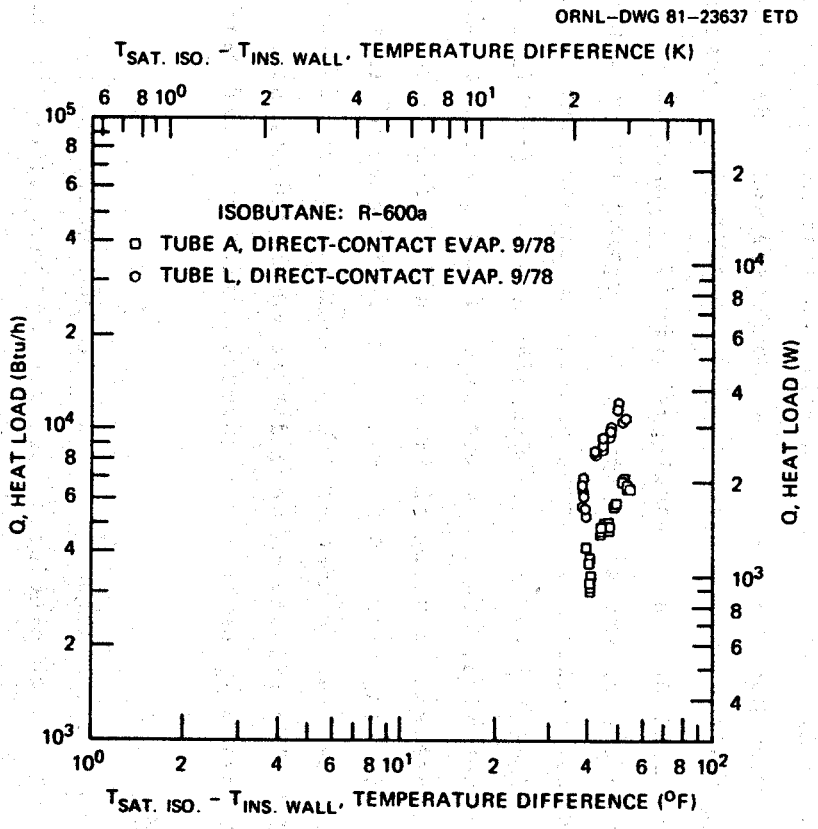

Fig. 6.8. The ORNL two-tube condenser – Group III test results, direct-contact evaporator mode, tubes A and L.

Because the field data seemed generally consistent and because the tubes tested at East Mesa in the two-tube condenser were identical to those tested in the laboratory situation, the inferior tube performance appeared to have been caused by working-fluid-side and/or water-side impurities encountered during the field tests. As regards the working-fluid side, noncondensibles (such as carbon dioxide, nitrogen, and oxygen), hydrocarbon contamination, and/or solid surface deposits (fouling) seemed the most likely culprits. On the water side, fouling was the only likely candidate. Because some fouling of the water side had been observed [although regular cleaning (Sect. 4.2) was believed to have minirized this effect] during the two-tube condenser tests, another series of tests (Group V) was planned to investigate in more detail whether water-side fouling might at least partially explain the observed inferior field performance.

6.1.3 Group V

The side-by-side arrangement of the two-tube condenser was used during the Group V tests to provide a real-time comparison of the performance of two identical F-3 tubes, with one tube channel supplied directly with site cooling tower water (normal or "dirty" mode), while the second tube channel was supplied by an isolated demineralized water loop (special or "clean" mode). Figure 6.9 is a schematic of the equipment configuration used for Group V tests.

Cleaned F-3 tubes were installed in both channels, and the clean water loop was charged with demineralized water in preparation for the comparison experiment. Initial tests verified channel-to-channel performance similarity. Then extended period operation was begun to examine the cumulative effects on relative heat transfer performance of the expected water-side fouling buildup in the dirty-channel tube. The results, typified by the data presented in Fig. 6.10, showed no significant heat transfer performance difference between the two channels over an operating period of 1 d (maximum exposure between cleanings in earlier tests), even though a subsequent visual examination of the inside surfaces of the two tubes showed clearly observable fouling in the dirty channel and almost no fouling in the clean channel. The conclusion taken from this test group was that cooling water quality had no significant effect on heat transfer

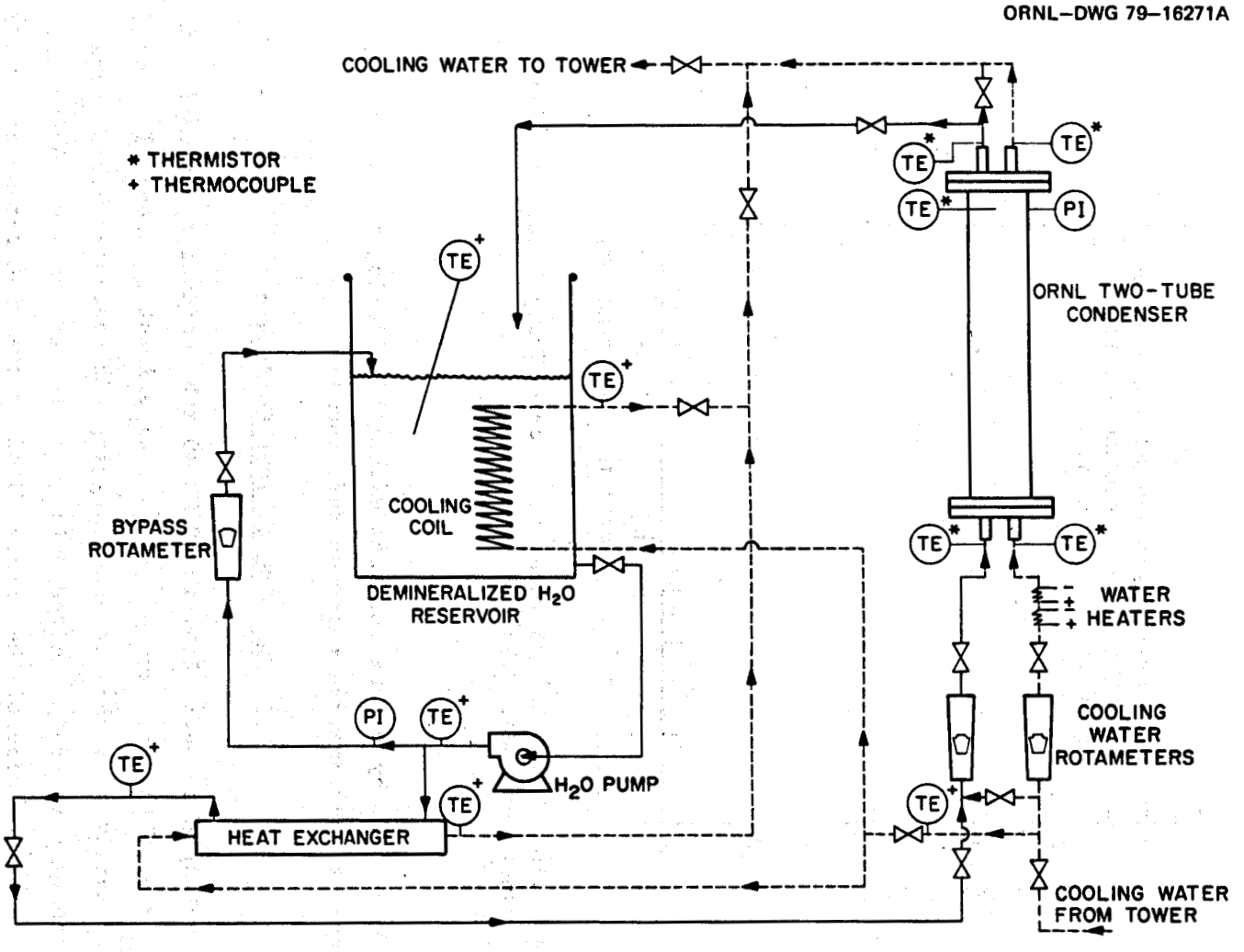

Fig. 6.9. Equipment schematic for Group V tests.

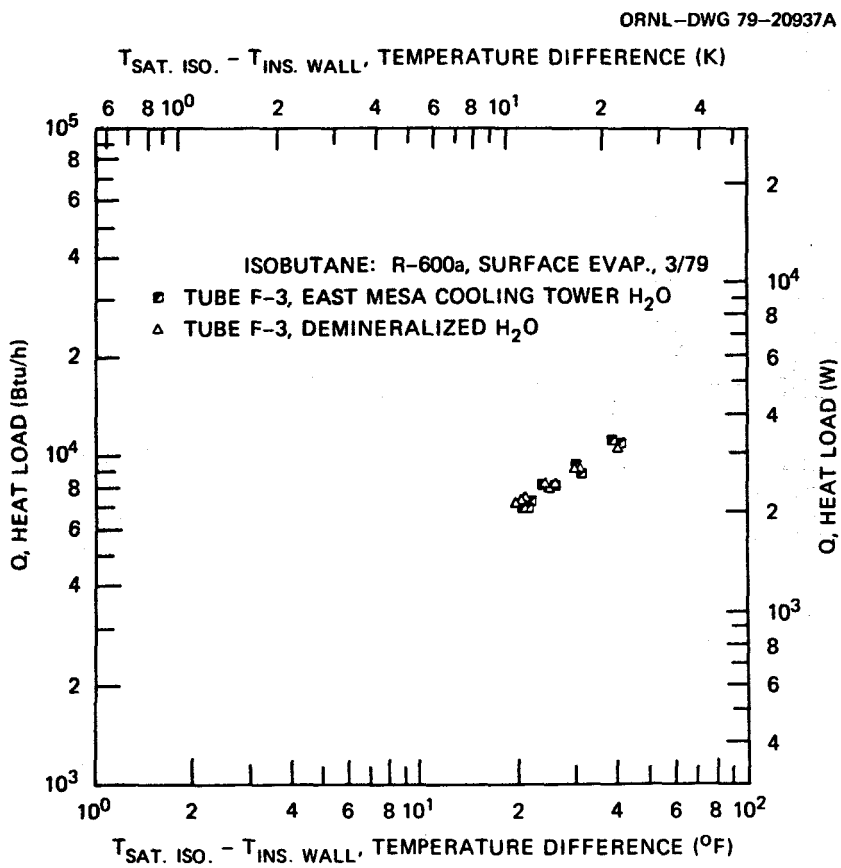

Fig. 6.10. The ORNL two-tube condenser – Group V test results, surface evaporator mode, tube F-3.

performance (and, by extension, that water-side fouling was not a significant cause of the observed inferior performance).

6.2 The ORNL 40-Tube Condenser

As outlined in Sect. 2.5, the ORNL 40-tube condenser was employed during three of the five groups of field experiments. Group II tests served primarily as shakedown and debugging runs because system operational problems severely limited data quantity and quality. Group III results confirmed some of the trends noted in the ORNL 2-tube condenser tests but also indicated some distinctions between the measured 2- and 40-tube performance levels. Group IV tests clarified the mechanisms responsible for performance tendencies observed during the earlier tests.

6.2.1 Group II

During the Group II test period, most effort was expended in attempting to achieve simultaneous, continuous, and harmonious operation of the DSS apparatus, the site service equipment, and the ORNL 40-tube condenser. As a result of unexpected problems regarding component failures and materials composition inconsistency in addition to the expected trial-and-error efforts in equipment integration, very few experimental data sequences were completed during this test group. The major output of this period was an extensive list of equipment improvements and procedure alterations to be made in preparation for the subsequent Group III tests outlined in previous sections of this report.

6.2.2 Group III

Even with the extensive modifications undertaken in preparation for the Group III tests described earlier, the achievement of steady-state operation of all associated equipment was a tedious process. However, improved monitoring capability and refined procedures led to the accumulation of representative performance data in both surface evaporator and direct-contact evaporator operating modes (Figs. 6.11–6.13). Figure 6.11 clearly demonstrates for the 40-tube bundle situation that, as in the 2-tube situation, (1) field performance was poorer than the previous laboratory levels and (2) direct-contact evaporator mode performance was poorer than that associated with the surface evaporator mode. Specific performance relationships expressed as composite condensing temperature differences, at a heat flux of 9460 W/m^2 (3000 $Btu/h \cdot ft^2$) were 1.56 K (2.8°F), 11.94 K (21.5°F), and 27.22 K (49.0°F) for the laboratory, field-surface evaporator, and field-direct-contact evaporator cases, respectively (Fig. 6.11).

However, with reference to the 2-tube condenser data (Sect. 6.1.2), for the 40-tube condenser, both the distinction between field and laboratory performance and the distinction between direct-contact evaporator mode and surface evaporator mode performances were greater than for the 2-tube condenser (Figs. 6.12 and 6.13).

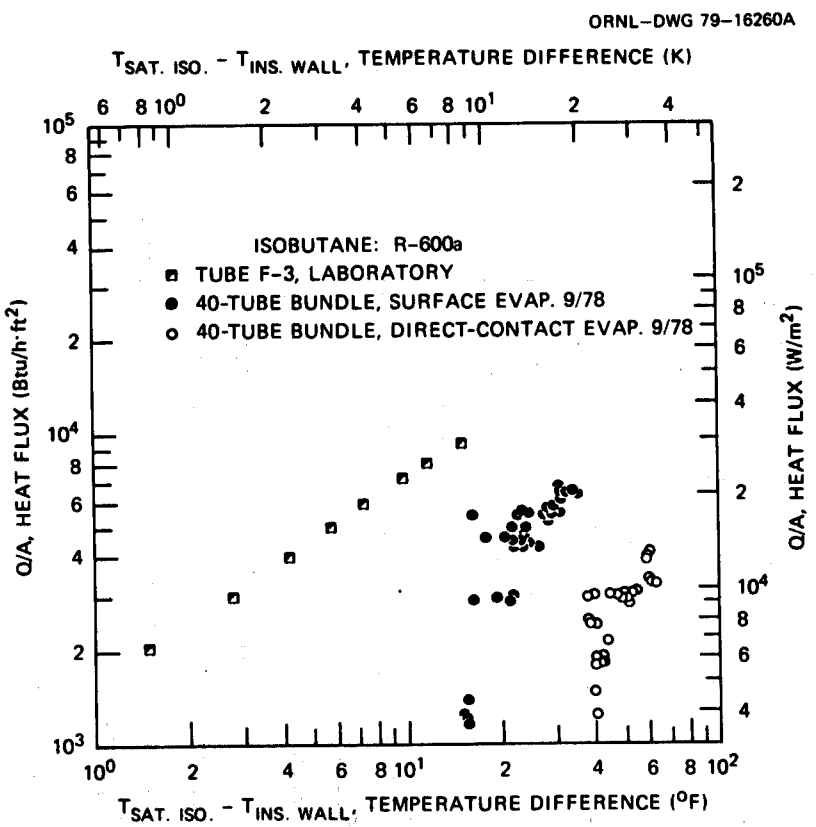

Fig. 6.11. The ORNL 40-tube condenser – Group III test results.

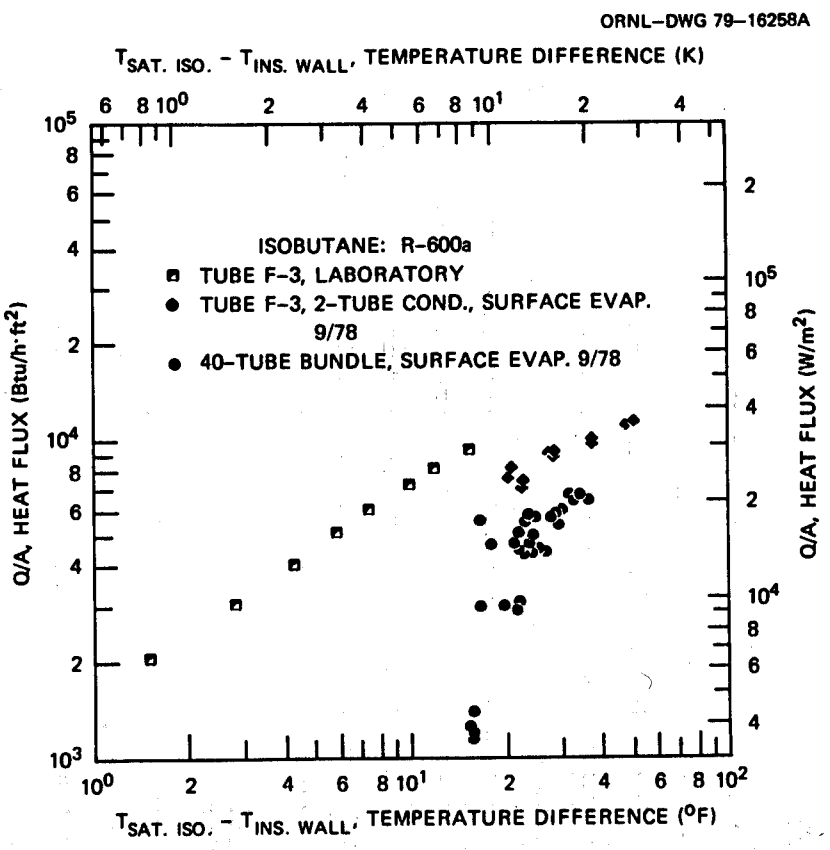

Fig. 6.12. The ORNL condensers – Group III test results, surface evaporator mode.

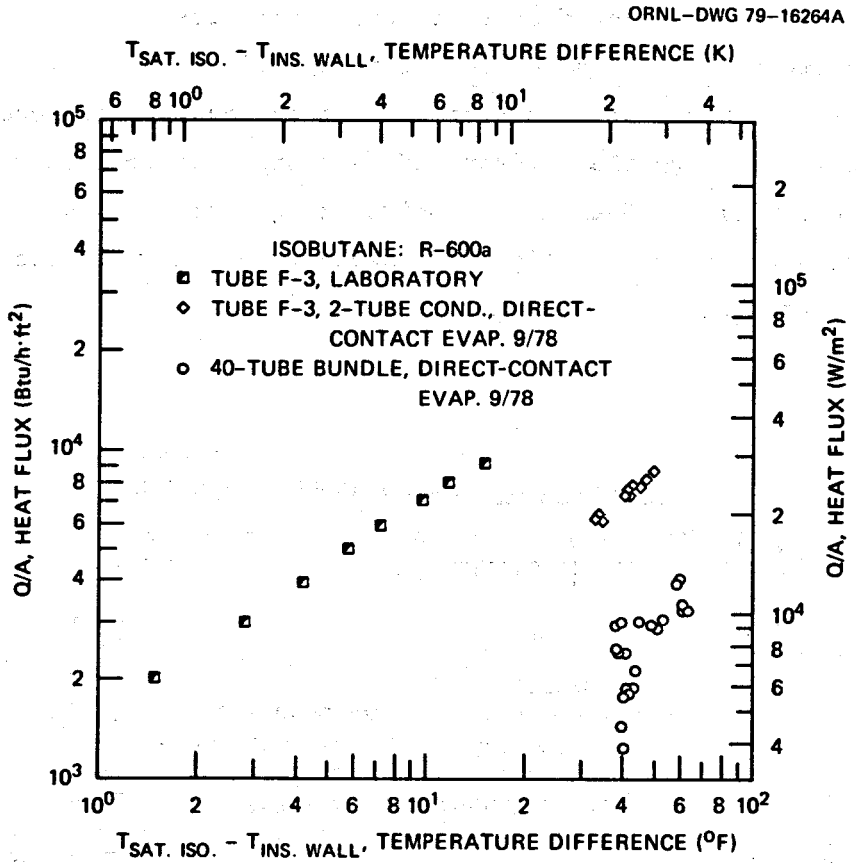

Fig. 6.13. The ORNL condensers — Group III test results, direct-contact evaporator mode.

6.2.3 Group IV

During the Group IV tests, the ORNL 40-tube condenser "floated" with the DSS apparatus as the various operating requirements for the Barber-Nichols preflash runs[7] were met. Although the primary purpose of this test group was (for Barber-Nichols) to ascertain the effectiveness of a flash-separator unit for removal of carbon dioxide from supply brine, it was decided to simultaneously attempt to determine preflash effects on condenser performance during operation in the direct-contact evaporator mode. If noncondensible gases such as carbon dioxide were responsible, at least in part, for the relatively poor performance attributed to the ORNL 40-tube condenser during the Group III tests, brine preflash was expected to reduce system levels of carbon dioxide and, thereby, improve such performance during operation in the direct-contact evaporator mode. Group IV

data taken with the Barber-Nichols preflash unit are given in Fig. 6.14 along with Group III data discussed in the previous section. It is clear from the figure that, during direct-contact evaporator mode operation, performance with brine preflash (Group IV) was superior to that without brine preflash (Group III). Such a conclusion is consistent with the expectations expressed earlier relative to noncondensible gas effects on condenser performance.

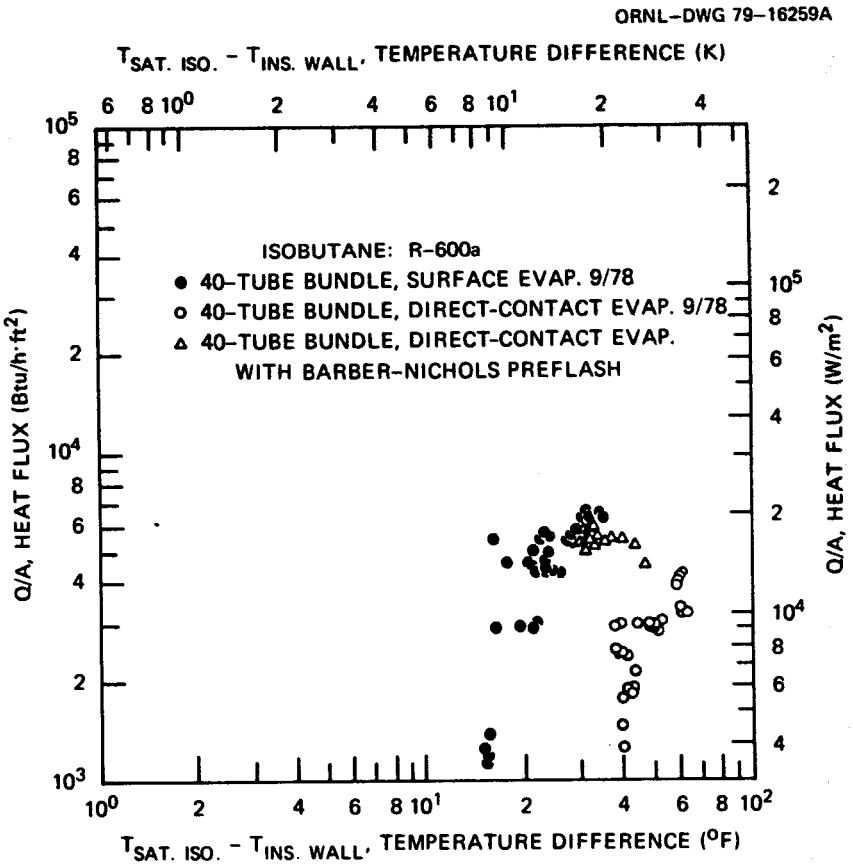

Fig. 6.14. The ORNL 40-tube condenser — Group IV test results.

7. CONCLUSIONS

The following major conclusions may be drawn from the condenser performance field tests described in this report:

1. Field performance was poorer than laboratory performance.
2. Direct-contact evaporator mode performance was poorer than surface evaporator mode performance.
3. Fluted tube performance was superior to smooth tube performance.
4. Cooling water quality had no significant effect on performance.
5. During direct-contact evaporator mode operation, performance with brine preflash was superior to that without brine preflash.

The most important practical implications of these conclusions for condensers in binary geothermal power plants are as follows:

1. Working-fluid-side impurities can significantly degrade condenser performance.
2. Surface evaporator mode power plants should take precautions to minimize introduction of impurities during filling and/or maintenance of working-fluid-side systems. Intermittent venting may be required to remove unavoidable contamination.
3. The performance of condensers in direct-contact evaporator mode power plants may be seriously diminished by the continuous introduction of brine impurities. Moderate brine preflash may help reduce the severity of this problem, but continuous condenser venting to a working-fluid recovery system may be required.
4. In all the experimental situations examined to date, vertical fluted tube condensers offer the potential of sizeable performance advantages over more conventional condensers.

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5. M. W. Urbanek, *Experimental Testing of a Direct Contact Heat Exchanger for Geothermal Brine*, ORNL/SUB-79/13564/1 and ORNL/SUB-79/45736/1 (December 1979).

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7. K. E. Nichols, *Direct Contact Heat Exchanger 10 kW Power Loop*, LBL-7036-66 (July 1979).

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9. E. E. Wilson, "Basis for Rational Design of Heat Transfer Apparatus," *Trans. ASME* 37, 47 (1915).

10. W. M. Rohsenow and J. P. Hartnett, *Handbook of Heat Transfer*, McGraw-Hill, New York, 1973.

Appendix A

ORNL TWO-TUBE CONDENSER FIELD TEST DATA

A.1 Data Reduction Program

Reduction of all measured data from the ORNL two-tube condenser was carried out using a computer program developed specifically to facilitate side-by-side comparison of vertical condenser tube performance. Measured quantities (temperatures, pressures, flow rates) were combined with fluid property values to calculate heat loads, heat fluxes, temperature differences, and heat transfer coefficients for performance comparison. A printout of the FORTRAN program used is presented in the section, along with a description of symbols that appear in the program.

```
C
C     THIS PROGRAM WAS USED TO REDUCE ISOBUTANE (R-600A) DATA OBTAINED FROM
C     AN ORNL DESIGNED TWO TUBE CONDENSER TESTED AT THE EAST MESA GEOTHERMAL
C     TEST FACILITY.  WATER-SIDE HEAT LOADS ARE USED TO OBTAIN HEAT TRANSFER
C     COEFFICIENTS FOR EACH TUBE IN THE CONDENSER.  VARIABLES FOR TUBE #1
C     AND #2 ARE AS FOLLOWS, WHERE "*" DENOTES EXPERIMENTAL MEASURED DATA:
C
C    *C1----------------OHMS, SHELL THERMISTOR
C    *C2----------------OHMS, TUBE #1 H2O IN THERMISTOR
C    *C3----------------OHMS, TUBE #2 H2O OUT THERMISTOR
C    *C4----------------OHMS, TUBE #1 H2O IN THERMISTOR
C    *C5----------------OHMS, TUBE #2 H2O OUT THERMISTOR
C     T1----------------SHELL TEMPERATURE FROM C1, DEG.F
C     T2----------------TUBE #1 H2O IN TEMPERATURE FROM C2, DEG.F
C     T3----------------TUBE #1 H2O OUT TEMPERATURE FROM C3, DEG.F
C     T4----------------TUBE #2 H2O IN TEMPERATURE FROM C4, DEG.F
C     T5----------------TUBE #2 H2O OUT TEMPERATURE FROM C5, DEG.F
C    *FL1 AND FL2-------PERCENT H2O FLOW FOR TUBE #1 AND #2
C     HV----------------VOLTAGE INPUT TO H2O IMMERSION HEATER
C    *PMEAS-------------MEASURED VAPOR PRESSURE IN SHELL
C    *CDT---------------CONDENSATE TEMPERATURE FROM THERMOCOUPLE, DEG.F
C    *PVAP--------------DSS VAPOR INLET PRESSURE
C    *TVAP--------------DSS VAPOR SUPPLY TEMPERATURE
C    *PWELL-------------DSS HOTWELL PRESSURE
C    *TWELL-------------DSS HOTWELL TEMPERATURE
C    *KWALL1 AND KWALL2-WALL THERMAL CONDUCTIVITY OF TUBE #1 AND #2
C    *A1 AND A2---------OUTSIDE SURFACE AREA OF TUBE #1 AND #2
C    *HD1 AND HD2-------HYDRAULIC DIAMETER OF TUBE #1 AND #2
C    *RI1 AND RI2-------INSIDE RADIUS OF TUBE #1 AND #2
C     TSAT--------------SATURATION TEMPERATURE CALCULATED FROM PMEAS
C     TAVG1 AND TAVG2---AVERAGE H2O TEMPERATURE FOR TUBE #1 AND #2
C     DT1 AND DT2-------H2O TEMPERATURE RISE FOR TUBE #1 AND #2
C     TDVM1 AND TDVM2---SHELL TEMP. MINUS AVERAGE H2O TEMP. FOR TUBE #1 AND #2
C     TDAVG-------------DIFFERENCE IN AVG. H2O TEMP. BETWEEN TUBE #1 AND #2
C     H2OFL1 AND H2OFL2-H2O FLOW FOR TUBE #1 AND #2, GPM
C     Q1 AND Q2---------H2O HEAT LOAD FOR TUBE #1 AND #2
C     Q1FLX AND Q2FLX---H2O HEAT FLUX FOR TUBE #1 AND #2
C     UA1 AND UA2-------OVERALL CONDUCTANCE FOR TUBE #1 AND #2, BASED ON T1
C     TSVM1 AND TSVM2---CALCULATED SATURATION TEMPERATURE TSAT MINUS THE
C                       AVERAGE H2O TEMPERATURE FOR TUBE #1 AND #2
C     US1 AND US2-------OVERALL CONDUCTANCE FOR TUBE #1 AND #2 BASED ON TSAT
C     VIS1 AND VIS2-----H2O VISCOSITY FOR TUBE #1 AND #2
C     K1H2O AND K2H2O---H2O THERMAL CONDUCTIVITY FOR TUBE #1 AND #2
C     PRH2O1 AND PRH2O2-H2O PRANDTL NUMBER FOR TUBE #1 AND #2
C     WVEL1 AND WVEL2---H2O VELOCITY FOR TUBE #1 AND #2
C     SVM1 AND SVM2-----H2O SPECIFIC VOLUME FOR TUBE #1 AND #2
C     RHOW1 AND RHOW2---H2O DENSITY FOR TUBE #1 AND #2
C     REH2O1 AND REH2O2-H2O REYNOLDS NUMBER FOR TUBE #1 AND #2
C     NU1 AND NU2-------H2O NUSSELT NUMBER FOR TUBE #1 AND #2
C     A1INSD AND A2INSD-INSIDE SURFACE AREA FOR TUBE #1 AND #2
C     UA1INV AND UA2INV-INVERSE OF UA1 AND UA2
C     H1INV AND H2INV---H2O HEAT TRANSFER RESISTANCE
C     HSAT1 AND HSAT2---COMPOSITE HEAT TRANSFER COEFF. FOR TUBE #1 AND #2
C     TCOMP1 AND TCOMP2-COMPOSITE TEMP. DIFFERENCE FOR TUBE #1 AND #2
C
```

```
      DIMENSION TITL1(21), TITL2(21)
      REAL KWALL1,KWALL2
      REAL K1H2O,K2H2O
      REAL MU1,MU2
  100 READ(5,2,END=5000) KWALL1,KWALL2,A1,A2,HD1,HD2,RI1,RI2
    2 FORMAT(2F6.2,2F6.4,4F10.7)
      G=1.0
      WRITE(6,320)
  320 FORMAT(1H ,128('-'))
      WRITE(6,310)
  310 FORMAT(1H1)
      IF(KWALL1.EQ.0) GO TO 1000
   10 READ(5,1) TITL1,C1,C2,C3,C4,C5,FL1,FL2
    1 FORMAT(21A1,5F7.0,2F6.3)
      IF(C1.EQ.0.0) GO TO 100
      READ(5,3) TITL2,PMEAS,HV,CDT,PVAP,TVAP,PWELL,TWELL
    3 FORMAT(21A1,7F7.1)
      PI=3.1415927
      R=C1
      A=-4.279903722
      BB=3.909937054E3
      C=-1.434309943E7
      CALL TMCAL(A,BB,C,R,T)
      T1=9./5.*T+32.
      R=C2
      A=-4.059011068
      BB=3.911466872E3
      C=-1.4414684 95E7
      CALL TMCAL(A,BB,C,R,T)
      T2=9./5.*T+32.
      R=C3
      A=-4.164037485
      BB=3.933640653E3
      C=-1.3550485 22E7
      CALL TMCAL(A,BB,C,R,T)
      T3=9./5.*T+32.
      R=C4
      A=-4.113977660
      BB=3.925546997E3
      C=-1.417939152E7
      CALL TMCAL(A,BB,C,R,T)
      T4=9./5.*T+32.
      R=C5
      A=-4.257907109
      BB=3.903163398E3
      C=-1.432368658E7
      CALL TMCAL(A,BB,C,R,T)
      T5=9./5.*T+32.
      P=PMEAS+14.696
      P34=7.06398E-3*P**3-1.21908E-4*P**4
      P56=1.33627E-6*P**5-8.92449E-9*P**6
      P78=3.30065E-11*P**7-5.16906E-14*P**8
      TSAT=-62.3124+7.7252*P-0.268216*P*P+P34+P56+P78
      TAVG1=(T2+T3)/2.
      TAVG2=(T4+T5)/2.
      DT1=T3-T2
      DT2=T5-T4
      TDVM1=T1-TAVG1
      TDVM2=T1-TAVG2
      TDAVG=TAVG1-TAVG2
      H2OFL1=7.7866667E-2+4.250242424*FL1
      H2OFL2=1.37666666E-1+5.398606061*FL2
      Q1=497.866*H2OFL1*DT1
      Q2=497.866*H2OFL2*DT2
      Q1FLX=Q1/A1
      Q2FLX=Q2/A2
      UA1=(Q1/TDVM1)
      UA2=(Q2/TDVM2)
      TSVM1=TSAT-TAVG1
      TSVM2=TSAT-TAVG2
      US1=(Q1/TSVM1)
      US2=(Q2/TSVM2)
      VIS1=8.0144599-1.6728317E-1*TAVG1+2.0423535E-3*TAVG1*TAVG1-1.63246
     *68E-5*TAVG1**3+8.8555744E-8*TAVG1**4-3.3015965E-10*TAVG1**5+8.4382
     *483E-13*TAVG1**6-1.4493830E-15*TAVG1**7+1.59638E-18*TAVG1**8-1.017
     *3273E-21*TAVG1**9+2.8496174E-25*TAVG1**10
      VIS2=8.0144599-1.6728317E-1*TAVG2+2.0423535E-3*TAVG2*TAVG2-1.63246
     *68E-5*TAVG2**3+8.8555744E-8*TAVG2**4-3.3015965E-10*TAVG2**5+8.4382
     *483E-13*TAVG2**6-1.4493830E-15*TAVG2**7+1.59638E-18*TAVG2**8-1.017
     *3273E-21*TAVG2**9+2.8496174E-25*TAVG2**10
      IF(TAVG1-80.) 20,30,30
   30 IF(TAVG1-130.) 40,50,50
   20 K1H2O=0.302+7.00E-4*TAVG1
      GO TO 60
   40 K1H2O=0.315+4.86E-4*TAVG1
      GO TO 60
   50 K1H2O=0.3426+2.66E-4*TAVG1
   60 CONTINUE
      IF(TAVG2-80.) 70,80,80
   80 IF(TAVG2-130.) 90,91,91
   70 K2H2O=0.302+7.00E-4*TAVG2
      GO TO 92
```

```
   90 K2H2O=0.315+4.86E-4*TAVG2
      GO TO 92
   91 K2H2O=0.3426+2.66E-4*TAVG2
   92 CONTINUE
      PRH2O1=VIS1/K1H2O
      PRH2O2=VIS2/K2H2O
    4 WVEL1=(H2OFL1*0.3208752)/(PI*RI1*RI1-0.44179)
    6 WVEL2=(H2OFL2*0.3208752)/(PI*RI2*RI2-0.44179)
    7 SVM1=1.60582E-2-1.98599E-6*TAVG1+2.59921E-8*TAVG1**2-1.61308E-11*T
     *AVG1**3
      SVM2=1.60582E-2-1.98599E-6*TAVG2+2.59921E-8*TAVG2**2-1.61308E-11*T
     *AVG2**3
      RHOW1=1./SVM1
      RHOW2=1./SVM2
      REH2O1=(WVEL1*HD1*RHOW1*3600.)/VIS1
      REH2O2=(WVEL2*HD2*RHOW2*3600.)/VIS2
      NU1=0.023*REH2O1**0.8*PRH2O1**0.40
      NU2=0.023*REH2O2**0.8*PRH2O2**0.40
      HW1=(NU1*K1H2O)/HD1
      HW2=(NU2*K2H2O)/HD2
      IF(A1.EQ.1.025) GO TO 96
      A1INSD=(PI*RI1*2.0*46.0)/144.0
      GO TO 97
   96 A1INSD=(PI*RI1*2.0*47.0)/144.0
   97 IF(A2.EQ.1.025) GO TO 98
      A2INSD=(PI*RI2*2.0*46.0)/144.0
      GO TO 99
   98 A2INSD=(PI*RI2*2.0*47.0)/144.0
   99 UA1INV=1.0/US1
      UA2INV= 1.0/US2
      H1INV=1.0/(HW1*A1INSD)
      H2INV=1.0/(HW2*A2INSD)
      HSAT1=1.0/(UA1INV-H1INV)/A1
      HSAT2=1.0/(UA2INV-H2INV)/A2
      TCOMP1=Q1FLX/HSAT1
      TCOMP2=Q2FLX/HSAT2
      G=G+1.0
      IF(G.EQ.8.0) GO TO 290
      GO TO 291
  290 WRITE(6,280)
      WRITE(6,300)
  300 FORMAT(1H1)
      G=2.0
  291 CONTINUE
      WRITE(6,280)
  280 FORMAT(1H ,128('-'))
      WRITE(6,200) TITL1
  200 FORMAT(1H ,2X,21A1,6X,' VAPOR      SAT.    T1AVG-     PMEAS   HEATER
     *  COND   ----------------DSS----------------')
      WRITE(6,220) TITL2
  220 FORMAT(1H ,2X,21A1,7X,' TEMP       TEMP      T2AVG     PSIG   VOLTS
     *  TEMP          PVAP      TVAP      PWELL     TWELL')
      WRITE(6,230) T1,TSAT,TDAVG,PMEAS,HV,CDT,PVAP,TVAP,PWELL,TWELL
  230 FORMAT(1H ,30X,F6.2,3X,F6.2,3X,F5.2,4X,F5.1,3X,F5.1,3X,F5.1,6X,F5.
     *1,3X,F5.1,2X,F5.1,3X,F5.1,/)
      WRITE(6,240)
  240 FORMAT(1H ,10X,'INLET    OUTLET     AVG      TEMP     TV-      TS-      H
     *2O    WVEL     HEAT     HEAT      UA       UA        COEFF   HT.SAT   DELTA',/,1
     *1X,'TEMP      TEMP     TEMP      RISE     TAVG      TAVG      FLOW    FT/S     L
     *OAD     FLUX     CALC     SAT       H2O      COMP     TCOMP')
      WRITE(6,260) T2,T3,TAVG1,DT1,TDVM1,TSVM1,H2OFL1,WVEL1,Q1,Q1FLX,UA1
     *,US1,HW1,HSAT1,TCOMP1
  260 FORMAT(1H ,2X,'TUBE 1  ',F5.2,3X,F5.2,4X,F5.2,2X,F5.2,2X,F6.2,2X,F
     *6.2,3X,F4.2,2X,F4.2,2X,F6.0,1X,F6.0,1X,F6.2,2X,F6.2,2X,F7.2,2X,F6.
     *2,2X,F5.2)
      WRITE(6,270) T4,T5,TAVG2,DT2,TDVM2,TSVM2,H2OFL2,WVEL2,Q2,Q2FLX,UA2
     *,US2,HW2,HSAT2,TCOMP2
  270 FORMAT(1H ,2X,'TUBE 2  ',F5.2,3X,F5.2,4X,F5.2,2X,F5.2,2X,F6.2,2X,F
     *6.2,3X,F4.2,2X,F4.2,2X,F6.0,1X,F6.0,1X,F6.2,2X,F6.2,2X,F7.2,2X,F6.
     *2,2X,F5.2)
      GO TO 10
 1000 CONTINUE
 5000 WRITE(6,280)
      WRITE(6,490)
  490 FORMAT(1H1)
      STOP
      END



      SUBROUTINE TMCAL(A,BB,C,R,T)
      D=ALOG(R)-A
      BB=-BB/D
      D=-C/D
      T=273.15+20.
   65 TOLD=T
      T=T-(T**3+BB*T**2+D)/(3*T**2+2*BB*T)
      IF(ABS(T-TOLD).LE.1E-03) GO TO 29
      GO TO 65
   29 T=T-273.15
      RETURN
      END
```

A.2 Output Format

Terms and abbreviations found in the program output are keyed here, accompanied by output samples generated from Groups I-A and III-D test data. The illustrated key may be used to identify and interpret the data listing presented in the next section for Groups I-A, I-B, III-B, III-D, and V tests.

```
                              KEY TO DATA OUTPUT

                            TITLE DESIGNATIONS

EM---------EAST MESA                        HP--------SURFACE EVAPORATOR
XX-XX-XX--MONTH, DAY, YEAR                  DC--------DIRECT CONTACT EVAPORATOR
XY---------TUBE #1(X), TUBE #2(Y)           D/H-------DESUPERHEAT ON
XXXA-------TIME OF DAY, AM                  C/V-------CONTINUOUS VENTING
XXXP-------TIME OF DAY, PM                  DW1/CW2---DIRTY H2O IN TUBE #1,
                                                      CLEAN H2O IN TUBE #2.

                          DEFINITION OF OUTPUT TERMS

  VAPOR TEMP----------MEASURED VAPOR TEMPERATURE IN SHELL
  SAT. TEMP-----------SATURATION TEMPERATURE CALCULATED FROM MEASURED
                      VAPOR PRESSURE IN SHELL
  T1AVG-T2AVG---------AVERAGE H2O TEMP. DIFFERENCE BETWEEN TUBE #1 AND #2
  PMEAS---------------MEASURED VAPOR PRESSURE IN SHELL
  HEATER VOLTS--------INPUT VOLTAGE TO IMMERSION H2O HEATER LOCATED IN
                      ONE TUBE CHANNEL TO CONTROL H2O TEMPERATURE
  COND. TEMP----------MEASURED CONDENSATE TEMPERATURE
  BARBER NICHOLS
  PRESSURE------------BARBER NICHOLS TURBINE OUTLET PRESSURE
  BARBER NICHOLS
  TOUTLET-------------BARBER NICHOLS TURBINE OUTLET TEMPERATURE
  BARBER NICHOLS
  TINLET--------------BARBER NICHOLS TURBINE INLET TEMPERATURE
  DSS PVAP------------DSS VAPOR SUPPLY PRESSURE
  DSS TVAP------------DSS VAPOR SUPPLY TEMPERATURE
  DSS PWELL-----------DSS HOTWELL PRESSURE
  DSS TWELL-----------DSS HOTWELL TEMPERATURE
  INLET TEMP----------H2O IN TEMPERATURE FOR TUBE #1 AND #2
  OUTLET TEMP---------H2O OUT TEMPERATURE FOR TUBE #1 AND #2
  AVG. TEMP-----------AVERAGE H2O TEMPERATURE FOR TUBE #1 AND #2
  TEMP RISE-----------H2O TEMPERATURE RISE FOR TUBE #1 AND #2
  TV-TAVG-------------MEASURED VAPOR TEMPERATURE MINUS AVERAGE H2O
                      TEMPERATURE FOR TUBE #1 AND #2
  TS-TAVG-------------CALCULATED SATURATION TEMPERATURE MINUS AVERAGE
                      H2O TEMPERATURE FOR TUBE #1 AND #2
  H2O FLOW------------H2O FLOW THROUGH TUBE #1 AND #2
  WVEL----------------H2O VELOCITY THROUGH TUBE #1 AND #2
  HEAT LOAD-----------H2O HEAT LOAD FOR TUBE #1 AND #2
  HEAT FLUX-----------H2O HEAT FLUX FOR TUBE #1 AND #2
  UA CALC-------------OVERALL CONDUCTANCE FOR TUBE #1 AND #2
                      BASED ON MEASURED VAPOR TEMPERATURE
  UA SAT--------------OVERALL CONDUCTANCE FOR TUBE #1 AND #2 BASED ON
                      SATURATION TEMP. INFERRED FROM MEASURED PRESSURE
  COEFF. H2O----------H2O HEAT TRANSFER COEFFICIENT FOR TUBE #1 AND #2
  HT. SAT. COMP-------COMPOSITE HEAT TRANSFER COEFFICIENT
                      FOR TUBE #1 AND #2 CALC. FROM UA SAT
  DELTA TCOMP---------COMPOSITE TEMP. DIFFERENCE FOR TUBE #1 AND #2
```

Sample of data output from Group I-A tests

EM03-20-78AF -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
115.43	98.73	-0.05	56.0	59.	58.0	136.00	202.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.09	71.31	69.70	3.21	45.73	29.03	2.37	4.99	3797.	3705.	83.05	130.82	1503.59	141.42	26.20
TUBE 2	67.73	71.77	69.75	4.04	45.68	28.98	3.03	5.00	6084.	5861.	133.20	209.96	1440.23	241.20	24.30

Sample of data output from Group III-D tests

EM-09-21-78AF3-11:20A
HP-D/H, AF3-11:20A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
104.02	94.84	0.45	52.0	132.0	89.0	52.0	136.0	51.5	87.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.73	70.61	69.17	2.87	34.85	25.67	2.37	4.99	3393.	3311.	97.38	132.17	1498.39	143.10	23.13
TUBE 2	66.11	71.34	68.72	5.24	35.29	26.12	3.03	5.00	7888.	7599.	223.48	301.97	1430.57	379.64	20.02

A.3 Data Listing

Performance data obtained with the ORNL two-tube condenser during Groups I-A, I-B, III-B, III-D, and V tests (see Table 2.2) are documented in Tables A.1-A.5, respectively. The information was generated by the computer code shown in Sect. A.1.

Table A.1. The ORNL two-tube condenser performance data for Group I-A tests (surface evaporator mode)

EM03-16-78AA-1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
73.33	0.0	0.14	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	55.68	55.85	55.77	0.17	17.57	-55.77	2.37	4.99	203.	198.	11.56	-3.64	1366.08	-3.54	*****
TUBE 2	55.52	55.73	55.63	0.20	17.71	-55.63	2.38	5.00	241.	235.	13.60	-4.33	1367.04	-4.21	*****

EM03-16-78AA-02P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
90.74	88.68	0.11	0.0	0.	46.0	125.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	57.30	60.08	58.69	2.77	32.05	29.99	2.37	4.99	3277.	3197.	102.25	109.28	1394.96	116.88	27.35
TUBE 2	57.18	59.97	58.58	2.79	32.16	30.10	2.38	5.00	3300.	3219.	102.59	109.62	1396.24	117.27	27.45

EM03-16-78AA -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
90.74	90.78	0.20	48.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	57.64	60.62	59.13	2.99	31.61	31.65	2.37	4.99	3529.	3443.	111.64	111.49	1399.33	119.44	28.82
TUBE 2	57.48	60.38	58.93	2.91	31.81	31.85	2.38	5.00	3443.	3359.	108.24	108.09	1399.75	115.44	29.10

EM03-16-78AA -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
94.81	90.78	0.19	0.0	0.	48.0	153.50	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	57.79	61.10	59.44	3.31	35.37	31.34	2.37	4.99	3907.	3812.	110.47	124.66	1402.40	135.08	28.22
TUBE 2	57.68	60.83	59.25	3.15	35.56	31.53	2.38	5.00	3727.	3636.	104.81	118.20	1402.93	127.34	28.55

EM03-16-78AA -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
103.20	91.82	0.20	49.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.32	61.70	60.01	3.37	43.19	31.80	2.37	4.99	3985.	3888.	92.28	125.31	1408.03	135.80	28.63
TUBE 2	58.20	61.43	59.82	3.23	43.38	32.00	2.38	5.00	3824.	3730.	88.14	119.49	1408.50	128.82	28.96

EM03-16-78AA -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
120.28	91.82	0.13	49.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.54	62.06	60.30	3.53	59.98	31.52	2.37	4.99	4165.	4063.	69.44	132.15	1410.88	144.06	28.21
TUBE 2	58.47	61.88	60.17	3.40	60.11	31.64	2.38	5.00	4031.	3933.	67.07	127.40	1412.05	138.28	28.44

Table A.1 (continued)

EH03-16-78AA -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
120.47	96.81	0.15	54.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.74	62.66	60.70	3.91	59.77	36.11	2.37	4.99	4624.	4511.	77.35	128.06	1414.83	139.04	32.44
TUBE 2	58.66	62.45	60.55	3.79	59.92	36.25	2.38	5.00	4490.	4381.	74.93	123.85	1415.80	133.97	32.70

EH03-16-78AA -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
120.89	96.81	0.09	54.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.79	62.75	60.77	3.96	60.13	36.04	2.37	4.99	4677.	4563.	77.78	129.77	1415.49	141.10	32.34
TUBE 2	58.75	62.60	60.67	3.84	60.22	36.13	2.38	5.00	4550.	4439.	75.56	125.93	1417.01	136.45	32.53

EH03-17-78AA -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
126.40	102.45	0.16	60.0	0.	62.0	192.40	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.59	67.52	65.55	3.93	60.85	36.90	2.37	4.99	4640.	4527.	76.26	125.73	1462.73	135.75	33.35
TUBE 2	63.47	67.31	65.39	3.83	61.01	37.07	2.38	5.00	4540.	4429.	74.41	122.48	1463.63	131.86	33.59

EH03-17-78AA-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
140.20	102.45	0.19	60.0	0.	62.0	245.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.52	68.45	66.48	3.93	73.72	35.97	2.37	4.99	4645.	4532.	63.01	129.14	1471.93	139.73	32.43
TUBE 2	64.38	68.22	66.30	3.84	73.90	36.16	2.38	5.00	4545.	4434.	61.50	125.71	1472.61	135.63	32.70

EH03-17-78AA -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
132.97	99.67	0.15	57.0	0.	78.0	190.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.82	68.48	66.65	3.66	66.32	33.02	2.37	4.99	4323.	4217.	65.18	130.90	1473.55	141.93	29.74
TUBE 2	64.70	68.29	66.50	3.59	66.47	33.17	2.38	5.00	4248.	4145.	63.91	128.06	1474.59	138.41	29.95

EH03-17-78AA -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
136.34	101.54	0.12	59.0	0.	62.0	207.80	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.42	69.27	67.35	3.86	68.99	34.19	2.37	4.99	4555.	4444.	66.02	133.23	1480.43	144.56	30.74
TUBE 2	65.34	69.12	67.23	3.78	69.11	34.30	2.38	5.00	4476.	4367.	64.77	130.48	1481.82	141.24	30.92

Table A.1 (continued)

EM03-17-78AA -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
118.41	94.84	0.10	52.0	0.	52.0	196.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.78	68.75	67.27	2.97	51.15	27.58	2.37	4.99	3511.	3425.	68.64	127.30	1479.63	137.45	24.92
TUBE 2	65.72	68.62	67.17	2.89	51.24	27.68	2.38	5.00	3427.	3344.	66.88	123.83	1481.20	133.30	25.08

EM03-17-78AA -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
115.71	93.85	0.01	51.0	0.	52.0	162.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.62	69.46	68.04	2.84	47.67	25.81	2.37	4.99	3351.	3270.	70.30	129.85	1487.24	140.43	23.28
TUBE 2	66.64	69.42	68.03	2.79	47.68	25.82	2.38	5.00	3299.	3218.	69.18	127.76	1489.69	137.90	23.34

EM03-17-78AA -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
117.62	95.83	0.03	53.0	0.	54.0	210.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.69	70.68	69.18	2.99	48.44	26.65	2.37	4.99	3528.	3442.	72.83	132.39	1498.52	143.36	24.01
TUBE 2	67.68	70.62	69.15	2.94	48.47	26.68	2.38	5.00	3480.	3395.	71.80	130.46	1500.78	141.02	24.08

EM03-17-78AA -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
129.63	102.45	0.08	60.0	0.	60.0	220.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.95	72.49	70.72	3.54	58.90	31.73	2.37	4.99	4179.	4078.	70.95	131.71	1513.66	142.39	28.64
TUBE 2	68.91	72.38	70.65	3.47	58.98	31.81	2.38	5.00	4105.	4005.	69.60	129.06	1515.50	139.20	28.77

EM03-17-78AA -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
120.70	100.61	0.08	58.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.02	72.27	70.65	3.25	50.05	29.96	2.37	4.99	3844.	3750.	76.79	128.28	1512.92	138.30	27.11
TUBE 2	68.99	72.14	70.56	3.15	50.13	30.04	2.38	5.00	3730.	3639.	74.40	124.15	1514.70	133.38	27.28

Table A.1 (continued)

EH03-20-78AF -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
117.45	0.0	0.09	0.0	60.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.12	67.22	65.67	3.11	51.77	-65.67	2.37	4.99	3669.	3580.	70.87	-55.87	1463.91	-52.27	*****
TUBE 2	63.72	67.45	65.58	3.74	51.86	-65.58	3.03	5.00	5631.	5425.	108.58	-85.86	1400.94	-77.46	*****

EH03-20-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
126.22	0.0	-0.03	0.0	51.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.79	68.17	66.48	3.39	59.74	-66.48	2.37	4.99	3999.	3902.	66.95	-60.16	1471.86	-56.12	*****
TUBE 2	64.42	68.61	66.51	4.18	59.70	-66.51	3.03	5.00	6304.	6073.	105.59	-94.78	1409.71	-84.98	*****

EH03-20-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
127.20	97.77	-0.00	55.0	54.	55.0	121.70	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.97	68.38	66.68	3.40	60.53	31.10	2.37	4.99	4018.	3920.	66.38	129.21	1473.81	139.80	28.04
TUBE 2	64.58	68.77	66.68	4.18	60.53	31.10	3.03	5.00	6301.	6071.	104.11	202.64	1411.24	232.13	26.15

EH03-20-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
128.21	98.73	-0.02	56.0	54.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.15	68.55	66.85	3.40	61.36	31.87	2.37	4.99	4023.	3925.	65.56	126.20	1475.55	136.18	28.82
TUBE 2	64.77	68.98	66.88	4.20	61.33	31.85	3.03	5.00	6332.	6101.	103.24	198.81	1413.13	226.87	26.89

EH03-20-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
129.90	97.77	0.02	55.0	54.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.48	69.09	67.29	3.61	62.61	30.48	2.37	4.99	4268.	4164.	68.17	140.02	1479.84	152.81	27.25
TUBE 2	65.09	69.44	67.26	4.35	62.64	30.51	3.03	5.00	6559.	6319.	104.72	215.01	1416.80	248.98	25.38

EH03-20-78AF -12A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
135.10	99.67	-0.03	57.0	54.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.60	69.08	67.34	3.48	67.76	32.33	2.37	4.99	4111.	4011.	60.68	127.17	1480.39	137.29	29.22
TUBE 2	65.16	69.59	67.37	4.43	67.73	32.30	3.03	5.00	6673.	6428.	98.52	206.57	1417.81	237.29	27.09

Table A.1 (continued)

EM03-20-78AF -12A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
140.54	100.61	-0.04	58.0	56.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.89	69.45	67.67	3.56	72.87	32.94	2.37	4.99	4206.	4104.	57.72	127.69	1483.58	137.88	29.76
TUBE 2	65.48	69.93	67.71	4.45	72.84	32.90	3.03	5.00	6700.	6455.	91.99	203.64	1420.96	233.18	27.68

EM03-20-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
99.09	100.61	-0.01	58.0	55.	61.0	142.80	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.35	69.81	68.08	3.46	31.01	32.53	2.37	4.99	4093.	3993.	132.00	125.83	1487.67	135.61	29.44
TUBE 2	65.97	70.22	68.10	4.26	30.99	32.51	3.03	5.00	6410.	6176.	206.85	197.17	1424.65	224.33	27.53

EM03-20-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
118.41	100.61	0.02	58.0	65.	61.0	184.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.09	70.55	68.82	3.46	49.59	31.79	2.37	4.99	4082.	3983.	82.32	128.42	1494.94	138.64	28.73
TUBE 2	66.65	70.94	68.80	4.29	49.61	31.81	3.03	5.00	6463.	6227.	130.27	203.19	1431.26	232.25	26.81

EM03-20-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
122.80	102.45	-0.00	60.0	65.	60.0	187.00	232.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.51	71.13	69.32	3.62	53.48	33.14	2.37	4.99	4277.	4172.	79.96	129.05	1499.81	139.34	29.94
TUBE 2	67.07	71.56	69.32	4.49	53.48	33.14	3.03	5.00	6765.	6517.	126.49	204.15	1436.17	233.41	27.92

EM03-20-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
121.61	100.61	-0.01	58.0	65.	60.0	167.50	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.86	71.22	69.54	3.36	52.07	31.07	2.37	4.99	3967.	3870.	76.19	127.67	1501.99	137.68	28.11
TUBE 2	67.44	71.64	69.54	4.20	52.06	31.07	3.03	5.00	6332.	6100.	121.62	203.82	1438.29	232.90	26.19

EM03-20-78AF -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
119.21	99.67	0.03	57.0	65.	60.0	153.00	216.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.97	71.29	69.63	3.32	49.59	30.04	2.37	4.99	3917.	3822.	79.00	130.38	1502.89	140.90	27.12
TUBE 2	67.53	71.65	69.59	4.12	49.62	30.08	3.03	5.00	6207.	5980.	125.10	206.37	1438.77	236.35	25.30

Table A.1 (continued)

EH03-20-78AF -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
115.43	98.73	-0.05	56.0	59.	58.0	136.00	202.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.09	71.31	69.70	3.21	45.73	29.03	2.37	4.99	3797.	3705.	83.05	130.82	1503.59	141.42	26.20
TUBE 2	67.73	71.77	69.75	4.04	45.68	28.98	3.03	5.00	6084.	5861.	133.20	209.96	1440.23	241.20	24.30

EH03-20-78AF -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
110.16	99.67	0.00	57.0	62.	58.0	134.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.47	71.53	70.00	3.06	40.16	29.67	2.37	4.99	3615.	3527.	90.01	121.82	1506.53	130.70	26.99
TUBE 2	68.07	71.92	70.00	3.86	40.17	29.68	3.03	5.00	5809.	5596.	144.61	195.72	1442.54	221.89	25.22

EH03-20-78AF -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
107.18	96.81	0.06	54.0	62.	56.0	125.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.36	71.30	69.83	2.93	37.35	26.98	2.37	4.99	3463.	3379.	92.72	128.39	1504.88	138.51	24.40
TUBE 2	67.94	71.61	69.77	3.68	37.41	27.03	3.03	5.00	5543.	5340.	148.17	205.04	1440.47	234.49	22.77

EH03-20-78AF -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
103.97	96.81	0.00	54.0	56.	55.0	125.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.62	70.52	69.07	2.90	34.90	27.74	2.37	4.99	3428.	3345.	98.23	123.59	1497.38	132.86	25.17
TUBE 2	67.26	70.87	69.06	3.62	34.90	27.74	3.03	5.00	5447.	5248.	156.07	196.35	1433.78	222.97	23.54

Table A.1 (continued)

EH03-21-78AF3-9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
98.44	92.84	-0.32	50.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.92	69.28	68.10	2.37	30.34	24.74	2.37	4.99	2794.	2726.	92.11	112.97	1487.87	120.46	22.63
TUBE 2	66.70	70.15	68.42	3.45	30.02	24.42	3.03	5.00	5192.	5002.	172.98	212.67	1427.72	245.35	20.39

EH03-21-78AF3-9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
99.21	93.85	-0.04	51.0	58.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.80	69.18	67.99	2.38	31.22	25.86	2.37	4.99	2809.	2741.	89.99	108.65	1486.76	115.46	23.74
TUBE 2	66.26	69.81	68.03	3.56	31.17	25.81	3.03	5.00	5357.	5160.	171.83	207.51	1424.06	238.37	21.65

EH03-21-78AF3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
103.03	0.0	-0.05	0.0	75.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.17	67.85	66.51	2.68	36.52	-66.51	2.37	4.99	3166.	3089.	86.69	-47.60	1472.14	-44.82	*****
TUBE 2	64.47	68.64	66.56	4.17	36.47	-66.56	3.03	5.00	6283.	6053.	172.28	-94.40	1410.13	-84.66	*****

EH03-21-78AF3-1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
101.83	0.0	-0.01	0.0	80.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.66	67.60	66.13	2.94	35.70	-66.13	2.37	4.99	3475.	3390.	97.34	-52.55	1468.40	-49.29	*****
TUBE 2	63.91	68.37	66.14	4.46	35.69	-66.14	3.03	5.00	6717.	6471.	188.21	******	1406.18	-90.60	*****

EH03-21-78AF3-1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
109.46	96.81	0.00	54.0	82.	55.0	165.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.90	68.27	66.59	3.38	42.87	30.22	2.37	4.99	3988.	3891.	93.03	131.97	1472.92	143.13	27.19
TUBE 2	64.08	69.08	66.58	5.00	42.87	30.23	3.03	5.00	7539.	7263.	175.83	249.41	1410.35	298.78	24.31

EH03-21-78AF3-2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
111.51	96.81	-0.06	54.0	92.	55.0	165.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.52	69.01	67.26	3.49	44.25	29.55	2.37	4.99	4125.	4025.	93.24	139.63	1479.59	152.34	26.42
TUBE 2	64.67	69.98	67.32	5.31	44.18	29.48	3.03	5.00	7995.	7703.	180.96	271.19	1417.36	331.48	23.24

Table A.1 (continued)

EM03-21-78AF3-2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
112.12	97.77	0.03	55.0	102.	57.0	102.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.89	69.42	67.65	3.53	44.46	30.12	2.37	4.99	4173.	4071.	93.85	138.54	1483.44	150.97	26.97
TUBE 2	64.91	70.32	67.62	5.41	44.50	30.15	3.03	5.00	8152.	7853.	183.20	270.35	1420.14	330.00	23.80

EM03-21-78AF3-2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
115.00	98.73	-0.00	56.0	102.	58.0	222.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.76	70.33	68.55	3.57	46.45	30.18	2.37	4.99	4214.	4111.	90.73	139.64	1492.26	152.20	27.01
TUBE 2	65.78	71.32	68.55	5.54	46.45	30.18	3.03	5.00	8339.	8034.	179.53	276.34	1428.93	338.76	23.72

EM03-21-78AF3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
119.71	98.73	-0.03	56.0	102.	58.0	225.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.00	70.61	68.80	3.61	50.91	29.92	2.37	4.99	4261.	4157.	83.70	142.40	1494.78	155.54	26.73
TUBE 2	66.03	71.63	68.83	5.60	50.88	29.89	3.03	5.00	8441.	8132.	165.90	282.37	1431.60	348.03	23.37

EM03-21-78AF3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
110.60	91.82	-0.01	49.0	100.	51.0	201.00	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.98	69.87	68.43	2.89	42.17	23.39	2.37	4.99	3414.	3330.	80.95	145.96	1491.08	159.95	20.82
TUBE 2	66.03	70.85	68.44	4.82	42.16	23.37	3.03	5.00	7263.	6997.	172.29	310.74	1427.91	394.39	17.74

EM03-22-78AF3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
96.81	91.82	-0.01	49.0	98.	52.0	148.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.38	65.66	64.02	3.29	32.79	27.79	2.37	4.99	3883.	3788.	118.42	139.70	1447.63	152.83	24.79
TUBE 2	61.41	66.65	64.03	5.24	32.78	27.79	3.03	5.00	7895.	7606.	240.83	284.12	1386.25	354.06	21.48

EM03-22-78AF3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
100.17	92.84	-0.03	50.0	100.	53.0	170.00	240.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.26	65.66	63.96	3.40	36.21	28.88	2.37	4.99	4016.	3918.	110.91	139.07	1446.99	152.06	25.77
TUBE 2	61.25	66.72	63.99	5.47	36.19	28.85	3.03	5.00	8242.	7941.	227.78	285.68	1385.83	356.61	22.27

Table A.1 (continued)

RH03-22-78AP3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
105.00	93.85	-0.02	51.0	103.	54.0	191.00	260.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.48	65.96	64.22	3.49	40.78	29.63	2.37	4.99	4120.	4020.	101.04	139.07	1449.58	152.03	26.44
TUBE 2	61.42	67.05	64.24	5.62	40.76	29.61	3.03	5.00	8473.	8163.	207.88	286.16	1388.20	357.21	22.85

RH03-22-78AP3-11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
105.34	95.83	0.00	53.0	105.	57.0	170.00	240.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.71	66.38	64.55	3.67	40.79	31.29	2.37	4.99	4333.	4227.	106.21	138.49	1452.80	151.27	27.94
TUBE 2	61.64	67.44	64.54	5.80	40.80	31.29	3.03	5.00	8744.	8424.	214.33	279.47	1391.09	346.25	24.33

RH03-22-78AP3-11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
107.33	96.81	-0.07	54.0	105.	58.0	183.00	260.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.93	66.75	64.84	3.82	42.48	31.96	2.37	4.99	4514.	4404.	106.26	141.23	1455.74	154.60	28.49
TUBE 2	61.88	67.95	64.91	6.06	42.41	31.89	3.03	5.00	9137.	8802.	215.42	286.48	1394.60	357.23	24.64

RH03-22-78AP3-12A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
101.83	94.84	-0.06	52.0	102.	56.0	137.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.24	66.76	65.00	3.53	36.83	29.84	2.37	4.99	4165.	4063.	113.09	139.56	1457.29	152.52	26.64
TUBE 2	62.23	67.90	65.06	5.67	36.76	29.78	3.03	5.00	8544.	8231.	232.40	286.89	1396.01	357.80	23.01

RH03-22-78AP3-2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
95.08	93.85	0.00	51.0	100.	54.0	130.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.75	65.08	63.42	3.33	31.66	30.43	2.37	4.99	3938.	3842.	124.38	129.41	1441.67	140.39	27.37
TUBE 2	60.79	66.04	63.42	5.24	31.66	30.43	3.03	5.00	7901.	7612.	249.52	259.63	1380.45	315.90	24.09

RH03-22-78AP3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
102.55	88.68	0.08	46.0	105.	58.0	206.00	260.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.32	65.18	63.75	2.86	38.80	24.93	2.37	4.99	3376.	3293.	87.00	135.43	1444.95	147.64	22.31
TUBE 2	61.31	66.02	63.67	4.71	38.88	25.01	3.03	5.00	7092.	6833.	182.40	283.59	1382.82	353.46	19.33

Table A.1 (continued)

EH03-22-78AF3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
103.33	88.68	-0.06	46.0	100.	70.0	210.00	260.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.24	65.14	63.69	2.90	39.64	24.99	2.37	4.99	3421.	3337.	86.30	136.90	1444.34	149.44	22.33
TUBE 2	61.34	66.16	63.75	4.83	39.58	24.93	3.03	5.00	7271.	7005.	183.71	291.70	1383.61	366.60	19.11

EH03-22-78AF3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
103.90	88.68	-0.07	46.0	100.	70.0	189.00	240.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.65	65.54	64.10	2.89	39.80	24.58	2.37	4.99	3413.	3329.	85.74	138.85	1448.39	151.77	21.94
TUBE 2	61.75	66.59	64.17	4.84	39.73	24.50	3.03	5.00	7296.	7029.	183.64	297.74	1387.61	376.22	18.68

EH03-22-78AF3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
102.10	88.68	-0.03	46.0	103.	58.0	186.00	240.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.97	65.83	64.40	2.87	37.70	24.28	2.37	4.99	3386.	3303.	89.79	139.45	1451.35	152.47	21.66
TUBE 2	62.01	66.85	64.43	4.84	37.67	24.25	3.03	5.00	7291.	7024.	193.53	300.69	1390.02	380.91	18.44

EH03-22-78AF3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
98.28	87.60	0.01	45.0	105.	58.0	162.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.23	65.99	64.61	2.76	33.67	22.99	2.37	4.99	3260.	3180.	96.81	141.78	1453.44	155.30	20.48
TUBE 2	62.25	66.95	64.60	4.70	33.68	23.00	3.03	5.00	7075.	6816.	210.05	307.57	1391.64	392.31	17.37

EH03-22-78AF3-4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
93.61	87.60	-0.02	45.0	105.	70.0	166.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.44	66.14	64.79	2.70	28.82	22.81	2.37	4.99	3191.	3114.	110.74	139.88	1455.20	152.95	20.36
TUBE 2	62.47	67.15	64.81	4.68	28.80	22.79	3.03	5.00	7047.	6789.	244.72	309.17	1393.63	394.82	17.19

Table A.1 (continued)

EM03-23-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
104.75	94.84	0.00	52.0	20.	53.0	151.00	290.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.26	65.43	63.85	3.17	40.90	31.00	2.37	4.99	3740.	3648.	91.43	120.65	1445.91	129.85	28.10
TUBE 2	62.02	65.68	63.85	3.66	40.90	31.00	3.03	5.00	5511.	5309.	134.73	177.78	1384.52	199.65	26.59

EM03-23-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
103.44	92.84	0.02	50.0	20.	54.0	131.00	280.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.60	65.63	64.11	3.03	39.33	28.72	2.37	4.99	3583.	3496.	91.11	124.74	1448.54	134.70	25.95
TUBE 2	62.32	65.88	64.10	3.56	39.34	28.74	3.03	5.00	5366.	5169.	136.39	186.71	1386.90	211.38	24.46

EM03-23-78AF -1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
103.72	92.84	-0.01	50.0	35.	53.0	135.00	285.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.45	66.24	64.85	2.78	38.88	27.99	2.37	4.99	3286.	3206.	84.53	117.41	1455.76	125.93	25.46
TUBE 2	63.15	66.56	64.85	3.41	38.87	27.98	3.03	5.00	5141.	4953.	132.25	183.70	1394.03	207.20	23.90

EM03-23-78AF -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
93.09	91.82	-0.00	49.0	44.	52.0	109.00	278.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.79	66.33	65.06	2.54	28.03	26.76	2.37	4.99	2996.	2923.	106.90	111.97	1457.85	119.53	24.45
TUBE 2	63.43	66.69	65.06	3.26	28.02	26.75	3.03	5.00	4918.	4738.	175.50	183.83	1396.01	207.33	22.85

EM03-23-78AF -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
77.00	90.78	0.00	48.0	45.	51.0	90.00	266.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.89	66.25	65.07	2.36	11.94	25.71	2.37	4.99	2782.	2714.	233.08	108.20	1457.96	115.14	23.58
TUBE 2	63.53	66.60	65.07	3.07	11.94	25.72	3.03	5.00	4630.	4461.	387.87	180.06	1396.05	202.36	22.04

EM03-23-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
76.46	90.78	-0.03	48.0	50.	51.0	90.40	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.97	66.23	65.10	2.25	11.36	25.68	2.37	4.99	2662.	2597.	234.46	103.67	1458.29	109.90	23.63
TUBE 2	63.63	66.64	65.14	3.01	11.32	25.65	3.03	5.00	4533.	4367.	400.39	176.74	1396.70	198.02	22.05

Table A.1 (continued)

EH03-23-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
76.07	92.84	0.03	50.0	55.	53.0	120.00	282.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.75	66.18	64.97	2.44	11.10	27.87	2.37	4.99	2878.	2808.	259.25	103.25	1456.94	109.43	25.66
TUBE 2	63.35	66.51	64.93	3.16	11.13	27.90	3.03	5.00	4760.	4586.	427.59	170.59	1394.80	130.09	24.12

EH03-23-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
75.75	92.84	0.02	50.0	55.	53.0	132.00	278.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.62	66.06	64.84	2.44	10.91	28.00	2.37	4.99	2880.	2810.	264.11	102.89	1455.71	109.01	25.78
TUBE 2	63.24	66.40	64.82	3.16	10.93	28.02	3.03	5.00	4759.	4585.	435.40	169.83	1393.70	189.13	24.24

Table A.2. The ORNL two-tube condenser performance data for Group I-B tests (direct-contact evaporator mode)

EH03-27-78AF -1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
77.50	102.45	0.07	60.0	0.	64.0	148.00	215.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.66	66.41	65.04	2.75	12.46	37.42	2.37	4.99	3250.	3170.	260.77	86.85	1457.67	90.80	34.92
TUBE 2	63.56	66.39	64.97	2.83	12.53	37.48	3.03	6.36	4266.	4162.	340.52	113.82	1769.74	119.67	34.78

EH03-27-78AF -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
113.88	102.45	0.00	60.0	25.	65.0	157.00	216.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.26	67.66	65.96	3.40	47.92	36.49	2.37	4.99	4015.	3917.	83.80	110.03	1466.78	117.21	33.42
TUBE 2	64.11	67.81	65.96	3.69	47.92	36.49	3.03	6.36	5562.	5426.	116.07	152.40	1781.57	164.45	33.00

EH03-27-78AF -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
117.18	101.54	-0.01	59.0	25.	65.0	152.00	217.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.99	67.30	65.64	3.30	51.53	35.89	2.37	4.99	3904.	3809.	75.76	108.78	1463.64	115.77	32.90
TUBE 2	63.83	67.49	65.66	3.67	51.52	35.88	3.03	6.36	5522.	5387.	107.19	153.91	1777.96	166.29	32.40

EH03-27-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
113.55	102.45	-0.02	60.0	18.	63.0	136.00	205.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.03	67.26	65.65	3.23	47.90	36.81	2.37	4.99	3811.	3718.	79.57	103.55	1463.66	109.72	33.89
TUBE 2	63.92	67.42	65.67	3.50	47.88	36.79	3.03	6.36	5269.	5141.	110.05	143.23	1778.07	153.61	33.47

EH03-28-78AF -8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
110.88	104.27	0.06	62.0	0.	66.0	154.00	218.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.98	62.42	60.70	3.44	50.18	43.57	2.37	4.99	4067.	3968.	81.05	93.36	1414.85	98.35	40.35
TUBE 2	58.92	62.37	60.64	3.45	50.24	43.63	3.03	6.36	5200.	5073.	103.50	119.18	1717.82	126.08	40.23

EH03-28-78AF -8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
118.78	105.16	0.01	63.0	0.	66.0	157.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.04	63.66	61.85	3.61	56.93	43.31	2.37	4.99	4270.	4166.	75.01	98.60	1426.18	104.27	39.95
TUBE 2	59.98	63.69	61.83	3.71	56.95	43.33	3.03	6.36	5584.	5448.	98.06	128.89	1732.13	137.19	39.71

Table A.2 (continued)

RM03-28-78AF -9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
115.20	106.05	0.03	64.0	0.	67.0	156.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.40	64.81	63.11	3.41	52.09	42.94	2.37	4.99	4027.	3929.	77.30	93.77	1438.59	98.70	39.80
TUBE 2	61.34	64.82	63.08	3.48	52.12	42.97	3.03	6.36	5247.	5119.	100.68	122.12	1747.05	129.27	39.60

RM03-28-78AF -9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
118.11	108.66	0.03	67.0	0.	69.0	161.00	224.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.84	66.29	64.57	3.45	53.54	44.09	2.37	4.99	4072.	3973.	76.06	92.36	1453.00	97.02	40.95
TUBE 2	62.76	66.32	64.54	3.56	53.57	44.12	3.03	6.36	5359.	5228.	100.04	121.46	1764.53	128.41	40.72

RM03-28-78AF -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
117.33	106.93	0.01	65.0	20.	69.0	156.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.07	69.41	67.74	3.34	49.58	39.18	2.37	4.99	3941.	3844.	79.47	100.56	1484.31	106.18	36.21
TUBE 2	65.97	69.49	67.73	3.52	49.60	39.20	3.03	6.36	5303.	5174.	106.92	135.29	1802.76	144.12	35.90

RM03-28-78AF -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
116.18	107.79	-0.02	66.0	20.	69.0	152.00	218.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.11	69.42	67.76	3.31	48.41	40.03	2.37	4.99	3911.	3815.	80.78	97.69	1484.53	102.89	37.08
TUBE 2	65.98	69.60	67.79	3.62	48.39	40.01	3.03	6.36	5451.	5318.	112.64	136.24	1803.45	145.21	36.62

RM03-28-78AF -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
116.73	107.79	0.01	66.0	20.	69.0	156.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.06	69.40	67.73	3.34	49.00	40.07	2.37	4.99	3950.	3854.	80.60	98.58	1484.17	103.92	37.08
TUBE 2	65.98	69.46	67.72	3.48	49.01	40.08	3.03	6.36	5246.	5118.	107.03	130.90	1802.64	139.03	36.81

RM03-28-78AF -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
119.87	107.79	-0.01	66.0	20.	69.0	162.00	226.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.89	69.34	67.61	3.46	52.26	40.18	2.37	4.99	4082.	3983.	78.12	101.60	1483.06	107.37	37.09
TUBE 2	65.81	69.44	67.62	3.63	52.25	40.17	3.03	6.36	5472.	5338.	104.73	136.22	1801.52	145.20	36.76

Table A.2 (continued)

RH03-28-78AF -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
121.57	107.79	0.00	66.0	25.	70.0	158.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.32	69.72	68.02	3.39	53.55	39.77	2.37	4.99	4010.	3912.	74.87	100.81	1487.06	106.44	36.75
TUBE 2	66.20	69.83	68.02	3.63	53.56	39.78	3.03	6.36	5467.	5334.	102.08	137.44	1806.20	146.59	36.39

RH03-28-78AF -6P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
120.63	107.79	-0.01	66.0	20.	69.0	158.00	225.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.17	69.55	67.86	3.38	52.77	39.93	2.37	4.99	3996.	3898.	75.72	100.06	1485.50	105.59	36.92
TUBE 2	66.07	69.67	67.87	3.61	52.76	39.92	3.03	6.36	5433.	5300.	102.96	136.08	1804.46	145.02	36.55

RH03-28-78AF -6P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
121.21	107.79	-0.00	66.0	20.	69.0	158.00	225.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.49	68.95	67.22	3.46	53.99	40.57	2.37	4.99	4089.	3989.	75.72	100.77	1479.17	106.44	37.48
TUBE 2	65.39	69.05	67.22	3.66	53.99	40.57	3.03	6.36	5515.	5380.	102.14	135.93	1796.71	144.90	37.13

RH03-28-78AF -7P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
119.87	106.93	0.01	65.0	22.	68.0	157.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.49	67.98	66.24	3.49	53.63	40.69	2.37	4.99	4125.	4024.	76.91	101.38	1469.51	107.20	37.54
TUBE 2	64.40	68.06	66.23	3.66	53.64	40.70	3.03	6.36	5517.	5383.	102.85	135.57	1784.77	144.57	37.23

Table A.2 (continued)

EH03-29-78AF3-8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
103.22	100.61	-0.09	58.0	80.	61.0	155.00	225.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.68	62.10	60.39	3.41	42.83	40.22	2.37	4.99	4029.	3931.	94.08	100.19	1411.77	106.19	37.02
TUBE 2	58.11	62.85	60.48	4.74	42.74	40.13	3.03	5.00	7135.	6874.	166.95	177.82	1352.70	200.49	34.29

EH03-29-78AF3-8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
104.50	100.61	-0.04	58.0	80.	63.0	166.00	226.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	59.14	62.67	60.90	3.52	43.60	39.70	2.37	4.99	4160.	4059.	95.42	104.78	1416.85	111.46	36.41
TUBE 2	58.60	63.29	60.95	4.68	43.56	39.66	3.03	5.00	7054.	6796.	161.95	177.85	1357.10	200.42	33.91

EH03-29-78AF3-9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
107.59	101.54	0.01	59.0	85.	62.0	155.00	222.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.53	64.07	62.30	3.55	45.29	39.24	2.37	4.99	4191.	4089.	92.53	106.81	1430.63	113.72	35.95
TUBE 2	59.88	64.70	62.29	4.82	45.30	39.25	3.03	5.00	7257.	6991.	160.19	184.90	1369.81	209.44	33.38

EH03-29-78AF3-9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
105.45	100.61	-0.03	58.0	80.	61.0	154.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.88	64.27	62.58	3.39	42.88	38.03	2.37	4.99	4007.	3909.	93.46	105.37	1433.39	112.03	34.90
TUBE 2	60.27	64.95	62.61	4.68	42.84	38.00	3.03	5.00	7044.	6786.	164.42	185.38	1372.84	209.99	32.32

EH03-29-78AF3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
105.23	101.54	-0.02	59.0	80.	62.0	155.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.98	64.34	62.66	3.37	42.57	38.88	2.37	4.99	3976.	3879.	93.42	102.28	1434.19	108.46	35.77
TUBE 2	60.37	64.99	62.68	4.62	42.54	38.85	3.03	5.00	6958.	6703.	163.56	179.09	1373.53	201.64	33.24

EH03-29-78AF3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
104.48	101.54	-0.01	59.0	80.	62.0	151.00	219.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.06	65.43	63.75	3.37	40.73	37.79	2.37	4.99	3979.	3881.	97.67	105.28	1448.92	111.85	34.70
TUBE 2	61.48	66.03	63.75	4.55	40.73	37.78	3.03	5.00	6854.	6603.	168.30	181.41	1383.65	204.45	32.30

Table A.2 (continued)

EM03-29-78AF3-7P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
104.17	101.54	0.01	59.0	100.	60.0	140.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.15	63.54	61.84	3.39	42.32	39.69	2.37	4.99	4007.	3909.	94.67	100.94	1426.14	106.97	36.54
TUBE 2	59.35	64.32	61.84	4.97	42.33	39.70	3.03	5.00	7489.	7215.	176.92	188.64	1365.52	214.55	33.63

EM03-29-78AF3-7P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
103.64	101.54	0.02	59.0	100.	60.0	150.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.17	63.58	61.88	3.41	41.76	39.66	2.37	4.99	4028.	3930.	96.47	101.57	1426.46	107.69	36.49
TUBE 2	59.37	64.35	61.86	4.98	41.78	39.68	3.03	5.00	7505.	7230.	179.63	189.14	1365.71	215.21	33.59

EM03-29-78AF3-7P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
103.64	100.61	0.00	58.0	100.	60.0	152.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.35	63.74	62.04	3.39	41.59	38.57	2.37	4.99	4006.	3908.	96.30	103.86	1428.11	110.33	35.42
TUBE 2	59.56	64.53	62.04	4.97	41.60	38.57	3.03	5.00	7490.	7216.	180.08	194.21	1367.45	222.01	32.50

EM03-29-78AF3-8P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
102.83	100.61	0.01	58.0	95.	60.0	152.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.00	64.30	62.65	3.30	40.18	37.96	2.37	4.99	3899.	3804.	97.04	102.72	1434.09	108.96	34.91
TUBE 2	60.26	65.03	62.64	4.77	40.19	37.97	3.03	5.00	7185.	6922.	178.79	189.25	1373.14	215.15	32.17

EM03-29-78AF3-9P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
106.01	100.61	-0.03	58.0	100.	60.0	156.00	225.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.05	64.46	62.75	3.41	43.25	37.85	2.37	4.99	4032.	3934.	93.23	106.53	1435.12	113.36	34.71
TUBE 2	60.28	65.29	62.78	5.01	43.22	37.82	3.03	5.00	7545.	7268.	174.55	199.47	1374.49	228.95	31.75

EM03-29-78AF3-9P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
105.75	101.54	-0.02	59.0	100.	61.0	154.00	224.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.30	64.66	62.98	3.37	42.77	38.55	2.37	4.99	3977.	3880.	92.98	103.15	1437.37	109.44	35.45
TUBE 2	60.53	65.48	63.01	4.95	42.75	38.53	3.03	5.00	7461.	7188.	174.54	193.64	1376.57	220.97	32.53

Table A.2 (continued)

EH03-30-78AF3-3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
107.33	105.16	0.03	63.0	90.	67.0	150.00	216.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.19	70.19	68.69	3.00	38.63	36.47	2.37	4.99	3546.	3459.	91.78	97.23	1493.70	102.32	33.81
TUBE 2	66.51	70.82	68.67	4.31	38.66	36.49	3.03	5.00	6501.	6263.	168.15	178.12	1430.02	199.05	31.46

EH03-30-78AF3-4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
107.90	105.16	0.00	63.0	95.	67.0	156.00	218.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.99	69.88	68.44	2.89	39.47	36.72	2.37	4.99	3415.	3331.	86.52	92.98	1491.17	97.53	34.16
TUBE 2	66.26	70.61	68.43	4.36	39.47	36.73	3.03	5.00	6563.	6323.	166.29	178.71	1427.83	199.87	31.64

EH03-30-78AF3-4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
106.10	105.16	-0.00	63.0	95.	67.0	156.00	216.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.66	69.61	68.13	2.95	37.97	37.03	2.37	4.99	3490.	3405.	91.93	94.27	1488.17	99.00	34.40
TUBE 2	65.91	70.36	68.13	4.46	37.97	37.03	3.03	5.00	6714.	6469.	176.85	181.35	1425.01	203.36	31.81

EH03-30-78AF3-5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
108.91	104.27	0.01	62.0	85.	65.0	158.00	224.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.59	66.86	65.23	3.27	43.68	39.04	2.37	4.99	3868.	3774.	88.56	99.08	1459.51	104.62	36.07
TUBE 2	62.97	67.45	65.21	4.48	43.69	39.06	3.03	5.00	6750.	6503.	154.48	172.83	1397.43	192.92	33.71

EH03-30-78AF3-6P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
105.45	102.45	0.02	60.0	90.	63.0	153.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.43	65.66	64.05	3.24	41.41	38.41	2.37	4.99	3826.	3733.	92.39	99.61	1447.87	105.30	35.45
TUBE 2	61.78	66.27	64.03	4.49	41.43	38.43	3.03	5.00	6759.	6512.	163.17	175.90	1386.23	197.16	33.03

EH03-30-78AF3-6P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
107.33	103.36	-0.06	61.0	90.	64.0	160.00	226.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.83	66.06	64.45	3.23	42.88	38.92	2.37	4.99	3810.	3717.	88.86	97.91	1451.83	103.33	35.98
TUBE 2	62.21	66.79	64.50	4.58	42.82	38.86	3.03	5.00	6904.	6651.	161.21	177.65	1390.72	199.34	33.37

Table A.2 (continued)

RH03-30-78AF3-7P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
107.42	102.45	0.02	60.0	90.	63.0	153.00	222.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.92	66.22	64.57	3.30	42.85	37.89	2.37	4.99	3901.	3806.	91.03	102.97	1453.02	109.13	34.88
TUBE 2	62.28	66.81	64.54	4.54	42.88	37.91	3.03	5.00	6834.	6584.	159.39	180.27	1391.11	202.76	32.47

RH03-31-78AF3-8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
105.64	99.67	-0.04	57.0	90.	60.0	149.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.43	63.56	61.99	3.13	43.65	37.68	2.37	4.99	3700.	3609.	84.76	98.18	1427.58	103.79	34.78
TUBE 2	59.79	64.27	62.03	4.48	43.61	37.64	3.03	5.00	6749.	6502.	154.78	179.31	1367.36	202.08	32.18

RH03-31-78AF3-9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
101.28	99.67	0.03	57.0	83.	60.0	148.00	219.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.53	63.67	62.10	3.15	39.18	37.57	2.37	4.99	3717.	3627.	94.87	98.93	1428.65	104.65	34.66
TUBE 2	59.91	64.23	62.07	4.32	39.21	37.60	3.03	5.00	6502.	6264.	165.82	172.91	1367.73	193.69	32.34

RH03-31-78AF3-9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
101.18	99.67	0.02	57.0	83.	60.0	149.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.49	63.77	62.13	3.28	39.04	37.54	2.37	4.99	3872.	3778.	99.17	103.15	1428.99	109.49	34.50
TUBE 2	59.88	64.34	62.11	4.46	39.07	37.56	3.03	5.00	6714.	6468.	171.85	178.73	1368.11	201.31	32.13

RH03-31-78AF3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
103.61	100.61	-0.01	58.0	83.	60.0	153.00	225.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.53	63.75	62.14	3.22	41.48	38.47	2.37	4.99	3806.	3713.	91.77	98.93	1429.02	104.64	35.49
TUBE 2	59.92	64.38	62.15	4.46	41.46	38.46	3.03	5.00	6722.	6476.	162.13	174.80	1368.49	196.13	33.02

RH03-31-78AF3-10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
105.52	100.61	-0.01	58.0	83.	61.0	157.00	227.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.65	63.99	62.32	3.34	43.20	38.29	2.37	4.99	3946.	3850.	91.34	103.07	1430.83	109.39	35.20
TUBE 2	60.06	64.60	62.33	4.55	43.19	38.28	3.03	5.00	6849.	6599.	158.58	178.94	1370.20	201.53	32.74

Table A.2 (continued)

RH03-31-78AF3-11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
108.64	100.61	-0.00	58.0	83.	61.0	161.00	227.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.02	64.40	62.71	3.38	45.92	37.90	2.37	4.99	3990.	3893.	86.89	105.30	1434.71	111.94	34.76
TUBE 2	60.40	65.04	62.72	4.64	45.92	37.89	3.03	5.00	6989.	6733.	152.20	184.45	1373.84	208.72	32.26

RH03-31-78AF3-12P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
103.79	100.61	-0.02	58.0	83.	60.0	151.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.25	64.35	62.80	3.10	40.99	37.81	2.37	4.99	3661.	3572.	89.32	96.84	1435.58	102.21	34.95
TUBE 2	60.65	64.99	62.82	4.35	40.97	37.79	3.03	5.00	6548.	6308.	159.82	173.28	1374.81	194.01	32.52

RH03-31-78AF3-1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
102.08	100.61	0.03	58.0	83.	60.0	148.00	219.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.27	64.42	62.84	3.15	39.24	37.77	2.37	4.99	3723.	3632.	94.88	98.58	1436.00	104.20	34.86
TUBE 2	60.67	64.95	62.81	4.28	39.27	37.80	3.03	5.00	6448.	6212.	164.19	170.59	1374.71	190.52	32.61

RH03-31-78AF3-2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
103.00	100.61	-0.02	58.0	83.	60.0	147.00	219.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.28	64.32	62.80	3.03	40.20	37.81	2.37	4.99	3584.	3497.	89.15	94.79	1435.57	99.87	35.01
TUBE 2	60.69	64.96	62.82	4.27	40.18	37.79	3.03	5.00	6438.	6202.	160.21	170.37	1374.84	190.23	32.60

Table A.2 (continued)

EH04-01-78AF -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
111.80	97.77	-0.01	55.0	19.	58.0	153.00	224.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.56	63.87	62.21	3.32	49.58	35.56	2.37	4.99	3917.	3821.	78.99	110.16	1429.79	117.63	32.49
TUBE 2	60.48	63.97	62.23	3.49	49.57	35.54	3.03	5.00	5261.	5068.	106.13	148.01	1369.23	161.97	31.29

EH04-01-78AF -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
113.11	98.73	-0.01	56.0	19.	59.0	157.00	227.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.22	65.48	63.35	4.26	49.76	35.38	2.37	4.99	5035.	4912.	101.18	142.32	1441.01	156.13	31.46
TUBE 2	61.10	65.63	63.37	4.53	49.74	35.36	3.03	5.00	6827.	6577.	137.24	193.06	1379.97	220.09	29.88

EH04-01-78AF -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
112.89	98.73	0.01	56.0	25.	59.0	158.00	227.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.23	65.53	63.38	4.30	49.52	35.35	2.37	4.99	5077.	4953.	102.53	143.62	1441.27	157.74	31.40
TUBE 2	61.07	65.67	63.37	4.60	49.53	35.36	3.03	5.00	6927.	6673.	139.86	195.90	1379.99	223.93	29.80

EH04-01-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
114.77	98.73	-0.00	56.0	25.	59.0	158.00	227.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.13	65.58	63.36	4.44	51.42	35.37	2.37	4.99	5249.	5121.	102.10	148.41	1441.05	163.69	31.29
TUBE 2	61.00	65.72	63.36	4.72	51.41	35.37	3.03	5.00	7113.	6853.	138.35	201.11	1379.91	231.03	29.66

EH04-01-78AF -12P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
113.66	98.73	0.03	56.0	0.	60.0	152.00	222.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.64	65.16	63.40	3.52	50.26	35.33	2.37	4.99	4161.	4060.	82.80	117.80	1441.50	126.51	32.09
TUBE 2	61.61	65.13	63.37	3.52	50.29	35.36	3.03	5.00	5310.	5115.	105.58	150.17	1380.01	164.49	31.10

EH04-01-78AF -12P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
114.41	98.73	0.08	56.0	0.	59.0	151.00	222.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.55	65.06	63.30	3.51	51.10	35.42	2.37	4.99	4143.	4042.	81.08	116.96	1440.56	125.54	32.20
TUBE 2	61.47	64.98	63.23	3.51	51.18	35.50	3.03	5.00	5290.	5097.	103.37	149.03	1378.68	163.09	31.25

Table A.2 (continued)

RH04-01-78AF -12P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
113.66	98.73	0.08	56.0	0.	59.0	158.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.65	65.22	63.43	3.57	50.22	35.29	2.37	4.99	4224.	4121.	84.10	119.68	1441.94	128.73	32.01
TUBE 2	61.59	65.12	63.36	3.53	50.30	35.37	3.03	5.00	5320.	5125.	105.77	150.42	1379.90	164.80	31.10

RH04-01-78AF -12P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
113.88	98.73	0.01	56.0	0.	59.0	151.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.38	64.87	63.12	3.49	50.75	35.60	2.37	4.99	4125.	4024.	81.27	115.86	1438.77	124.25	32.39
TUBE 2	61.33	64.89	63.11	3.56	50.77	35.62	3.03	5.00	5362.	5166.	105.62	150.56	1377.55	165.01	31.31

RH04-01-78AF -1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
112.41	98.73	0.06	56.0	0.	59.0	148.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.47	65.02	63.25	3.55	49.16	35.48	2.37	4.99	4196.	4094.	85.35	118.27	1440.00	127.09	32.21
TUBE 2	61.42	64.95	63.19	3.53	49.22	35.54	3.03	5.00	5311.	5116.	107.90	149.43	1378.28	163.60	31.27

RH04-02-78AF -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
116.94	97.77	0.00	55.0	0.	58.0	162.00	230.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.16	61.57	59.86	3.41	57.07	37.91	2.37	4.99	4034.	3936.	70.68	106.42	1406.58	113.45	34.69
TUBE 2	58.09	61.64	59.86	3.55	57.07	37.91	3.03	5.00	5343.	5147.	93.61	140.94	1346.86	153.57	33.52

RH04-02-78AF -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
116.00	97.77	0.03	55.0	10.	58.0	163.00	230.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.35	61.76	60.06	3.41	55.94	37.71	2.37	4.99	4025.	3927.	71.95	106.73	1408.48	113.90	34.51
TUBE 2	58.27	61.79	60.03	3.51	55.97	37.74	3.03	5.00	5295.	5101.	94.60	140.30	1348.44	152.76	33.39

RH04-02-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
114.07	97.77	0.02	55.0	10.	58.0	163.00	230.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.52	61.84	60.18	3.32	53.89	37.59	2.37	4.99	3920.	3824.	72.74	104.28	1409.71	110.94	34.47
TUBE 2	58.44	61.88	60.16	3.44	53.91	37.61	3.03	5.00	5185.	4995.	96.18	137.88	1349.70	149.77	33.35

Table A.2 (continued)

RH04-02-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
113.58	97.77	-0.01	55.0	5.	58.0	160.00	226.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.68	62.02	60.35	3.34	53.23	37.42	2.37	4.99	3944.	3848.	74.09	105.38	1411.33	112.20	34.29
TUBE 2	58.60	62.10	60.35	3.50	53.22	37.42	3.03	5.00	5267.	5074.	98.97	140.77	1351.48	153.29	33.10

RH04-02-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
118.90	98.73	0.07	56.0	5.	59.0	161.00	227.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.86	62.38	60.62	3.52	58.28	38.10	2.37	4.99	4160.	4058.	71.37	109.17	1414.06	116.59	34.81
TUBE 2	58.77	62.34	60.56	3.58	58.35	38.17	3.03	5.00	5387.	5190.	92.33	141.13	1353.40	153.71	33.76

RH04-02-78AF -12A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
115.25	98.73	-0.01	56.0	0.	58.0	157.00	224.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	59.13	62.54	60.84	3.41	54.42	37.89	2.37	4.99	4034.	3936.	74.13	106.47	1416.18	113.43	34.70
TUBE 2	59.10	62.60	60.85	3.50	54.41	37.88	3.03	5.00	5273.	5080.	96.92	139.20	1356.15	151.30	33.58

RH04-03-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
120.35	98.73	-0.02	56.0	15.	59.0	157.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	57.99	61.49	59.74	3.50	60.61	38.99	2.37	4.99	4130.	4029.	68.14	105.92	1405.33	112.87	35.69
TUBE 2	57.88	61.63	59.75	3.75	60.59	38.97	3.03	5.00	5647.	5440.	93.20	144.90	1345.82	158.49	34.33

RH04-03-78AF -11A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
120.83	98.73	-0.02	56.0	15.	59.0	159.00	225.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.27	61.83	60.05	3.56	60.77	38.67	2.37	4.99	4204.	4102.	69.18	108.71	1408.44	116.11	35.33
TUBE 2	58.19	61.96	60.08	3.78	60.75	38.65	3.03	5.00	5692.	5484.	93.70	147.27	1348.86	161.39	33.98

RH04-03-78AF -12P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
117.93	98.73	0.00	56.0	15.	59.0	155.00	222.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.62	62.11	60.36	3.49	57.56	38.36	2.37	4.99	4127.	4026.	71.70	107.58	1411.52	114.76	35.08
TUBE 2	58.52	62.21	60.36	3.69	57.56	38.36	3.03	5.00	5559.	5356.	96.57	144.90	1351.56	158.40	33.81

Table A.2 (continued)

EH04-03-78AF -12P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
116.20	99.67	0.07	57.0	0.	60.0	155.00	222.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	59.16	62.27	60.71	3.11	55.49	38.96	2.71	5.70	4204.	4101.	75.76	107.90	1574.97	114.03	35.97
TUBE 2	59.10	62.19	60.65	3.09	55.56	39.03	3.65	6.02	5604.	5399.	100.87	143.60	1572.32	153.91	35.08

EH04-03-78AF -1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
118.66	99.67	0.09	57.0	0.	60.0	157.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	59.62	62.77	61.20	3.15	57.46	38.48	2.71	5.70	4249.	4145.	73.94	110.43	1580.28	116.89	35.46
TUBE 2	59.56	62.64	61.10	3.08	57.55	38.57	3.65	6.02	5595.	5391.	97.22	145.07	1577.35	155.61	34.64

EH04-03-78AF -1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
114.60	99.67	0.00	57.0	35.	60.0	156.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.62	65.76	63.19	5.14	51.41	36.48	1.23	2.58	3137.	3061.	61.02	86.00	848.36	94.65	32.34
TUBE 2	60.25	66.13	63.19	5.88	51.41	36.48	1.57	2.59	4589.	4421.	89.25	125.77	814.71	146.14	30.25

EH04-03-78AF -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
113.71	99.67	-0.03	57.0	35.	60.0	159.00	224.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.99	66.22	63.61	5.23	50.11	36.07	1.23	2.58	3189.	3111.	63.64	88.41	850.78	97.63	31.87
TUBE 2	60.66	66.61	63.64	5.95	50.08	36.04	1.57	2.59	4647.	4477.	92.81	128.96	817.21	150.54	29.74

EH04-03-78AF -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
117.06	99.67	-0.02	57.0	15.	60.0	162.00	226.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.72	65.02	62.87	4.30	54.19	36.80	1.80	3.78	3856.	3762.	71.16	104.77	1150.98	113.83	33.05
TUBE 2	60.61	65.18	62.90	4.56	54.16	36.78	2.30	3.79	5216.	5025.	96.30	141.82	1103.39	159.29	31.54

EH04-03-78AF -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
117.45	99.67	-0.04	57.0	15.	60.0	161.00	226.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.81	65.14	62.97	4.32	54.47	36.70	1.80	3.78	3872.	3778.	71.09	105.52	1151.79	114.72	32.93
TUBE 2	60.72	65.31	63.01	4.59	54.43	36.66	2.30	3.79	5249.	5057.	96.44	143.18	1104.27	161.07	31.40

Table A.2 (continued)

EH04-04-78WX -8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
63.70	0.0	-0.01	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	59.89	59.95	59.92	0.07	3.78	-59.92	2.84	5.97	93.	90.	24.51	-1.55	1624.88	-1.51	*****
TUBE 2	59.90	59.96	59.93	0.07	3.77	-59.93	2.94	6.19	95.	93.	25.30	-1.59	1672.58	-1.55	*****

EH04-04-78WX -8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
63.93	0.0	-0.00	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.31	60.37	60.34	0.06	3.59	-60.34	2.84	5.97	87.	85.	24.26	-1.44	1629.65	-1.41	*****
TUBE 2	60.31	60.38	60.34	0.06	3.58	-60.34	2.94	6.19	93.	91.	26.07	-1.55	1677.45	-1.51	*****

EH04-04-78WX -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
67.15	0.0	0.01	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.23	65.27	65.25	0.05	1.90	-65.25	2.97	6.24	69.	67.	36.28	-1.05	1745.89	-1.03	*****
TUBE 2	65.22	65.26	65.24	0.04	1.91	-65.24	3.11	6.53	69.	68.	36.36	-1.06	1810.82	-1.04	*****

EH04-04-78WX -1P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
71.79	0.0	-0.01	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.03	70.08	70.05	0.05	1.73	-70.05	2.93	6.15	67.	65.	38.38	-0.95	1781.82	-0.93	*****
TUBE 2	70.04	70.08	70.06	0.03	1.73	-70.06	3.00	6.30	50.	49.	28.83	-0.71	1817.55	-0.69	*****

EH04-04-78WX -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
70.59	0.0	0.07	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.30	66.33	66.31	0.03	4.28	-66.31	2.97	6.24	43.	42.	10.01	-0.65	1758.40	-0.63	*****
TUBE 2	66.22	66.25	66.24	0.03	4.36	-66.24	3.00	6.30	49.	48.	11.30	-0.74	1772.14	-0.72	*****

EH04-04-78WX -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
69.13	0.0	0.01	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.89	63.94	63.91	0.05	5.21	-63.91	2.84	5.97	70.	68.	13.35	-1.09	1670.41	-1.06	*****
TUBE 2	63.88	63.93	63.90	0.06	5.23	-63.90	3.03	6.36	85.	83.	16.34	-1.34	1756.94	-1.30	*****

Table A.2 (continued)

RN04-04-78WX -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
70.55	0.0	0.57	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.67	64.72	63.70	2.05	6.85	-63.70	2.86	6.01	2926.	2855.	426.86	-45.93	1677.91	-43.48	*****
TUBE 2	62.68	63.59	63.13	0.91	7.42	-63.13	2.94	6.19	1336.	1303.	180.01	-21.16	1710.17	-20.36	*****

RN04-04-78WX -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
71.76	94.84	0.07	52.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.61	63.97	63.29	1.36	8.46	31.55	2.84	5.97	1922.	1875.	227.01	60.90	1663.33	61.96	30.26
TUBE 2	62.60	63.84	63.22	1.24	8.54	31.62	2.94	6.19	1814.	1770.	212.45	57.35	1711.21	58.14	30.44

RN04-04-78WX -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
93.31	94.84	-0.07	52.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.56	64.70	63.63	2.14	29.68	31.22	2.88	6.06	3074.	2999.	103.57	98.48	1687.06	102.81	29.17
TUBE 2	62.58	64.82	63.70	2.24	29.61	31.15	2.89	6.08	3228.	3149.	109.00	103.63	1691.60	108.56	29.01

RN04-04-78WX -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
79.26	0.0	0.01	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.89	62.02	61.95	0.13	17.31	-61.95	2.88	6.06	135.	180.	10.68	-2.98	1667.71	-2.90	*****
TUBE 2	61.88	62.00	61.94	0.12	17.32	-61.94	2.86	6.02	165.	161.	9.55	-2.67	1658.75	-2.60	*****

RN04-04-78WX -6P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
107.64	0.0	0.22	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.44	64.36	62.90	2.92	44.74	-62.90	2.97	6.24	4314.	4209.	96.42	-68.58	1718.15	-64.04	*****
TUBE 2	61.38	63.99	62.68	2.61	44.95	-62.68	2.89	6.08	3762.	3670.	83.69	-60.02	1679.86	-56.30	*****

RN04-05-78WX -8A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
76.86	0.0	-0.07	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.54	69.34	68.94	0.80	7.92	-68.94	2.84	5.97	1129.	1101.	142.49	-16.37	1727.65	-15.80	*****
TUBE 2	68.50	69.52	69.01	1.02	7.85	-69.01	3.00	6.30	1518.	1481.	193.23	-21.99	1805.10	-21.17	*****

Table A.2 (continued)

EH04-05-78WX -9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
110.78	0.0	0.18	0.0	0.	0.0	0.0	0.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.71	69.07	67.89	2.36	42.89	-67.89	2.93	6.15	3443.	3359.	80.28	-50.71	1756.65	-47.92	*****
TUBE 2	66.56	68.86	67.71	2.30	43.07	-67.71	3.05	6.42	3495.	3410.	81.16	-51.62	1815.41	-48.81	*****

EH04-05-78WX -9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
114.89	99.67	0.17	57.0	0.	61.0	161.00	213.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.62	66.33	64.97	2.70	49.91	34.70	2.93	6.15	3938.	3842.	78.89	113.48	1722.63	119.54	32.14
TUBE 2	63.50	66.11	64.80	2.61	50.08	34.87	3.05	6.42	3973.	3876.	79.33	113.94	1780.33	119.75	32.37

EH04-05-78WX -9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
118.02	99.67	0.16	57.0	0.	61.0	159.00	212.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.43	65.27	63.85	2.83	54.17	35.82	2.93	6.15	4123.	4022.	76.11	115.08	1709.52	121.44	33.12
TUBE 2	62.33	65.05	63.69	2.71	54.33	35.98	3.05	6.42	4123.	4022.	75.88	114.56	1766.88	120.53	33.37

EH04-05-78WX -9A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
117.30	99.67	0.20	57.0	0.	61.0	159.00	212.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.01	64.86	63.44	2.85	53.86	36.24	2.93	6.15	4146.	4045.	76.98	114.41	1704.71	120.70	33.51
TUBE 2	61.87	64.60	63.23	2.72	54.06	36.44	3.05	6.42	4141.	4040.	76.59	113.63	1761.38	119.50	33.80

EH04-05-78WX -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
119.18	98.73	0.12	56.0	0.	59.0	159.00	213.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.44	64.82	63.13	3.38	56.05	35.60	2.37	4.99	3990.	3893.	71.19	112.10	1438.83	119.83	32.49
TUBE 2	61.35	64.67	63.01	3.32	56.17	35.71	2.38	5.00	3931.	3835.	69.99	110.08	1440.14	117.46	32.65

EH04-05-78WX -10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
119.49	97.77	0.08	55.0	0.	58.0	159.00	213.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	60.23	63.61	61.92	3.38	57.58	35.85	2.37	4.99	3995.	3897.	69.38	111.41	1426.84	119.12	32.72
TUBE 2	60.17	63.50	61.83	3.32	57.66	35.94	2.38	5.00	3933.	3837.	68.21	109.44	1428.49	116.80	32.85

Table A.2 (continued)

RH04-05-78WX -10A	VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	BARBER-NICHOLS TOUTLET	BARBER-NICHOLS TINLET
	116.85	97.77	0.08	55.0	0.	58.0	159.00	213.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCORE
TUBE 1	59.76	62.93	61.34	3.16	55.51	36.43	2.37	4.99	3739.	3647.	67.35	102.63	1421.18	108.95	33.49
TUBE 2	59.69	62.84	61.27	3.15	55.58	36.50	2.38	5.00	3729.	3638.	67.09	102.15	1422.86	108.38	33.57

Table A.2 (continued)

EH04-05-78YZ -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
115.97	108.66	2.56	67.0	0.	70.0	159.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.50	69.68	66.09	7.18	49.88	42.57	1.14	4.98	4076.	3976.	81.71	95.74	1683.84	100.27	39.65
TUBE 2	62.20	64.86	63.53	2.66	52.44	45.13	3.54	7.44	4686.	4571.	89.35	103.84	1986.34	107.61	42.48

EH04-05-78YZ -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
112.97	108.66	2.50	67.0	0.	70.0	158.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.31	69.43	65.87	7.12	47.11	42.79	1.14	4.98	4044.	3946.	85.85	94.51	1681.33	98.90	39.90
TUBE 2	62.03	64.71	63.37	2.67	49.60	45.29	3.54	7.44	4712.	4597.	94.99	104.05	1984.13	107.85	42.63

EH04-05-78YZ -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
116.94	108.66	2.44	67.0	0.	70.0	160.00	222.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.61	69.79	66.20	7.18	50.74	42.46	1.14	4.98	4076.	3977.	80.33	96.00	1685.04	100.55	39.55
TUBE 2	62.39	65.11	63.75	2.72	53.19	44.91	3.54	7.44	4800.	4682.	90.24	106.88	1989.33	110.96	42.20

EH04-05-78YZ -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
117.53	108.66	2.51	67.0	0.	70.0	159.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.71	69.93	66.32	7.22	51.21	42.34	1.14	4.98	4099.	3999.	80.03	96.81	1686.47	101.46	39.41
TUBE 2	62.47	65.14	63.81	2.67	53.73	44.85	3.54	7.44	4702.	4587.	87.52	104.83	1990.06	108.70	42.20

EH04-05-78YZ -2P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
122.63	109.51	2.48	68.0	0.	71.0	160.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	62.93	70.19	66.56	7.26	56.07	42.95	1.14	4.98	4123.	4023.	73.54	96.00	1689.21	100.54	40.01
TUBE 2	62.73	65.45	64.09	2.72	58.55	45.43	3.54	7.44	4793.	4676.	81.87	105.52	1993.86	109.44	42.73

EH04-05-78YZ -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
125.43	113.67	0.16	73.0	0.	73.0	160.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.09	69.24	66.16	6.15	59.26	47.51	1.40	6.09	4271.	4166.	72.06	89.89	1979.85	92.77	44.91
TUBE 2	63.10	68.91	66.00	5.81	59.42	47.67	1.38	2.90	3992.	3895.	67.18	83.75	950.57	90.66	42.96

Table A.2 (continued)

RH04-05-78YZ -3P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
126.25	112.86	0.19	72.0	0.	76.0	164.00	223.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.10	69.31	66.21	6.22	60.05	46.65	1.40	6.09	4318.	4213.	71.91	92.56	1980.41	95.69	44.03
TUBE 2	63.13	68.89	66.01	5.76	60.24	46.85	1.41	2.96	4034.	3935.	66.96	86.11	965.47	93.34	42.16

RH04-05-78YZ -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
125.46	113.67	0.13	73.0	0.	77.0	162.00	220.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.30	69.40	66.35	6.09	59.11	47.32	1.40	6.09	4234.	4130.	71.62	89.47	1982.36	92.30	44.75
TUBE 2	63.37	69.07	66.22	5.70	59.24	47.45	1.41	2.96	3993.	3895.	67.40	84.14	966.85	90.96	42.82

RH04-05-78YZ -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
126.54	115.30	0.23	75.0	0.	80.0	163.00	221.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.36	69.68	66.52	6.31	60.02	48.78	1.40	6.09	4387.	4280.	73.09	89.95	1984.61	92.82	46.12
TUBE 2	63.36	69.23	66.30	5.86	60.25	49.00	1.41	2.96	4106.	4006.	68.16	83.80	967.32	90.55	44.24

RH04-05-78YZ -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
124.76	115.30	1.68	75.0	0.	80.0	161.00	218.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.58	70.12	66.85	6.54	57.91	48.45	1.31	5.72	4264.	4160.	73.64	88.01	1891.41	90.96	45.74
TUBE 2	63.44	66.90	65.17	3.46	59.59	50.13	2.62	5.51	4521.	4411.	75.88	90.19	1579.75	94.01	46.92

RH04-05-78YZ -4P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
123.96	115.30	1.63	75.0	0.	80.0	160.00	217.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.40	69.89	66.65	6.49	57.31	48.65	1.31	5.72	4232.	4129.	73.85	87.00	1888.89	89.86	45.95
TUBE 2	63.26	66.77	65.01	3.50	58.94	50.28	2.62	5.51	4573.	4461.	77.58	90.94	1578.07	94.85	47.03

RH04-05-78YZ -5P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	BARBER-NICHOLS PRESSURE	TOUTLET	TINLET
121.21	116.10	1.59	76.0	0.	80.0	163.00	218.00

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.33	69.78	66.55	6.45	54.66	49.55	1.31	5.72	4205.	4103.	76.93	84.87	1887.69	87.54	46.86
TUBE 2	63.25	66.68	64.96	3.43	56.25	51.14	2.62	5.51	4475.	4366.	79.55	87.51	1577.50	91.04	47.96

Table A.3. The ORNL two-tube condenser performance data for Group III-B tests (surface evaporator mode)

EM-09-19-78AA - 2:25P VAPOR TEMP 92.22 SAT. TEMP 92.84 T1AVG-T2AVG -0.04 PMEAS PSIG 50.0 HEATER VOLTS 0.0 COND TEMP 88.0
HP- AA - 2:25P DSS: PVAP 50.0 TVAP 103.0 PWELL 49.0 TWELL 87.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.30	72.67	71.48	2.38	20.73	21.35	2.33	4.90	2758.	2691.	133.05	129.18	1499.30	139.51	19.29
TUBE 2	70.28	72.77	71.53	2.49	20.69	21.31	2.38	5.00	2951.	2879.	142.61	138.45	1524.16	150.39	19.14

EM-09-19-78AA - 2:40P VAPOR TEMP 96.23 SAT. TEMP 95.34 T1AVG-T2AVG 0.32 PMEAS PSIG 52.5 HEATER VOLTS 61.0 COND TEMP 91.0
HP- AA - 2:40P DSS: PVAP 52.3 TVAP 118.0 PWELL 51.0 TWELL 88.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.85	73.48	72.16	2.64	24.06	23.18	2.33	4.90	3058.	2983.	127.07	131.94	1505.88	142.74	20.90
TUBE 2	70.47	73.22	71.84	2.75	24.38	23.50	2.38	5.00	3254.	3175.	133.47	138.51	1527.28	150.43	21.11

EM-09-19-78AA - 2:50P VAPOR TEMP 99.48 SAT. TEMP 95.83 T1AVG-T2AVG 0.25 PMEAS PSIG 53.0 HEATER VOLTS 60.0 COND TEMP 91.0
HP- AA - 2:50P DSS: PVAP 53.0 TVAP 120.0 PWELL 54.0 TWELL 89.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.77	73.37	72.07	2.60	27.40	23.76	2.42	5.08	3124.	3048.	114.00	131.49	1548.76	141.77	21.50
TUBE 2	70.44	73.21	71.82	2.77	27.65	24.01	2.41	5.05	3317.	3236.	119.95	138.17	1540.92	149.86	21.60

EM-09-19-78AA - 3:05P VAPOR TEMP 104.33 SAT. TEMP 96.32 T1AVG-T2AVG 0.28 PMEAS PSIG 53.5 HEATER VOLTS 60.0 COND TEMP 92.0
HP- AA - 3:05P DSS: PVAP 53.0 TVAP 137.0 PWELL 53.0 TWELL 89.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.86	73.55	72.20	2.69	32.12	24.11	2.37	4.99	3174.	3096.	98.80	131.61	1528.22	142.12	21.79
TUBE 2	70.52	73.33	71.93	2.81	32.40	24.39	2.39	5.02	3343.	3261.	103.18	137.06	1533.68	148.61	21.95

EM-09-19-78AA - 3:25P VAPOR TEMP 104.58 SAT. TEMP 95.83 T1AVG-T2AVG -0.03 PMEAS PSIG 53.0 HEATER VOLTS 0.0 COND TEMP 91.0
HP- AA - 3:25P DSS: PVAP 53.0 TVAP 140.0 PWELL 52.5 TWELL 89.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.68	73.40	72.04	2.72	32.54	23.79	2.37	4.99	3213.	3134.	98.74	135.03	1526.57	146.23	21.43
TUBE 2	70.66	73.49	72.07	2.83	32.50	23.76	2.38	5.00	3347.	3265.	102.97	140.88	1529.53	153.27	21.31

EM-09-19-78AA - 3:33P VAPOR TEMP 105.30 SAT. TEMP 95.83 T1AVG-T2AVG 0.22 PMEAS PSIG 53.0 HEATER VOLTS 55.0 COND TEMP 91.0
HP- AA - 3:33P DSS: PVAP 53.0 TVAP 139.0 PWELL 53.0 TWELL 89.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.61	73.34	71.97	2.73	33.33	23.86	2.35	4.94	3199.	3121.	95.98	134.07	1514.99	145.21	21.49
TUBE 2	70.31	73.19	71.75	2.87	33.55	24.08	2.38	5.00	3403.	3320.	101.42	141.30	1526.35	153.81	21.59

Table A.3 (continued)

EH-09-19-78AA - 3:55P VAPOR TEMP 103.91 SAT. TEMP 102.45 T1AVG-T2AVG -0.06 PMEAS PSIG 60.0 HEATER VOLTS 0.0 COND TEMP 103.0 DSS: PVAP 60.0 TVAP 165.0 PWELL 59.0 TWELL 93.0
HP- AA - 3:55P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.88	73.33	71.60	3.45	32.30	30.85	2.37	4.99	4077.	3978.	126.21	132.16	1522.31	142.93	27.85
TUBE 2	69.87	73.46	71.67	3.60	32.24	30.79	2.38	5.00	4259.	4155.	132.10	138.33	1525.53	150.23	27.66

EH-09-19-78AA - 4:05P VAPOR TEMP 116.20 SAT. TEMP 102.91 T1AVG-T2AVG 0.30 PMEAS PSIG 60.5 HEATER VOLTS 63.0 COND TEMP 103.0 DSS: PVAP 60.2 TVAP 190.0 PWELL 59.0 TWELL 94.0
HP- AA - 4:05P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.91	73.44	71.67	3.53	44.53	31.24	2.35	4.94	4132.	4031.	92.78	132.27	1512.08	143.08	28.17
TUBE 2	69.51	73.23	71.37	3.72	44.84	31.54	2.38	5.00	4402.	4295.	98.19	139.57	1522.62	151.76	28.30

EH-09-19-78AA - 4:15P VAPOR TEMP 120.03 SAT. TEMP 103.36 T1AVG-T2AVG -0.07 PMEAS PSIG 61.0 HEATER VOLTS 10.0 COND TEMP 103.0 DSS: PVAP 60.5 TVAP 195.0 PWELL 59.0 TWELL 94.0
HP- AA - 4:15P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.53	73.15	71.34	3.61	48.69	32.02	2.37	4.99	4266.	4162.	87.61	133.20	1519.73	144.11	28.38
TUBE 2	69.52	73.29	71.41	3.77	48.62	31.96	2.38	5.00	4468.	4359.	91.90	139.81	1522.97	152.05	28.67

EH-09-19-78AA - 4:30P VAPOR TEMP 125.11 SAT. TEMP 103.82 T1AVG-T2AVG 0.48 PMEAS PSIG 61.5 HEATER VOLTS 0.0 COND TEMP 103.0 DSS: PVAP 60.5 TVAP 193.0 PWELL 60.0 TWELL 95.0
HP- AA - 4:30P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.24	73.85	72.05	3.61	53.06	31.77	2.37	4.99	4268.	4164.	80.43	134.32	1526.66	145.38	28.64
TUBE 2	69.66	73.47	71.57	3.82	53.54	32.25	2.38	5.01	4530.	4419.	84.60	140.44	1527.32	152.76	28.93

EH-09-19-78AA - 4:45P VAPOR TEMP 124.62 SAT. TEMP 104.27 T1AVG-T2AVG 0.02 PMEAS PSIG 62.0 HEATER VOLTS 25.0 COND TEMP 98.5 DSS: PVAP 62.0 TVAP 158.0 PWELL 60.0 TWELL 95.0
HP-D/H, AA - 4:45P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.67	73.38	71.52	3.71	53.09	32.75	2.37	4.99	4386.	4279.	82.60	133.93	1521.53	144.96	29.51
TUBE 2	69.56	73.45	71.51	3.90	53.11	32.76	2.38	5.00	4613.	4500.	86.86	140.79	1523.95	153.23	29.37

Table A.3 (continued)

EM-09-20-78AF -10:40A VAPOR TEMP 121.44 SAT. TEMP 101.07 T1AVG-T2AVG -0.51 PMEAS PSIG 58.5 HEATER VOLTS 0.0 COND TEMP 97.0 DSS: PVAP 58.0 TVAP 175.0 PWELL 57.0 TWELL 94.0
HP- AF -10:40A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.96	72.47	70.72	3.50	50.73	30.36	2.37	4.99	4138.	4037.	81.58	136.32	1513.59	147.93	27.29
TUBE 2	68.87	73.58	71.23	4.71	50.22	29.85	3.03	5.00	7099.	6839.	141.37	237.84	1454.13	279.80	24.44

EM-09-20-78AF -11:25A VAPOR TEMP 119.09 SAT. TEMP 97.29 T1AVG-T2AVG 0.12 PMEAS PSIG 54.5 HEATER VOLTS 70.0 COND TEMP 98.5 DSS: PVAP 54.0 TVAP 160.0 PWELL 54.0 TWELL 90.0
HP-D/H, AF -11:25A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.82	68.36	66.59	3.54	52.49	30.70	2.37	4.99	4182.	4080.	79.67	136.24	1473.01	148.29	27.51
TUBE 2	64.06	68.88	66.47	4.82	52.61	30.82	3.03	5.00	7262.	6996.	138.02	235.65	1409.34	278.60	25.11

EM-09-20-78AF -11:41A VAPOR TEMP 121.77 SAT. TEMP 97.29 T1AVG-T2AVG -0.13 PMEAS PSIG 54.5 HEATER VOLTS 61.0 COND TEMP 93.0 DSS: PVAP 54.0 TVAP 165.0 PWELL 53.0 TWELL 89.5
HP-D/H, AF -11:41A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.13	67.75	65.94	3.62	55.83	31.35	2.36	4.97	4263.	4159.	76.36	135.99	1462.40	148.11	28.08
TUBE 2	63.63	68.52	66.07	4.90	55.70	31.22	3.03	5.00	7378.	7108.	132.47	236.34	1405.57	279.78	25.40

EM-09-20-78AF -12:00P VAPOR TEMP 123.44 SAT. TEMP 97.77 T1AVG-T2AVG -0.10 PMEAS PSIG 55.0 HEATER VOLTS 70.2 COND TEMP 93.0 DSS: PVAP 54.5 TVAP 165.0 PWELL 54.0 TWELL 90.0
HP-D/H, AF -12:00P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.04	67.70	65.87	3.66	57.57	31.90	2.35	4.94	4291.	4186.	74.53	134.51	1455.37	146.40	28.59
TUBE 2	63.48	68.47	65.97	4.99	57.47	31.80	3.03	5.00	7511.	7236.	130.70	236.22	1404.61	279.64	25.84

EM-09-20-78AF -12:20P VAPOR TEMP 120.99 SAT. TEMP 98.73 T1AVG-T2AVG -0.04 PMEAS PSIG 56.0 HEATER VOLTS 77.0 COND TEMP 93.5 DSS: PVAP 56.0 TVAP 150.0 PWELL 55.0 TWELL 90.5
HP-D/H, AF -12:20P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.22	68.85	67.03	3.63	53.95	31.69	2.37	4.99	4286.	4181.	79.43	135.23	1477.33	147.02	28.44
TUBE 2	64.58	69.56	67.07	4.98	53.92	31.65	3.03	5.00	7497.	7222.	139.05	236.84	1414.99	280.07	25.79

EM-09-20-78AF -12:40P VAPOR TEMP 118.93 SAT. TEMP 99.20 T1AVG-T2AVG 0.02 PMEAS PSIG 56.5 HEATER VOLTS 80.0 COND TEMP 94.0 DSS: PVAP 56.0 TVAP 143.0 PWELL 55.0 TWELL 90.5
HP-D/H, AF -12:40P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.05	69.69	67.87	3.64	51.07	31.33	2.37	4.99	4297.	4192.	84.14	137.14	1485.56	149.23	28.09
TUBE 2	65.38	70.32	67.85	4.94	51.09	31.35	3.03	5.00	7439.	7166.	145.61	237.26	1422.31	280.36	25.56

Table A.3 (continued)

EM-09-20-78AF -12:55P
HP-D/H, AF -12:55P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
118.23	99.95	0.01	57.3	79.0	94.0	57.0	158.0	56.5	92.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.49	70.15	68.32	3.65	49.91	31.63	2.33	4.90	4241.	4137.	84.97	134.06	1468.63	145.70	28.40
TUBE 2	65.84	70.78	68.31	4.94	49.92	31.65	3.03	5.00	7438.	7166.	148.99	235.04	1426.64	276.95	25.87

EM-09-20-78AF - 1:10P
HP-D/H, AF - 1:10P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
118.90	100.42	-0.03	57.8	77.0	94.5	57.0	163.0	57.0	91.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.38	70.12	68.25	3.74	50.66	32.17	2.34	4.92	4354.	4248.	85.96	135.34	1472.20	147.21	28.86
TUBE 2	65.76	70.81	68.28	5.05	50.62	32.14	3.03	5.00	7610.	7332.	150.33	236.77	1426.39	279.47	26.23

EM-09-20-78AF - 2:15P
HP-D/H, AF - 2:15P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
99.18	87.60	0.16	45.0	79.0	83.5	45.0	90.0	44.0	83.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.19	69.48	68.34	2.29	30.84	19.27	2.37	4.99	2707.	2640.	87.75	140.47	1490.17	153.23	17.23
TUBE 2	66.53	69.82	68.18	3.29	31.00	19.43	3.03	5.00	4960.	4778.	160.00	255.34	1425.42	306.85	15.57

EM-09-20-78AF - 2:30P
HP-D/H, AF - 2:30P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
96.45	87.60	0.12	45.0	74.0	84.0	45.0	87.0	44.0	83.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.93	69.23	68.08	2.30	28.37	19.52	2.37	4.99	2713.	2647.	95.63	138.96	1487.67	151.43	17.48
TUBE 2	66.35	69.58	67.96	3.23	28.49	19.64	3.03	5.00	4871.	4693.	171.01	248.03	1423.39	296.06	15.85

EM-09-20-78AF - 2:40P
HP-D/H, AF - 2:40P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
94.97	87.60	0.04	45.0	68.0	83.0	45.0	87.0	43.5	83.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.74	69.07	67.91	2.33	27.06	19.70	2.35	4.94	2733.	2666.	100.98	138.73	1475.27	151.29	17.62
TUBE 2	66.25	69.48	67.87	3.23	27.10	19.74	3.03	5.00	4873.	4695.	179.81	246.89	1422.47	298.44	15.95

EM-09-20-78AF - 2:50P
HP-D/H, AF - 2:50P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
94.29	87.39	0.03	44.8	65.0	83.0	45.0	87.0	43.5	83.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.49	68.85	67.67	2.35	26.62	19.72	2.35	4.94	2756.	2689.	103.53	139.77	1472.97	152.59	17.62
TUBE 2	66.03	69.24	67.64	3.21	26.65	19.75	3.03	5.00	4839.	4662.	181.54	244.98	1420.30	291.72	15.98

Table A.3 (continued)

EM-09-20-78AF - 3:00P VAPOR TEMP 94.24 SAT. TEMP 87.60 T1AVG-T2AVG 0.03 PMEAS PSIG 45.0 HEATER VOLTS 65.0 COND TEMP 83.0 DSS: PVAP 45.0 TVAP 87.0 PWELL 44.0 TWELL 83.0
HP-D/H, AF - 3:00P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.80	69.05	67.93	2.25	26.31	19.68	2.37	4.99	2654.	2589.	100.86	134.86	1486.14	146.47	17.68
TUBE 2	66.30	69.49	67.90	3.19	26.34	19.71	3.03	5.00	4802.	4627.	182.34	243.71	1422.78	289.74	15.97

EM-09-20-78AF - 3:35P VAPOR TEMP 103.40 SAT. TEMP 104.27 T1AVG-T2AVG 0.07 PMEAS PSIG 62.0 HEATER VOLTS 65.0 COND TEMP 98.0 DSS: PVAP 61.0 TVAP 101.0 PWELL 60.0 TWELL 97.0
HP-D/H, AF - 3:35P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.96	71.06	69.01	4.10	34.40	35.26	2.37	4.99	4843.	4725.	140.82	137.35	1496.77	149.37	31.64
TUBE 2	66.51	71.36	68.94	4.85	34.46	35.33	3.03	5.00	7309.	7041.	212.07	206.86	1432.57	237.21	29.68

EM-09-20-78AF - 3:50P VAPOR TEMP 102.30 SAT. TEMP 104.27 T1AVG-T2AVG 0.09 PMEAS PSIG 62.0 HEATER VOLTS 64.0 COND TEMP 98.5 DSS: PVAP 62.5 TVAP 100.0 PWELL 60.0 TWELL 98.0
HP-D/H, AF - 3:50P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.34	71.23	69.28	3.89	33.02	34.99	2.37	4.99	4600.	4488.	139.33	131.50	1499.50	142.27	31.55
TUBE 2	66.84	71.56	69.20	4.72	33.10	35.07	3.03	5.00	7106.	6846.	214.67	202.63	1435.04	231.38	29.59

EM-09-20-78AF - 4:00P VAPOR TEMP 102.60 SAT. TEMP 103.82 T1AVG-T2AVG 0.05 PMEAS PSIG 61.5 HEATER VOLTS 62.0 COND TEMP 98.0 DSS: PVAP 61.0 TVAP 102.0 PWELL 60.0 TWELL 95.0
HP-D/H, AF - 4:00P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.59	70.61	68.60	4.02	34.00	35.21	2.35	4.94	4708.	4593.	138.48	133.69	1482.11	145.11	31.65
TUBE 2	66.12	70.99	68.55	4.87	34.05	35.26	3.00	4.95	7267.	7001.	213.43	206.06	1418.76	236.55	29.59

EM-09-20-78AF - 4:10P VAPOR TEMP 102.64 SAT. TEMP 104.27 T1AVG-T2AVG 0.01 PMEAS PSIG 62.0 HEATER VOLTS 61.0 COND TEMP 98.0 DSS: PVAP 62.0 TVAP 115.0 PWELL 60.0 TWELL 97.0
HP-D/H, AF - 4:10P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.89	70.80	68.84	3.90	33.80	35.43	2.35	4.94	4572.	4460.	135.25	129.05	1484.44	139.49	31.97
TUBE 2	66.44	71.23	68.84	4.79	33.81	35.43	3.03	5.00	7218.	6953.	213.48	203.69	1431.62	232.92	29.85

EM-09-20-78AF - 4:20P VAPOR TEMP 103.18 SAT. TEMP 104.72 T1AVG-T2AVG -0.02 PMEAS PSIG 62.5 HEATER VOLTS 61.0 COND TEMP 98.0 DSS: PVAP 62.0 TVAP 106.0 PWELL 61.0 TWELL 97.0
HP-D/H, AF - 4:20P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.21	71.10	69.16	3.89	34.03	35.56	2.37	4.99	4598.	4486.	135.14	129.32	1498.26	139.68	32.12
TUBE 2	66.76	71.60	69.18	4.84	34.00	35.54	3.00	4.95	7221.	6957.	212.36	203.21	1424.61	232.49	29.92

Table A.3 (continued)

EH-09-20-78AF - 4:30P
HP-D/H, AF - 4:30P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
107.59	109.68	0.01	68.2	65.0	105.0	68.0	107.0	67.0	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.89	71.33	69.11	4.43	38.49	40.57	2.37	4.99	5240.	5112.	136.15	129.14	1497.78	139.47	36.65
TUBE 2	66.43	71.76	69.09	5.34	38.50	40.59	3.03	5.00	8039.	7745.	208.81	198.06	1434.05	225.26	34.39

EH-09-20-78AF - 4:40P
HP-D/H, AF - 4:40P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
107.67	109.51	0.05	68.0	64.0	104.0	67.5	110.0	66.5	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.83	71.27	69.05	4.44	38.61	40.46	2.37	4.99	5243.	5115.	135.77	129.57	1497.22	140.00	36.54
TUBE 2	66.37	71.63	69.00	5.26	38.67	40.51	3.03	5.00	7925.	7634.	204.94	195.60	1433.15	221.98	34.39

EH-09-20-78AF - 4:50P
HP-D/H, AF - 4:50P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
107.50	109.34	0.03	67.8	64.0	104.0	67.0	111.0	66.5	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.70	71.13	68.91	4.43	38.58	40.43	2.37	4.99	5228.	5101.	135.51	129.33	1495.87	139.71	36.51
TUBE 2	66.26	71.52	68.89	5.26	38.61	40.46	3.00	4.95	7855.	7567.	203.42	194.15	1421.86	220.36	34.34

EH-09-20-78AF - 5:00P
HP-D/H, AF - 5:00P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
107.07	109.08	0.06	67.5	64.0	103.5	67.0	110.0	66.0	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.70	71.07	68.89	4.37	38.18	40.20	2.37	4.99	5162.	5036.	135.20	128.43	1495.60	138.64	36.33
TUBE 2	66.24	71.40	68.82	5.16	38.25	40.26	3.03	5.00	7776.	7492.	203.32	193.15	1431.49	218.76	34.25

Table A.3 (continued)

EM-09-21-78AP3- 9:46A VAPOR TEMP 115.11 SAT. TEMP 93.85 T1AVG-T2AVG -0.21 PMEAS PSIG 51.0 HEATER VOLTS 100.0 COND TEMP 89.0 DSS: PVAP 51.0 TVAP 175.0 PWELL 50.0 TWELL 86.0
HP- AP3- 9:46A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.96	68.08	66.52	3.12	48.60	27.33	2.37	4.99	3687.	3597.	75.88	134.91	1472.24	146.69	24.52
TUBE 2	63.92	69.54	66.73	5.62	48.38	27.12	3.03	5.00	8471.	8161.	175.09	312.40	1411.75	398.62	20.47

EM-09-21-78AP3-10:00A VAPOR TEMP 113.28 SAT. TEMP 93.65 T1AVG-T2AVG -0.04 PMEAS PSIG 50.8 HEATER VOLTS 112.0 COND TEMP 89.0 DSS: PVAP 50.6 TVAP 165.0 PWELL 49.0 TWELL 86.0
HP- AP3-10:00A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	65.67	68.66	67.17	2.99	46.11	26.48	2.37	4.99	3527.	3441.	76.50	133.22	1478.66	144.57	23.80
TUBE 2	64.48	69.93	67.20	5.46	46.07	26.44	3.03	5.00	8219.	7918.	178.40	310.84	1416.23	395.59	20.02

EM-09-21-78AP3-10:15A VAPOR TEMP 112.04 SAT. TEMP 94.05 T1AVG-T2AVG -0.03 PMEAS PSIG 51.2 HEATER VOLTS 111.0 COND TEMP 90.0 DSS: PVAP 51.0 TVAP 160.0 PWELL 50.0 TWELL 86.0
HP- AP3-10:15A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.09	69.03	67.56	2.95	44.48	26.49	2.37	4.99	3484.	3399.	78.34	131.54	1482.53	142.51	23.85
TUBE 2	64.90	70.29	67.59	5.39	44.45	26.46	3.00	4.95	8049.	7754.	181.09	304.24	1409.75	385.12	20.13

EM-09-21-78AP3-10:40A VAPOR TEMP 107.04 SAT. TEMP 94.15 T1AVG-T2AVG -0.00 PMEAS PSIG 51.3 HEATER VOLTS 110.0 COND TEMP 89.0 DSS: PVAP 51.0 TVAP 135.0 PWELL 55.0 TWELL 87.0
HP-D/H, AP3-10:40A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.91	69.80	68.35	2.90	38.69	25.79	2.37	4.99	3422.	3338.	88.44	132.67	1490.34	143.78	23.22
TUBE 2	65.74	70.97	68.35	5.23	38.69	25.79	3.01	4.97	7831.	7544.	202.40	303.61	1420.97	383.13	19.69

EM-09-21-78AP3-10:50A VAPOR TEMP 104.89 SAT. TEMP 94.64 T1AVG-T2AVG -1.57 PMEAS PSIG 51.8 HEATER VOLTS 110.0 COND TEMP 90.0 DSS: PVAP 51.8 TVAP 129.0 PWELL 50.0 TWELL 87.0
HP-D/H, AP3-10:50A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.77	69.68	68.22	2.91	36.67	26.42	2.36	4.97	3427.	3344.	93.47	129.72	1484.79	140.29	23.83
TUBE 2	65.59	73.99	69.79	8.40	35.10	24.85	3.03	5.00	12652.	12189.	360.49	509.11	1440.65	805.73	15.13

EM-09-21-78AP3-11:10A VAPOR TEMP 102.11 SAT. TEMP 94.64 T1AVG-T2AVG 1.20 PMEAS PSIG 51.8 HEATER VOLTS 160.0 COND TEMP 90.0 DSS: PVAP 52.0 TVAP 132.0 PWELL 51.0 TWELL 87.0
HP-D/H, AP3-11:10A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.43	71.22	69.83	2.79	32.28	24.82	2.36	4.97	3286.	3205.	101.77	132.39	1500.54	143.33	22.36
TUBE 2	66.02	71.23	68.63	5.21	33.48	26.02	3.00	4.95	7776.	7492.	232.25	299.88	1419.44	375.48	19.95

Table A.3 (continued)

EM-09-21-78AF3-11:20A VAPOR SAT. T1AVG- PMEAS HEATER COND ----------DSS----------
HP-D/H, AF3-11:20A TEMP TEMP T2AVG PSIG VOLTS TEMP PVAP TVAP PWELL TWELL
104.02 94.84 0.45 52.0 132.0 89.0 52.0 136.0 51.5 87.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.73	70.61	69.17	2.87	34.85	25.67	2.37	4.99	3393.	3311.	97.38	132.17	1498.39	143.10	23.13
TUBE 2	66.11	71.34	68.72	5.24	35.29	26.12	3.03	5.00	7888.	7599.	223.48	301.97	1430.57	379.64	20.02

EM-09-21-78AF3-12:40P VAPOR SAT. T1AVG- PMEAS HEATER COND ----------DSS----------
HP-D/H, AF3-12:40P TEMP TEMP T2AVG PSIG VOLTS TEMP PVAP TVAP PWELL TWELL
97.22 97.77 0.03 55.0 102.0 92.5 55.0 100.0 54.0 90.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.33	71.21	69.77	2.88	27.45	28.00	2.38	5.01	3415.	3332.	124.39	121.94	1508.56	130.82	25.47
TUBE 2	67.30	72.19	69.74	4.89	27.48	28.03	3.11	5.13	7562.	7285.	275.20	269.79	1470.90	326.15	22.34

EM-09-21-78AF3-12:50P VAPOR SAT. T1AVG- PMEAS HEATER COND ----------DSS----------
HP-D/H, AF3-12:50P TEMP TEMP T2AVG PSIG VOLTS TEMP PVAP TVAP PWELL TWELL
96.96 97.68 0.03 54.9 101.0 92.4 55.0 100.0 54.0 90.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.36	71.18	69.77	2.83	27.19	27.91	2.37	4.99	3339.	3258.	122.84	119.67	1504.28	128.18	25.42
TUBE 2	67.33	72.15	69.74	4.82	27.21	27.93	3.04	5.02	7304.	7037.	268.42	261.49	1446.33	314.97	22.34

EM-09-21-78AF3- 1:00P VAPOR SAT. T1AVG- PMEAS HEATER COND ----------DSS----------
HP-D/H, AF3- 1:00P TEMP TEMP T2AVG PSIG VOLTS TEMP PVAP TVAP PWELL TWELL
97.16 97.29 -0.01 54.5 100.5 92.5 54.2 100.0 54.0 90.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.39	71.22	69.80	2.83	27.36	27.49	2.37	4.99	3341.	3260.	122.12	121.55	1504.59	130.40	25.00
TUBE 2	67.42	72.21	69.81	4.79	27.35	27.48	3.03	5.00	7211.	6947.	263.66	262.43	1440.83	316.69	21.94

EM-09-21-78AF3- 1:30P VAPOR SAT. T1AVG- PMEAS HEATER COND ----------DSS----------
HP- AF3- 1:30P TEMP TEMP T2AVG PSIG VOLTS TEMP PVAP TVAP PWELL TWELL
106.88 106.05 -0.15 64.0 96.0 101.0 63.5 175.0 63.5 97.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.09	72.90	71.00	3.80	35.88	35.05	2.37	4.99	4491.	4382.	125.17	128.14	1516.33	138.09	31.73
TUBE 2	68.11	74.18	71.15	6.07	35.73	34.90	3.04	5.02	9188.	8851.	257.12	263.24	1459.59	316.88	27.93

EM-09-21-78AF3- 1:40P VAPOR SAT. T1AVG- PMEAS HEATER COND ----------DSS----------
HP- AF3- 1:40P TEMP TEMP T2AVG PSIG VOLTS TEMP PVAP TVAP PWELL TWELL
113.49 106.05 -0.20 64.0 97.0 102.0 64.0 167.0 63.0 99.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.77	72.66	70.72	3.89	42.78	35.33	2.37	4.99	4597.	4485.	107.47	130.12	1513.62	140.48	31.92
TUBE 2	67.82	74.01	70.92	6.20	42.58	35.13	3.03	5.00	9339.	8997.	219.34	265.83	1451.21	321.25	28.01

Table A.3 (continued)

EM-09-21-78AP3- 1:50P VAPOR TEMP 115.17 SAT. TEMP 106.05 T1AVG-T2AVG -0.10 PMEAS PSIG 64.0 HEATER VOLTS 102.0 COND TEMP 101.0 DSS: PVAP 64.0, TVAP 160.0, PWELL 63.5, TWELL 99.0
HP- AP3- 1:50P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.26	73.07	71.17	3.81	44.00	34.88	2.35	4.94	4457.	4348.	101.29	127.78	1507.14	137.75	31.57
TUBE 2	68.22	74.31	71.27	6.09	43.90	34.78	3.03	5.00	9170.	8834.	208.87	263.65	1454.52	317.77	27.80

EM-09-21-78AP3- 2:00P VAPOR TEMP 107.50 SAT. TEMP 105.60 T1AVG-T2AVG -0.07 PMEAS PSIG 63.5 HEATER VOLTS 102.0 COND TEMP 101.5 DSS: PVAP 63.0, TVAP 158.0, PWELL 62.5, TWELL 98.0
HP- AP3- 2:00P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.16	73.03	71.09	3.87	36.40	34.51	2.35	4.94	4535.	4424.	124.56	131.39	1506.41	142.08	31.14
TUBE 2	68.11	74.22	71.17	6.11	36.33	34.44	3.03	5.00	9205.	8868.	253.37	267.30	1453.58	323.35	27.43

EM-09-21-78AP3- 2:15P VAPOR TEMP 113.38 SAT. TEMP 115.30 T1AVG-T2AVG -0.09 PMEAS PSIG 75.0 HEATER VOLTS 102.0 COND TEMP 110.0 DSS: PVAP 74.8, TVAP 162.0, PWELL 74.0, TWELL 107.0
HP- AP3- 2:15P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.76	73.44	71.10	4.68	42.29	44.20	2.37	4.99	5529.	5394.	130.76	125.10	1517.35	134.48	40.11
TUBE 2	67.74	74.63	71.19	6.89	42.20	44.11	3.03	5.00	10373.	9994.	245.82	235.16	1453.75	275.98	36.21

EM-09-21-78AP3- 2:25P VAPOR TEMP 119.65 SAT. TEMP 115.70 T1AVG-T2AVG -0.05 PMEAS PSIG 75.5 HEATER VOLTS 104.0 COND TEMP 111.0 DSS: PVAP 75.0, TVAP 167.0, PWELL 74.4, TWELL 108.0
HP- AP3- 2:25P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.55	73.29	70.92	4.73	48.73	44.78	2.36	4.97	5573.	5437.	114.37	124.46	1511.26	133.78	40.64
TUBE 2	67.52	74.43	70.97	6.92	48.68	44.73	3.03	5.00	10436.	10054.	214.40	233.34	1453.82	273.38	36.78

EM-09-21-78AP3- 2:35P VAPOR TEMP 116.38 SAT. TEMP 115.70 T1AVG-T2AVG -0.05 PMEAS PSIG 75.5 HEATER VOLTS 104.0 COND TEMP 111.0 DSS: PVAP 75.0, TVAP 170.0, PWELL 74.5, TWELL 108.0
HP- AP3- 2:35P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.23	73.04	70.63	4.81	45.75	45.07	2.36	4.97	5661.	5523.	123.75	125.62	1508.44	135.17	40.86
TUBE 2	67.20	74.17	70.68	6.97	45.70	45.01	3.03	5.00	10494.	10110.	229.65	233.13	1449.04	273.27	37.00

EM-09-21-78AP3- 2:50P VAPOR TEMP 122.63 SAT. TEMP 116.10 T1AVG-T2AVG 0.03 PMEAS PSIG 76.0 HEATER VOLTS 105.0 COND TEMP 111.5 DSS: PVAP 76.0, TVAP 172.0, PWELL 75.0, TWELL 108.5
HP- AP3- 2:50P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.68	73.46	71.07	4.78	51.56	45.03	2.35	4.94	5599.	5463.	108.60	124.35	1506.22	133.69	40.86
TUBE 2	67.62	74.46	71.04	6.85	51.59	45.06	3.03	5.00	10313.	9935.	199.89	228.87	1452.39	267.09	37.20

Table A.3 (continued)

EM-09-21-78AF3- 3:20P VAPOR TEMP 125.89 SAT. TEMP 126.18 T1AVG-T2AVG 0.08 PMEAS PSIG 89.5 HEATER VOLTS 105.0 COND TEMP 121.0 DSS: PVAP 89.0, TVAP 177.0, PWELL 88.5, TWELL 118.0
HP- AF3- 3:20P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.23	74.01	71.12	5.78	54.77	55.07	2.37	4.99	6826.	6660.	124.63	123.97	1517.54	133.13	50.02
TUBE 2	67.18	74.89	71.04	7.72	54.85	55.15	3.03	5.00	11623.	11197.	211.89	210.76	1452.35	241.92	46.29

EM-09-21-78AF3- 3:30P VAPOR TEMP 127.83 SAT. TEMP 126.87 T1AVG-T2AVG 0.17 PMEAS PSIG 90.5 HEATER VOLTS 105.0 COND TEMP 121.5 DSS: PVAP 89.8, TVAP 175.0, PWELL 89.0, TWELL 118.0
HP- AF3- 3:30P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.29	74.19	71.24	5.91	56.59	55.63	2.37	4.99	6978.	6808.	123.30	125.43	1518.75	134.85	50.48
TUBE 2	67.19	74.96	71.07	7.77	56.76	55.80	3.00	4.95	11607.	11182.	204.49	208.01	1442.33	238.47	46.89

EM-09-21-78AF3- 3:40P VAPOR TEMP 128.02 SAT. TEMP 127.56 T1AVG-T2AVG -0.04 PMEAS PSIG 91.5 HEATER VOLTS 97.0 COND TEMP 122.0 DSS: PVAP 90.5, TVAP 176.0, PWELL 90.5, TWELL 119.0
HP- AF3- 3:40P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.14	74.13	71.14	6.00	56.89	56.43	2.36	4.97	7059.	6887.	124.10	125.11	1513.37	134.52	51.20
TUBE 2	67.24	75.12	71.18	7.88	56.84	56.38	3.03	5.00	11870.	11435.	208.81	210.51	1453.68	241.53	47.34

EM-09-21-78AF3- 3:50P VAPOR TEMP 131.57 SAT. TEMP 128.25 T1AVG-T2AVG 0.12 PMEAS PSIG 92.5 HEATER VOLTS 97.0 COND TEMP 123.0 DSS: PVAP 91.8, TVAP 178.0, PWELL 92.0, TWELL 120.0
HP- AF3- 3:50P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	68.17	74.31	71.24	6.14	60.34	57.01	2.35	4.94	7187.	7012.	119.12	126.07	1507.82	135.71	51.67
TUBE 2	67.17	75.06	71.12	7.89	60.46	57.13	3.00	4.95	11779.	11348.	194.83	206.18	1442.73	235.97	48.09

EM-09-21-78AF3- 4:05P VAPOR TEMP 128.44 SAT. TEMP 128.93 T1AVG-T2AVG 0.18 PMEAS PSIG 93.5 HEATER VOLTS 98.0 COND TEMP 124.0 DSS: PVAP 93.0, TVAP 180.0, PWELL 95.0, TWELL 120.0
HP- AF3- 4:05P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.87	74.17	71.02	6.30	57.42	57.91	2.35	4.94	7376.	7196.	128.46	127.37	1505.69	137.29	52.42
TUBE 2	66.87	74.81	70.84	7.94	57.60	58.09	3.00	4.95	11850.	11416.	205.72	204.00	1440.12	233.08	48.98

Table A.3 (continued)

EH-09-22-78AL - 7:55A VAPOR TEMP 90.56 SAT. TEMP 81.78 T1AVG-T2AVG 0.02 PMEAS PSIG 39.8 HEATER VOLTS 125.0 COND TEMP 78.0
HP- AL - 7:55A DSS: PVAP 40.0 TVAP 163.0 PWELL 38.5 TWELL 75.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	57.06	59.54	58.30	2.48	32.27	23.48	2.38	5.01	2942.	2870.	91.18	125.27	1395.08	135.89	21.12
TUBE 2	55.59	60.97	58.28	5.38	32.28	23.50	3.03	6.36	8101.	5386.	250.93	344.69	1689.47	299.06	18.01

EH-09-22-78AL - 8:10A VAPOR TEMP 104.49 SAT. TEMP 83.39 T1AVG-T2AVG -0.08 PMEAS PSIG 41.2 HEATER VOLTS 126.0 COND TEMP 80.0
HP- AL - 8:10A DSS: PVAP 41.0 TVAP 166.0 PWELL 40.0 TWELL 76.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	58.38	60.93	59.65	2.54	44.83	23.74	2.38	5.01	3016.	2943.	67.28	127.08	1408.53	137.93	21.34
TUBE 2	56.91	62.56	59.74	5.64	44.75	23.65	3.04	6.38	8532.	5673.	190.66	360.70	1711.82	316.11	17.95

EH-09-22-78AL - 8:25A VAPOR TEMP 111.07 SAT. TEMP 83.73 T1AVG-T2AVG -0.12 PMEAS PSIG 41.5 HEATER VOLTS 126.0 COND TEMP 81.0
HP- AL - 8:25A DSS: PVAP 41.8 TVAP 172.0 PWELL 40.5 TWELL 78.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	59.61	62.22	60.91	2.61	50.15	22.82	2.37	4.99	3078.	3003.	61.38	134.91	1416.95	147.34	20.38
TUBE 2	58.13	63.93	61.03	5.80	50.03	22.70	3.03	6.37	8754.	5820.	174.97	385.68	1724.98	344.71	16.88

EH-09-22-78AL - 8:45A VAPOR TEMP 113.22 SAT. TEMP 86.30 T1AVG-T2AVG 0.07 PMEAS PSIG 43.8 HEATER VOLTS 130.0 COND TEMP 81.0
HP-D/H, AL - 8:45A DSS: PVAP 44.0 TVAP 158.0 PWELL 43.5 TWELL 79.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.13	63.64	62.38	2.51	50.84	23.91	2.37	4.99	2961.	2889.	58.24	123.82	1431.46	133.77	21.59
TUBE 2	59.50	65.13	62.31	5.62	50.91	23.98	3.02	6.35	8457.	5623.	166.13	352.64	1735.40	305.59	18.40

EH-09-22-78AL - 9:00A VAPOR TEMP 107.47 SAT. TEMP 88.68 T1AVG-T2AVG 0.11 PMEAS PSIG 46.0 HEATER VOLTS 129.0 COND TEMP 83.0
HP-D/H, AL - 9:00A DSS: PVAP 46.0 TVAP 100.0 PWELL 44.0 TWELL 81.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.62	66.05	64.84	2.43	42.64	23.84	2.35	4.94	2846.	2776.	66.75	119.38	1445.25	128.35	21.63
TUBE 2	61.99	67.46	64.72	5.47	42.75	23.95	3.03	6.36	8233.	5474.	192.59	343.72	1766.77	294.06	18.62

EH-09-22-78AL - 9:15A VAPOR TEMP 100.63 SAT. TEMP 88.46 T1AVG-T2AVG 0.20 PMEAS PSIG 45.8 HEATER VOLTS 129.0 COND TEMP 85.0
HP-D/H, AL - 9:15A DSS: PVAP 46.0 TVAP 98.0 PWELL 45.0 TWELL 81.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.73	67.23	65.98	2.49	34.65	22.48	2.37	4.99	2945.	2873.	84.99	130.99	1466.96	142.01	20.23
TUBE 2	63.08	68.48	65.78	5.41	34.85	22.68	3.03	6.36	8144.	5415.	233.70	359.06	1779.45	310.49	17.44

Table A.3 (continued)

EM-09-22-78AL - 9:30A VAPOR TEMP 98.04 SAT. TEMP 93.85 T1AVG-T2AVG 0.05 PMEAS PSIG 51.0 HEATER VOLTS 125.0 COND TEMP 89.0 DSS: PVAP 51.0 TVAP 105.0 PWELL 49.0 TWELL 86.0
HP-D/H, AL - 9:30A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	66.77	69.29	68.03	2.52	30.01	25.82	2.37	4.99	2981.	2908.	99.31	115.45	1487.15	123.37	23.57
TUBE 2	65.21	70.75	67.98	5.53	30.06	25.87	3.03	6.36	8334.	5541.	277.23	322.20	1805.76	269.25	20.58

EM-09-22-78AL - 9:45A VAPOR TEMP 103.67 SAT. TEMP 94.84 T1AVG-T2AVG -0.10 PMEAS PSIG 52.0 HEATER VOLTS 124.0 COND TEMP 91.0 DSS: PVAP 52.0 TVAP 150.0 PWELL 51.5 TWELL 87.5
HP- AL - 9:45A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	67.68	70.47	69.07	2.79	34.59	25.77	2.37	4.99	3297.	3216.	95.30	127.92	1497.41	138.01	23.31
TUBE 2	66.16	72.18	69.17	6.01	34.50	25.68	3.03	6.36	9059.	6023.	262.60	352.81	1819.99	301.53	19.97

EM-09-22-78AL -10:05A VAPOR TEMP 96.88 SAT. TEMP 97.96 T1AVG-T2AVG -0.09 PMEAS PSIG 55.2 HEATER VOLTS 124.0 COND TEMP 93.5 DSS: PVAP 55.0 TVAP 100.0 PWELL 54.0 TWELL 90.0
HP-D/H, AL -10:05A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	69.23	72.11	70.67	2.88	26.21	27.30	2.37	4.99	3404.	3321.	129.87	124.71	1513.10	134.05	24.78
TUBE 2	67.73	73.78	70.75	6.05	26.13	27.21	3.04	6.39	9161.	6091.	350.63	336.65	1846.77	282.91	21.53

EM-09-22-78AL -10:20A VAPOR TEMP 99.16 SAT. TEMP 98.82 T1AVG-T2AVG -0.05 PMEAS PSIG 56.1 HEATER VOLTS 126.0 COND TEMP 94.0 DSS: PVAP 56.4 TVAP 102.0 PWELL 55.0 TWELL 91.0
HP-D/H, AL -10:20A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	70.44	73.25	71.85	2.82	27.31	26.98	2.37	4.99	3326.	3245.	121.79	123.31	1524.70	132.30	24.53
TUBE 2	68.89	74.89	71.89	6.00	27.26	26.93	3.03	6.36	9043.	6012.	331.67	335.80	1852.52	281.77	21.34

EM-09-22-78AL -10:30A VAPOR TEMP 99.10 SAT. TEMP 99.20 T1AVG-T2AVG -0.03 PMEAS PSIG 56.5 HEATER VOLTS 126.0 COND TEMP 94.0 DSS: PVAP 56.3 TVAP 102.0 PWELL 55.5 TWELL 92.0
HP-D/H, AL -10:30A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	71.02	73.76	72.39	2.74	26.71	26.81	2.37	4.99	3233.	3154.	121.05	120.59	1530.05	129.05	24.44
TUBE 2	69.48	75.36	72.42	5.88	26.68	26.78	3.03	6.36	8865.	5895.	332.33	331.06	1858.83	276.53	21.32

EM-09-22-78AL -11:30A VAPOR TEMP 105.32 SAT. TEMP 104.54 T1AVG-T2AVG -0.01 PMEAS PSIG 62.3 HEATER VOLTS 127.0 COND TEMP 100.5 DSS: PVAP 62.5 TVAP 110.0 PWELL 62.0 TWELL 98.0
HP-D/H, AL -11:30A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	71.76	74.82	73.29	3.05	32.03	31.25	2.39	5.03	3639.	3550.	113.61	116.46	1549.89	124.07	28.61
TUBE 2	70.19	76.40	73.30	6.21	32.02	31.24	3.05	6.42	9435.	6274.	294.63	302.03	1882.60	246.03	25.50

Table A.3 (continued)

EM-09-22-78AL -11:40A VAPOR TEMP 105.44 SAT. TEMP 105.16 T1AVG-T2AVG -0.50 PMEAS PSIG 63.0 HEATER VOLTS 105.0 COND TEMP 101.0 DSS: PVAP 63.0 TVAP 110.0 PWELL 63.0 TWELL 98.2
HP-D/H, AL -11:40A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	71.36	74.46	72.91	3.10	32.52	32.25	2.38	5.01	3673.	3584.	112.94	113.91	1539.56	121.18	29.57
TUBE 2	70.28	76.54	73.41	6.26	32.03	31.75	3.05	6.42	9514.	6326.	297.07	299.65	1883.94	243.62	25.97

EM-09-22-78AL -11:50A VAPOR TEMP 105.39 SAT. TEMP 105.52 T1AVG-T2AVG -0.21 PMEAS PSIG 63.4 HEATER VOLTS 122.0 COND TEMP 101.0 DSS: PVAP 63.8 TVAP 101.0 PWELL 62.3 TWELL 99.0
HP-D/H, AL -11:50A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	72.36	75.66	74.01	3.30	31.38	31.51	2.37	4.99	3901.	3806.	124.31	123.82	1545.93	132.71	28.68
TUBE 2	70.95	77.49	74.22	6.54	31.17	31.30	3.03	6.36	9847.	6547.	315.91	314.63	1880.26	258.80	25.30

EM-09-22-78AL -12:00P VAPOR TEMP 106.06 SAT. TEMP 105.60 T1AVG-T2AVG -0.06 PMEAS PSIG 63.5 HEATER VOLTS 129.0 COND TEMP 101.2 DSS: PVAP 64.0 TVAP 115.0 PWELL 62.5 TWELL 99.0
HP-D/H, AL -12:00P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	73.12	76.39	74.76	3.26	31.30	30.85	2.37	4.99	3855.	3761.	123.15	124.97	1553.25	134.01	28.07
TUBE 2	71.61	78.03	74.82	6.41	31.24	30.79	3.03	6.36	9661.	6424.	309.25	313.82	1887.38	257.74	24.92

EM-09-22-78AL -12:30P VAPOR TEMP 115.34 SAT. TEMP 115.21 T1AVG-T2AVG 0.05 PMEAS PSIG 74.9 HEATER VOLTS 127.0 COND TEMP 110.0 DSS: PVAP 74.5 TVAP 120.0 PWELL 74.0 TWELL 108.0
HP-D/H, AL -12:30P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	74.43	78.39	76.41	3.96	38.93	38.80	2.37	4.99	4684.	4570.	120.32	120.72	1569.46	128.89	35.46
TUBE 2	72.88	79.84	76.36	6.96	38.98	38.85	3.01	6.33	10430.	6935.	267.58	268.46	1897.58	213.01	32.56

EM-09-22-78AL -12:40P VAPOR TEMP 115.08 SAT. TEMP 115.70 T1AVG-T2AVG 0.02 PMEAS PSIG 75.5 HEATER VOLTS 125.0 COND TEMP 111.0 DSS: PVAP 75.0 TVAP 120.0 PWELL 74.5 TWELL 108.5
HP-D/H, AL -12:40P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	74.89	78.83	76.86	3.95	38.22	38.84	2.37	4.99	4662.	4548.	121.96	120.03	1573.85	128.05	35.52
TUBE 2	73.39	80.28	76.84	6.90	38.25	38.86	3.00	6.30	10296.	6846.	269.19	264.94	1897.72	209.68	32.65

EM-09-22-78AL -12:50P VAPOR TEMP 115.37 SAT. TEMP 116.41 T1AVG-T2AVG 0.08 PMEAS PSIG 76.4 HEATER VOLTS 124.0 COND TEMP 111.5 DSS: PVAP 76.0 TVAP 120.0 PWELL 75.0 TWELL 109.0
HP-D/H, AL -12:50P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	74.78	78.80	76.79	4.01	38.58	39.63	2.35	4.94	4700.	4585.	121.82	119.60	1561.86	126.48	36.25
TUBE 2	73.24	80.18	76.71	6.95	38.66	39.70	3.00	6.30	10373.	6897.	268.31	261.25	1896.22	206.25	33.44

Table A.3 (continued)

EM-09-22-78AL - 1:00P VAPOR TEMP 115.74 SAT. TEMP 116.50 T1AVG-T2AVG 0.06 PMEAS PSIG 76.5 HEATER VOLTS 124.0 COND TEMP 111.8 DSS: PVAP 76.0, TVAP 125.0, PWELL 75.0, TWELL 109.5
HP-D/H, AL - 1:00P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	75.62	79.58	77.60	3.96	38.14	38.89	2.35	4.94	4636.	4523.	121.57	119.21	1569.76	127.12	35.58
TUBE 2	74.12	80.98	77.55	6.86	38.20	38.95	3.02	6.34	10297.	6846.	269.58	264.35	1914.31	208.79	32.79

EM-09-22-78AL - 1:40P VAPOR TEMP 124.37 SAT. TEMP 124.25 T1AVG-T2AVG 0.03 PMEAS PSIG 86.8 HEATER VOLTS 124.0 COND TEMP 119.0 DSS: PVAP 86.0, TVAP 132.0, PWELL 86.0, TWELL 117.0
HP-D/H, AL - 1:40P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	76.21	80.81	78.51	4.59	45.86	45.74	2.37	4.99	5426.	5294.	118.31	118.62	1589.97	126.28	41.92
TUBE 2	74.76	82.21	78.48	7.45	45.89	45.77	3.03	6.36	11218.	7459.	244.47	245.09	1930.93	190.68	39.12

EM-09-22-78AL - 1:50P VAPOR TEMP 126.18 SAT. TEMP 124.98 T1AVG-T2AVG 0.08 PMEAS PSIG 87.8 HEATER VOLTS 123.0 COND TEMP 119.0 DSS: PVAP 87.0, TVAP 137.0, PWELL 86.0, TWELL 117.0
HP-D/H, AL - 1:50P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	76.64	81.22	78.93	4.59	47.25	46.05	2.37	4.99	5417.	5285.	114.65	117.63	1594.07	125.11	42.24
TUBE 2	75.10	82.61	78.86	7.50	47.32	46.13	3.01	6.33	11243.	7475.	237.58	243.74	1927.04	189.51	39.45

EM-09-22-78AL - 2:00P VAPOR TEMP 126.62 SAT. TEMP 125.12 T1AVG-T2AVG -0.01 PMEAS PSIG 88.0 HEATER VOLTS 131.0 COND TEMP 119.0 DSS: PVAP 87.0, TVAP 137.0, PWELL 86.5, TWELL 117.5
HP-D/H, AL - 2:00P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	76.57	81.21	78.89	4.64	47.72	46.22	2.37	4.99	5482.	5348.	114.87	118.59	1593.71	126.23	42.37
TUBE 2	75.17	82.63	78.90	7.47	47.72	46.22	3.05	6.42	11351.	7547.	237.89	245.60	1949.66	190.83	39.55

EM-09-22-78AL - 2:15P VAPOR TEMP 127.69 SAT. TEMP 126.39 T1AVG-T2AVG 0.01 PMEAS PSIG 89.8 HEATER VOLTS 120.0 COND TEMP 121.0 DSS: PVAP 89.7, TVAP 138.0, PWELL 88.0, TWELL 118.5
HP-D/H, AL - 2:15P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.14	81.91	79.53	4.77	48.16	46.86	2.33	4.90	5535.	5400.	114.94	118.12	1576.93	125.81	42.93
TUBE 2	75.70	83.33	79.51	7.62	48.17	46.87	3.03	6.36	11484.	7636.	238.40	245.00	1943.12	190.39	40.11

EM-09-22-78AL - 2:45P VAPOR TEMP 135.28 SAT. TEMP 135.46 T1AVG-T2AVG 0.02 PMEAS PSIG 103.5 HEATER VOLTS 122.0 COND TEMP 129.5 DSS: PVAP 103.8, TVAP 174.0, PWELL 102.5, TWELL 127.5
HP-D/H, AL - 2:45P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.20	83.25	80.23	6.06	55.05	55.24	2.37	4.99	7155.	6980.	129.96	129.53	1595.46	139.02	50.21
TUBE 2	75.75	84.67	80.21	8.93	55.07	55.26	3.03	6.36	13446.	8940.	244.16	243.34	1937.72	188.98	47.31

Table A.3 (continued)

EM-09-22-78AL - 2:55P VAPOR TEMP 143.06 SAT. TEMP 137.07 T1AVG-T2AVG -0.04 PMEAS PSIG 106.0 HEATER VOLTS 121.0 COND TEMP 132.0 DSS: PVAP 106.0 TVAP 196.0 PWELL 105.5 TWELL 129.0
HP-D/H, AL - 2:55P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	76.93	83.19	80.06	6.26	63.00	57.01	2.35	4.94	7338.	7155.	116.41	128.64	1582.50	138.08	51.82
TUBE 2	75.46	84.74	80.10	9.28	62.96	56.97	3.02	6.35	13960.	9282.	221.74	245.04	1933.76	190.59	48.70

EM-09-22-78AL - 3:05P VAPOR TEMP 146.41 SAT. TEMP 137.70 T1AVG-T2AVG -0.00 PMEAS PSIG 107.0 HEATER VOLTS 123.0 COND TEMP 132.0 DSS: PVAP 106.4 TVAP 200.0 PWELL 106.5 TWELL 130.0
HP-D/H, AL - 3:05P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.16	83.51	80.34	6.35	66.07	57.36	2.37	4.99	7504.	7321.	113.58	130.82	1596.46	140.54	52.09
TUBE 2	75.67	85.01	80.34	9.35	66.07	57.36	3.04	6.39	14156.	9412.	214.25	246.78	1947.45	191.94	49.04

EM-09-22-78AL - 3:15P VAPOR TEMP 150.06 SAT. TEMP 138.36 T1AVG-T2AVG -0.01 PMEAS PSIG 108.0 HEATER VOLTS 123.0 COND TEMP 133.0 DSS: PVAP 107.0 TVAP 202.0 PWELL 107.0 TWELL 130.0
HP-D/H, AL - 3:15P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.14	83.55	80.34	6.40	69.72	58.01	2.37	4.99	7565.	7380.	108.50	130.40	1596.53	140.04	52.70
TUBE 2	75.63	85.07	80.35	9.44	69.71	58.01	3.03	6.36	14220.	9455.	203.98	245.14	1939.27	190.59	49.61

EM-09-22-78AL - 3:25P VAPOR TEMP 148.37 SAT. TEMP 139.30 T1AVG-T2AVG -0.10 PMEAS PSIG 109.5 HEATER VOLTS 123.0 COND TEMP 134.0 DSS: PVAP 108.8 TVAP 224.0 PWELL 109.0 TWELL 131.0
HP- AL - 3:25P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	NVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.02	83.49	80.26	6.47	68.12	59.05	2.37	4.99	7645.	7459.	112.23	129.48	1595.72	138.96	53.67
TUBE 2	75.54	85.17	80.35	9.63	69.02	58.95	3.03	6.36	14504.	9644.	213.23	246.05	1939.32	191.41	50.38

Table A.4. The ORNL two-tube condenser performance data for Group III-D tests (direct-contact evaporator mode)

EM-09-27-78AL - 6:44A
DC D/H,C/V,AL - 6:44A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
72.94	26.88	0.10	5.8	0.0	69.0	43.0	0.0	42.5	76.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	64.60	64.67	64.63	0.07	8.30	-37.76	2.37	4.99	86.	84.	10.38	-2.28	1453.68	-2.22	*****
TUBE 2	64.51	64.56	64.54	0.06	9.40	-37.66	3.03	6.36	93.	55.	9.93	-2.22	1764.53	-1.47	*****

EM-09-27-78AL - 8:40A
DC D/H, AL - 8:40A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
106.36	118.84	-0.05	79.5	55.0	112.0	79.0	124.0	79.0	101.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	75.02	78.48	76.75	3.46	29.61	42.09	2.37	4.99	4085.	3986.	137.97	97.07	1572.77	101.74	39.19
TUBE 2	74.64	78.97	76.81	4.34	29.56	42.03	3.03	6.36	6532.	4343.	220.99	155.39	1911.00	113.93	38.12

EM-09-27-78AL - 8:55A
DC D/H, AL - 8:55A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
93.47	119.22	-0.06	80.0	59.0	112.5	79.8	122.0	79.5	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	75.24	78.26	76.75	3.02	16.71	42.47	2.37	4.99	3564.	3477.	213.26	83.92	1572.79	87.08	39.93
TUBE 2	74.83	78.80	76.82	3.97	16.65	42.41	3.03	6.36	5982.	3977.	359.29	141.06	1911.13	102.45	38.82

EM-09-27-78AL - 9:10A
DC D/H, AL - 9:10A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
94.48	119.52	0.04	80.4	64.0	112.5	80.0	120.0	79.5	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	75.99	78.68	77.33	2.70	17.15	42.19	2.35	4.94	3156.	3079.	183.99	74.79	1567.15	77.09	39.93
TUBE 2	75.48	79.11	77.29	3.63	17.19	42.23	3.03	6.36	5468.	3636.	318.09	129.49	1916.80	93.32	38.96

EM-09-27-78AL - 9:23A
DC D/H, AL - 9:23A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
93.78	119.60	-0.08	80.5	61.0	112.5	80.0	120.0	80.0	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	76.14	78.73	77.43	2.59	16.34	42.16	2.37	4.99	3056.	2982.	187.01	72.49	1579.46	74.56	40.06
TUBE 2	75.69	79.33	77.51	3.64	16.27	42.09	3.03	6.36	5482.	3645.	336.98	130.25	1919.39	93.90	38.82

EM-09-27-78AL - 9:40A
DC D/H, AL - 9:40A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
93.26	119.98	0.05	81.0	65.0	114.0	80.8	120.0	80.0	102.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	76.36	78.86	77.61	2.50	15.64	42.37	2.36	4.97	2945.	2873.	188.22	69.50	1576.67	71.33	40.28
TUBE 2	75.85	79.28	77.56	3.44	15.69	42.42	3.03	6.36	5176.	3441.	329.81	122.02	1920.01	87.50	39.33

Table A.4 (continued)

EM-09-27-78AL -10:10A VAPOR TEMP 92.30 SAT. TEMP 121.11 T1AVG-T2AVG -0.15 PMEAS PSIG 82.5 HEATER VOLTS 66.0 COND TEMP 113.5 DSS: PVAP 82.0 TVAP 148.0 PWELL 82.0 TWELL 103.0
DC AL -10:10A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	76.89	79.68	78.29	2.79	14.02	42.82	2.37	4.99	3297.	3216.	235.23	76.99	1587.77	79.43	40.49
TUBE 2	76.36	80.50	78.43	4.14	13.87	42.67	3.02	6.35	6222.	4137.	448.64	145.80	1927.55	106.14	38.98

EM-09-27-78AL -10:25A VAPOR TEMP 91.45 SAT. TEMP 121.33 T1AVG-T2AVG -0.08 PMEAS PSIG 82.8 HEATER VOLTS 74.0 COND TEMP 113.0 DSS: PVAP 82.0 TVAP 149.0 PWELL 82.0 TWELL 102.0
DC AL -10:25A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.16	80.31	78.74	3.15	12.71	42.59	2.37	4.99	3726.	3635.	293.12	87.47	1592.18	90.94	39.97
TUBE 2	76.53	81.10	78.82	4.58	12.63	42.52	3.03	6.36	6895.	4585.	545.87	162.18	1934.86	119.28	38.43

EM-09-27-78AL -11:05A VAPOR TEMP 130.85 SAT. TEMP 126.87 T1AVG-T2AVG -0.07 PMEAS PSIG 90.5 HEATER VOLTS 81.0 COND TEMP 118.0 DSS: PVAP 90.5 TVAP 156.0 PWELL 90.0 TWELL 108.0
DC AL -11:05A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.77	81.77	79.77	4.00	51.08	47.11	2.37	4.99	4727.	4612.	92.54	100.35	1602.23	105.29	43.80
TUBE 2	77.05	82.63	79.84	5.59	51.01	47.04	3.03	6.36	8419.	5598.	165.05	179.00	1946.99	133.02	42.08

EM-09-27-78AL -11:15A VAPOR TEMP 130.65 SAT. TEMP 126.87 T1AVG-T2AVG 0.01 PMEAS PSIG 90.5 HEATER VOLTS 84.0 COND TEMP 117.8 DSS: PVAP 90.5 TVAP 152.0 PWELL 90.0 TWELL 108.5
DC AL -11:15A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	78.01	81.93	79.97	3.93	50.68	46.90	2.37	4.99	4642.	4529.	91.60	98.97	1604.20	103.73	43.66
TUBE 2	77.20	82.72	79.96	5.51	50.69	46.92	3.03	6.36	8303.	5521.	163.80	176.99	1948.41	131.34	42.03

EM-09-27-78AL -11:25A VAPOR TEMP 129.82 SAT. TEMP 126.87 T1AVG-T2AVG -0.13 PMEAS PSIG 90.5 HEATER VOLTS 83.0 COND TEMP 117.5 DSS: PVAP 90.5 TVAP 150.0 PWELL 90.0 TWELL 108.5
DC AL -11:25A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	77.68	81.61	79.65	3.93	50.18	47.23	2.37	4.99	4645.	4532.	92.58	98.36	1601.05	103.05	43.98
TUBE 2	76.97	82.58	79.78	5.61	50.05	47.10	3.03	6.36	8451.	5619.	168.86	179.43	1946.23	133.39	42.13

EM-09-27-78AL -11:35A VAPOR TEMP 113.33 SAT. TEMP 126.87 T1AVG-T2AVG 0.09 PMEAS PSIG 90.5 HEATER VOLTS 90.0 COND TEMP 117.5 DSS: PVAP 91.0 TVAP 148.0 PWELL 90.5 TWELL 109.0
DC AL -11:35A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	78.02	81.85	79.93	3.84	33.40	46.94	2.36	4.97	4516.	4406.	135.23	96.21	1599.25	100.65	43.78
TUBE 2	77.14	82.54	79.84	5.40	33.49	47.04	3.03	6.36	8138.	5411.	243.01	173.03	1946.99	128.08	42.25

Table A.4 (continued)

			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS			
EM-09-27-78AL	-12:10P		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL
DC	AL	-12:10P	131.29	130.60	0.01	96.0	88.0	121.3	95.8	151.0	95.0	112.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	78.45	82.93	80.69	4.49	50.60	49.91	2.36	4.96	5270.	5142.	104.16	105.60	1592.81	111.30	46.20
TUBE 2	77.63	83.74	80.69	6.10	50.60	49.91	3.03	6.36	9192.	6112.	181.65	184.17	1942.99	137.37	44.49

			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS			
EM-09-27-78AL	-12:30P		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL
DC	AL	-12:30P	133.86	131.27	-0.06	97.0	88.0	122.0	96.8	153.0	96.0	113.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.19	83.33	81.26	4.14	52.59	50.00	2.37	4.99	4839.	4769.	92.95	97.76	1604.88	102.37	46.59
TUBE 2	78.42	84.22	81.32	5.81	52.54	49.95	3.03	6.36	8748.	5817.	166.52	175.15	1950.00	129.81	44.81

			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS			
EM-09-27-78AL	-12:45P		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL
DC	AL	-12:45P	130.61	130.93	-0.08	96.5	88.0	120.5	95.8	158.0	95.5	112.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.35	83.29	81.32	3.94	49.29	49.61	2.37	4.99	4650.	4537.	94.34	93.74	1605.40	97.35	46.36
TUBE 2	78.57	84.22	81.40	5.65	49.21	49.53	3.03	6.36	8516.	5663.	173.05	171.93	1950.85	127.15	44.53

			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS			
EM-09-27-78AL	- 1:00P		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL
DC	AL	- 1:00P	138.78	131.59	-0.01	97.5	92.0	123.0	97.0	166.0	96.5	112.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.84	84.01	81.93	4.17	56.85	49.66	2.37	4.99	4932.	4811.	86.75	99.31	1610.93	104.08	46.23
TUBE 2	78.99	84.88	81.94	5.90	56.84	49.65	3.03	6.36	8884.	5907.	156.29	178.93	1956.81	132.88	44.45

			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS			
EM-09-27-78AL	- 1:30P		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL
DC	AL	- 1:30P	138.78	135.46	0.09	103.5	92.0	126.5	103.0	164.5	104.0	116.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.31	85.14	82.73	4.83	56.05	52.74	2.37	4.99	5708.	5569.	101.85	108.24	1618.22	114.16	48.78
TUBE 2	79.42	85.86	82.64	6.44	56.14	52.83	3.03	6.36	9705.	6453.	172.88	183.71	1964.57	136.80	47.17

			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS			
EM-09-27-78AL	- 1:45P		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL
DC	AL	- 1:45P	136.70	135.15	0.05	103.0	89.0	126.5	102.5	158.0	102.5	116.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.19	84.90	82.54	4.71	54.16	52.60	2.37	4.99	5559.	5424.	102.65	105.68	1616.55	111.26	48.75
TUBE 2	79.34	85.64	82.49	6.30	54.21	52.66	3.03	6.36	9496.	6314.	175.17	180.34	1962.94	134.01	47.12

Table A.4 (continued)

	VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-27-78AL - 2:00P DC AL - 2:00P	138.07	135.66	0.04	103.8	87.0	127.0	103.0	162.5	103.0	116.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.96	84.85	82.41	4.89	55.67	53.26	2.33	4.90	5678.	5540.	102.00	106.61	1592.10	112.45	49.26
TUBE 2	79.12	85.61	82.37	6.49	55.71	53.30	3.03	6.37	9796.	6513.	175.85	183.80	1964.39	136.88	47.59

	VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-27-78AL - 2:15P DC AL - 2:15P	141.29	140.91	0.00	112.0	88.0	131.0	111.8	168.0	111.5	121.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.32	84.77	82.05	5.45	59.24	58.86	2.31	4.85	6270.	6118.	105.85	106.53	1577.30	112.45	54.40
TUBE 2	78.49	85.60	82.05	7.11	59.24	58.86	3.03	6.36	10706.	7118.	180.71	191.88	1958.03	135.33	52.60

	VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-27-78AL - 2:25P DC AL - 2:25P	143.00	140.26	-0.07	111.0	88.0	130.5	111.0	169.5	110.5	120.5

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.54	84.92	82.23	5.38	60.78	58.03	2.38	5.01	6380.	6224.	104.97	109.93	1618.31	116.09	53.61
TUBE 2	78.77	85.83	82.30	7.06	60.70	57.96	3.00	6.30	10538.	7007.	173.60	181.82	1946.85	135.37	51.76

	VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-27-78AL - 2:35P DC AL - 2:35P	141.34	139.95	0.01	110.5	88.0	130.0	110.0	167.0	110.2	120.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.87	85.18	82.52	5.31	58.82	57.42	2.37	4.99	6272.	6119.	106.64	109.23	1616.36	115.30	53.07
TUBE 2	79.05	85.99	82.52	6.95	58.82	57.43	3.03	6.36	10463.	6957.	177.88	182.19	1963.24	135.55	51.32

	VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-27-78AL - 2:45P DC AL - 2:45P	141.94	140.26	-0.04	111.0	88.0	130.0	110.0	168.0	110.5	120.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.75	85.09	82.42	5.34	59.52	57.84	2.37	4.99	6308.	6154.	105.97	109.05	1615.41	115.10	53.47
TUBE 2	78.96	85.96	82.46	7.00	59.48	57.80	3.03	6.36	10552.	7016.	177.40	182.55	1962.60	135.85	51.64

	VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-27-78AL - 2:55P DC C/V,AL - 2:55P	143.89	138.85	-0.15	108.8	88.0	129.0	108.5	169.5	109.0	119.5

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	79.58	85.22	82.40	5.64	61.49	56.45	2.36	4.97	6643.	6481.	108.05	117.69	1610.61	125.06	51.83
TUBE 2	78.78	86.33	82.55	7.54	61.33	56.30	3.03	6.36	11366.	7557.	185.32	201.89	1963.64	152.15	49.67

Table A.4 (continued)

EM-09-27-78AL - 3:05P			VAPOR		SAT.	T1AVG-	PMEAS	HEATER	COND	DSS						
DC C/V,AL - 3:05P			TEMP		TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL			
			145.97		139.63	-0.15	110.0	92.0	130.0	109.8	170.0	109.5	120.0			
	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV- TAVG	TS- TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP	
TUBE 1	79.79	85.53	82.66	5.74	63.31	56.97	2.36	4.97	6756.	6591.	106.71	118.59	1612.95	126.09	52.27	
TUBE 2	78.89	86.73	82.81	7.84	63.16	56.82	3.03	6.36	11805.	7849.	186.91	207.78	1966.43	157.17	49.94	
EM-09-27-78AL - 3:15P			VAPOR		SAT.	T1AVG-	PMEAS	HEATER	COND	DSS						
DC C/V,AL - 3:15P			TEMP		TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL			
			143.00		138.98	-0.09	109.0	99.0	129.5	108.0	165.0	108.0	120.5			
	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV- TAVG	TS- TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP	
TUBE 1	79.86	85.52	82.69	5.66	60.32	56.29	2.37	4.99	6685.	6522.	110.83	118.76	1617.85	126.25	51.66	
TUBE 2	78.91	86.64	82.77	7.73	60.23	56.20	3.03	6.36	11641.	7740.	193.27	207.13	1966.05	156.61	49.42	

Table A.4 (continued)

EM-09-28-78AF3- 9:05A VAPOR TEMP 120.31 SAT. TEMP 119.22 T1AVG-T2AVG -0.01 PMEAS PSIG 80.0 HEATER VOLTS 69.0 COND TEMP 115.0 DSS: PVAP 79.8, TVAP 146.0, PWELL 79.5, TWELL 105.0
DC- AF3- 9:05A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.29	83.57	81.93	3.27	38.38	37.29	2.37	4.99	3869.	3775.	100.79	103.74	1610.96	109.09	34.60
TUBE 2	79.78	84.10	81.94	4.31	38.37	37.28	3.03	5.00	6499.	6261.	169.35	174.31	1542.67	191.94	32.62

EM-09-28-78AF3- 9:20A VAPOR TEMP 120.60 SAT. TEMP 120.36 T1AVG-T2AVG 0.02 PMEAS PSIG 81.5 HEATER VOLTS 69.0 COND TEMP 114.8 DSS: PVAP 82.0, TVAP 146.0, PWELL 81.2, TWELL 106.0
DC- AF3- 9:20A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.75	84.12	82.44	3.37	38.16	37.92	2.33	4.90	3911.	3816.	102.49	103.14	1592.38	108.50	35.17
TUBE 2	80.25	84.57	82.41	4.32	38.19	37.95	3.03	5.00	6507.	6269.	170.40	171.48	1546.79	188.32	33.29

EM-09-28-78AF3- 9:35A VAPOR TEMP 121.87 SAT. TEMP 121.11 T1AVG-T2AVG -0.01 PMEAS PSIG 82.5 HEATER VOLTS 67.0 COND TEMP 115.5 DSS: PVAP 81.5, TVAP 148.0, PWELL 82.5, TWELL 107.0
DC- AF3- 9:35A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	81.36	84.73	83.04	3.37	38.82	38.06	2.37	4.99	3992.	3885.	102.56	104.61	1621.10	110.02	35.31
TUBE 2	80.86	85.24	83.05	4.38	38.82	38.06	3.03	5.00	6595.	6353.	169.89	173.29	1552.33	190.49	33.35

EM-09-28-78AF3- 9:50A VAPOR TEMP 123.27 SAT. TEMP 122.22 T1AVG-T2AVG -0.02 PMEAS PSIG 84.0 HEATER VOLTS 67.0 COND TEMP 117.0 DSS: PVAP 83.6, TVAP 150.0, PWELL 83.5, TWELL 107.0
DC- AF3- 9:50A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	81.87	85.23	83.55	3.36	39.72	38.67	2.37	4.99	3971.	3874.	99.97	102.68	1625.71	107.91	35.93
TUBE 2	81.40	85.74	83.57	4.35	39.70	38.65	3.03	5.00	6549.	6309.	164.95	169.42	1556.84	185.58	34.00

EM-09-28-78AF3-10:05A VAPOR TEMP 129.01 SAT. TEMP 130.93 T1AVG-T2AVG -0.08 PMEAS PSIG 96.5 HEATER VOLTS 67.0 COND TEMP 126.0 DSS: PVAP 96.0, TVAP 156.0, PWELL 96.4, TWELL 117.0
DC- AF3-10:05A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	82.29	86.28	84.28	4.00	44.72	46.64	2.37	4.99	4723.	4607.	105.59	101.24	1632.34	106.16	43.40
TUBE 2	81.81	86.92	84.37	5.11	44.68	46.56	3.03	5.00	7693.	7411.	172.31	165.21	1563.73	180.24	41.12

EM-09-28-78AF3-10:20A VAPOR TEMP 133.81 SAT. TEMP 130.60 T1AVG-T2AVG -0.04 PMEAS PSIG 96.0 HEATER VOLTS 70.0 COND TEMP 125.0 DSS: PVAP 95.0, TVAP 164.0, PWELL 95.5, TWELL 116.5
DC- AF3-10:20A

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	82.88	86.82	84.85	3.94	48.97	45.75	2.37	4.99	4658.	4545.	95.13	101.82	1637.43	106.78	42.56
TUBE 2	82.35	87.43	84.89	5.08	48.92	45.71	3.03	5.00	7652.	7372.	156.40	167.40	1568.27	182.89	40.31

Table A.4 (continued)

EM-09-28-78AF3-10:35A			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS							
DC-	AF3-10:35A		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL				
			134.63	131.65	0.02	97.6	73.0	126.0	97.0	164.0	97.0	117.0				
	INLET	OUTLET	AVG	TEMP	TV-	TS-	H2O	WVEL	HEAT	HEAT	UA	UA	COEFF	HT.SAT	DELTA	
	TEMP	TEMP	TEMP	RISE	TAVG	TAVG	FLOW	FT/S	LOAD	FLUX	CALC	SAT	H2O	COMP	TCOMP	
TUBE 1	83.12	87.31	85.22	4.19	49.41	46.43	2.37	4.99	4949.	4828.	100.16	106.58	1640.79	112.15	43.05	
TUBE 2	82.54	87.85	85.20	5.31	49.43	46.46	3.03	5.00	8003.	7710.	161.91	172.28	1570.93	188.90	40.82	
EM-09-28-78AF3-10:50A			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS							
DC-	AF3-10:50A		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL				
			133.90	132.24	0.04	98.5	71.0	126.0	97.8	155.0	98.0	118.0				
	INLET	OUTLET	AVG	TEMP	TV-	TS-	H2O	WVEL	HEAT	HEAT	UA	UA	COEFF	HT.SAT	DELTA	
	TEMP	TEMP	TEMP	RISE	TAVG	TAVG	FLOW	FT/S	LOAD	FLUX	CALC	SAT	H2O	COMP	TCOMP	
TUBE 1	82.89	87.17	85.03	4.28	48.87	47.21	2.37	4.99	5062.	4939.	103.59	107.22	1639.07	112.88	43.75	
TUBE 2	82.33	87.65	84.99	5.33	48.91	47.25	3.03	5.00	8025.	7731.	164.09	169.84	1569.15	185.90	41.59	
EM-09-28-78AF3-11:05A			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS							
DC-	AF3-11:05A		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL				
			137.43	135.46	0.02	103.5	68.0	128.5	103.0	166.0	104.0	119.5				
	INLET	OUTLET	AVG	TEMP	TV-	TS-	H2O	WVEL	HEAT	HEAT	UA	UA	COEFF	HT.SAT	DELTA	
	TEMP	TEMP	TEMP	RISE	TAVG	TAVG	FLOW	FT/S	LOAD	FLUX	CALC	SAT	H2O	COMP	TCOMP	
TUBE 1	82.47	86.90	84.68	4.43	52.74	50.78	2.37	4.99	5238.	5110.	99.30	103.14	1635.95	108.28	47.19	
TUBE 2	81.94	87.40	84.67	5.46	52.76	50.80	3.03	5.00	8226.	7925.	155.91	161.93	1566.36	176.17	44.98	
EM-09-28-78AF3-11:15A			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS							
DC-	AF3-11:15A		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL				
			138.73	136.74	-0.04	105.5	68.0	129.3	105.0	166.0	105.3	120.0				
	INLET	OUTLET	AVG	TEMP	TV-	TS-	H2O	WVEL	HEAT	HEAT	UA	UA	COEFF	HT.SAT	DELTA	
	TEMP	TEMP	TEMP	RISE	TAVG	TAVG	FLOW	FT/S	LOAD	FLUX	CALC	SAT	H2O	COMP	TCOMP	
TUBE 1	81.97	86.53	84.25	4.56	54.48	52.49	2.37	4.99	5385.	5254.	98.85	102.59	1632.00	107.68	48.80	
TUBE 2	81.45	87.13	84.29	5.68	54.44	52.45	3.03	5.00	8556.	8243.	157.16	163.12	1563.06	177.67	46.39	
EM-09-28-78AF3-11:30A			VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS							
DC-	AF3-11:30A		TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL				
			140.55	139.63	0.01	110.0	69.0	131.5	109.5	0.0	110.0	122.0				
	INLET	OUTLET	AVG	TEMP	TV-	TS-	H2O	WVEL	HEAT	HEAT	UA	UA	COEFF	HT.SAT	DELTA	
	TEMP	TEMP	TEMP	RISE	TAVG	TAVG	FLOW	FT/S	LOAD	FLUX	CALC	SAT	H2O	COMP	TCOMP	
TUBE 1	81.62	86.62	84.12	5.00	56.43	55.50	2.37	4.99	5906.	5762.	104.66	106.40	1630.85	112.00	51.44	
TUBE 2	81.09	87.13	84.11	6.04	56.44	55.52	3.03	5.00	9100.	8767.	161.23	163.92	1561.50	178.69	49.07	

Table A.4 (continued)

EM-09-28-78AP - 1:10P VAPOR TEMP 134.28 SAT. TEMP 124.04 T1AVG-T2AVG 0.23 PMEAS PSIG 86.5 HEATER VOLTS 0.0 COND TEMP 117.0 DSS: PVAP 86.0 TVAP 162.0 PWELL 86.0 TWELL 109.0
DC AP - 1:10P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.05	83.98	82.01	3.93	52.27	42.03	2.37	4.99	4643.	4530.	88.83	110.48	1611.74	116.75	38.80
TUBE 2	79.96	83.61	81.79	3.65	52.49	42.25	3.03	5.00	5498.	5296.	104.73	130.11	1541.34	138.27	38.30

EM-09-28-78AP - 1:25P VAPOR TEMP 135.24 SAT. TEMP 124.04 T1AVG-T2AVG 0.19 PMEAS PSIG 86.5 HEATER VOLTS 0.0 COND TEMP 116.5 DSS: PVAP 86.0 TVAP 165.0 PWELL 85.5 TWELL 119.0
DC AP - 1:25P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.31	84.22	82.27	3.91	52.97	41.78	2.37	4.99	4619.	4506.	87.20	110.56	1614.03	116.83	38.57
TUBE 2	80.23	83.92	82.08	3.68	53.16	41.97	3.03	5.00	5549.	5345.	104.37	132.21	1543.84	140.72	37.99

EM-09-28-78AP - 1:40P VAPOR TEMP 136.70 SAT. TEMP 123.68 T1AVG-T2AVG 0.19 PMEAS PSIG 86.0 HEATER VOLTS 0.0 COND TEMP 116.0 DSS: PVAP 85.8 TVAP 166.0 PWELL 85.5 TWELL 110.0
DC AP - 1:40P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.12	84.03	82.08	3.91	54.62	41.60	2.37	4.99	4624.	4512.	84.66	111.15	1612.31	117.53	38.39
TUBE 2	80.02	83.75	81.89	3.73	54.81	41.79	3.03	5.00	5615.	5409.	102.43	134.34	1542.20	143.24	37.76

EM-09-28-78AP - 1:55P VAPOR TEMP 137.89 SAT. TEMP 123.68 T1AVG-T2AVG 0.14 PMEAS PSIG 86.0 HEATER VOLTS 0.0 COND TEMP 115.5 DSS: PVAP 86.0 TVAP 167.5 PWELL 85.5 TWELL 110.0
DC AP - 1:55P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.17	84.14	82.16	3.97	55.73	41.52	2.37	4.99	4694.	4580.	84.23	113.06	1613.04	119.71	38.26
TUBE 2	80.10	83.93	82.02	3.83	55.87	41.66	3.03	5.00	5766.	5555.	103.19	138.39	1543.33	148.02	37.51

EM-09-28-78AP - 2:15P VAPOR TEMP 140.21 SAT. TEMP 130.33 T1AVG-T2AVG 0.14 PMEAS PSIG 95.6 HEATER VOLTS 0.0 COND TEMP 122.4 DSS: PVAP 95.5 TVAP 169.0 PWELL 95.0 TWELL 115.5
DC AP - 2:15P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.15	84.74	82.45	4.59	57.76	47.88	2.37	4.99	5423.	5291.	93.88	113.25	1615.66	119.92	44.12
TUBE 2	80.09	84.52	82.30	4.42	57.91	48.02	3.03	5.00	6663.	6419.	115.07	138.75	1545.84	148.42	43.25

EM-09-28-78AP - 2:25P VAPOR TEMP 142.49 SAT. TEMP 130.60 T1AVG-T2AVG 0.17 PMEAS PSIG 96.0 HEATER VOLTS 0.0 COND TEMP 122.5 DSS: PVAP 95.8 TVAP 169.5 PWELL 95.5 TWELL 116.0
DC AP - 2:25P

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.27	84.92	82.60	4.65	59.90	48.00	2.37	4.99	5491.	5357.	91.67	114.39	1617.02	121.21	44.20
TUBE 2	80.18	84.67	82.43	4.49	60.07	48.17	3.03	5.00	6762.	6514.	112.58	140.38	1546.91	150.35	43.33

Table A.4 (continued)

EM-09-28-78AF - 2:35P
DC AF - 2:35P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
142.54	130.93	0.14	96.5	0.0	122.8	96.2	171.0	96.0	116.5

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.09	84.72	82.40	4.63	60.14	48.53	2.37	4.99	5469.	5335.	90.93	112.69	1615.28	119.27	44.73
TUBE 2	80.03	84.50	82.27	4.47	60.28	48.66	3.03	5.00	6733.	6486.	111.70	138.36	1545.52	147.96	43.84

EM-09-28-78AF - 2:45P
DC AF - 2:45P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
144.10	131.59	0.10	97.5	0.0	123.5	97.0	174.0	96.5	117.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.31	85.03	82.67	4.72	61.42	48.91	2.37	4.99	5576.	5440.	90.78	114.00	1617.71	120.76	45.05
TUBE 2	80.29	84.84	82.57	4.55	61.53	49.02	3.03	5.00	6850.	6599.	111.33	139.75	1548.13	149.58	44.12

EM-09-28-78AF - 3:00P
DC AF - 3:00P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
148.37	137.20	0.23	106.2	0.0	128.5	106.0	176.0	106.0	123.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.24	85.57	82.91	5.33	65.47	54.29	2.37	4.99	6300.	6146.	96.23	116.04	1619.85	123.09	49.93
TUBE 2	80.18	85.17	82.68	4.98	65.70	54.52	3.03	5.00	7509.	7235.	114.30	137.73	1549.07	147.18	49.16

EM-09-28-78AF - 3:10P
DC AF - 3:10P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
147.75	137.38	0.26	106.5	0.0	128.8	106.0	174.0	106.4	123.5

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.64	85.97	83.31	5.33	64.44	54.07	2.37	4.99	6302.	6149.	97.80	116.56	1623.46	123.67	49.72
TUBE 2	80.59	85.50	83.04	4.91	64.70	54.33	3.03	5.00	7399.	7128.	114.35	136.18	1552.26	145.31	49.05

EM-09-28-78AF - 3:20P
DC AF - 3:20P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
148.20	137.59	0.22	106.8	0.0	128.5	106.0	174.0	106.5	124.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.43	85.79	83.11	5.35	65.09	54.47	2.37	4.99	6326.	6172.	97.19	116.13	1621.70	123.19	50.10
TUBE 2	80.40	85.38	82.89	4.99	65.31	54.70	3.03	5.00	7514.	7239.	115.05	137.38	1550.93	146.74	49.33

EM-09-28-78AF - 3:30P
DC AF - 3:30P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
148.72	137.38	0.24	106.5	0.0	128.5	106.0	174.0	106.2	124.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.50	85.81	83.15	5.32	65.56	54.22	2.37	4.99	6282.	6128.	95.81	115.85	1622.08	122.86	49.80
TUBE 2	80.44	85.38	82.91	4.95	65.81	54.47	3.03	5.00	7454.	7181.	113.27	136.85	1551.10	146.12	49.14

Table A.4 (continued)

EM-09-28-78AP - 3:45P	VAPOR	SAT.	T1AVG-	PMEAS	HEATER	COND	DSS			
DC C/V,AP - 3:45P	TEMP	TEMP	T2AVG	PSIG	VOLTS	TEMP	PVAP	TVAP	PWELL	TWELL
	150.72	136.42	0.21	105.0	0.0	128.0	105.0	174.0	104.8	123.5

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	80.32	85.84	83.08	5.51	67.64	53.34	2.37	4.99	6513.	6354.	96.28	122.10	1621.40	130.10	48.84
TUBE 2	80.27	85.46	82.86	5.18	67.85	53.55	3.03	5.00	7805.	7520.	115.03	145.75	1550.71	156.72	47.98

Table A.5. The ORNL two-tube condenser performance data for Group V tests (surface evaporator mode)

EM-03-25-79F3F3-1007A / HP-DW1/CW2-F3F3-1007A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
96.80	97.29	-0.28	54.5	160.0	97.0	54.0	126.0	53.0	87.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.05	65.75	63.40	4.70	33.41	33.89	3.03	2.21	7092.	6833.	212.30	209.26	591.23	331.50	20.61
TUBE 2	61.25	66.10	63.68	4.86	33.13	33.61	3.03	2.21	7314.	7046.	220.79	217.60	591.45	353.71	19.92

EM-03-25-79F3F3-1020A / HP-DW1/CW2-F3F3-1020A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
98.63	97.29	-0.02	54.5	170.0	96.5	54.0	126.0	53.0	91.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.53	66.21	63.87	4.68	34.75	33.42	3.03	2.21	7065.	6806.	203.30	211.42	593.16	336.46	20.23
TUBE 2	61.46	66.33	63.89	4.87	34.73	33.40	3.03	2.21	7340.	7071.	211.32	219.77	592.31	359.34	19.68

EM-03-25-79F3F3-1035A / HP-DW1/CW2-F3F3-1035A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
100.57	98.25	-0.04	55.5	170.0	97.0	55.0	130.0	54.5	88.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	61.79	66.53	64.16	4.74	36.41	34.09	3.03	2.21	7147.	6886.	196.32	209.67	594.33	331.45	20.77
TUBE 2	61.76	66.64	64.20	4.88	36.36	34.05	3.03	2.21	7351.	7082.	202.15	215.91	593.57	348.27	20.34

EM-03-25-79F3F3-1139A / HP-DW1/CW2-F3F3-1139A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
105.39	106.05	0.08	64.0	185.0	104.5	63.5	133.0	63.5	97.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.05	68.51	65.78	5.47	39.61	40.27	3.03	2.21	8251.	7949.	208.29	204.90	600.87	317.13	25.07
TUBE 2	62.93	68.48	65.70	5.55	39.69	40.34	3.03	2.21	8356.	8050.	210.53	207.10	599.63	323.06	24.92

EM-03-25-79F3F3-1155A / HP-DW1/CW2-F3F3-1155A

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
105.37	105.60	0.09	63.5	182.0	104.5	63.0	132.0	63.0	100.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.01	68.48	65.75	5.47	39.62	39.86	3.03	2.21	8256.	7953.	208.37	207.13	600.74	322.77	24.64
TUBE 2	62.86	68.45	65.66	5.58	39.71	39.95	3.03	2.21	8410.	8102.	211.77	210.52	599.44	331.84	24.42

EM-03-25-79F3F3-1210P / HP-DW1/CW2-F3F3-1210P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
105.64	107.36	0.11	65.5	180.0	105.0	65.0	132.0	64.5	98.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.05	68.50	65.78	5.45	39.87	41.58	3.03	2.21	8230.	7929.	206.44	197.92	600.86	300.13	26.42
TUBE 2	62.88	68.45	65.67	5.56	39.98	41.69	3.03	2.21	8381.	8075.	209.65	201.02	599.48	308.02	26.21

Table A.5 (continued)

EM-03-25-79F3F3-1245P
HP-DW1/CW2-F3F3-1245P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
113.25	113.67	-0.10	73.0	175.0	114.0	72.5	124.0	72.0	105.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.82	69.96	66.89	6.14	46.36	46.79	3.03	2.21	9265.	8926.	199.85	198.03	605.36	299.12	29.84
TUBE 2	63.87	70.10	66.99	6.23	46.26	46.69	3.03	2.21	9383.	9040.	202.82	200.97	604.81	306.31	29.51

EM-03-25-79F3F3- 100P
HP-DW1/CW2-F3F3- 100P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
112.49	114.08	-0.13	73.5	178.0	113.5	73.0	118.0	73.5	104.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.83	69.97	66.90	6.14	45.59	47.18	3.03	2.21	9269.	8929.	203.30	196.43	605.40	295.34	30.23
TUBE 2	63.92	70.14	67.03	6.21	45.46	47.05	3.03	2.21	9363.	9020.	205.95	198.99	605.06	301.47	29.92

EM-03-25-79F3F3- 115P
HP-DW1/CW2-F3F3- 115P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
111.69	113.52	-0.08	72.8	180.0	112.2	72.0	115.0	72.0	105.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.86	69.85	66.85	5.99	44.84	46.66	3.03	2.21	9041.	8710.	201.63	193.75	605.21	289.15	30.12
TUBE 2	63.84	70.02	66.93	6.18	44.76	46.58	3.03	2.21	9305.	8964.	207.88	199.75	604.66	303.43	29.54

EM-03-25-79F3F3- 145P
HP-DW1/CW2-F3F3- 145P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
124.76	126.87	-0.16	90.5	180.0	125.0	90.0	122.0	89.5	115.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.35	70.68	67.01	7.33	57.74	59.86	3.03	2.21	11062.	10657.	191.57	184.79	605.86	268.79	39.65
TUBE 2	63.56	70.79	67.17	7.23	57.58	59.70	3.03	2.21	10887.	10489.	189.07	182.36	605.57	263.55	39.80

EM-03-25-79F3F3- 203P
HP-DW1/CW2-F3F3- 203P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
124.69	126.87	0.16	90.5	185.0	124.0	90.0	127.0	90.0	118.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.36	70.80	67.08	7.43	57.61	59.80	3.03	2.21	11219.	10809.	194.76	187.63	606.15	275.02	39.30
TUBE 2	63.29	70.55	66.92	7.26	57.77	59.96	3.03	2.21	10933.	10533.	189.25	182.34	604.54	263.75	39.93

EM-03-25-79F3F3- 220P
HP-DW1/CW2-F3F3- 220P

VAPOR TEMP	SAT. TEMP	T1AVG-T2AVG	PMEAS PSIG	HEATER VOLTS	COND TEMP	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
124.20	126.52	0.01	90.0	181.0	124.0	89.0	127.0	89.0	115.0

	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	TV-TAVG	TS-TAVG	H2O FLOW	WVEL FT/S	HEAT LOAD	HEAT FLUX	UA CALC	UA SAT	COEFF H2O	HT.SAT COMP	DELTA TCOMP
TUBE 1	63.29	70.69	66.99	7.40	57.21	59.53	3.03	2.21	11164.	10755.	195.13	187.53	605.76	274.89	39.12
TUBE 2	63.38	70.58	66.98	7.20	57.22	59.54	3.03	2.21	10840.	10443.	189.45	182.07	604.76	263.10	39.69

Appendix B

ORNL 40-TUBE CONDENSER FIELD TEST DATA

B.1 Data Reduction Program

A computer program was developed for the ORNL 40-tube condenser to carry out complete data reduction and facilitate performance comparison for the test groups outlined in Table 2.2. A printout of the FORTRAN program and a description of symbols used in the algorithm is presented in this section.

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CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C                                                                      C
C                                                                      C
C                                                                      C
C                                                                      C
C   THIS PROGRAM WAS DESIGNED TO REDUCE ISOBUTANE (R-600A) CONDENSING DATA  C
C   OBTAINED FROM A 40 TUBE CONDENSER DESIGNED AT ORNL AND TESTED AT THE EAST  C
C   MESA GEOTHERMAL TEST FACILITY.  EXPLANATION OF VARIABLES ARE AS FOLLOWS,  C
C   WHERE "*" DENOTES EXPERIMENTAL MEASURED DATA:                      C
C                                                                      C
C                                                                      C
C                                                                      C
C     *C1------OHMS, SHELL THERMISTOR      KWALL--TUBE WALL THERMAL COND.       C
C     *C2------OHMS, SHELL THERMISTOR      AT-----OUTSIDE BUNDLE SURFACE AREA   C
C     *C3------OHMS, SHELL THERMISTOR      APERT--OUTSIDE AREA PER TUBE         C
C     *C4------OHMS, H2O IN THERMISTOR     HDIAM--HYDRAULIC DIAMETER            C
C     *C5------OHMS, H2O OUT THERMISTOR    AINSD--INSIDE BUNDLE SURFACE AREA    C
C     *TC1-----THERMOCOUPLE, SHELL         RI-----INSIDE TUBE RADIUS            C
C     *TC2-----THERMOCOUPLE, SHELL        *WLPRS--H2O LINE PRESSURE             C
C     *TC3-----THERMOCOUPLE, SHELL        *OREAD--ORIFICE, H2O READING          C
C     *TC4-----THERMOCOUPLE, H2O IN       *OINCH--ORIFICE, INCHES OF H2O        C
C     *TC5-----THERMOCOUPLE, H2O OUT       H2OFLT-TOTAL H2O FLOW, GPM           C
C     *TC6-----THERMOCOUPLE, CONDENSATE    H2OFPC-H2O FLOW PER PASS, GPM        C
C     *TC8-----THERMOCOUPLE, VAPOR IN      WVEL---H2O VELOCITY                  C
C     *TC9-----THERMOCOUPLE, SHELL         KH2O---H2O THERMAL CONDUCTIVITY      C
C      TM1-----SHELL TEMP. FROM C1         SVM1---H2O SPECIFIC VOLUME           C
C      TM2-----SHELL TEMP. FROM C2         RHOW---H2O DENSITY                   C
C      TM3-----SHELL TEMP. FROM C3         VIS1---H2O VISCOSITY                 C
C      TM4-----H2O IN TEMP. FROM C4        REH2O--H2O REYNOLDS NUMBER           C
C      TM5-----H2O OUT TEMP. FROM C5       PRH2O--H2O PRANDTL NUMBER            C
C     *PSAT----SHELL SATURATION PRESSURE   NU-----H2O NUSSELT NUMBER            C
C     *PVAP----DSS VAPOR INLET PRESSURE    QOVLL--HEAT LOAD, H2O                C
C     *PWELL---DSS HOTWELL PRESSURE        QFLX---HEAT FLUX, H2O                C
C     *TVAP----DSS VAPOR SUPPLY TEMP.      UAOVM1-OVERALL CONDUCTANCE FROM TM1  C
C     *TWELL---DSS HOTWELL TEMPERATURE     UAOVM2-OVERALL CONDUCTANCE FROM TM2  C
C      TSAT----SATURATION TEMP. FROM PSAT  UAOVM3-OVERALL CONDUCTANCE FROM TM3  C
C      TMAVG---H2O AVERAGE TEMPERATURE     UAOVC1-OVERALL CONDUCTANCE FROM TC1  C
C      DTTM----H2O TEMPERATURE RISE        UAOVC2-OVERALL CONDUCTANCE FROM TC2  C
C      TDVM1---TM1 MINUS TMAVG             UAOVC3-OVERALL CONDUCTANCE FROM TC3  C
C      TDVM2---TM2 MINUS TMAVG             USOVL1-OVERALL CONDUCTANCE FROM TSAT C
C      TDVM3---TM3 MINUS TMAVG             USINV--INVERSE OF USOVL1             C
C      TDVC1---TC1 MINUS TMAVG             HWNU---H2O HEAT TRANS. COEFF.        C
C      TDVC2---TC2 MINUS TMAVG             HINV1--H2O HEAT TRANS. RESISTANCE    C
C      TDVC3---TC3 MINUS TMAVG             HSAT1--COMPOSITE HEAT TRANS. COEFF.  C
C      TSVM1---TSAT MINUS TMAVG            TCOMP--COMPOSITE TEMP. DIFFERENCE    C
C                                                                      C
C                                                                      C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
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      DIMENSION TITL1(20), TITL2(20)
      REAL KH2O,NU,KWALL
    7 WRITE(6,330)
  330 FORMAT(1HI)
      G=1.0
   10 READ(5,1) TITL1,C1,C2,C3,C4,C5,TC1,TC2,TC3,TC4,TC5
    1 FORMAT(20A1,2X,F5.0,4F6.0,2X,F5.1,2F6.1,2F5.1)
      IF(C1.EQ.0.0) GO TO 1000
      READ(5,3) TITL2,TC6,TC8,OREAD,PH2O,PSHELL,PVAP,TVAP,PWELL,TWELL,TC
     *9
    3 FORMAT(20A1,2F7.1,2F5.1,6F6.1)
      PI=3.1415927
      HDIAM=0.0750
      AT=48.29
      APERT=AT/40.
      KWALL=99.
      RI=0.45
      AINSD=0.87*AT
      PSAT=PSHELL
      R=C1
      A=-4.228678565
      BB=3.892594094E3
      C=-1.414371847E7
      CALL TMCAL(A,BB,C,R,T)
      TM1=9./5.*T+32.
      R=C2
      IF(R.EQ.0.0) GO TO 73
      A=-4.257907109
      BB=3.903163398E3
      C=-1.432368658E7
      CALL TMCAL(A,BB,C,R,T)
      TM2=9./5.*T+32.
   73 R=C3
      A=-4.336734907
      BB=3.927372065E3
      C=-1.437921896E7
      CALL TMCAL(A,BB,C,R,T)
      TM3=9./5.*T+32.
      R=C4
      A=-4.162269080
      BB=3.940039585E3
      C=-1.415872490E7
      CALL TMCAL(A,BB,C,R,T)
      TM4=9./5.*T+32.
   74 R=C5
      A=-4.272363183
      BB=3.908235143E3
      C=-1.438534705E7
      CALL TMCAL(A,BB,C,R,T)
      TM5=9./5.*T+32.
      IF(C2.EQ.0.0) TM2=TC9
      P=PSAT+14.696
      P345=7.06398E-3*P**3-1.21908E-4*P**4+1.33627E-6*P**5
      P678=-8.92449E-9*P**6+3.30065E-11*P**7-5.16906E-14*P**8
      TSAT=-62.3124+7.7252*P-0.268216*P*P+P345+P678
      TMAVG=(TM4+TM5)/2.
      IF(TM4.EQ.0.0) TMAVG=0.0
      IF(TM5.EQ.0.0) TMAVG=0.0
      DTTM=TM5-TM4
      TDVM1=TM1-TMAVG
      TDVM2=TM2-TMAVG
      TDVM3=TM3-TMAVG
      TDVC1=TC1-TMAVG
      TDVC2=TC2-TMAVG
      TDVC3=TC3-TMAVG
      TSVM1=TSAT-TMAVG
      T=TMAVG
      SVM1=1.60582E-2-1.98599E-6*T+2.59921E-8*T**2-1.61308E-11*T**3
      RHOW=1.0/SVM1
      VIS1=8.0144599-1.6728317E-1*T+2.0423535E-3*T**2-1.6324668E-5*T**3+
     *8.8555744E-8*T**4-3.3015965E-10*T**5+8.4382483E-13*T**6-1.4493830E
     *-15*T**7+1.59638E-18*T**8-1.0173273E-21*T**9+2.8496174E-25*T**10
      IF(T-80.) 20,30,30
   30 IF(T-130.) 40,50,50
   20 KH2O=0.302+7.00E-4*T
      GO TO 60
   40 KH2O=0.315+4.86E-4*T
      GO TO 60
   50 KH2O=0.3426+2.66E-4*T
   60 CONTINUE
      PRH2O=VIS1/KH2O
      Z=OREAD
      OINCH=3.19669E-6+2.58384*Z-0.822366*Z*Z+7.01862E-2*Z**3-2.58727E-3
     **Z**4+5.05315E-5*Z**5-5.44754E-7*Z**6+3.06910E-9*Z**7-7.06658E-12*
     *Z**8
      IF(Z.EQ.0.0) OINCH=0.0
      H2OFLT=21.4646+1.43268*OINCH-1.13566E-2*OINCH**2+4.35967E-5*OINCH*
     **3
      IF(OINCH.EQ.0.0) H2OFLT=0.0
      H2OFPC=H2OFLT/10.
      QOVLL=497.866*H2OFLT*DTTM
      QFLX=QOVLL/AT
```

```
      UAOVM1=QOVLL/TDVM1
      UAOVM2=QOVLL/TDVM2
      UAOVM3=QOVLL/TDVM3
      UAOVC1=QOVLL/TDVC1
      UAOVC2=QOVLL/TDVC2
      UAOVC3=QOVLL/TDVC3
      USOVL1=QOVLL/TSVM1
      WVEL=(H2OFPC*0.3208752)/(PI*RI*RI)
      REH2O=(WVEL*HDIAM*RHOW*3600.)/VIS1
      NU=0.023*REH2O**0.8*PRH2O**0.40
      HWNU=(NU*KH2O)/HDIAM
      IF(USOVL1.NE.0.0) GO TO 2
      USINV=0.0
      HINV1=0.0
      HSAT=0.0
      GO TO 4
    2 USINV=1.0/USOVL1
      HINV1=1.0/(HWNU*AINSD)
      HSAT1=1.0/(USINV-HINV1)/AT
      TCOMP=QFLX/HSAT1
    4 WRITE(6,180)
  180 FORMAT(1H ,128('-'),/)
      WRITE(6,200) TITL1
  200 FORMAT(1H ,2X,20A1,4X,'PSHELL   SAT.     TVAP     COND    PH2O     WVE
     *L.     HEAT          ----------------DSS----------------')
      WRITE(6,220) TITL2
  220 FORMAT(1H ,2X,20A1,5X,'PSIG     TEMP     PIPE     TEMP    PSIG    FT/SE
     *C     LOAD          PVAP     TVAP     PWELL    TWELL')
      WRITE(6,230) PSHELL,TSAT,TC8,TC6,PH2O,WVEL,QOVLL,PVAP,TVAP,PWELL,T
     *WELL
  230 FORMAT(1H,26X,F5.1,3X,F6.2,2X,F5.1,3X,F5.1,3X,F4.1,4X,F4.2,3X,F8.0
     *,7X,F5.1,3F8.1,//)
      WRITE(6,240)
  240 FORMAT(1H ,2X,'GPM    INLET    OUTLET    AVG     TEMP     MEAS  SHELL
     *   TSHL-    TSAT-   OVERALL      SAT.     REYNOLDS      HT.COEFF.
     *HT.SAT.',/,3X,'H2O    TEMP     TEMP      TEMP    RISE     LOC.  TEMP
     *   TAVG     TAVG       UA         UA         H2O          H2O          C
     *OMPOSITE')
      WRITE(6,260) H2OFLT,TM4,TM5,TMAVG,DTTM,TM3,TDVM1,TSVM1,UAOVM1,USOV
     *L1,REH2O,HWNU,HSAT1
  260 FORMAT(1H ,1X,F5.1,2X,F5.2,2F8.2,2X,F5.2,6X,'1-',3F8.2,2F10.2,3X,F
     *8.2,6X,F7.2,7X,F7.2)
      IF(TM2.NE.TC9) GO TO 999
      WRITE(6,998) TC4,TC5,TM2,TDVM2,UAOVM2
  998 FORMAT(1H ,8X,F4.1,4X,F4.1,22X,'2-',2X,F5.1,4X,F4.1,11X,F7.1)
      GO TO 997
  999 WRITE(6,270) TC4,TC5,TM2,TDVM2,UAOVM2
  270 FORMAT(1H ,8X,F4.1,4X,F4.1,22X,'2-',2F8.2,10X,F8.2)
  997 CONTINUE
      WRITE(6,280) TM3,TDVM3,UAOVM3
  280 FORMAT(1H ,42X,'3-',2F8.2,10X,F8.2,29X,'HEAT',9X,'DELTA')
      WRITE(6,290) TC1,TDVC1,UAOVC1
  290 FORMAT(1H ,42X,'1-',2X,F5.1,4X,F4.1,11X,F7.1,30X,'FLUX',9X,'TCOMP'
     *)
      WRITE(6,300) TC2,TDVC2,UAOVC2,QFLX,TCOMP
  300 FORMAT(1H ,42X,'2-',2X,F5.1,4X,F4.1,11X,F7.1,30X,F5.0,8X,F5.2)
      WRITE(6,310) TC3,TDVC3,UAOVC3
  310 FORMAT(1H ,42X,'3-',2X,F5.1,4X,F4.1,11X,F7.1)
      G=G+1.0
      IF(G.EQ.5.0) GO TO 7
      GO TO 10
 1000 CONTINUE
 5000 WRITE(6,180)
      WRITE(6,490)
  490 FORMAT(1H1)
      STOP
      END
```

```
      SUBROUTINE TMCAL(A,BB,C,R,T)
      D=ALOG(R)-A
      BB=-BB/D
      D=-C/D
      T=273.15+20.
   65 TOLD=T
      T=T-(T**3+BB*T**2+D)/(3*T**2+2*BB*T)
      IF(ABS(T-TOLD).LE.1E-03) GO TO 29
      GO TO 65
   29 T=T-273.15
      RETURN
      END
```

B.2 Output Format

The key to terms and abbreviations found in the program output is presented in this section. A sample of data output from Group III-C tests is shown to illustrate the data format. The key may be used as a guide in identifying and interpreting the data listing presented in the next section for Groups III-A, III-C, and IV tests using the ORNL 40-tube condenser.

```
                              KEY TO DATA OUTPUT


                            TITLE DESIGNATIONS

EM--------EAST MESA                      HP----SURFACE EVAPORATOR
T40-------40 TUBE CONDENSER              DC----DIRECT CONTACT EVAPORATOR
XX-XX-XX--MONTH, DAY, YEAR               D/H---DESUPERHEAT ON
XXXA------TIME OF DAY, AM                VHO---VENT TO DSS HOTWELL OPEN
XXXP------TIME OF DAY, PM                C/V---CONTINUOUS VENTING

                            DEFINITION OF TERMS

          PSHELL-------------SHELL GAUGE PRESSURE
          SAT. TEMP----------SATURATION TEMP. FROM PSHELL
          TVAP PIPE----------VAPOR TEMP. INTO CONDENSER
          COND. TEMP---------CONDENSATE TEMPERATURE
          PH2O---------------H2O LINE PRESSURE
          WVEL---------------H2O VELOCITY
          HEAT LOAD----------H2O HEAT LOAD
          PVAP---------------DSS VAPOR SUPPLY PRESSURE
          TVAP---------------DSS VAPOR SUPPLY TEMPERATURE
          PWELL--------------DSS HOTWELL PRESSURE
          TWELL--------------DSS HOTWELL TEMPERATURE
          GPM H2O------------H2O FLOW RATE
          INLET TEMP---------H2O INLET TEMPERATURE
          OUTLET TEMP--------H2O OUTLET TEMPERATURE
          AVG TEMP-----------H2O AVERAGE TEMPERATURE
          TEMP RISE----------H2O TEMPERATURE RISE
          MEAS LOC.----------TEMPERATURE MEASURING STATION
          SHELL TEMP---------VAPOR TEMP. FROM THERMISTORS (HUNDREDTHS)
                              AND FROM THERMOCOUPLES (TENTHS)
          TSHL-TAVG----------MEASURED SHELL TEMP. MINUS AVG. H2O TEMP.
          TSAT-TAVG----------CALC. SATURATION TEMP. MINUS AVG. H2O TEMP.
          OVERALL UA---------OVERALL CONDUCTANCE CALCULATED FROM TSHELL
          SAT. UA------------OVERALL CONDUCTANCE CALCULATED FROM TSAT
          REYNOLDS H2O-------H2O REYNOLDS NUMBER
          HT.COEFF.H2O-------H2O HEAT TRANSFER COEFFICIENT (VIA NUSSELT)
          HT.SAT.COMPOSITE---VAPOR SIDE COEFF. PLUS TUBE WALL CONDUCTANCE
          HEAT FLUX----------H2O HEAT LOAD DIVIDED BY TOTAL AREA
          DELTA TCOMP--------DIFFERENCE BETWEEN SATURATION TEMPERATURE
                              AND INSIDE WALL TEMPERATURE
```

Sample of data output generated from Group III-C data:

EM-09-26-78T40- 415P DC-D/H-VHO- 415P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	77.6	117.35	134.5	103.0	43.0	4.55	119140.	78.0	135.0	77.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.58	75.23	73.90	2.65	1-	85.14	10.13	43.45	11757.20	2741.97	33970.67	958.97	60.93
	72.5	73.0			2-	122.02	48.12		2476.02				
					3-	85.14	11.24		10600.97				
					1-	88.8	14.9		7997.9			HEAT FLUX	DELTA TCOMP
					2-	124.0	50.1		2378.2			2467.	40.49
					3-	105.0	31.1		3831.3				

The location of temperature measuring probes referred to in the output format (hundredths for thermistors and tenths for thermocouples) is shown in Fig. B.1.

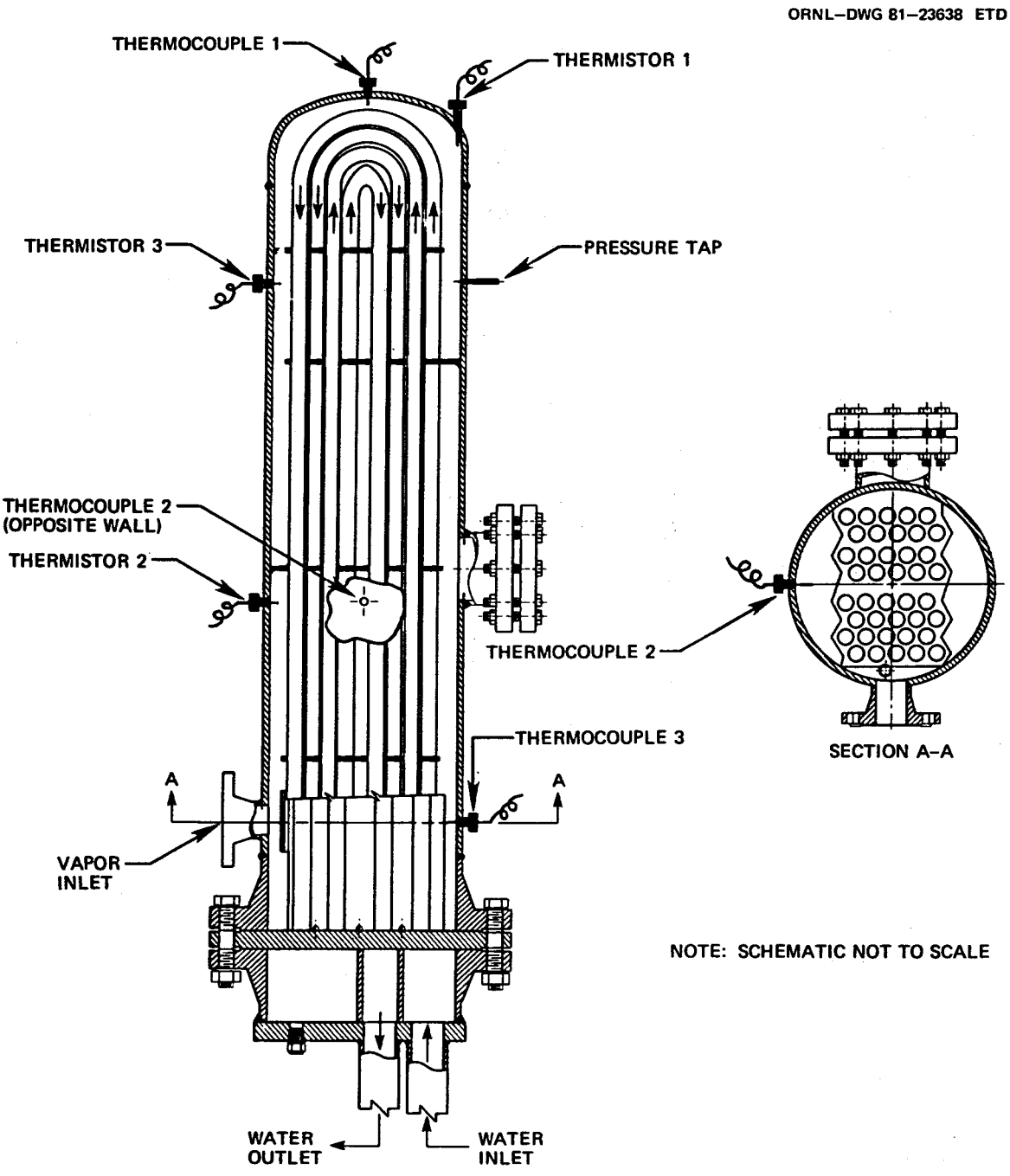

Fig. B.1. Schematic of shell temperature measuring locations on the ORNL 40-tube condenser.

B.3 Data Listing

Tables B.1 and B.2 present performance data obtained with the ORNL 40-tube condenser during Groups III-A and III-C tests, respectively. Tables B.3–B.5 list performance data obtained during Group IV tests. Most Group IV test data were taken with the 40-tube condenser operating in the direct-contact evaporator mode with the Barber-Nichols brine preflash unit (see Sect. 6.2.3). However, because of occasional preflash unit problems, some data were taken during operation with the DSS direct-contact evaporator alone. Table B.4 lists condenser data obtained during this period. Also during this group of tests, an attempt was made to operate the direct-contact unit using brine from the Mesa 8-1 well without the Barber-Nichols brine preflash unit. Condenser data using this well are presented in Table B.5.

Table B.1. The ORNL 40-tube condenser performance data for Group III-A tests (surface evaporator mode)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-08-78T40-	145P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	145P	49.6	92.43	0.0	81.0	44.0	4.55	67421.	51.0	156.0	51.0	86.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.43	75.93	75.18	1.50	1-	80.64	5.44	17.25	12389.53	3908.40	34535.96	966.73	89.55
	74.5	74.5			2-	107.92	32.74		2059.40				
					3-	80.64	5.46		12340.70			HEAT	DELTA
					1-	90.0	14.8		4549.2			FLUX	TCOMP
					2-	122.0	46.8		1440.0			1396.	15.59
					3-	84.0	8.8		7643.9				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-08-78T40-	200P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	200P	49.0	91.82	0.0	81.0	44.0	4.55	60655.	50.0	153.0	50.0	85.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.45	75.81	75.13	1.35	1-	81.21	5.66	16.69	10719.92	3635.13	34514.09	966.44	82.68
	74.5	74.5			2-	109.37	34.24		1771.51				
					3-	81.21	6.08		9981.86			HEAT	DELTA
					1-	88.0	12.9		4713.0			FLUX	TCOMP
					2-	122.0	46.9		1294.1			1256.	15.19
					3-	84.0	8.9		6838.5				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-08-78T40-	215P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H-	215P	49.1	91.92	0.0	83.0	44.0	4.55	55605.	51.0	115.0	50.0	86.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.53	75.77	75.15	1.24	1-	79.44	7.60	16.77	7318.91	3316.52	34523.80	966.57	74.79
	75.0	75.0			2-	105.58	30.43		1827.34				
					3-	79.44	4.29		12969.07			HEAT	DELTA
					1-	84.0	8.8		6284.7			FLUX	TCOMP
					2-	109.0	33.8		1642.8			1151.	15.40
					3-	86.0	10.8		5126.0				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-08-78T40-	225P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H-	225P	49.3	92.12	0.0	82.0	44.0	4.55	57045.	51.0	113.0	51.0	86.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.64	75.91	75.27	1.27	1-	79.60	8.60	16.85	6635.10	3385.19	34577.38	967.30	76.47
	74.5	74.5			2-	104.14	28.86		1976.42				
					3-	79.60	4.33		13182.59			HEAT	DELTA
					1-	84.0	8.7		6536.6			FLUX	TCOMP
					2-	106.0	30.7		1856.5			1181.	15.45
					3-	86.0	10.7		5317.9				

Table B.1 (continued)

Run		PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-08-78T40- HP-D/M-	330P 330P	58.3	100.89	0.0	93.0	44.0	4.55	140167.	59.0	157.0	59.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.64	77.76	76.20	3.12	1-	89.65	5.08	24.69	27584.40	5677.23	34989.92	972.93	136.53
	74.5	75.0			2-	116.72	40.52		3459.12				
					3-	89.65	13.45		10421.43			HEAT	DELTA
					1-	86.0	9.8		14301.1			FLUX	TCOMP
					2-	125.0	48.8		2872.2			2903.	21.26
					3-	96.0	19.8		7078.7				

Run		PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-08-78T40- HP-D/M-	340P 340P	58.6	101.17	0.0	94.0	44.0	4.55	145494.	59.0	153.0	59.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.51	77.75	76.13	3.24	1-	91.21	5.37	25.04	27071.04	5810.77	34958.06	972.50	140.28
	74.5	75.0			2-	116.19	40.06		3631.45				
					3-	91.21	15.08		9646.26			HEAT	DELTA
					1-	86.0	9.9		14737.5			FLUX	TCOMP
					2-	129.0	52.9		2751.8			3013.	21.48
					3-	96.0	19.9		7321.4				

Run		PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-08-78T40- HP-D/M-	405P 405P	63.0	105.16	0.0	98.0	47.0	4.55	217944.	65.0	163.0	64.0	102.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.30	79.15	76.73	4.86	1-	93.30	39.94	28.43	5457.28	7665.04	35225.85	976.13	195.22
	74.0	76.0			2-	112.32	35.59		6123.71				
					3-	93.30	16.57		13153.45			HEAT	DELTA
					1-	86.0	9.3		23502.7			FLUX	TCOMP
					2-	131.0	54.3		4015.7			4513.	23.12
					3-	102.0	25.3		8623.5				

Run		PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
EM-09-08-78T40- HP-D/M	415P 415P	62.4	104.63	0.0	96.0	48.0	4.55	222087.	65.0	161.0	63.0	102.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.26	79.20	76.73	4.95	1-	93.69	40.05	27.90	5545.08	7961.42	35227.15	976.15	204.58
	74.0	76.0			2-	112.00	35.27		6297.17				
					3-	93.69	16.96		13091.30			HEAT	DELTA
					1-	92.0	15.3		14543.9			FLUX	TCOMP
					2-	131.0	54.3		4092.2			4599.	22.48
					3-	102.0	25.3		8788.5				

Table B.1 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-12-78T40-	330P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	330P	61.8	104.09	0.0	94.0	48.0	4.55	210843.	66.0	145.0	0.0	102.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.50	75.20	72.85	4.70	1-	108.74	46.20	31.24	4563.80	6749.48	33505.89	952.54	168.13
	69.0	71.0			2-	104.94	32.10		6569.30				
					3-	108.74	35.90		5873.85			HEAT	DELTA
					1-	110.0	37.2		5675.2			FLUX	TCOMP
					2-	121.0	48.2		4378.7			4366.	25.97
					3-	100.0	27.2		7765.4				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-12-78T40-	340P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	340P	60.3	102.73	0.0	93.0	48.0	4.55	212796.	65.0	145.0	0.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.47	75.21	72.84	4.74	1-	107.79	44.72	29.89	4758.88	7119.05	33501.32	952.48	179.33
	69.0	71.0			2-	101.27	28.44		7483.31				
					3-	107.79	34.96		6087.57			HEAT	DELTA
					1-	115.0	42.2		5047.1			FLUX	TCOMP
					2-	120.0	47.2		4512.0			4407.	24.57
					3-	98.0	25.2		8457.0				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-12-78T40-	355P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	355P	58.8	101.35	0.0	90.0	48.0	4.55	210647.	60.0	136.0	0.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.28	74.97	72.63	4.69	1-	105.86	41.13	28.72	5121.38	7333.25	33408.83	951.20	185.99
	69.0	71.0			2-	105.49	32.86		6409.85				
					3-	105.86	33.23		6338.23			HEAT	DELTA
					1-	111.0	38.4		5489.5			FLUX	TCOMP
					2-	115.0	42.4		4971.3			4362.	23.45
					3-	97.0	24.4		8642.7				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-12-78T40-	405P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H-	405P	56.8	99.48	0.0	92.0	48.0	4.55	208812.	57.0	142.0	0.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.06	74.71	72.38	4.65	1-	107.01	43.06	27.10	4848.94	7704.50	33300.91	949.70	197.73
	69.0	71.0			2-	104.94	32.56		6412.71				
					3-	107.01	34.62		6030.75			HEAT	DELTA
					1-	113.0	40.6		5140.8			FLUX	TCOMP
					2-	118.0	45.6		4577.3			4324.	21.87
					3-	96.0	23.6		8841.0				

Table B.1 (continued)

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-12-78T40- 420P											
HP-D/H- 420P	57.8	100.42	0.0	93.0	48.0	4.55	218635.	58.0	146.0	0.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.79	74.66	72.23	4.87	1-	107.41	43.76	28.19	4995.83	7754.60	33233.79	948.76	199.37
	69.0	71.0			2-	105.79	33.56		6514.45				
					3-	107.41	35.18		6214.36			HEAT	DELTA
					1-	113.0	40.8		5362.4			FLUX	TCOMP
					2-	119.0	46.8		4674.5			4528.	22.71
					3-	98.0	25.8		8483.4				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-13-78T40- 850A											
HP- 850A	64.5	106.49	0.0	98.0	60.0	1.14	143673.	67.0	225.0	0.0	101.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
22.7	70.26	82.99	76.62	12.73	1-	107.94	68.87	29.86	2086.18	4811.31	8842.88	323.20	154.31
	68.0	74.0			2-	126.49	49.87		2881.02				
					3-	107.94	31.31		4588.10			HEAT	DELTA
					1-	147.0	70.4		2041.5			FLUX	TCOMP
					2-	160.0	83.4		1723.2			2975.	19.28
					3-	103.0	26.4		5447.1				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-13-78T40- 920A											
HP- 920A	61.5	103.82	0.0	99.0	63.0	1.14	141834.	64.0	220.0	0.0	102.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
22.7	70.76	83.33	77.04	12.57	1-	106.25	67.96	26.77	2086.88	5297.39	9890.25	324.05	179.57
	70.0	80.0			2-	126.09	49.05		2891.67				
					3-	106.25	29.21		4855.66			HEAT	DELTA
					1-	147.0	70.0		2027.5			FLUX	TCOMP
					2-	160.0	83.0		1709.8			2937.	16.36
					3-	103.0	26.0		5464.6				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-13-78T40-1050A											
HP- 1050A	53.9	96.71	0.0	91.0	51.0	4.55	262721.	58.0	190.0	0.0	90.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.14	76.99	74.07	5.85	1-	93.59	54.28	22.64	4840.12	11602.93	34042.64	959.96	337.32
	71.0	74.0			2-	107.80	33.73		7788.92				
					3-	93.59	19.52		13456.42			HEAT	DELTA
					1-	130.0	55.9		4697.0			FLUX	TCOMP
					2-	139.0	64.9		4046.0			5440.	16.13
					3-	95.0	20.9		12550.2				

Table B.1 (continued)

EH-09-13-78T40-1110A / HP-1110A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	54.0	96.81	0.0	91.0	51.0	4.55	223547.	56.0	170.0	0.0	91.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.97	75.95	73.46	4.98	1-	93.64	48.59	23.34	4600.50	9576.25	33776.35	956.29	260.37
	71.0	74.0			2-	106.37	32.91		6793.21				
					3-	93.64	20.18		11078.16			HEAT	DELTA
					1-	124.0	50.5		4423.4			FLUX	TCOMP
					2-	132.0	58.5		3818.9			4629.	17.78
					3-	94.0	20.5		10885.1				

EH-09-14-78T40-850A / HP-850A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	69.0	110.36	0.0	104.0	63.0	0.0	0.	69.0	151.0	72.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
0.0	76.54	78.19	77.36	1.66	1-	109.94	37.46	32.99	0.0	0.0	0.0	0.0	260.37
	76.0	76.0			2-	110.87	33.51		0.0				
					3-	109.94	32.58		0.0			HEAT	DELTA
					1-	115.0	37.6		0.0			FLUX	TCOMP
					2-	122.0	44.6		0.0			0.	17.78
					3-	113.0	35.6		0.0				

EH-09-14-78T40-940A / HP-940A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	67.3	108.91	0.0	103.0	48.0	4.55	311462.	70.0	165.0	65.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.60	72.53	69.06	6.94	1-	111.72	58.57	39.85	5317.94	7815.89	31859.59	929.46	202.36
	65.0	68.0			2-	109.49	40.43		7703.70				
					3-	111.72	42.66		7301.79			HEAT	DELTA
					1-	126.0	56.9		5470.5			FLUX	TCOMP
					2-	131.0	61.9		5028.8			6450.	31.87
					3-	106.0	36.9		8832.6				

EH-09-14-78T40-955A / HP-955A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	69.9	111.11	0.0	106.0	48.0	4.55	314677.	73.0	167.0	68.0	106.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.80	72.81	69.30	7.01	1-	112.87	61.45	41.81	5120.91	7526.43	31961.97	930.91	193.00
	65.0	69.0			2-	113.48	44.18		7122.86				
					3-	112.87	43.56		7223.38			HEAT	DELTA
					1-	129.0	59.7		5271.2			FLUX	TCOMP
					2-	134.0	64.7		4863.8			6516.	33.76
					3-	109.0	39.7		7926.8				

Table B.1 (continued)

EH-09-14-78T40-1010A / HP-1010A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	70.7	111.78	0.0	106.0	48.0	4.55	315466.	73.0	167.0	68.0	107.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.79	72.82	69.30	7.03	1-	112.92	61.65	42.48	5117.29	7426.72	31962.67	930.92	189.84
	65.0	69.0			2-	113.73	44.42		7101.18				
					3-	112.92	43.62		7232.82			HEAT	DELTA
					1-	129.0	59.7		5284.6			FLUX	TCOMP
					2-	134.0	64.7		4876.1			6533.	34.41
					3-	110.0	40.7		7751.8				

EH-09-14-78T40-1145A / HP-1145A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	70.8	111.87	165.0	108.0	48.0	4.55	321186.	73.0	166.0	68.0	108.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.08	73.23	69.65	7.16	1-	113.25	61.30	42.21	5239.80	7608.95	32113.82	933.06	195.52
	65.0	70.0			2-	112.08	42.42		7570.99				
					3-	113.25	43.59		7368.04			HEAT	DELTA
					1-	130.0	60.3		5322.4			FLUX	TCOMP
					2-	134.0	64.3		4991.5			6651.	34.02
					3-	110.0	40.3		7960.8				

EH-09-14-78T40-1200P / HP-1200P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	72.4	113.19	166.0	107.0	48.0	4.55	313927.	74.0	167.0	69.0	109.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.24	73.23	69.73	6.99	1-	112.68	61.58	43.45	5098.06	7224.46	32148.68	933.55	183.39
	65.0	70.0			2-	113.56	43.83		7162.59				
					3-	112.68	42.94		7310.36			HEAT	DELTA
					1-	130.0	60.3		5209.1			FLUX	TCOMP
					2-	135.0	65.3		4810.0			6501.	35.45
					3-	109.0	39.3		7995.0				

EH-09-14-78T40-1250P / HP-1250P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	67.7	109.26	184.0	103.0	48.0	4.55	301638.	71.0	184.0	65.0	106.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	67.18	73.90	70.54	6.72	1-	111.90	66.27	38.72	4551.36	7790.63	32496.66	938.45	201.06
	66.0	70.0			2-	117.91	47.38		6367.00				
					3-	111.90	41.37		7291.75			HEAT	DELTA
					1-	135.0	68.5		4679.3			FLUX	TCOMP
					2-	141.0	70.5		4280.9			6246.	31.07
					3-	106.0	35.5		6505.9				

Table B.1 (continued)

EM-09-14-78T40- 110P HP- 110P	PSHELL PSIG 65.0	SAT. TEMP 106.93	TVAP PIPE 186.0	COND TEMP 100.0	PH2O PSIG 48.0	WVEL. FT/SEC 4.55	HEAT LOAD 286391.	DSS PVAP 67.0	DSS TVAP 186.0	DSS PWELL 62.0	DSS TWELL 104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	67.41	73.79	70.60	6.38	1-	109.34	65.76	36.33	4354.89	7883.76	32523.31	938.83	204.04
	67.0	71.0			2-	117.34	46.74		6126.91				
					3-	109.34	38.74		7392.77			HEAT	DELTA
					1-	136.0	65.4		4379.0			FLUX	TCOMP
					2-	143.0	72.4		3955.6			5931.	29.07
					3-	104.0	33.4		8574.3				

EM-09-14-78T40- 120P HP- 120P	PSHELL PSIG 62.2	SAT. TEMP 104.45	TVAP PIPE 186.0	COND TEMP 97.0	PH2O PSIG 48.0	WVEL. FT/SEC 4.55	HEAT LOAD 267849.	DSS PVAP 63.0	DSS TVAP 189.0	DSS PWELL 60.0	DSS TWELL 101.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	67.71	73.68	70.70	5.97	1-	115.45	65.26	33.75	4104.13	7936.27	32566.34	939.43	205.71
	67.0	70.0			2-	116.90	46.20		5797.77				
					3-	115.45	44.75		5985.26			HEAT	DELTA
					1-	135.0	64.3		4165.5			FLUX	TCOMP
					2-	142.0	71.3		3756.5			5547.	26.96
					3-	101.0	30.3		8839.3				

EM-09-14-78T40- 140P HP- 140P	PSHELL PSIG 58.1	SAT. TEMP 100.70	TVAP PIPE 181.0	COND TEMP 94.0	PH2O PSIG 48.0	WVEL. FT/SEC 4.55	HEAT LOAD 244021.	DSS PVAP 59.0	DSS TVAP 182.0	DSS PWELL 56.0	DSS TWELL 107.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	67.91	73.35	70.63	5.44	1-	116.20	61.49	30.07	3968.19	8114.52	32536.91	939.02	211.55
	67.5	70.0			2-	113.34	42.71		5712.93				
					3-	116.20	45.57		5355.09			HEAT	DELTA
					1-	132.0	61.4		3976.2			FLUX	TCOMP
					2-	139.0	68.4		3569.1			5053.	23.89
					3-	98.0	27.4		8915.7				

EM-09-14-78T40- 155P HP- 155P	PSHELL PSIG 54.5	SAT. TEMP 97.29	TVAP PIPE 179.0	COND TEMP 91.0	PH2O PSIG 48.0	WVEL. FT/SEC 4.55	HEAT LOAD 220686.	DSS PVAP 58.0	DSS TVAP 178.0	DSS PWELL 52.0	DSS TWELL 93.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	67.91	72.83	70.37	4.92	1-	113.79	58.36	26.92	3781.76	8197.80	32424.09	937.43	214.39
	68.0	70.0			2-	110.36	39.99		5519.04				
					3-	113.79	43.42		5082.26			HEAT	DELTA
					1-	129.0	58.6		3764.1			FLUX	TCOMP
					2-	137.0	66.6		3312.1			4570.	21.32
					3-	95.0	24.6		8960.2				

Table B.1 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	920A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	920A	58.8	101.35	192.0	95.0	50.0	4.55	282249.	62.0	192.0	57.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	62.73	69.02	65.87	6.29	1-	99.56	71.26	35.48	3961.04	7955.41	30496.46	909.94	208.03
	62.0	65.0			2-	112.48	46.60		6056.23				
					3-	99.56	33.69		8378.57			HEAT	DELTA
					1-	137.0	71.1		3968.2			FLUX	TCOMP
					2-	144.0	78.1		3612.7			5845.	28.10
					3-	98.0	32.1		8785.5				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	930A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	930A	60.0	102.45	192.0	97.0	49.0	4.55	282387.	62.0	193.0	58.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.48	69.77	66.63	6.29	1-	100.20	70.78	35.83	3989.89	7881.85	30816.28	914.55	205.34
	63.0	67.0			2-	114.28	47.66		5925.52				
					3-	100.20	33.58		8410.38			HEAT	DELTA
					1-	138.0	71.4		3956.5			FLUX	TCOMP
					2-	145.0	78.4		3603.1			5848.	28.48
					3-	100.0	33.4		8461.6				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	950A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H-	950A	61.8	104.09	190.0	98.0	49.0	4.55	286194.	64.0	190.0	59.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.36	70.73	67.54	6.38	1-	101.39	69.40	36.54	4123.64	7831.86	31207.25	920.16	203.39
	64.0	68.0			2-	115.39	47.84		5982.20				
					3-	101.39	33.85		8454.98			HEAT	DELTA
					1-	137.0	69.5		4120.5			FLUX	TCOMP
					2-	145.0	77.5		3694.9			5927.	29.14
					3-	101.0	33.5		8554.4				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	1010A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H-	1010A	62.2	104.45	188.0	100.0	49.0	4.55	286509.	64.0	188.0	60.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.90	71.29	68.09	6.38	1-	102.00	68.22	36.35	4199.59	7881.24	31442.72	923.53	204.81
	65.0	69.0			2-	113.98	45.88		6244.39				
					3-	102.00	33.91		8449.83			HEAT	DELTA
					1-	136.0	67.9		4219.2			FLUX	TCOMP
					2-	143.0	74.9		3825.0			5933.	28.97
					3-	102.0	33.9		8450.3				

Table B.1 (continued)

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
EH-09-15-78T40-1035A HP-D/H-1035A	63.8	105.87	184.0	101.0	49.0	4.55	285957.	65.0	184.0	61.0	101.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.01	72.38	69.19	6.37	1-	102.81	66.06	36.68	4328.47	7795.86	31918.43	930.24	201.67
	66.0	69.0			2-	115.24	46.05		6209.63				
					3-	102.81	33.62		8505.63			HEAT	DELTA
					1-	135.0	65.8		4345.3			FLUX	TCOMP
					2-	141.0	71.8		3982.2			5922.	29.36
					3-	103.0	33.8		8458.2				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
EH-09-15-78T40-1050A HP-D/H-1050A	64.6	106.57	179.0	102.0	49.0	4.55	285405.	66.0	179.0	62.0	102.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.93	73.28	70.11	6.36	1-	103.53	63.81	36.47	4472.44	7826.20	32309.10	935.81	202.35
	67.0	71.0			2-	115.73	45.62		6255.55				
					3-	103.53	33.42		8539.43			HEAT	DELTA
					1-	134.0	63.9		4466.8			FLUX	TCOMP
					2-	140.0	69.9		4093.3			5910.	29.21
					3-	104.0	33.9		8420.3				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
EH-09-15-78T40-1105A HP-D/H-1105A	65.5	107.36	172.0	102.0	49.0	4.55	283432.	67.0	172.0	63.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	68.01	74.32	71.17	6.31	1-	104.30	60.07	36.19	4718.64	7830.91	32769.55	942.28	202.15
	68.0	72.0			2-	114.51	43.34		6539.47				
					3-	104.30	33.13		8554.20			HEAT	DELTA
					1-	131.0	59.8		4736.9			FLUX	TCOMP
					2-	136.0	64.8		4371.6			5869.	29.03
					3-	105.0	33.8		8376.9				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
EH-09-15-78T40-1130A HP-D/H-1130A	66.1	107.88	167.0	101.0	49.0	4.55	282091.	67.0	168.0	63.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	68.53	74.82	71.68	6.28	1-	104.45	58.05	36.20	4859.28	7792.14	32992.43	945.40	200.74
	69.0	72.0			2-	114.37	42.69		6607.82				
					3-	104.45	32.78		8605.95			HEAT	DELTA
					1-	128.0	56.3		5008.4			FLUX	TCOMP
					2-	133.0	61.3		4600.0			5842.	29.10
					3-	105.0	33.3		8465.2				

Table B.1 (continued)

EM-09-15-78T40-1150A / HP-D/H-1150A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	66.3	108.05	163.0	101.0	49.0	4.55	280651.	67.0	164.0	64.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	68.72	74.97	71.85	6.25	1-	104.59	56.27	36.20	4987.37	7751.86	33067.29	946.45	199.40
	68.0	72.0			2-	113.95	42.10		6665.95				
					3-	104.59	32.74		6571.75			HEAT FLUX	DELTA TCOMP
					1-	127.0	55.2		5088.6			5812.	29.15
					2-	132.0	60.2		4665.7				
					3-	105.0	33.2		8465.4				

EM-09-15-78T40-1220P / HP-D/H-1220P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	67.5	109.08	156.0	102.0	49.0	4.55	282347.	68.0	156.0	65.0	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.47	75.76	72.62	6.29	1-	105.95	53.12	36.47	5315.34	7742.29	33403.52	951.12	198.86
	69.0	72.0			2-	113.95	41.33		6930.78				
					3-	105.95	33.34		8469.06			HEAT FLUX	DELTA TCOMP
					1-	124.0	51.4		5494.7			5847.	29.40
					2-	128.0	55.4		5097.9				
					3-	105.0	32.4		8718.5				

EM-09-15-78T40-1235P / HP-D/H-1235P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	68.1	109.60	146.0	103.0	49.0	4.55	280395.	70.0	149.0	66.0	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.97	76.22	73.09	6.25	1-	106.33	49.59	36.50	5653.82	7681.05	33613.67	954.04	196.77
	70.0	72.0			2-	112.21	39.12		7168.05				
					3-	106.33	33.23		8437.57			HEAT FLUX	DELTA TCOMP
					1-	120.0	46.9		5977.7			5806.	29.51
					2-	124.0	50.9		5508.0				
					3-	106.0	32.9		8520.9				

EM-09-15-78T40-1250P / HP-D/H-1250P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	68.1	109.60	135.0	103.0	49.0	4.55	276982.	70.0	142.0	66.0	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.26	76.44	73.35	6.17	1-	106.65	44.69	36.25	6198.43	7641.33	33726.74	955.60	195.44
	70.0	73.0			2-	109.42	36.07		7679.12				
					3-	106.65	33.30		8317.22			HEAT FLUX	DELTA TCOMP
					1-	115.0	41.6		6650.3			5736.	29.35
					2-	119.0	45.6		6067.5				
					3-	107.0	33.6		8231.3				

Table B.1 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	105P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H-	105P	68.9	110.27	125.0	104.0	49.0	4.55	276489.	70.0	139.0	66.5	106.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.51	76.67	73.59	6.16	1-	107.43	41.66	36.69	6637.23	7536.59	33831.01	957.04	192.07
	70.0	73.0			2-	108.28	34.70		7969.03				
					3-	107.43	33.85		8168.82			HEAT	DELTA
					1-	112.0	38.4		7197.8			FLUX	TCOMP
					2-	115.0	41.4		6676.4			5726.	29.81
					3-	108.0	34.4		8034.4				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	140P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H	140P	68.8	110.19	125.0	105.0	49.0	4.55	276587.	70.0	139.0	67.0	106.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.54	76.70	73.62	6.16	1-	107.58	40.80	36.57	6778.27	7562.96	33845.60	957.25	192.89
	71.0	74.0			2-	108.48	34.86		7934.71				
					3-	107.58	33.96		8145.22			HEAT	DELTA
					1-	113.0	39.4		7023.6			FLUX	TCOMP
					2-	115.0	41.4		6684.1			5728.	29.69
					3-	108.0	34.4		8045.0				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	150P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H	150P	69.4	110.70	113.0	105.0	49.0	4.55	274674.	71.0	133.0	66.5	106.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.59	76.71	73.65	6.12	1-	106.96	37.22	37.04	7379.81	7414.87	33860.29	957.45	188.25
	71.0	75.0			2-	108.26	34.60		7937.63				
					3-	106.96	33.31		8247.22			HEAT	DELTA
					1-	108.0	34.3		7997.1			FLUX	TCOMP
					2-	110.0	36.3		7557.1			5688.	30.22
					3-	109.0	35.3		7770.9				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	210P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-D/H	210P	69.3	110.62	106.0	105.0	0.0	4.55	274004.	71.0	130.0	67.0	107.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.56	76.67	73.61	6.10	1-	106.86	34.91	37.00	7847.79	7405.29	33843.17	957.21	187.96
	71.0	74.0			2-	108.45	34.84		7864.91				
					3-	106.86	33.25		8240.79			HEAT	DELTA
					1-	106.0	32.4		8460.7			FLUX	TCOMP
					2-	108.0	34.4		7968.6			5674.	30.19
					3-	108.0	34.4		7968.6				

Table B.1 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	215P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
HP-D/H	215P	69.6	110.86	105.0	105.0	49.0	4.55	272682.	71.0	129.0	67.0	107.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.70	76.77	73.73	6.07	1-	106.39	34.72	37.13	7853.27	7343.82	33895.63	957.94	186.02
	70.0	74.0			2-	108.40	34.67		7864.91				
					3-	106.39	32.66		8348.88			HEAT	DELTA
					1-	105.0	31.3		8721.2			FLUX	TCOMP
					2-	107.0	33.3		8196.9			5647.	30.36
					3-	107.0	33.3		8196.9				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	230P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
HP-D/H	230P	69.3	110.62	105.0	105.0	49.0	4.55	272682.	71.0	124.0	67.0	106.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.70	76.77	73.73	6.07	1-	106.63	34.82	36.88	7831.17	7393.31	33895.63	957.94	187.56
	70.0	74.0			2-	108.48	34.74		7848.20				
					3-	106.63	32.90		8289.39			HEAT	DELTA
					1-	104.0	30.3		9009.4			FLUX	TCOMP
					2-	107.0	33.3		8196.9			5647.	30.11
					3-	107.0	33.3		8196.9				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	245P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
HP-D/H	245P	69.1	110.44	106.0	105.0	49.0	4.55	271104.	71.0	120.0	67.0	107.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.74	76.78	73.76	6.04	1-	106.09	34.40	36.68	7881.04	7391.02	33908.61	958.12	187.48
	71.0	74.0			2-	108.18	34.42		7875.90				
					3-	106.09	32.33		8385.60			HEAT	DELTA
					1-	105.0	31.2		8678.9			FLUX	TCOMP
					2-	107.0	33.2		8156.7			5614.	29.95
					3-	107.0	33.2		8156.7				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-15-78T40-	300P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
HP-D/H	300P	66.8	108.49	103.0	103.0	49.0	4.55	260215.	70.0	109.0	64.0	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.67	76.47	73.57	5.80	1-	103.64	32.82	34.92	7927.57	7452.51	33824.12	956.95	189.45
	75.0	78.0			2-	106.44	32.87		7916.76				
					3-	103.64	30.06		8555.16			HEAT	DELTA
					1-	105.0	31.4		8279.6			FLUX	TCOMP
					2-	105.0	31.4		8279.6			5389.	28.44
					3-	105.0	31.4		8279.6				

Table B.1 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-09-18-78T40-	125P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	125P	44.3	86.84	146.0	64.0	50.0	4.55	224809.	44.0	148.0	43.0	84.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	ISAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	57.83	62.83	60.33	5.01	1-	93.73	50.62	26.51	4441.00	8478.73	28188.77	875.97	228.14
	56.0	59.0			2-	94.66	34.33		6548.50				
					3-	93.73	33.40		6730.81			HEAT	DELTA
					1-	109.0	48.7		4619.0			FLUX	TCOMP
					2-	114.0	53.7		4188.7			4655.	20.41
					3-	84.0	23.7		9497.4				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-09-18-78T40-	200P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	200P	46.5	89.21	180.0	85.0	50.0	4.55	244790.	45.0	160.0	45.0	88.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	ISAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	58.33	63.78	61.05	5.45	1-	100.90	59.67	28.16	4102.68	8694.25	28485.27	880.40	235.37
	57.0	62.0			2-	99.94	38.89		6294.79				
					3-	100.90	39.84		6143.58			HEAT	DELTA
					1-	123.0	61.9		3951.6			FLUX	TCOMP
					2-	132.0	70.9		3450.3			5069.	21.54
					3-	88.0	26.9		9084.0				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-09-19-78T40-	900A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	900A	58.2	100.79	187.0	94.0	48.5	4.55	272011.	60.0	187.0	57.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	ISAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	67.24	73.30	70.27	6.06	1-	114.91	64.21	30.53	4236.28	8909.74	32378.46	936.79	238.50
	66.0	70.0			2-	111.73	41.47		6559.58				
					3-	114.91	44.64		6092.82			HEAT	DELTA
					1-	133.0	62.7		4335.9			FLUX	TCOMP
					2-	141.0	70.7		3845.5			5633.	23.62
					3-	98.0	27.7		9807.6				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-09-19-78T40-	915A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
HP-	915A	56.4	99.11	183.0	93.0	48.5	4.55	266627.	58.0	184.0	56.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	ISAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.78	72.72	69.75	5.94	1-	113.11	63.07	29.35	4227.29	9083.37	32156.71	933.67	244.78
	66.0	70.0			2-	111.23	41.48		6427.60				
					3-	113.11	43.36		6149.61			HEAT	DELTA
					1-	131.0	61.2		4353.3			FLUX	TCOMP
					2-	139.0	69.2		3850.4			5521.	22.56
					3-	97.0	27.2		9785.6				

Table B.1 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	NVEL.	HEAT	DSS			
EM-09-19-78T40-	925A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
HP-	925A	56.8	99.48	183.0	94.0	48.5	4.55	272129.	58.0	180.0	55.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.27	72.34	69.30	6.06	1-	113.25	62.86	30.18	4329.05	9016.98	31962.77	930.92	242.68
	66.0	70.0			2-	108.18	38.88		6999.09				
					3-	113.25	43.94		6193.01			HEAT	DELTA
					1-	132.0	62.7		4340.5			FLUX	TCOMP
					2-	139.0	69.7		3904.5			5635.	23.22
					3-	97.0	27.7		9825.7				

		PSHELL	SAT.	TVAP	COND	PH2O	NVEL.	HEAT	DSS			
EM-09-19-78T40-1224P		PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
HP-D/H-	1224P	66.3	108.05	173.0	101.0	42.0	4.55	314361.	66.0	175.0	64.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.80	72.81	69.31	7.00	1-	109.54	61.68	38.75	5096.23	8113.39	31963.45	930.93	211.99
	64.0	69.0			2-	111.16	41.85		7511.53				
					3-	109.54	40.23		7813.68			HEAT	DELTA
					1-	128.0	58.7		5355.9			FLUX	TCOMP
					2-	136.0	66.7		4713.5			6510.	30.71
					3-	104.0	34.7		9060.9				

		PSHELL	SAT.	TVAP	COND	PH2O	NVEL.	HEAT	DSS			
EM-09-19-78T40-1230P		PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWALL	TWALL
HP-D/H-	1230P	66.5	108.23	178.0	100.0	42.0	4.55	321167.	66.8	178.0	64.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.83	72.99	69.41	7.16	1-	109.86	64.00	38.82	5018.08	8273.55	32008.15	931.56	217.26
	64.0	69.0			2-	109.12	39.71		8087.66				
					3-	109.86	40.46		7938.84			HEAT	DELTA
					1-	131.0	61.6		5214.5			FLUX	TCOMP
					2-	137.0	67.6		4751.6			6651.	30.61
					3-	104.0	34.6		9284.8				

Table B.2. The ORNL 40-tube condenser performance data for Group III-C tests (direct-contact evaporator mode)

EH-09-25-78T40-1150A / DC- 1150A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	81.2	120.13	167.0	103.0	42.0	4.55	104386.	0.0	0.0	0.0	0.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.95	75.28	74.11	2.33	1-	90.88	61.76	46.02	1690.19	2268.26	34063.13	960.24	49.77
	73.0	74.0			2-	136.0	61.9		1686.7				
					3-	90.88	16.77		6224.07			HEAT	DELTA
					1-	124.0	49.9		2092.4			FLUX	TCOMP
					2-	146.5	72.4		1442.0			2162.	43.43
					3-	103.0	28.9		3613.6				

EH-09-25-78T40-1220P / DC- -VHO- 1220P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	91.0	127.22	159.5	110.0	42.0	4.55	146657.	92.0	160.0	90.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.26	76.53	74.89	3.27	1-	98.57	14.32	52.32	10243.45	2802.82	34409.10	965.00	62.35
	73.0	74.5			2-	139.0	64.1		2287.7				
					3-	98.57	23.68		6193.37			HEAT	DELTA
					1-	103.0	28.1		5218.0			FLUX	TCOMP
					2-	143.0	68.1		2153.4			3037.	48.71
					3-	138.5	63.6		2305.7				

EH-09-25-78T40-1235P / DC- -VHO- 1235P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	93.0	128.59	160.0	110.0	42.0	4.55	146676.	93.0	161.0	92.0	98.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.54	76.81	75.17	3.27	1-	94.73	13.23	53.41	11087.98	2746.05	34532.70	966.69	60.99
	73.0	75.0			2-	140.0	64.8		2262.6				
					3-	94.73	19.56		7498.27			HEAT	DELTA
					1-	98.0	22.8		6425.4			FLUX	TCOMP
					2-	145.0	69.8		2100.5			3037.	49.80
					3-	140.0	64.8		2262.6				

EH-09-25-78T40-1255P / DC- -VHO- 1255P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	94.0	129.25	158.0	113.0	42.5	4.55	144113.	94.0	158.0	93.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.98	77.19	75.59	3.21	1-	91.33	13.33	53.67	10814.07	2685.30	34717.00	969.21	59.53
	73.5	75.0			2-	140.0	64.4		2237.3				
					3-	91.33	15.74		9156.41			HEAT	DELTA
					1-	95.0	19.4		7423.4			FLUX	TCOMP
					2-	143.5	67.9		2122.0			2984.	50.13
					3-	118.0	42.4		3397.8				

Table B.2 (continued)

EH-09-25-78T40- 120P DC- -VHO- 120P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	95.3	130.13	154.5	113.0	42.8	4.55	141193.	95.0	155.0	94.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	74.15	77.30	75.73	3.15	1-	88.94	11.70	54.40	12069.14	2595.30	34778.77	970.05	57.40
	74.0	74.5			2-	139.0	63.3		2231.4				
					3-	88.94	13.22		10681.98			HEAT	DELTA
					1-	91.5	15.8		8950.7			FLUX	TCOMP
					2-	142.0	66.3		2130.4			2924.	50.94
					3-	113.0	37.3		3787.9				

EH-09-25-78T40- 200P DC- 200P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	92.0	127.91	161.0	109.0	43.0	4.55	144527.	92.0	161.0	92.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.60	76.82	75.21	3.22	1-	94.89	11.00	52.70	13141.20	2742.51	34548.36	966.90	60.90
	73.0	74.5			2-	140.0	64.8		2230.6				
					3-	94.89	19.69		7341.27			HEAT	DELTA
					1-	91.0	15.8		9151.7			FLUX	TCOMP
					2-	145.0	69.8		2070.8			2993.	49.14
					3-	111.0	35.8		4037.9				

EH-09-25-78T40- 220P DC- 220P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	92.4	128.18	159.0	111.0	43.0	4.55	142436.	92.0	160.0	94.0	98.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.51	76.68	75.09	3.17	1-	92.70	12.29	53.09	11591.71	2683.02	34496.82	966.20	59.49
	73.2	73.5			2-	140.2	65.1		2187.7				
					3-	92.70	17.61		8090.39			HEAT	DELTA
					1-	91.0	15.9		8953.5			FLUX	TCOMP
					2-	143.0	67.9		2097.5			2950.	49.58
					3-	110.0	34.9		4080.3				

EH-09-25-78T40- 250P DC- 250P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	109.6	139.38	169.0	118.0	46.0	4.55	167132.	109.0	172.0	109.0	114.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.39	77.11	75.25	3.72	1-	90.03	14.23	64.13	11744.18	2606.11	34566.38	967.15	57.67
	73.0	73.8			2-	150.0	74.8		2235.8				
					3-	90.03	14.78		11306.70			HEAT	DELTA
					1-	89.0	13.8		12153.4			FLUX	TCOMP
					2-	154.0	78.8		2122.3			3461.	60.02
					3-	123.0	47.8		3500.0				

Table B.2 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-25-78T40-	305P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
DC-	305P	110.0	139.63	168.0	118.5	47.5	4.55	163029.	110.0	169.0	109.0	116.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.51	77.14	75.33	3.63	1-	88.43	14.56	64.30	11194.22	2535.60	34502.27	967.64	56.00
	73.5	74.0			2-	150.0	74.7		2183.3				
					3-	88.43	13.10		12440.91			HEAT	DELTA
					1-	89.0	13.7		11925.1			FLUX	TCOMP
					2-	154.0	78.7		2072.3			3376.	60.29
					3-	123.0	47.7		3419.9				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-25-78T40-	320P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
DC-	320P	114.0	142.17	166.0	118.0	43.5	4.55	161096.	114.0	167.0	113.0	116.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	73.31	76.90	75.10	3.59	1-	87.03	14.60	67.07	11036.15	2401.99	34502.50	966.28	52.87
	72.8	73.5			2-	149.0	73.9		2180.0				
					3-	87.03	11.92		13509.31			HEAT	DELTA
					1-	88.0	12.9		12492.3			FLUX	TCOMP
					2-	151.0	75.9		2122.6			3336.	63.10
					3-	124.0	48.9		3294.7				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-26-78T40-	900A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
DC- -VHO-	900A	69.2	110.53	161.0	92.0	42.5	4.55	92452.	69.5	168.0	68.5	86.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.78	68.84	67.81	2.06	1-	81.08	52.47	42.72	1762.14	2163.92	31319.07	921.76	47.46
	65.0	66.0			2-	124.50	56.69		1630.75				
					3-	81.08	13.27		6966.09			HEAT	DELTA
					1-	124.0	56.2		1645.2			FLUX	TCOMP
					2-	136.5	68.7		1345.8			1915.	40.34
					3-	86.0	18.2		5081.4				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-26-78T40-	915A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
DC-	915A	72.8	113.52	168.5	96.0	42.5	4.55	91584.	73.0	174.0	73.0	88.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	67.66	69.70	68.68	2.04	1-	82.08	50.96	44.83	1797.33	2042.84	31695.64	927.13	44.65
	66.5	66.8			2-	131.68	63.00		1453.82				
					3-	82.08	13.40		6836.87			HEAT	DELTA
					1-	126.0	57.3		1597.9			FLUX	TCOMP
					2-	142.0	73.3		1249.2			1897.	42.48
					3-	88.5	19.8		4621.7				

Table B.2 (continued)

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40- 930A	72.3	113.10	168.0	96.0	42.5	4.55	88704.	73.0	172.0	72.0	88.5
DC- 930A											

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	68.59	70.56	69.57	1.98	1-	84.19	50.35	43.53	1761.82	2037.82	32079.38	932.57	44.51
	68.0	68.5			2-	130.67	61.10		1451.77				
					3-	84.19	14.61		6069.70			HEAT	DELTA
					1-	127.0	57.4		1544.7			FLUX	TCOMP
					2-	141.2	71.6		1238.4			1837.	41.26
					3-	88.0	18.4		4814.1				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40- 945A	75.6	115.78	171.5	97.5	42.5	4.55	89631.	75.0	175.0	74.8	90.5
DC- 945A											

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.71	71.70	70.71	2.00	1-	85.31	52.32	45.07	1713.21	1988.64	32569.85	939.48	43.37
	69.0	69.5			2-	133.88	63.18		1418.76				
					3-	85.31	14.61		6136.38			HEAT	DELTA
					1-	127.0	56.3		1592.2			FLUX	TCOMP
					2-	144.0	73.3		1222.9			1856.	42.80
					3-	90.0	19.3		4645.6				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40-1030A	72.0	112.86	132.5	96.0	42.5	4.55	86436.	72.5	122.0	71.5	91.0
DC-D/H- 1030A											

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.77	71.69	70.73	1.93	1-	83.47	18.15	42.12	4762.48	2051.95	32581.05	939.64	44.82
	69.0	69.2			2-	118.86	48.13		1795.98				
					3-	83.47	12.74		6783.84			HEAT	DELTA
					1-	109.8	39.1		2212.5			FLUX	TCOMP
					2-	120.5	49.8		1736.8			1790.	39.93
					3-	102.0	31.3		2764.4				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40-1045A	71.0	112.03	118.0	96.0	42.5	4.55	71484.	72.0	115.0	70.0	91.0
DC-D/H- 1045A											

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.85	71.44	70.64	1.59	1-	81.91	17.62	41.39	4057.22	1727.05	32542.25	939.09	37.40
	69.0	69.2			2-	111.21	40.57		1762.17				
					3-	81.91	11.27		6344.97			HEAT	DELTA
					1-	93.5	22.9		3127.4			FLUX	TCOMP
					2-	114.0	43.4		1648.7			1480.	39.58
					3-	101.5	30.9		2316.6				

Table B.2 (continued)

EM-09-26-78T40-1100A / DC-D/H-1100A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	71.5	112.44	106.6	96.6	42.5	4.55	60398.	72.0	118.0	70.5	91.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.93	71.28	70.60	1.35	1-	81.54	15.69	41.84	3849.42	1443.63	32525.34	938.86	31.03
	69.5	70.0			2-	92.75	22.15		2726.65				
					3-	81.54	10.94		5521.21			HEAT	DELTA
					1-	89.5	18.9		3196.3			FLUX	TCOMP
					2-	95.5	24.9		2426.0			1251.	40.31
					3-	99.5	28.9		2090.2				

EM-09-26-78T40-1220P / DC-D/H-1220P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	105.8	136.94	168.0	121.0	43.0	4.55	197924.	104.5	166.0	104.8	115.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.53	74.94	72.74	4.41	1-	92.17	11.50	64.20	17216.61	3082.85	33456.54	951.86	69.17
	71.0	73.0			2-	146.66	73.92		2677.51				
					3-	92.17	19.44		10182.60			HEAT	DELTA
					1-	92.0	19.3		10274.3			FLUX	TCOMP
					2-	151.5	78.8		2512.9			4099.	59.25
					3-	123.0	50.3		3937.7				

EM-09-26-78T40-1230P / DC-D/H-1230P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	106.0	137.07	165.0	121.0	43.0	4.55	196464.	105.5	164.0	105.0	115.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.59	74.96	72.77	4.38	1-	89.79	12.76	64.30	15393.17	3055.60	33473.36	952.09	68.51
	71.0	72.5			2-	145.08	72.30		2717.18				
					3-	89.79	17.02		11545.18			HEAT	DELTA
					1-	92.0	19.2		10218.7			FLUX	TCOMP
					2-	149.5	76.7		2560.6			4068.	59.38
					3-	122.5	49.7		3950.9				

EM-09-26-78T40-1240P / DC-D/H-1240P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	104.5	136.10	164.5	121.0	43.0	4.55	192538.	105.0	166.0	104.0	115.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.62	74.91	72.76	4.29	1-	88.04	13.11	63.34	14688.35	3039.78	33468.02	952.02	68.13
	71.0	72.8			2-	144.65	71.89		2678.26				
					3-	88.04	15.27		12605.75			HEAT	DELTA
					1-	92.0	19.2		10008.3			FLUX	TCOMP
					2-	150.0	77.2		2492.8			3987.	58.53
					3-	120.5	47.7		4033.2				

Table B.2 (continued)

EM-09-26-78T40- 100P DC- 100P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	106.5	137.38	167.0	122.0	43.0	4.55	199461.	107.0	167.0	106.0	116.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.72	75.16	72.94	4.44	1-	89.71	11.32	64.43	17623.20	3095.62	33546.91	953.11	69.48
	70.8	73.0			2-	147.10	74.16		2689.64				
					3-	89.71	16.77		11893.65			HEAT	DELTA
					1-	91.5	18.6		10747.8			FLUX	TCOMP
					2-	151.4	78.5		2542.3			4130.	59.45
					3-	122.5	49.6		4024.8				

EM-09-26-78T40- 120P DC- 120P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	106.4	137.31	162.5	121.0	43.2	4.55	193249.	106.0	162.0	105.0	115.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.12	75.42	73.27	4.31	1-	86.94	12.65	64.04	15282.56	3017.45	33690.79	955.11	67.57
	70.0	72.5			2-	143.71	70.44		2743.58				
					3-	86.94	13.67		14135.49			HEAT	DELTA
					1-	91.5	18.2		10599.9			FLUX	TCOMP
					2-	149.0	75.7		2551.8			4002.	59.23
					3-	123.5	50.2		3847.2				

EM-09-26-78T40- 135P DC- 135P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	107.0	137.70	159.5	121.0	43.2	4.55	193998.	106.0	160.0	106.0	115.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.40	75.73	73.56	4.32	1-	86.10	12.49	64.13	15526.35	3024.87	33821.32	956.91	67.74
	70.8	72.5			2-	142.52	68.96		2813.34				
					3-	86.10	12.54		15471.39			HEAT	DELTA
					1-	91.0	17.4		11126.9			FLUX	TCOMP
					2-	147.5	73.9		2623.9			4017.	59.31
					3-	123.0	49.4		3924.3				

EM-09-26-78T40- 200P DC- 200P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	95.8	130.45	172.0	112.0	43.2	4.55	145494.	96.0	172.0	94.5	102.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.62	74.86	73.24	3.24	1-	85.80	10.75	57.21	13529.99	2543.09	33678.95	954.94	56.23
	71.0	71.5			2-	145.19	71.94		2022.31				
					3-	85.80	12.56		11585.49			HEAT	DELTA
					1-	89.0	15.8		9232.9			FLUX	TCOMP
					2-	151.0	77.8		1871.1			3013.	53.58
					3-	112.0	38.8		3753.9				

Table B.2 (continued)

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40- 215P											
DC- 215P	95.2	130.06	168.5	112.0	44.5	4.55	145494.	95.0	170.0	94.5	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.80	75.04	73.42	3.24	1-	86.95	11.42	56.64	12743.60	2568.80	33757.26	956.03	56.83
	71.4	72.0			2-	145.08	71.66		2030.37				
					3-	86.95	13.54		10749.31			HEAT	DELTA
					1-	89.0	15.6		9338.3			FLUX	TCOMP
					2-	149.0	75.6		1925.0			3013.	53.02
					3-	111.5	38.1		3820.7				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40- 230P											
DC- 230P	95.5	130.26	167.4	112.5	44.2	4.55	145474.	96.0	168.0	94.5	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.86	75.10	73.48	3.24	1-	86.47	11.35	56.79	12821.08	2561.81	33782.29	956.37	56.66
	71.8	72.0			2-	143.60	70.13		2078.49				
					3-	86.47	12.99		11197.00			HEAT	DELTA
					1-	99.5	26.0		5590.0			FLUX	TCOMP
					2-	148.5	75.0		1939.0			3013.	53.16
					3-	111.0	37.5		3876.8				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40- 245P											
DC- C/V- 245P	83.8	122.08	161.0	104.5	43.5	4.55	146874.	83.0	164.0	83.0	101.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.06	75.33	73.70	3.27	1-	91.82	50.25	48.38	2922.94	3035.67	33878.79	957.70	67.99
	73.0	73.2			2-	134.44	60.74		2418.00				
					3-	91.82	18.13		8102.52			HEAT	DELTA
					1-	127.0	53.3		2755.4			FLUX	TCOMP
					2-	141.0	67.3		2182.2			3042.	44.73
					3-	102.5	28.8		5099.0				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EH-09-26-78T40- 250P											
DC- C/V- 250P	77.0	116.88	155.5	103.0	43.2	4.55	146500.	76.5	152.0	76.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.07	75.33	73.70	3.26	1-	90.67	44.46	43.18	3295.25	3392.60	33980.61	957.73	76.72
	73.0	73.2			2-	130.64	56.94		2573.07				
					3-	90.67	16.97		8631.01			HEAT	DELTA
					1-	121.0	47.3		3097.2			FLUX	TCOMP
					2-	136.0	62.3		2351.5			3034.	39.54
					3-	102.0	28.3		5176.6				

Table B.2 (continued)

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-26-78T40- 305P								PVAP	TVAP	PWELL	TWELL
DC- C/V- 305P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD				
	74.5	114.89	150.0	101.8	43.2	4.55	144566.	75.0	149.0	73.5	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.01	75.23	73.62	3.22	1-	96.33	48.53	41.27	2978.70	3502.56	33845.70	957.25	79.45
	72.0	72.5			2-	127.15	53.53		2700.57				
					3-	96.33	22.71		6365.30			HEAT	DELTA
					1-	119.0	45.4		3185.7			FLUX	TCOMP
					2-	131.0	57.4		2519.5			2994.	37.68
					3-	100.5	26.9		5378.3				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-26-78T40- 330P								PVAP	TVAP	PWELL	TWELL
DC- 330P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD				
	74.3	114.73	138.5	99.5	43.1	4.55	122592.	74.0	140.0	74.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.01	74.74	73.38	2.73	1-	92.54	15.26	41.35	8035.07	2964.45	33737.85	955.76	66.28
	72.0	72.3			2-	121.76	48.38		2533.85				
					3-	92.54	19.17		6395.44			HEAT	DELTA
					1-	102.0	28.6		4282.8			FLUX	TCOMP
					2-	125.5	52.1		2351.9			2539.	38.30
					3-	98.7	25.3		4880.9				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-26-78T40- 340P								PVAP	TVAP	PWELL	TWELL
DC- 340P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD				
	75.5	115.70	138.3	101.0	43.0	4.55	120245.	76.0	139.0	75.0	98.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.39	75.07	73.73	2.68	1-	89.84	12.21	41.96	9849.34	2865.51	33896.06	957.94	63.89
	72.5	73.0			2-	123.36	49.63		2422.94				
					3-	89.84	16.10		7466.49			HEAT	DELTA
					1-	96.5	22.8		5281.9			FLUX	TCOMP
					2-	125.0	51.3		2385.5			2490.	38.98
					3-	99.0	25.3		4759.2				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EH-09-26-78T40- 350P								PVAP	TVAP	PWELL	TWELL
DC- 350P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD				
	76.0	116.10	137.0	102.0	43.0	4.55	120206.	76.0	136.0	75.5	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT. COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.49	75.16	73.82	2.68	1-	87.33	11.66	42.27	10313.48	2843.67	33935.83	958.49	63.36
	72.8	73.0			2-	122.45	48.63		2471.94				
					3-	87.33	13.50		8902.37			HEAT	DELTA
					1-	94.0	20.2		5958.0			FLUX	TCOMP
					2-	125.0	51.2		2348.9			2489.	39.29
					3-	101.0	27.2		4423.3				

Table B.2 (continued)

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-09-26-78T40-	400P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
DC-D/H	400P	77.0	116.88	133.0	102.5	42.8	4.55	119673.	77.0	133.0	76.5	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.45	75.12	73.79	2.67	1-	86.23	11.58	43.10	10335.45	2776.90	33918.62	958.25	61.77
	72.0	72.8			2-	121.50	47.71		2508.36				
					3-	86.23	12.45		9613.06			HEAT	DELTA
					1-	91.0	17.2		6951.9			FLUX	TCOMP
					2-	122.6	48.8		2451.6			2478.	40.12
					3-	102.8	29.0		4124.6				

		PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-09-26-78T40-	415P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
DC-D/H-VHO-	415P	77.6	117.35	134.5	103.0	43.0	4.55	119140.	78.0	135.0	77.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.58	75.23	73.90	2.65	1-	85.14	10.13	43.45	11757.20	2741.97	33970.67	958.97	60.93
	72.5	73.0			2-	122.02	48.12		2476.02				
					3-	85.14	11.24		10600.97			HEAT	DELTA
					1-	88.8	14.9		7997.9			FLUX	TCOMP
					2-	124.0	50.1		2378.2			2467.	40.49
					3-	105.0	31.1		3831.3				

Table B.3. The ORNL 40-tube condenser performance data for Group IV tests (direct-contact evaporator mode with Barber-Nichols brine preflash unit)

EM-11-03-78T40- 645P
DC- -VHO- 645P

PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
82.5	121.11	128.0	116.0	84.0	0.0	0.	82.0	177.0	81.0	95.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
0.0	66.23	70.64	68.44	4.41	1-	116.29	47.93	52.67	0.0	0.0	0.0	0.0	0.0
	67.0	68.0			2-	122.69	54.25		0.0				
					3-	116.29	47.85		0.0			HEAT	DELTA
					1-	116.0	47.6		0.0			FLUX	TCOMP
					2-	124.0	55.6		0.0			0.	0.0
					3-	119.0	50.6		0.0				

EM-11-03-78T40- 700P
DC- -VHO- 700P

PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
82.2	120.89	178.0	113.5	82.0	0.50	43429.	80.0	190.0	79.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
10.0	62.66	71.40	67.03	8.73	1-	117.83	75.68	53.86	573.83	806.39	3432.93	157.75	19.01
	64.0	69.0			2-	150.09	83.06		522.86				
					3-	117.83	50.79		854.98			HEAT	DELTA
					1-	144.5	77.5		560.6			FLUX	TCOMP
					2-	154.0	87.0		499.4			899.	47.30
					3-	118.0	51.0		852.1				

EM-11-03-78T40- 725P
DC- -VHO- 725P

PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
79.5	118.84	198.0	110.0	73.0	3.42	223836.	79.5	199.0	79.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
67.9	61.82	68.45	65.13	6.62	1-	127.18	80.36	53.70	2785.42	4168.06	22720.99	721.38	100.08
	64.0	67.5			2-	144.65	79.52		2814.90				
					3-	127.18	62.05		3607.27			HEAT	DELTA
					1-	148.5	83.4		2685.0			FLUX	TCOMP
					2-	156.0	90.9		2463.3			4635.	46.32
					3-	115.5	50.4		4444.1				

EM-11-03-78T40- 740P
DC- -VHO- 740P

PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
76.2	116.26	198.0	104.0	69.0	3.97	258916.	76.0	199.0	75.0	101.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
78.7	61.71	68.32	65.02	6.61	1-	131.55	79.35	51.24	3262.81	5053.34	26300.89	811.37	122.86
	63.5	72.0			2-	125.24	60.22		4299.70				
					3-	131.55	66.53		3891.49			HEAT	DELTA
					1-	147.0	82.0		3158.2			FLUX	TCOMP
					2-	154.5	89.5		2893.5			5362.	43.54
					3-	115.5	50.5		5129.0				

Table B.3 (continued)

EH-11-03-78T40- 800P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 800P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	70.0	111.19	196.0	101.5	69.0	4.55	270374.	71.5	194.0	68.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	61.02	67.04	64.03	6.02	1-	122.25	76.15	47.16	3550.70	5733.14	29721.13	898.66	139.98
	63.0	66.0			2-	110.77	46.74		5785.13				
					3-	122.25	58.22		4644.02			HEAT	DELTA
					1-	143.5	79.5		3402.3			FLUX	TCOMP
					2-	151.5	87.5		3091.1			5599.	40.00
					3-	106.5	42.5		6366.5				

EH-11-03-78T40- 835P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 835P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	70.5	111.62	191.0	104.0	69.0	4.55	260782.	72.5	189.0	69.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.05	71.06	68.06	6.01	1-	127.63	72.22	43.56	3735.70	6193.66	31427.00	923.31	152.63
	66.0	69.0			2-	117.28	49.22		5480.62				
					3-	127.63	59.57		4528.70			HEAT	DELTA
					1-	142.5	74.4		3624.1			FLUX	TCOMP
					2-	149.5	81.4		3312.6			5587.	36.60
					3-	109.5	41.4		6509.9				

EH-11-03-78T40- 900P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 900P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	71.0	112.03	194.5	103.0	62.5	4.78	264805.	72.0	194.0	70.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
94.7	67.61	73.22	70.41	5.62	1-	128.88	69.81	41.62	3793.01	6362.36	34081.80	975.41	155.97
	69.0	71.0			2-	112.32	41.90		6319.34				
					3-	128.88	58.46		4529.48			HEAT	DELTA
					1-	142.0	71.6		3699.1			FLUX	TCOMP
					2-	151.0	80.6		3280.0			5484.	35.16
					3-	108.5	38.1		6952.7				

EH-11-03-78T40- 925P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 925P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	70.2	111.37	195.0	101.0	59.5	5.12	264767.	71.5	196.0	68.5	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
101.5	70.08	75.32	72.70	5.24	1-	125.84	67.72	38.67	3909.61	6847.34	37634.18	1045.97	167.97
	71.5	73.0			2-	113.76	41.06		6448.78				
					3-	125.84	53.14		4902.51			HEAT	DELTA
					1-	141.0	68.3		3876.5			FLUX	TCOMP
					2-	151.0	78.3		3381.4			5483.	32.64
					3-	107.0	34.3		7719.0				

Table B.3 (continued)

EM-11-03-78T40- 940P / DC- -VHO- 940P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	70.0	111.19	186.0	101.0	59.5	5.12	257264.	71.5	195.0	68.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
101.5	70.55	75.65	73.10	5.09	1-	120.59	63.98	38.09	4020.82	6754.01	37832.82	1048.66	165.19
	71.5	73.5			2-	115.84	42.74		6018.76				
					3-	120.59	47.49		5417.40			HEAT	DELTA
					1-	137.5	64.4		3994.8			FLUX	TCOMP
					2-	145.5	72.4		3553.4			5327.	32.25
					3-	106.0	32.9		7819.8				

EM-11-03-78T40-1000P / DC- -VHO- 1000P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	71.0	112.03	189.0	102.5	59.5	5.12	258485.	71.5	187.0	69.0	97.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
101.5	71.97	77.09	74.53	5.12	1-	113.60	64.36	37.51	4016.20	6891.88	38541.81	1058.21	168.90
	73.5	75.5			2-	114.03	39.50		6543.15				
					3-	113.60	39.07		6615.41			HEAT	DELTA
					1-	140.0	65.5		3948.0			FLUX	TCOMP
					2-	142.5	68.0		3802.8			5353.	31.69
					3-	109.0	34.5		7498.4				

EM-11-03-78T40-1020P / DC- -VHO- 1020P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	73.2	113.85	191.0	104.5	60.0	5.12	260927.	75.0	191.0	72.5	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
101.5	73.46	78.63	76.05	5.17	1-	117.89	63.94	37.80	4080.75	6902.65	39300.67	1068.35	168.92
	75.0	77.0			2-	116.05	40.00		6522.75				
					3-	117.89	41.84		6236.11			HEAT	DELTA
					1-	142.0	66.0		3956.1			FLUX	TCOMP
					2-	150.0	74.0		3528.2			5403.	31.99
					3-	111.0	35.0		7464.6				

EM-11-03-78T40-1050P / DC- -VHO- 1050P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	75.0	115.30	190.0	105.5	60.0	5.12	258929.	76.0	191.0	74.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
101.5	74.24	79.36	76.80	5.13	1-	118.37	63.52	38.50	4076.14	6726.14	39681.21	1073.40	163.70
	76.5	78.0			2-	117.94	41.14		6293.66				
					3-	118.37	41.57		6228.79			HEAT	DELTA
					1-	141.0	64.2		4033.3			FLUX	TCOMP
					2-	150.0	73.2		3537.4			5362.	32.75
					3-	112.0	35.2		7356.3				

Table B.3 (continued)

EM-11-03-78T40-1120P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1120P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	78.0	117.67	196.0	106.5	64.5	4.55	263095.	79.0	196.0	76.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	75.59	81.45	78.52	5.86	1-	134.30	65.33	39.15	4027.23	6719.89	36030.90	987.00	166.07
	77.5	80.0			2-	120.24	41.72		6306.29				
					3-	134.30	55.79		4716.16			HEAT	DELTA
					1-	145.5	67.0		3927.9			FLUX	TCOMP
					2-	154.0	75.5		3485.6			5448.	32.81
					3-	114.0	35.5		7415.0				

EM-11-03-78T40-1150P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1150P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	78.5	118.06	197.0	108.0	64.5	4.55	267751.	79.0	197.5	77.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.18	82.15	79.16	5.97	1-	133.37	65.69	38.89	4076.22	6883.97	36322.31	990.91	170.80
	78.0	80.5			2-	124.53	45.37		5901.60				
					3-	133.37	54.21		4939.53			HEAT	DELTA
					1-	146.5	67.3		3976.3			FLUX	TCOMP
					2-	155.0	75.8		3530.6			5545.	32.46
					3-	114.5	35.3		7577.2				

EM-11-04-78T40-1220A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1220A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	76.4	116.41	182.0	105.5	64.5	4.55	254278.	77.0	178.0	75.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.22	81.88	79.05	5.66	1-	121.95	59.60	37.36	4266.15	6805.92	36270.70	990.22	168.51
	78.0	79.5			2-	118.86	39.81		6387.32				
					3-	121.95	42.90		5926.68			HEAT	DELTA
					1-	140.0	61.0		4171.9			FLUX	TCOMP
					2-	146.0	67.0		3798.0			5266.	31.25
					3-	112.0	33.0		7717.0				

EM-11-04-78T40-1245A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1245A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	78.0	117.67	182.0	105.5	64.5	4.55	248381.	79.0	178.0	77.0	102.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.75	82.28	79.51	5.53	1-	128.88	59.00	38.16	4209.80	6509.25	36480.07	993.02	159.71
	77.5	79.5			2-	119.48	39.97		6214.38				
					3-	128.88	49.36		5031.68			HEAT	DELTA
					1-	139.0	59.5		4175.3			FLUX	TCOMP
					2-	146.0	66.5		3735.7			5144.	32.20
					3-	112.0	32.5		7645.4				

Table B.3 (continued)

EM-11-04-78T40- DC-	105A -VHO- 105A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		77.4	117.20	190.0	106.5	64.5	4.55	257769.	78.0	192.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.91	82.65	79.78	5.74	1-	124.32	61.92	37.41	4162.87	6889.85	36602.30	994.65	170.85
	78.5	83.0			2-	118.49	38.71		6659.20				
					3-	124.32	44.54		5787.44			HEAT	DELTA
					1-	142.5	62.7		4110.0			FLUX	TCOMP
					2-	150.0	70.2		3671.0			5338.	31.24
					3-	113.0	33.2		7760.0				

EM-11-04-78T40- DC-	125A -VHO- 125A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		77.0	116.88	190.5	107.0	64.5	4.55	258302.	78.0	191.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.47	82.23	79.35	5.75	1-	125.09	62.45	37.53	4135.88	6882.09	36406.12	992.03	170.70
	78.0	80.0			2-	119.36	40.01		6456.40				
					3-	125.09	45.74		5646.88			HEAT	DELTA
					1-	142.5	63.2		4090.2			FLUX	TCOMP
					2-	150.5	71.2		3630.3			5349.	31.33
					3-	113.0	33.7		7675.9				

EM-11-04-78T40- DC-	145A -VHO- 145A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		77.0	116.88	193.0	107.0	64.0	4.55	259111.	77.5	192.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.48	82.25	79.37	5.77	1-	120.46	62.89	37.52	4120.12	6906.83	36413.96	992.14	171.44
	78.5	81.0			2-	119.89	40.52		6394.13				
					3-	120.46	41.10		6305.17			HEAT	DELTA
					1-	143.5	64.1		4040.2			FLUX	TCOMP
					2-	152.0	72.6		3567.4			5366.	31.30
					3-	114.0	34.6		7491.5				

EM-11-04-78T40- DC-	205A -VHO- 205A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		76.8	116.73	191.0	107.3	64.5	4.55	255541.	78.0	191.0	77.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.60	82.29	79.45	5.69	1-	122.48	62.11	37.28	4114.45	6854.53	36449.95	992.62	169.87
	79.5	84.5			2-	119.11	39.66		6443.00				
					3-	122.48	43.04		5937.43			HEAT	DELTA
					1-	143.5	64.1		3989.4			FLUX	TCOMP
					2-	151.0	71.6		3571.3			5292.	31.15
					3-	114.0	34.6		7395.3				

Table B.3 (continued)

EM-11-04-78T40- 225A DC- -VHO- 225A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	77.2	117.04	194.0	108.0	64.5	4.55	259288.	77.5	193.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.66	82.44	79.55	5.78	1-	123.94	63.21	37.49	4101.82	6915.91	36497.61	993.25	171.67
	79.2	83.5			2-	119.58	40.02		6478.26				
					3-	123.94	44.39		5841.10			HEAT	DELTA
					1-	145.0	65.4		3961.7			FLUX	TCOMP
					2-	153.0	73.4		3530.2			5369.	31.28
					3-	114.0	34.4		7526.8				

EM-11-04-78T40- 245A DC- -VHO- 245A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	77.5	117.28	194.0	107.0	64.0	4.55	256230.	78.0	193.0	76.5	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.72	82.43	79.57	5.71	1-	120.65	63.09	37.71	4061.37	6795.39	36507.09	993.38	168.09
	79.0	85.5			2-	119.11	39.54		6481.04				
					3-	120.65	41.08		6237.14			HEAT	DELTA
					1-	144.2	64.6		3964.7			FLUX	TCOMP
					2-	153.0	73.4		3489.5			5306.	31.57
					3-	114.0	34.4		7442.5				

EM-11-04-78T40- 305A DC- -VHO- 305A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	77.4	117.20	190.0	106.5	64.0	4.55	261656.	77.5	195.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.34	82.17	79.26	5.83	1-	119.61	64.17	37.94	4077.31	6897.19	36365.15	991.48	171.17
	78.0	84.5			2-	121.99	42.73		6123.59				
					3-	119.61	40.35		6484.73			HEAT	DELTA
					1-	145.5	66.2		3950.0			FLUX	TCOMP
					2-	153.0	73.7		3548.3			5418.	31.65
					3-	113.2	33.9		7709.0				

EM-11-04-78T40- 325A DC- -VHO- 325A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	78.0	117.67	199.0	107.0	64.5	4.55	263155.	78.0	200.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.22	82.08	79.15	5.86	1-	113.99	65.97	38.52	3989.14	6831.33	36315.47	990.82	169.24
	78.0	84.0			2-	121.99	42.84		6142.88				
					3-	113.99	34.84		7553.70			HEAT	DELTA
					1-	146.0	66.9		3936.4			FLUX	TCOMP
					2-	155.0	75.9		3469.3			5449.	32.20
					3-	113.5	34.4		7660.7				

Table B.3 (continued)

EH-11-04-78T40- 345A DC- -VHO- 345A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	76.5	116.49	193.0	105.0	64.5	4.55	255462.	77.0	193.0	75.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.54	82.23	79.38	5.69	1-	124.11	62.62	37.11	4079.32	6883.27	36420.49	992.22	170.73
	78.5	84.0			2-	122.15	42.77		5972.55				
					3-	124.11	44.73		5710.75			HEAT	DELTA
					1-	143.0	63.6		4015.5			FLUX	TCOMP
					2-	151.5	72.1		3542.2			5290.	30.99
					3-	112.5	33.1		7713.4				

EH-11-04-78T40- 405A DC- -VHO- 405A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	75.4	115.62	194.0	107.0	64.5	4.55	259545.	76.0	194.0	75.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.42	82.20	79.31	5.78	1-	126.60	63.35	36.31	4096.75	7147.70	36387.53	991.78	178.66
	78.0	83.2			2-	117.88	38.57		6728.36				
					3-	126.60	47.29		5488.41			HEAT	DELTA
					1-	144.0	64.7		4012.0			FLUX	TCOMP
					2-	153.0	73.7		3522.0			5375.	30.08
					3-	112.0	32.7		7039.1				

EH-11-04-78T40- 425A DC- -VHO- 425A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	76.0	116.10	193.0	107.2	64.5	4.55	259308.	76.5	192.5	75.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.78	82.56	79.67	5.78	1-	122.35	62.43	36.42	4153.35	7119.01	36551.87	993.98	177.72
	78.0	84.0			2-	121.99	42.32		6127.80				
					3-	122.35	42.68		6075.62			HEAT	DELTA
					1-	144.0	64.3		4031.0			FLUX	TCOMP
					2-	152.0	72.3		3585.1			5370.	30.22
					3-	107.0	27.3		9488.4				

EH-11-04-78T40- 445A DC- -VHO- 445A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	77.4	117.20	199.0	109.0	64.5	4.55	263076.	78.0	198.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.82	82.68	79.75	5.86	1-	125.87	64.62	37.45	4070.96	7025.62	36587.75	994.46	174.90
	78.5	85.2			2-	124.36	44.61		5897.30				
					3-	125.87	46.12		5703.63			HEAT	DELTA
					1-	147.0	67.3		3911.9			FLUX	TCOMP
					2-	156.2	76.5		3441.1			5448.	31.15
					3-	113.5	33.8		7794.8				

Table B.3 (continued)

EM-11-04-78T40- 505A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 505A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	78.0	117.67	199.0	109.0	64.5	4.55	262247.	78.0	198.0	77.0	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	77.36	83.21	80.29	5.84	1-	132.87	64.62	37.38	4058.46	7014.88	36831.12	990.70	174.71
	79.0	85.5			2-	125.41	45.13		5811.29				
					3-	132.87	52.58		4987.47			HEAT	DELTA
					1-	147.0	66.7		3930.9			FLUX	TCOMP
					2-	156.0	75.7		3463.7			5431.	31.08
					3-	109.0	28.7		9133.1				

EM-11-04-78T40- 525A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 525A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	77.2	117.04	200.0	108.5	64.5	4.55	264653.	77.0	200.0	76.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	77.04	82.94	79.99	5.90	1-	124.39	65.02	37.05	4070.29	7142.32	36695.93	995.90	178.35
	79.0	85.0			2-	123.50	43.51		6082.58				
					3-	124.39	44.40		5960.32			HEAT	DELTA
					1-	146.5	66.5		3979.1			FLUX	TCOMP
					2-	156.5	76.5		3459.0			5481.	30.73
					3-	114.0	34.0		7781.3				

EM-11-04-78T40- 545A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 545A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	77.0	116.88	199.0	108.0	64.5	4.55	265482.	77.0	199.0	75.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.87	82.79	79.83	5.91	1-	123.56	65.07	37.05	4079.81	7165.42	36624.53	994.95	179.08
	78.2	79.5			2-	122.45	42.62		6228.84				
					3-	123.56	43.73		6070.54			HEAT	DELTA
					1-	147.0	67.2		3952.5			FLUX	TCOMP
					2-	156.0	76.2		3485.4			5498.	30.70
					3-	113.0	33.2		8004.0				

EM-11-04-78T40- 605A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 605A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	76.6	116.57	188.5	107.0	64.5	4.55	267395.	77.0	199.0	77.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.76	82.72	79.74	5.96	1-	122.32	65.43	36.83	4086.89	7260.27	36584.46	994.41	181.97
	77.5	83.5			2-	123.16	43.42		6158.94				
					3-	122.32	42.58		6280.55			HEAT	DELTA
					1-	147.0	67.3		3975.7			FLUX	TCOMP
					2-	155.5	75.8		3529.6			5537.	30.43
					3-	112.0	32.3		8289.4				

Table B.3 (continued)

EH-11-04-78T40- DC-	-VHO-	625A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		625A	75.4	115.62	189.5	105.0	64.5	4.55	258480.	76.0	192.0	74.0	104.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	76.80	82.56	79.68	5.76	1-	118.99	61.92	35.94	4174.19	7192.09	36556.14	994.04	179.92
	76.5	83.0			2-	120.52	40.84		6328.38				
					3-	118.99	39.31		6576.16			HEAT	DELTA
					1-	141.5	61.8		4181.2			FLUX	TCOMP
					2-	150.0	70.3		3675.8			5353.	29.75
					3-	111.0	31.3		8252.9				

EH-11-04-78T40- DC-	-VHO-	710A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		710A	74.0	114.49	196.0	100.0	64.5	4.55	270157.	74.0	199.0	72.5	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.52	77.53	74.53	6.02	1-	121.59	67.53	39.96	4000.61	6760.25	34245.73	962.76	168.09
	71.0	77.0			2-	114.39	39.87		6776.06				
					3-	121.59	47.07		5739.82			HEAT	DELTA
					1-	142.0	67.5		4003.8			FLUX	TCOMP
					2-	151.0	76.5		3532.6			5594.	33.28
					3-	108.0	33.5		8070.5				

EH-11-04-78T40- DC-	-VHO-	740A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		740A	65.0	106.93	201.0	97.0	64.8	4.55	281164.	68.5	202.0	65.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.39	72.65	69.52	6.26	1-	121.04	71.74	37.41	3919.33	7516.14	32055.01	932.23	192.61
	65.5	72.0			2-	108.01	38.50		7303.61				
					3-	121.04	51.52		5457.21			HEAT	DELTA
					1-	144.0	74.5		3774.9			FLUX	TCOMP
					2-	152.0	82.5		3408.8			5822.	30.23
					3-	103.0	33.5		8397.4				

EH-11-04-78T40- DC-	-VHO-	800A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
		800A	66.4	108.14	201.0	97.0	65.0	4.55	290809.	68.0	203.0	66.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.57	71.04	67.80	6.48	1-	113.06	73.60	40.33	3951.22	7210.15	31318.47	921.76	183.47
	64.0	70.0			2-	107.41	39.61		7342.32				
					3-	113.06	45.25		6426.62			HEAT	DELTA
					1-	144.0	76.2		3816.6			FLUX	TCOMP
					2-	151.5	83.7		3474.6			6022.	32.82
					3-	102.5	34.7		8381.8				

Table B.3 (continued)

EM-11-04-78T40- 930A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 930A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	65.5	107.36	201.0	97.5	66.0	4.55	282386.	67.0	200.0	64.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.98	70.27	67.13	6.29	1-	113.79	72.86	40.23	3875.88	7019.19	31029.75	917.62	177.71
	63.0	69.0			2-	106.23	39.10		7221.77				
					3-	113.79	46.66		6051.39			HEAT	DELTA
					1-	143.0	75.9		3721.9			FLUX	TCOMP
					2-	151.2	84.1		3358.9			5848.	32.91
					3-	102.0	34.9		8097.9				

EM-11-04-78T40- 950A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 950A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	65.6	107.45	200.0	97.0	66.0	4.55	283748.	68.0	200.0	64.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.92	70.24	67.08	6.32	1-	112.04	72.76	40.36	3899.94	7029.67	31010.71	917.35	178.05
	63.0	70.0			2-	105.88	38.80		7313.51				
					3-	112.04	44.95		6312.13			HEAT	DELTA
					1-	142.5	75.4		3762.4			FLUX	TCOMP
					2-	151.0	83.9		3381.3			5876.	33.00
					3-	102.0	34.9		8126.6				

EM-11-04-78T40-1010A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1010A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	65.4	107.27	201.0	96.5	66.0	4.55	284872.	68.0	202.0	63.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.12	70.46	67.29	6.35	1-	108.35	72.36	39.98	3936.88	7125.08	31098.34	918.60	180.96
	64.0	70.0			2-	104.97	37.68		7560.92				
					3-	108.35	41.06		6937.61			HEAT	DELTA
					1-	143.0	75.7		3762.6			FLUX	TCOMP
					2-	152.0	84.7		3362.9			5899.	32.60
					3-	101.5	34.2		8327.0				

EM-11-04-78T40-1040A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1040A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	64.0	106.05	197.0	95.2	66.2	4.55	280769.	65.0	198.0	62.0	95.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.32	70.57	67.44	6.26	1-	113.88	70.23	38.60	3997.63	7273.09	31164.37	919.55	185.54
	63.5	70.0			2-	102.33	34.88		8048.70				
					3-	113.88	46.43		6046.87			HEAT	DELTA
					1-	141.0	73.6		3817.1			FLUX	TCOMP
					2-	149.0	81.6		3442.7			5814.	31.34
					3-	101.0	33.6		8367.2				

Table B.3 (continued)

EM-11-04-78T40-1055A	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1055A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	64.2	106.22	195.0	96.5	66.5	4.55	276252.	66.0	196.0	62.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.54	70.69	67.61	6.15	1-	114.07	69.88	38.61	3953.25	7155.38	31237.29	920.59	181.81
	65.0	70.0			2-	103.04	35.42		7798.71				
					3-	114.07	46.45		5946.69			HEAT	DELTA
					1-	141.0	73.4		3764.4			FLUX	TCOMP
					2-	148.5	80.9		3415.4			5721.	31.46
					3-	100.5	32.9		8400.5				

EM-11-04-78T40-1200P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC- -VHO- 1200A	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	64.2	106.22	195.0	95.5	67.0	4.55	276232.	66.0	194.0	63.5	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.50	71.65	68.58	6.15	1-	111.69	69.10	37.65	3997.50	7337.65	31649.52	926.48	187.25
	64.5	71.0			2-	102.33	33.75		8184.34				
					3-	111.69	43.12		6406.59			HEAT	DELTA
					1-	140.0	71.4		3867.5			FLUX	TCOMP
					2-	150.0	81.4		3392.5			5720.	30.55
					3-	101.0	32.4		8519.5				

EM-11-08-78T40-1200P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- -1200P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	64.5	106.49	186.0	95.0	63.5	4.55	165811.	64.0	187.0	63.0	90.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.81	68.50	66.66	3.69	1-	86.00	56.30	39.83	2945.08	4162.92	30828.24	914.73	96.68
	65.0	67.0			2-	136.15	69.49		2386.10				
					3-	86.00	19.35		8570.19			HEAT	DELTA
					1-	139.0	72.3		2292.0			FLUX	TCOMP
					2-	147.5	80.8		2051.0			3434.	35.52
					3-	98.0	31.3		5289.9				

EM-11-08-78T40-1230P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- -1230P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	78.2	117.82	190.0	109.0	63.5	4.55	246210.	80.0	189.0	77.5	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.83	70.31	67.57	5.49	1-	98.38	62.31	50.25	3951.20	4899.59	31218.57	920.33	116.18
	65.0	69.0			2-	135.88	68.31		3604.40				
					3-	98.38	30.81		7991.80			HEAT	DELTA
					1-	143.0	75.4		3264.1			FLUX	TCOMP
					2-	153.0	85.4		2882.0			5099.	43.98
					3-	112.0	44.4		5541.7				

Table B.3 (continued)

EM-11-08-78T40- 100P DC -VHO- - 100P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	77.2	117.04	196.0	107.0	63.5	4.55	255146.	78.0	194.0	76.0	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.83	70.51	67.67	5.68	1-	98.81	76.97	49.37	3315.03	5167.82	31261.15	920.94	123.51
	65.0	70.0			2-	138.99	71.32		3577.40				
					3-	98.81	31.14		8194.14			HEAT	DELTA
					1-	148.5	80.8		3156.6			FLUX	TCOMP
					2-	155.5	87.8		2905.0			5284.	42.78
					3-	111.5	43.8		5821.3				

EM-11-08-78T40- 120P DC -VHO- - 120P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	75.8	115.93	198.0	105.5	63.5	4.55	261537.	77.5	197.0	74.5	105.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.67	70.49	67.58	5.83	1-	106.14	77.75	48.35	3363.74	5408.72	31222.09	920.38	130.22
	64.5	69.0			2-	136.50	68.92		3794.52				
					3-	106.14	38.56		6782.67			HEAT	DELTA
					1-	149.0	81.4		3212.2			FLUX	TCOMP
					2-	155.5	87.9		2974.7			5416.	41.59
					3-	110.0	42.4		6165.3				

EM-11-08-78T40- 200P DC -VHO- - 200P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	73.5	114.08	184.0	102.5	63.5	4.55	250274.	75.0	183.0	72.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.94	70.51	67.72	5.58	1-	94.27	69.00	46.36	3627.30	5398.47	31284.39	921.27	129.91
	64.5	68.0			2-	131.23	63.51		3940.71				
					3-	94.27	26.55		9427.29			HEAT	DELTA
					1-	142.5	74.8		3347.0			FLUX	TCOMP
					2-	147.0	79.3		3157.0			5183.	39.89
					3-	108.5	40.8		6137.9				

EM-11-08-78T40- 230P DC -VHO- - 230P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	71.4	112.36	182.0	103.5	63.5	4.55	249564.	73.0	180.0	71.0	103.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.88	70.44	67.66	5.56	1-	96.55	68.43	44.70	3646.91	5583.29	31257.86	920.89	135.12
	64.5	69.5			2-	125.95	58.29		4281.62				
					3-	96.55	28.89		8637.88			HEAT	DELTA
					1-	141.0	73.3		3403.0			FLUX	TCOMP
					2-	145.5	77.8		3206.2			5168.	38.25
					3-	107.0	39.3		6344.2				

Table B.3 (continued)

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-11-08-78T40- 300P DC -VHO- - 300P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	66.5	108.23	184.0	98.5	59.5	5.05	254305.	67.5	182.0	65.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
100.1	64.77	69.87	67.32	5.10	1-	89.82	66.86	40.91	3803.75	6216.40	34544.45	999.05	151.11
	65.0	67.5			2-	114.23	46.91		5421.32				
					3-	89.82	22.50		11300.58			HEAT	DELTA
					1-	139.0	71.7		3547.7			FLUX	TCOMP
					2-	144.0	76.7		3316.4			5266.	34.85
					3-	103.0	35.7		7127.2				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-11-08-78T40- 330P DC -VHO- - 330P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	66.2	107.97	173.0	99.0	59.5	5.05	253562.	67.5	179.0	64.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
100.1	65.38	70.46	67.92	5.09	1-	87.90	62.08	40.05	4084.26	6331.53	34829.09	1003.04	154.30
	65.0	68.0			2-	109.82	41.90		6051.04				
					3-	87.90	19.98		12690.52			HEAT	DELTA
					1-	134.0	66.1		3837.1			FLUX	TCOMP
					2-	141.0	73.1		3469.6			5251.	34.03
					3-	102.0	34.1		7439.9				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-11-08-78T40- 400P DC -VHO- - 400P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	66.2	107.97	182.0	98.5	59.5	5.05	261074.	67.0	181.0	64.5	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
100.1	65.44	70.68	68.06	5.24	1-	91.94	66.03	39.90	3954.02	6542.63	34897.54	1003.99	160.36
	66.0	68.0			2-	111.10	43.04		6065.59				
					3-	91.94	23.88		10934.60			HEAT	DELTA
					1-	135.0	66.9		3900.3			FLUX	TCOMP
					2-	143.0	74.9		3483.9			5406.	33.71
					3-	102.5	34.4		7501.2				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
EM-11-08-78T40- 430P DC -VHO- - 430P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	64.6	106.57	184.5	98.0	59.5	5.05	259934.	67.0	184.0	63.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
100.1	65.22	70.43	67.83	5.22	1-	91.72	67.26	38.75	3864.82	6708.34	34784.55	1002.41	165.24
	65.0	67.5			2-	112.21	44.39		5856.27				
					3-	91.72	23.90		10877.08			HEAT	DELTA
					1-	135.0	67.2		3869.5			FLUX	TCOMP
					2-	144.0	76.2		3412.3			5383.	32.59
					3-	101.0	33.2		7835.3				

Table B.3 (continued)

EM-11-08-78T40- 500P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- - 500P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	64.6	106.57	188.0	96.0	59.5	5.05	264665.	67.0	188.0	63.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
100.1	65.05	70.36	67.71	5.31	1-	93.80	68.88	38.86	3842.49	6809.89	34729.00	1001.63	168.25
	65.0	68.0			2-	106.79	39.09		6771.46				
					3-	93.80	26.09		10144.20			HEAT	DELTA
					1-	137.0	69.3		3819.6			FLUX	TCOMP
					2-	146.0	78.3		3380.5			5481.	32.58
					3-	101.0	33.3		7949.9				

EM-11-08-78T40- 530P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- - 530P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	63.8	105.87	191.0	97.5	59.0	5.05	266834.	65.5	194.5	62.5	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
100.1	64.58	69.94	67.26	5.35	1-	97.36	70.19	38.61	3801.80	6910.88	34517.32	998.67	171.33
	65.0	67.5			2-	108.80	41.54		6424.15				
					3-	97.36	30.10		8864.74			HEAT	DELTA
					1-	138.5	71.2		3745.7			FLUX	TCOMP
					2-	147.5	80.2		3325.5			5526.	32.25
					3-	101.5	34.2		7793.5				

Table B.4. The ORNL 40-tube condenser performance data for Group IV tests (direct-contact evaporator mode without Barber-Nichols brine preflash unit)

EH-11-06-78T40-1200P DC -VHO- -1200P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	82.5	121.11	183.0	105.0	61.5	4.55	198712.	82.5	184.0	80.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.42	69.85	67.64	4.43	1-	103.77	63.80	53.47	3114.79	3716.43	31246.77	920.73	85.14
	65.0	69.0			2-	138.52	70.88		2803.32				
					3-	103.77	36.13		5499.84			HEAT	DELTA
					1-	145.0	77.4		2568.6			FLUX	TCOMP
					2-	149.5	81.9		2427.4			4115.	48.33
					3-	108.0	40.4		4923.1				

EH-11-06-78T40-1235P DC -VHO- -1235P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	83.0	121.48	179.0	106.0	61.5	4.55	198100.	83.0	178.0	82.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.88	70.29	68.09	4.41	1-	97.84	60.75	53.40	3260.74	3709.94	31439.45	923.48	84.95
	66.0	70.0			2-	137.23	69.14		2865.18				
					3-	97.84	29.75		6658.38			HEAT	DELTA
					1-	143.0	74.9		2644.4			FLUX	TCOMP
					2-	148.5	80.4		2463.5			4102.	48.29
					3-	111.0	42.9		4616.3				

EH-11-06-78T40- 115P DC -VHO- - 115P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	83.0	121.48	170.0	105.5	61.5	4.55	196898.	82.5	169.0	81.5	95.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	66.08	70.46	68.27	4.39	1-	93.42	62.92	53.22	3129.25	3700.04	31517.60	924.60	84.69
	66.5	70.5			2-	134.35	66.08		2979.58				
					3-	93.42	25.15		7829.79			HEAT	DELTA
					1-	134.0	65.7		2995.5			FLUX	TCOMP
					2-	144.0	75.7		2600.0			4077.	48.15
					3-	111.0	42.7		4607.9				

EH-11-06-78T40- 150P DC -VHO- - 150P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	88.0	125.12	197.0	109.0	62.5	4.61	218685.	88.0	199.0	87.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
91.5	66.23	71.03	68.63	4.80	1-	113.77	78.51	56.49	2785.56	3871.29	32129.98	937.49	88.91
	66.5	71.5			2-	146.55	77.91		2806.77				
					3-	113.77	45.13		4845.26			HEAT	DELTA
					1-	153.5	84.9		2576.8			FLUX	TCOMP
					2-	161.0	92.4		2367.5			4529.	50.94
					3-	113.0	44.4		4928.9				

Table B.4 (continued)

EH-11-07-78T40-1015A DC -VHO- -1015A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	86.0	123.68	175.0	108.0	64.0	4.55	180742.	86.0	174.0	85.0	95.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.00	68.02	66.01	4.03	1-	91.77	57.76	57.67	3129.04	3134.07	30554.17	910.77	70.69
	64.0	68.0			2-	139.28	73.27		2466.91				
					3-	91.77	25.76		7015.53			HEAT	DELTA
					1-	139.0	73.0		2476.2			FLUX	TCOMP
					2-	150.0	84.0		2151.9			3743.	52.95
					3-	111.0	45.0		4017.3				

EH-11-07-78T40-1030A DC -VHO- -1030A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	86.8	124.25	174.0	107.5	63.5	4.55	190151.	88.0	179.0	86.0	98.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.65	67.88	65.76	4.24	1-	92.97	69.19	58.49	2748.39	3251.04	30450.50	909.27	73.59
	63.5	67.0			2-	138.66	72.90		2608.47				
					3-	92.97	27.21		6989.52			HEAT	DELTA
					1-	141.0	75.2		2527.4			FLUX	TCOMP
					2-	151.5	85.7		2217.9			3938.	53.51
					3-	109.5	43.7		4347.8				

EH-11-07-78T40-1100A DC -VHO- -1100A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	92.2	128.04	191.0	110.5	63.5	4.55	199402.	92.0	190.0	90.0	101.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.40	67.85	65.62	4.44	1-	93.96	74.46	62.42	2678.08	3194.61	30391.35	908.42	72.20
	63.5	67.0			2-	145.78	80.16		2487.71				
					3-	93.96	28.33		7038.01			HEAT	DELTA
					1-	148.5	82.9		2406.0			FLUX	TCOMP
					2-	158.0	92.4		2158.6			4129.	57.19
					3-	111.5	45.9		4346.6				

EH-11-07-78T40-1130A DC -VHO- -1130A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	91.6	127.63	188.5	109.0	63.5	4.55	202283.	90.5	187.0	89.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.42	67.93	65.68	4.51	1-	94.57	72.23	61.96	2800.43	3264.89	30412.98	908.73	73.93
	63.0	66.5			2-	142.57	76.90		2630.58				
					3-	94.57	28.90		7000.04			HEAT	DELTA
					1-	144.0	78.3		2582.6			FLUX	TCOMP
					2-	156.0	90.3		2239.5			4189.	56.66
					3-	112.0	46.3		4366.7				

Table B.4 (continued)

RN-11-07-78T40-1200P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- -1200P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	86.5	124.04	176.0	106.5	63.5	4.55	192795.	86.5	177.0	85.0	96.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.83	68.13	65.98	4.30	1-	94.34	70.83	58.06	2721.77	3320.33	30540.83	910.58	75.29
	63.0	66.5			2-	138.43	72.45		2661.09				
					3-	94.34	28.37		6796.82			HEAT	DELTA
					1-	130.0	64.0		3011.4			FLUX	TCOMP
					2-	149.5	83.5		2308.3			3992.	53.03
					3-	109.0	43.0		4481.3				

RN-11-07-78T40-1230P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- -1230P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	88.0	125.12	180.5	108.0	63.5	4.55	192538.	88.0	180.0	87.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	63.88	68.17	66.03	4.29	1-	92.14	70.25	59.09	2740.95	3258.22	30562.05	910.89	73.75
	64.0	66.5			2-	140.38	74.36		2589.44				
					3-	92.14	26.11		7373.65			HEAT	DELTA
					1-	141.0	75.0		2568.1			FLUX	TCOMP
					2-	152.0	86.0		2239.5			3987.	54.06
					3-	110.0	44.0		4378.6				

RN-11-07-78T40- 100P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- - 100P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	89.8	126.39	188.0	110.0	63.5	4.55	195024.	90.0	188.0	89.5	99.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.42	68.77	66.60	4.34	1-	93.97	73.63	59.79	2648.67	3261.78	30803.15	914.36	73.81
	64.0	67.0			2-	144.97	78.37		2488.35				
					3-	93.97	27.38		7123.45			HEAT	DELTA
					1-	146.0	79.4		2456.1			FLUX	TCOMP
					2-	156.0	89.4		2181.4			4039.	54.71
					3-	112.0	45.4		4295.3				

RN-11-07-78T40- 130P	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
DC -VHO- - 130P	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
	89.2	125.96	186.0	109.5	63.8	4.55	199561.	89.5	181.0	87.5	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.82	69.27	67.04	4.45	1-	94.48	69.18	58.91	2884.48	3387.40	30993.81	917.10	76.91
	64.5	68.0			2-	145.29	78.25		2550.34				
					3-	94.48	27.44		7272.59			HEAT	DELTA
					1-	143.5	76.5		2610.2			FLUX	TCOMP
					2-	155.0	88.0		2268.9			4133.	53.73
					3-	111.0	44.0		4540.0				

Table B.4 (continued)

EH-11-07-78T40- 200P DC -VHO- - 200P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	85.8	123.54	178.0	107.0	63.5	4.55	192143.	85.5	178.0	83.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.86	69.14	67.00	4.28	1-	93.96	71.37	56.54	2692.19	3398.55	30975.88	916.85	77.19
	65.0	67.5			2-	140.09	73.09		2628.87				
					3-	93.96	26.95		7128.42			HEAT	DELTA
					1-	130.0	63.0		3050.0			FLUX	TCOMP
					2-	150.5	83.5		2301.2			3979.	51.55
					3-	110.5	43.5		4417.3				

EH-11-07-78T40- 230P DC -VHO- - 230P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	84.8	122.81	176.5	107.5	63.5	4.55	192775.	85.0	177.0	84.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	65.06	69.35	67.21	4.29	1-	92.44	69.47	55.60	2774.94	3467.07	31063.17	918.10	78.89
	65.0	68.0			2-	137.27	70.07		2751.32				
					3-	92.44	25.24		7638.93			HEAT	DELTA
					1-	137.0	69.8		2762.1			FLUX	TCOMP
					2-	149.5	82.3		2342.5			3992.	50.60
					3-	110.0	42.8		4504.8				

EH-11-07-78T40- 300P DC -VHO- - 300P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	84.2	122.37	178.0	107.0	63.5	4.55	193544.	85.0	177.0	83.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	64.69	69.00	66.84	4.31	1-	93.56	68.94	55.53	2807.35	3485.69	30907.69	915.87	79.37
	65.0	67.0			2-	137.73	70.89		2730.20				
					3-	93.56	26.71		7245.29			HEAT	DELTA
					1-	133.5	66.7		2903.5			FLUX	TCOMP
					2-	150.0	83.2		2327.4			4008.	50.50
					3-	111.5	44.7		4333.9				

Table B.5. The ORNL 40-tube condenser performance data for Group IV tests (direct-contact evaporator mode using Mesa 8-1 well without Barber-Nichols brine preflash unit)

EM-11-09-78T40-1000A DC -VHO- -1000A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	67.4	109.00	177.0	97.0	63.0	4.55	139379.	67.0	179.0	67.0	87.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	68.50	71.60	70.05	3.11	1-	85.92	54.34	38.95	2564.73	3578.41	32284.99	935.47	81.53
	68.0	71.0			2-	136.95	66.91		2083.22				
					3-	85.92	15.87		8784.73			HEAT	DELTA
					1-	102.5	32.5		4295.1			FLUX	TCOMP
					2-	144.0	74.0		1884.8			2886.	35.40
					3-	100.0	30.0		4653.6				

EM-11-09-78T40-1020A DC -VHO- -1020A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	70.4	111.54	183.0	98.0	63.0	4.55	142515.	70.0	186.0	69.0	87.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.32	72.49	70.90	3.18	1-	86.82	58.63	40.63	2430.81	3507.57	32656.26	940.70	79.71
	69.0	71.5			2-	139.85	68.95		2067.06				
					3-	86.82	15.92		8953.76			HEAT	DELTA
					1-	117.0	46.1		3091.8			FLUX	TCOMP
					2-	148.5	77.6		1836.7			2951.	37.02
					3-	102.0	31.1		4583.2				

EM-11-09-78T40-1040A DC -VHO- -1040A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	83.0	121.48	193.5	111.0	63.0	4.55	199915.	83.0	195.0	81.0	97.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	69.92	74.38	72.15	4.45	1-	93.97	68.91	49.33	2901.20	4052.29	33199.83	948.29	93.42
	69.5	72.0			2-	145.13	72.98		2739.26				
					3-	93.97	21.82		9160.57			HEAT	DELTA
					1-	138.0	65.8		3035.9			FLUX	TCOMP
					2-	158.0	85.8		2328.7			4140.	44.32
					3-	113.0	40.8		4893.9				

EM-11-09-78T40-1100A DC -VHO- -1100A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	85.2	123.11	199.0	111.5	63.0	4.55	207017.	85.0	102.0	82.5	98.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.27	74.88	72.58	4.61	1-	95.67	70.96	50.53	2917.51	4097.18	33387.63	950.90	94.54
	69.5	74.0			2-	147.49	74.91		2763.38				
					3-	95.67	23.09		8964.80			HEAT	DELTA
					1-	128.0	55.4		3735.3			FLUX	TCOMP
					2-	162.0	89.4		2315.1			4287.	45.34
					3-	114.5	41.9		4938.2				

Table B.5 (continued)

EH-11-09-78T40-1120A / DC -VHO- -1120A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	87.0	124.41	196.0	111.5	63.0	4.55	214118.	87.0	197.0	86.0	99.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	70.78	75.55	73.16	4.77	1-	96.93	71.26	51.25	3004.53	4178.23	33643.12	954.45	96.59
	70.0	73.5			2-	149.38	76.22		2809.05				
					3-	96.93	23.77		9008 47			HEAT	DELTA
					1-	123.5	50.3		4253.4			FLUX	TCOMP
					2-	160.5	87.3		2451.5			4434.	45.91
					3-	116.5	43.3		4940.4				

EH-11-09-78T40-1140A / DC -VHO- -1140A	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	86.5	124.04	190.0	112.5	63.0	4.55	208436.	86.0	190.0	82.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.44	76.08	73.76	4.64	1-	97.59	69.88	50.29	2992.69	4145.06	33906.22	958.08	95.69
	71.5	75.0			2-	144.71	70.95		2937.89				
					3-	97.59	23.83		8745.67			HEAT	DELTA
					1-	115.0	41.2		5053.9			FLUX	TCOMP
					2-	157.0	83.2		2504.0			4316.	45.11
					3-	115.5	41.7		4993.4				

EH-11-09-78T40-1200P / DC -VHO-C/V-1200P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	88.0	125.12	193.5	112.0	63.0	4.55	211218.	88.0	195.0	83.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.56	76.26	73.91	4.71	1-	96.93	69.11	51.21	3056.25	4124.43	33973.46	959.01	95.15
	73.0	75.5			2-	144.86	70.95		2976.79				
					3-	96.93	23.02		9175.80			HEAT	DELTA
					1-	133.5	59.6		3544.5			FLUX	TCOMP
					2-	158.0	84.1		2511.8			4374.	45.97
					3-	116.5	42.6		4959.3				

EH-11-09-78T40-1215P / DC -VHO-C/V-1215P	PSHELL PSIG	SAT. TEMP	TVAP PIPE	COND TEMP	PH2O PSIG	WVEL. FT/SEC	HEAT LOAD	DSS PVAP	DSS TVAP	DSS PWELL	DSS TWELL
	87.8	124.98	195.0	113.0	63.0	4.55	212777.	87.0	195.0	87.0	98.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.80	76.54	74.17	4.74	1-	96.76	68.65	50.82	3099.63	4187.27	34088.09	960.59	96.75
	72.5	76.5			2-	145.94	71.77		2964.54				
					3-	96.76	22.59		9418.75			HEAT	DELTA
					1-	125.5	51.3		4145.2			FLUX	TCOMP
					2-	161.0	86.8		2450.5			4406.	45.54
					3-	117.0	42.8		4967.8				

Table B.5 (continued)

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EM-11-09-78T40-1230P DC -VHO-C/V-1230P	88.8	125.68	197.0	114.0	63.0	4.55	210567.	89.0	197.0	87.0	99.5

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.01	76.70	74.36	4.69	1-	96.22	69.08	51.33	3048.32	4102.38	34170.60	961.72	94.55
	73.0	76.5			2-	147.44	73.08		2881.27				
					3-	96.22	21.87		9630.04				
					1-	127.0	52.6		3999.8			HEAT FLUX	DELTA TCOMP
					2-	161.5	87.1		2416.3			4360.	46.12
					3-	117.5	43.1		8880.5				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EM-11-09-78T40-1245P DC -VHO-C/V-1245P	87.2	124.55	196.5	113.5	63.0	4.55	209719.	87.0	195.0	85.5	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	71.69	76.37	74.03	4.67	1-	97.02	70.85	50.52	2976.94	4151.48	34026.66	959.74	95.84
	73.0	76.0			2-	144.18	70.15		2989.76				
					3-	97.02	22.99		9121.33				
					1-	142.5	68.5		3062.9			HEAT FLUX	DELTA TCOMP
					2-	162.0	88.0		2384.0			4343.	45.32
					3-	118.0	44.0		4769.6				

	PSHELL	SAT.	TVAP	COND	PH2O	WVEL.	HEAT	DSS			
	PSIG	TEMP	PIPE	TEMP	PSIG	FT/SEC	LOAD	PVAP	TVAP	PWELL	TWELL
EM-11-09-78T40- 100P DC -VHO-C/V- 100P	86.3	123.90	193.0	112.0	63.0	4.55	205063.	86.0	192.0	85.0	100.0

GPM H2O	INLET TEMP	OUTLET TEMP	AVG TEMP	TEMP RISE	MEAS LOC.	SHELL TEMP	TSHL-TAVG	TSAT-TAVG	OVERALL UA	SAT. UA	REYNOLDS H2O	HT.COEFF. H2O	HT.SAT. COMPOSITE
90.2	72.13	76.70	74.42	4.57	1-	95.06	68.76	49.49	2982.42	4143.91	34197.69	962.10	95.62
	74.0	76.0			2-	145.02	70.61		2904.26				
					3-	95.06	20.64		9935.96				
					1-	131.0	56.6		3624.1			HEAT FLUX	DELTA TCOMP
					2-	158.5	84.1		2438.8			4246.	44.41
					3-	116.0	41.6		8931.4				

Appendix C

LABORATORY TEST DATA

Laboratory test results from experiments performed with condensation on the outside of single vertical tubes A, F, and F-3 are presented in Tables C.1–C.3, respectively. Data for these tables were taken from Ref. 1. The Wilson-plot method[2] was used in determining composite condensing heat transfer coefficients and composite condensing temperature differences.

References

1. S. K. Combs, G. S. Mailen, and R. W. Murphy, *Condensation of Refrigerants on Vertical Fluted Tubes*, ORNL/TM-5848 (August 1978).

2. E. E. Wilson, "Basis for Rational Design of Heat Transfer Apparatus," *Trans. ASME* 37, 47 (1915).

Table C.1. Laboratory performance for R-600a condensing on the outside of vertical smooth tube A

Run No.	Condenser heat load [W (Btu/h)]		Difference (%)	Vapor temperature range [K (°F)]	Condensing temperature difference [K (°F)]	Condensing heat transfer coefficient [W/m²·K (Btu/h·ft²·°F)]
	Q_c	Q_w				
R-600a-001A to -004A	491 (1674)	515 (1758)	-5.0	302-308 (84-94)	4.5 (8.1)	1125.7 (198.5)
R-600a-005A to -008A	828 (2828)	864 (2949)	-4.3	306-308 (92-95)	8.5 (15.4)	996.7 (175.8)
R-600a-009A to -012A	1159 (3954)	1194 (4077)	-3.1	310-313 (99-104)	12.4 (22.4)	957.8 (168.9)
R-600a-013A to -016A	1355 (4625)	1372 (4682)	-2.1	313-315 (103-108)	14.8 (26.6)	940.1 (165.8)
R-600a-017A to -020A	1705 (5819)	1725 (5889)	-1.2	318-322 (112-119)	18.8 (33.9)	928.9 (163.8)
R-600a-021A to -024A	2187 (7464)	2211 (7545)	-1.1	323-328 (121-130)	24.4 (43.9)	920.7 (162.4)

Table C.2. Laboratory performance for R-600a condensing on the outside of vertical fluted tube F

Run No.	Condenser heat load [W (Btu/h)]		Difference (%)	Vapor temperature range [K (°F)]	Condensing temperature difference [K (°F)]	Condensing heat transfer coefficient [W/m²·K (Btu/h·ft²·°F)]
	Q_c	Q_w				
R-600a-001F to -004F	634 (2164)	604 (2060)	4.8	311-313 (100-103)	1.1 (2.0)	6049.8 (1067.0)
R-600a-005F to -008F	1031 (3520)	1003 (3425)	2.7	310-313 (99-104)	2.5 (4.5)	4319.3 (761.8)
R-600a-013F to -016F	1362 (4649)	1358 (4636)	0.3	310-313 (98-103)	4.7 (8.4)	3010.4 (530.9)
R-600a-017F to -020F	1565 (5346)	1549 (5287)	1.0	308-312 (95-101)	6.1 (11.0)	2643.4 (466.2)
R-600a-021F to -024F	1966 (6710)	1961 (6694)	0.2	310-315 (99-108)	9.2 (16.6)	2209.0 (389.6)
R-600a-025F to -028F	2358 (8047)	2353 (8030)	0.2	309-313 (96-103)	12.5 (22.5)	1956.7 (345.1)

Table C.3. Laboratory performance for R-600a condensing on the outside of vertical fluted tube F-3

Run No.	Condenser heat load [W (Btu/h)]		Difference (%)	Vapor temperature range [K (°F)]	Condensing temperature difference [K (°F)]	Condensing heat transfer coefficient [W/m²·K (Btu/h·ft²·°F)]
	Q_c	Q_w				
R-600a-001F3 to -004F3	616 (2103)	616 (2103)	0.0	311-312 (100-103)	0.8 (1.5)	7788.5 (1373.6)
R-600a-005F3 to -008F3	910 (3115)	910 (3107)	0.2	311-313 (100-104)	1.5 (2.8)	6179.3 (1089.8)
R-600a-009F3 to -012F3	1217 (4154)	1218 (4156)	-0.0	310-311 (99-104)	2.3 (4.2)	5445.7 (960.4)
R-600a-013F3 to -016F3	1531 (5225)	1535 (5238)	-0.3	309-313 (96-104)	3.2 (5.7)	4993.5 (880.7)
R-600a-017F3 to -020F3	1826 (6232)	1819 (6208)	0.4	309-314 (97-106)	4.0 (7.2)	4752.6 (838.2)
R-600a-021F3 to -024F3	2182 (7448)	2172 (7412)	0.5	308-315 (97-107)	5.4 (9.6)	4221.6 (744.6)
R-600a-025F3 to -028F3	2458 (8390)	2422 (8266)	1.5	308-316 (95-109)	6.5 (11.6)	3940.0 (694.9)
R-600a-029F3 to -032F3	2830 (9660)	2819 (9621)	0.4	306-315 (91-107)	8.3 (14.9)	3536.2 (623.7)

Appendix D

LABORATORY CHECKOUT OF FIELD DATA METHOD WITH REFRIGERANT-11

As noted in Sect. 5, because the Wilson-plot method employed for previous laboratory data acquisition was not applicable to the East Mesa test situation, an alternate method was selected. In establishing the standard experimental situation for the ORNL two-tube condenser, several interacting water-side operational preferences were taken into account:

1. Water temperature rise amenable to measurement for reasonable heat load accuracy – favors relatively low water flow rates.
2. Fully developed turbulent water flow for accurate application of the relevant correlation – favors high Reynolds numbers and length-to-hydraulic diameter ratios.
3. Low water-side film heat transfer resistances to minimize uncertainty when subtracting estimates (computed from correlation) from measured overall resistances – favors high Reynolds numbers and small hydraulic diameters.
4. Low water-side fouling resistance to minimize maintenance requirements and/or the importance of an uncontrolled performance factor – favors moderately high velocities (based on others' experience).

The compromise choice configuration for the water-side in the ORNL two-tube condenser during Groups I and III tests was a water flow of about 1.9×10^{-4} m³/s (3 gpm) with a 19.0-m-diam (0.75-in.) full-length solid rod insert centered inside the tube in each channel. Experience during the Groups I and III tests showed that even the relatively high water velocity [1.5 m/s (5 ft/s)] promoted by this arrangement was not effective in preventing the formation of visible fouling on the inside of the aluminum tube surfaces. Because of this observation, we decided to determine whether confidence levels would be affected by reverting to the 12.7-mm-diam (0.5-in.) rod used successfully in the earlier laboratory Wilson-plot-based tests.

To test the hypothesis under controlled conditions, a simple comparison experiment was conducted with the laboratory condenser test loop that had previously produced the relevant baseline fluted and smooth tube data. Refrigerant-11 was substituted for isobutane (R-600a) as the working-fluid because it provided comparable condensing performance[1] without attendant fire hazard. Tube type F-3 was chosen as the standard condenser surface.

Three different sets of points are presented in Fig. D.1 representing two different experimental data sequences – one with the 12.7-mm (0.50-in.) rod and one with the 19.0-mm (0.75-in.) rod. The 12.7-mm (0.50-in.) rod sequence data, taken in the standard laboratory Wilson-plot manner,[1] were reduced first by the Wilson-plot technique and then by the field procedure outlined in Sect. 5, where the common water flow was taken to be 1.9×10^{-4} m³/s (3 gpm). Comparison of the results of the two data reduction methods (Fig. D.1) shows excellent agreement. The 19.0-mm (0.75-in.)

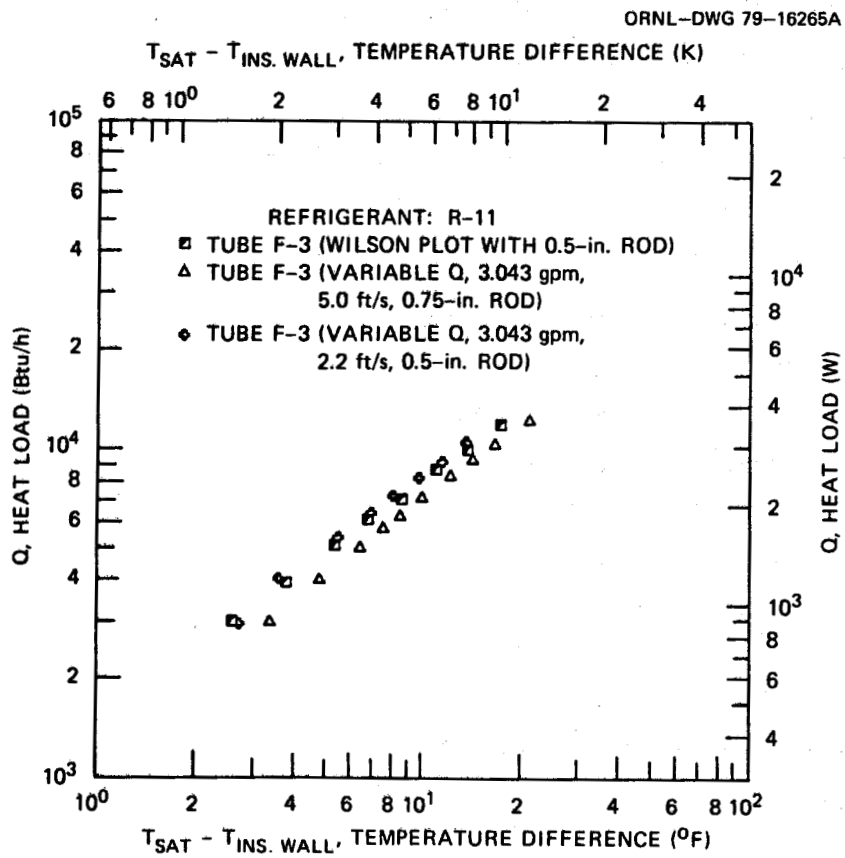

Fig. D.1. Laboratory data for field method checkout – Refrigerant 11, tube F-3.

rod sequence data taken at the same flow rate and reduced in the field manner indicated slightly lower apparent composite performance in this situation. In particular, at a heat load of 2080 W (7100 Btu/h), the deduced composite condensing temperature difference for the Wilson-plot method, 12.7-mm (0.50-in.) rod case, was 4.89 K (8.8°F), while that for the field method, 19.0-mm (0.75-in.) rod case, was 5.56 K (10.0°F).

The conclusion from these results was that although the field method using a 19.0-mm (0.75-in.) rod gave good agreement with the laboratory method, the field method using a 12.7-mm (0.50-in.) rod was superior. Because use of the 19.0-mm (0.75-in.) rod had not prevented water-side fouling in the Group I or III tests, we decided to standardize on the 12.7-mm (0.50-in.) rod for the Group V tests.

Reference

1. S. K. Combs, G. S. Mailen, and R. W. Murphy, *Condensation of Refrigerants on Vertical Fluted Tubes*, ORNL/TM-5848 (August 1978).

Appendix E

VAPOR-FEED SUPERHEAT EFFECTS

During the Group III-A tests with the ORNL 40-tube condenser, experiments on Sept. 15, 1978, were conducted to evaluate vapor-feed superheat effects on condenser performance. Operation was limited to the surface evaporator mode to minimize uncontrolled operational variables.

The system was brought to an initial steady-state condition with the ORNL 40-tube condenser operating at a moderate heat flux and receiving vapor at full superheat [~50 K (90°F)] from the DSS surface evaporator. Then the valve to the desuperheater nozzle in the vapor-feed line was opened very slightly to allow a small amount of liquid isobutane to mix with and reduce the superheat in the vapor feed. Condenser performance data were recorded when steady-state conditions were again achieved. The desuperheater nozzle valve opening was then increased very slightly and another data set taken at the new steady-state conditions. This process was carefully repeated throughout the day to vary vapor superheat in an orderly fashion without incurring system instabilities.

The results listed in Appendix B show that, as vapor-feed superheat decreased from 50 to 5.6 K (90 to 10°F), the heat flux decreased by about 5%, and the composite temperature difference increased by about 3%. Each result indicates a slight deterioration in apparent heat transfer performance which, when combined in composite conductance or coefficient form, gives roughly an 8% reduction in apparent condenser capability.

Such a deterioration is predicted by standard treatments of conventional single-component condensers because, as vapor superheat decreases, the fraction of total enthalpy change associated with phase change increases. This means that for a given condenser heat load, more condensate is formed and a greater resistance to heat flow is encountered between the assigned saturation and wall temperatures. For the operating parameter range relevant to the tests reported here, vapor-feed superheat effects on condenser performance were judged to be small relative to other observed variations and did not alter any of the major conclusions developed in this report.

Appendix F

VIEW PORT AND LIQUID-LEVEL OBSERVATIONS

The only provisions for on-line visual observation of working-fluid-side conditions associated with the ORNL condensers were view ports installed in the shell wall (two in the 2-tube condenser and one in the 40-tube condenser) and liquid-level indicators (one for each condenser).

The liquid-level indicators provided remote visual observation through high-pressure glass of a liquid leg of working-fluid to allow judgment of the degree of shell flooding present during Groups III, IV, and V tests. For all such steady-state data points, the observed condensate level was at or very near (within a few millimeters) the bottom of the shell space. Only during system transients associated with operational instabilities did either condenser show evidence of significant shell-side flooding. During direct-contact operation a liquid-liquid (apparently isobutane-water) interface was observed in the indicators.

It was generally impossible to make observations through the view ports on either condenser during operation in the direct-contact evaporator mode. Such operation resulted in apparent fogginess in the shells and a rapid buildup of small, liquid droplets on the internal glass window surfaces, effectively preventing clear observation of vapor-space occurrences (Figs. F.1 and F.2). Efforts to clear the view ports by intentional shell-side flooding provided only very brief improvement.

During operation in the surface evaporator mode, condensate could be observed running down the condenser tubes and draining as expected from skirts [2-tube (Fig. F.3)] or sheets (40-tube) located within the view port fields of view. Stationary liquid drops were also observed on the tubes both during surface evaporator mode operation and during shutdown periods between test runs (Fig. F.4). During operation, active condensate seemed to flow around and/or over the stationary drops.

ORNL–PHOTO 7549–79

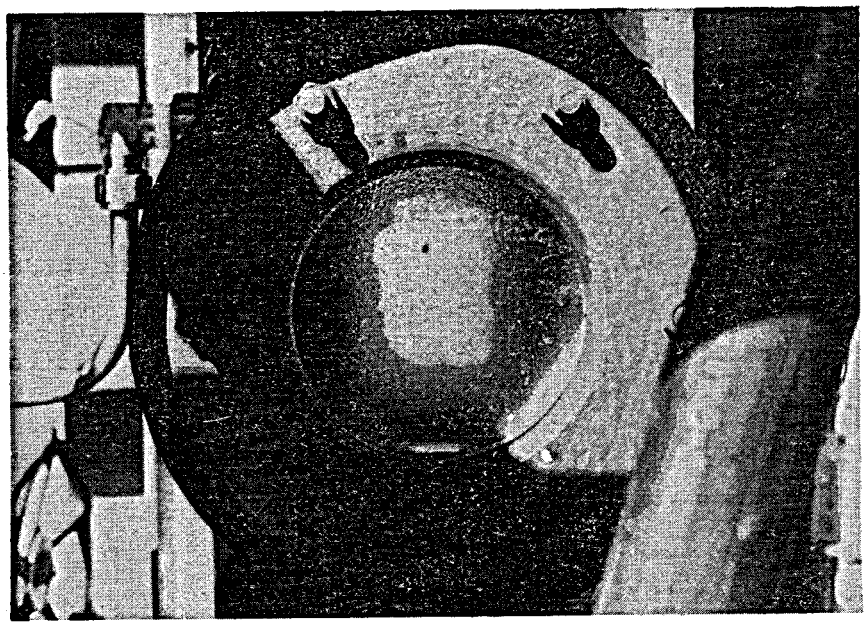

Fig. F.1. The ORNL two-tube condenser – view port during direct-contact evaporator mode tests.

ORNL–PHOTO 7550–79

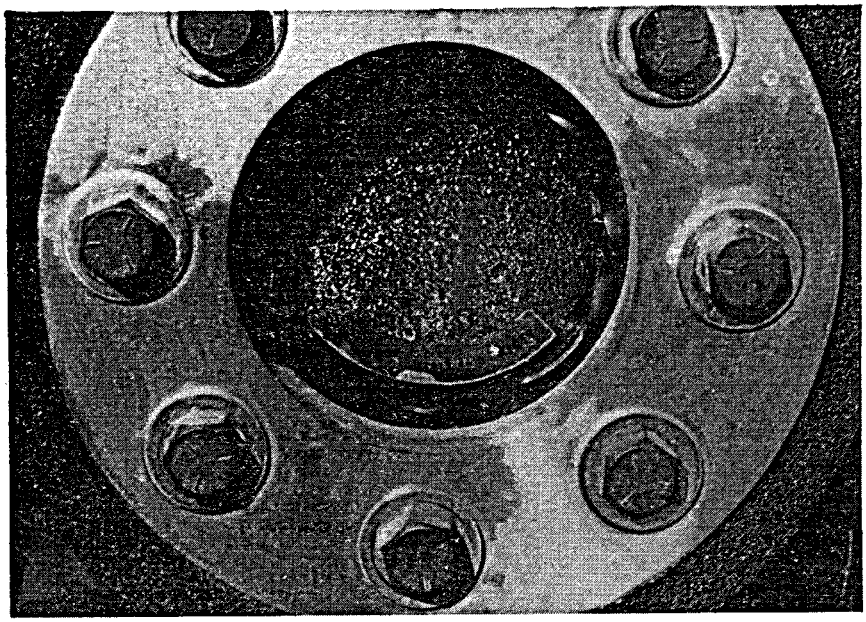

Fig. F.2. The ORNL 40-tube condenser – view port during direct-contact evaporator mode tests.

ORNL–PHOTO 7564–79

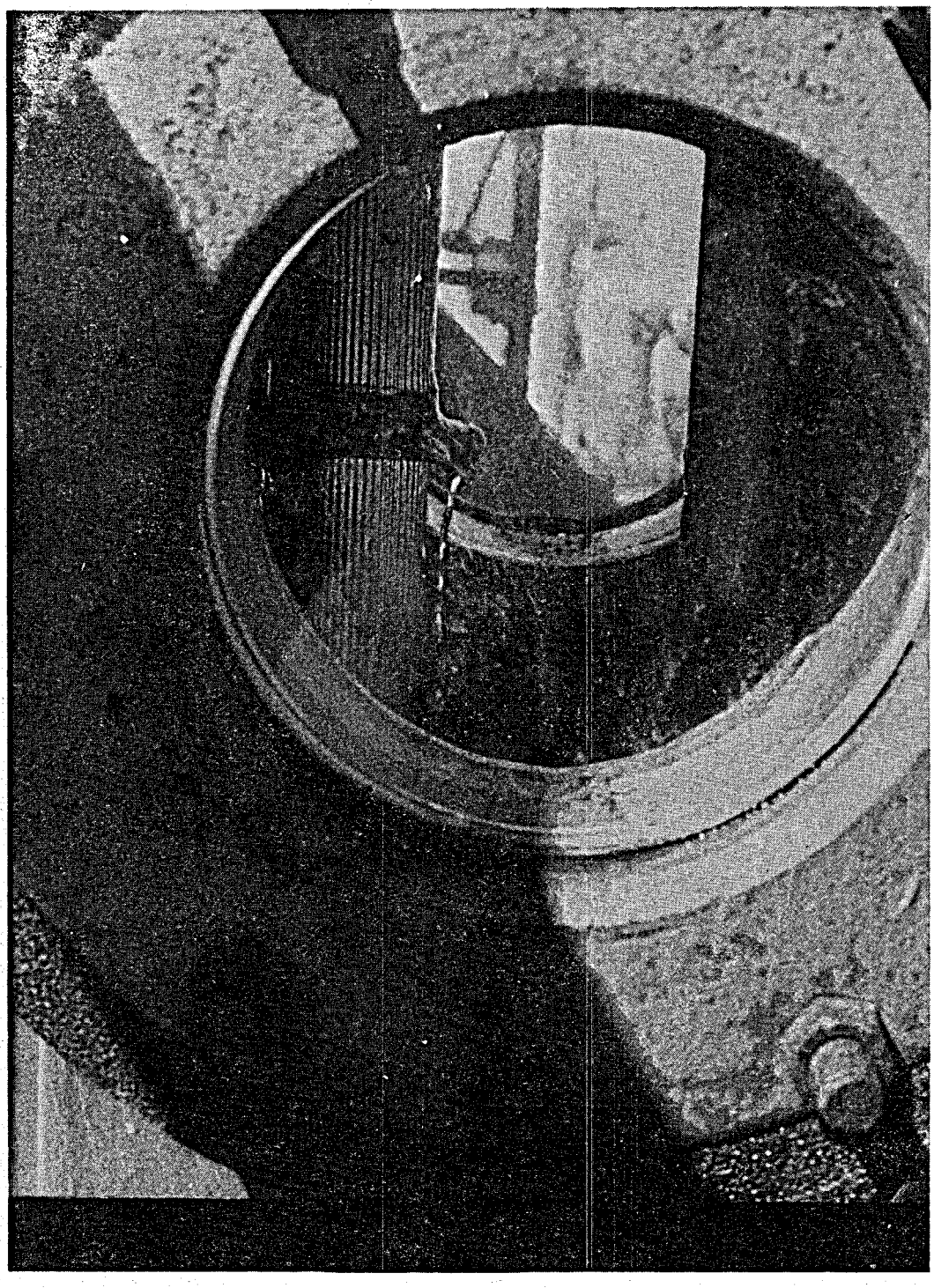

Fig. F.3. The ORNL two–tube condenser – view port during surface evaporator mode tests, tube F-3 showing skirt condensate drainage.

ORNL–PHOTO 7565–79

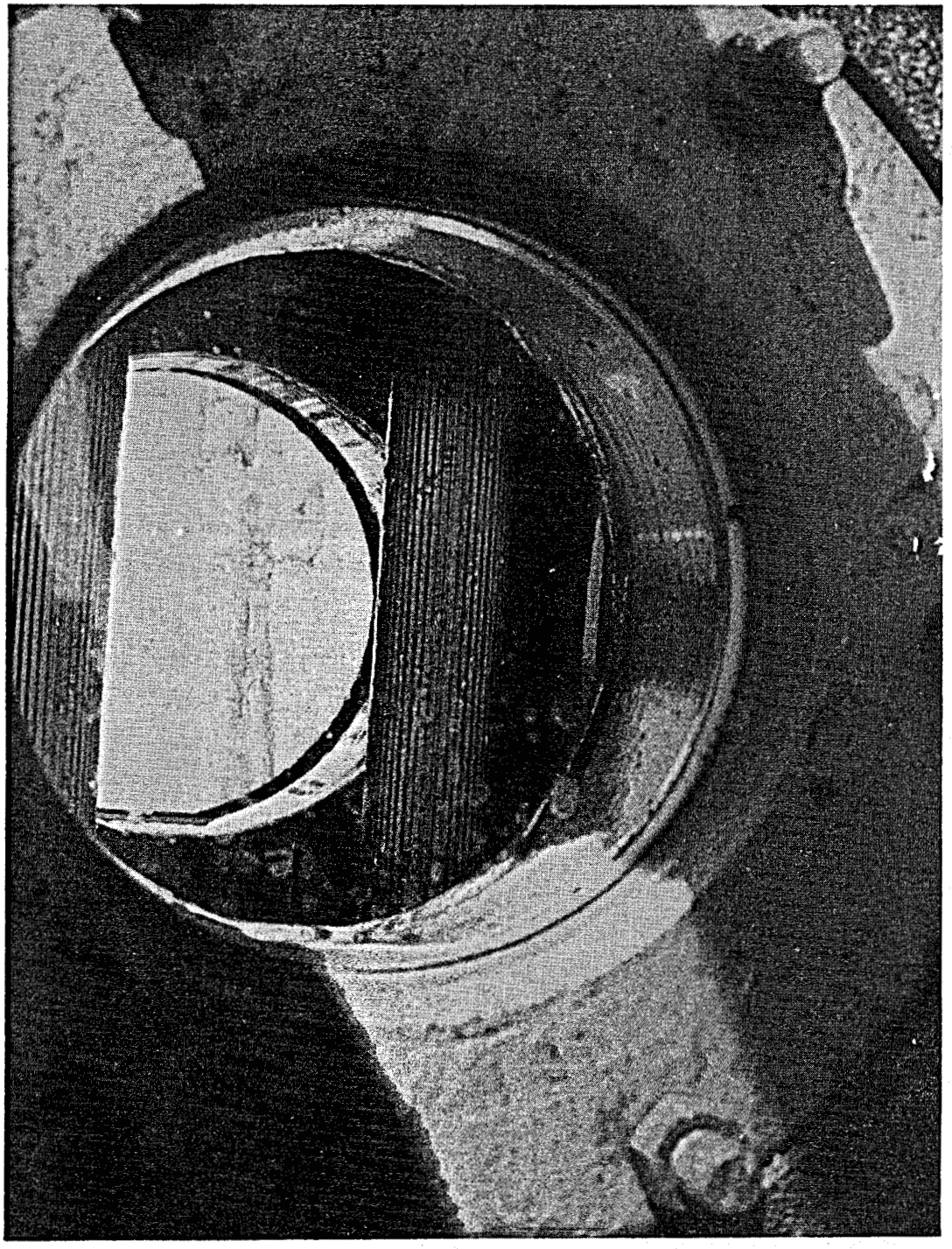

Fig F.4. The ORNL two-tube condenser – view port during surface evaporator mode tests, tube F showing stationary liquid drops.

Appendix G

GAS SAMPLE ANALYSIS

A concern throughout this test program was that varying amounts of contaminants (e.g., carbon dioxide, nitrogen, oxygen or water) in the working fluid (isobutane) were contributing, at least in part, to the inferior performance obtained with the ORNL 2- and 40-tube condensers. "Noncondensible" gases (e.g., carbon dioxide, nitrogen, or oxygen) are known to impede the heat transfer performance of surface condensers by setting up a resistance on each tube surface through which the condensing vapor must diffuse.

In an attempt to identify and quantify such impurities, a number of isobutane gas samples were collected from both ORNL condensers during selected test runs (Sect. 3.4). Other samples were collected at various stations by DSS personnel to provide more complete system characterization. Results from these additional samples are reported in Refs. 1 and 2.

Gas chromatographic analyses of samples taken from the ORNL 40- and 2-tube condensers are presented in Tables G.1 and G.2, respectively. All samples given in Table G.1 for the ORNL 40-tube condenser were obtained during operation with the DSS direct-contact evaporator, whereas samples collected from the ORNL 2-tube condenser (Table G.2) were taken during operation in the surface evaporation mode. Included in Table G.2 are duplicate samples collected from the ORNL two-tube condenser vent and vapor supply line. These were taken to cross-check the method of chemical analysis employed by Westec personnel and to provide confidence in earlier results given in Table G.1. Except for samples 1, 2, and 3 (Table G.2), all samples collected during field testing were analyzed at East Mesa. Samples 1, 2, and 3 were analyzed via gas chromatograph by the ORNL Analytical Chemistry Division.

Samples collected from both ORNL 2- and 40-tube condenser vents show the presence of carbon dioxide (CO_2) in significant amounts (Tables G.1 and G.2). One point of interest is that CO_2 concentrations from the 40-tube condenser vent (samples 1163, 1177, and 1186 in Table G.1) were higher than those obtained from the two-tube condenser vent (samples 1446

Table G.1. Analyses of gas samples from ORNL 40-tube condenser[a]

Sample			Composition (% volume)									
Date	No.	Description	Carbon dioxide	Methane	Ethane	Propane	Isobutane	Isopentane	Nitrogen	Oxygen	Air	Water
6/29/78	1163[b]	40-tube condenser vent	2.01	0.13	0.005	0.13	97.72	NA[c]	NA[c]	NA[c]	0.0	NA[c]
11/4/78	1177[d]	40-tube condenser vent (7.7°F flash)[e]	1.96	0.34	0.067	4.14	93.44	NA[c]	NA[c]	NA[c]	0.06	NA[c]
11/8/78	1136[d]	40-tube condenser vent (6.1°F flash)[e]	0.64	0.41	0.04	3.53	95.09	NA[c]	NA[c]	NA[c]	0.89	NA[c]

[a] All samples analyzed by Westec Chemical Laboratory in East Mesa, Calif.

[b] Sample taken during Group II-B tests.

[c] NA means not analyzed.

[d] Samples taken during Group IV (Barber-Nichols brine flash separator) experiments.

[e] Differential temperature between Barber-Nichols brine flash separator inlet and flash nozzle (100% venting equals a temperature difference across separator of 18°F).

Table G.2. Analyses of gas samples from ORNL two-tube condenser[a]

Sample			Composition (% volume)									
Date	No.	Description	Carbon dioxide	Methane	Ethane	Propane	Isobutane	Isopentane	Nitrogen	Oxygen	Air	Water
3/24/79	1446	Two-tube condenser vent	0.22	0.022	0.001	0.027	94.67	NA[b]	NA[b]	NA[b]	5.06	0.005[c]
3/24/79	1[d]	Two-tube condenser vent	0.28	<0.01[e]	<0.01[e]	<0.01[e]	99+	0.01	<0.01[e]	<0.01[e]	NA[b]	<0.01[e]
3/25/79	2[d]	Linde isobutane supply cylinder	0.024	<0.01[e]	<0.01[e]	<0.01[e]	99+	0.01	<0.01[e]	<0.01[e]	NA[b]	<0.01[e]
3/26/79	1447	Isobutane vapor to two-tube condenser	0.14	0.001	0.0004	0.003	99.67	NA[b]	NA[b]	NA[b]	0.19	0.006[c]
3/26/79	3[d]	Isobutane vapor to two-tube condenser	0.034	<0.01[e]	<0.01[e]	0.01	99+	0.01	<0.01[e]	<0.01[e]	NA[b]	<0.01[e]

[a] All samples taken during Group V tests.

[b] NA means not analyzed.

[c] Value obtained by the Karl Fischer titration method.

[d] Sample analyzed by the ORNL Analytical Chemistry Division.

[e] Concentrations <0.01% could not be measured on gas chromatograph.

and 1 in Table G.2). This difference was anticipated since, unlike the 2-tube condenser samples, those from the 40-tube condenser vent were obtained during operation with the direct-contact evaporator (Groups II-B and IV tests). During this mode of operation, CO_2 released in the evaporator from the geothermal brine was transported with vaporized isobutane into the condenser. When a brine preflash degassing step was introduced ahead of the direct-contact evaporator (Group IV tests), CO_2 contents in the 40-tube condenser (samples 1177 and 1186, in Table G.1) were somewhat reduced.

These samples also indicate that changes in preflash conditions can affect the amount of CO_2 present in the condenser. Table G.1 indicates that preflashing appears to have reduced CO_2 levels in the 40-tube condenser by as much as 68%.

As also indicated in Table G.1, measured concentrations of ethane were detected in very small amounts. However, concentrations of methane and propane were found in comparatively large quantities. Why such high concentrations were present in samples 1177 and 1186, during operation with the brine preflash unit, is not clear. One possible explanation is that one of several isobutane supply cylinders, used during periodic addition to the system, may have been contaminated with these hydrocarbons. An alternate source may have been the brine, because wellhead flashed vapor samples collected and analyzed by Westec during Groups II-B and IV tests were found to have high methane concentrations. Also unclear is the difference in air content detected between samples 1177 and 1186; that is, the amount of air appears to be higher when the concentration of CO_2 is lower (sample 1186). One possible explanation for this circumstance is that air may have been accidentally introduced during the gas chromatographic analysis of the sample.

In principle, operating in the surface evaporator mode has the advantage of maintaining isobutane purity, assuming that the overall system had been stringently cleaned, evacuated, and charged with high-grade isobutane prior to the start of testing. However, in Table G.2, the presence of CO_2 in condenser samples 1446 and 1 suggests that some of these requirements were not sufficiently met prior to initiating Group V tests. Based on results from sample 2 (taken from a supply cylinder), it is clear, however, that high-grade isobutane was used to charge the system. Note that

CO_2 contents in the ORNL two-tube condenser (samples 1446 and 1) were higher than those found in the vapor supply line to the condenser (samples 1447 and 3). This supports the notion that noncondensibles (like CO_2) ultimately accumulate in the condenser.

One disturbing result shown in Table G.2 is the difference in air concentration found between Westec and ORNL analyses of the duplicate samples collected from the condenser vent (1446 and 1) and the vapor supply line (1447 and 3). Samples analyzed at East Mesa showed high concentrations of air, whereas those analyzed at ORNL contained little or no air. Such a discrepancy between findings obtained by Westec and ORNL suggests that an error may have existed in the method of analysis. As indicated earlier with other samples, air may have been introduced into the gas chromatograph accidentally. Consequently, the failure by separate investigators to generate similar results from similar samples seems to preclude a high degree of confidence in the accuracy of the results shown in Table G.2 and probably Table G.1.

In contrast to ORNL 40-tube condenser results (Table G.1), ORNL 2-tube condenser results indicate that concentrations of the lighter hydrocarbons (methane, ethane, and propane) were found to be negligible.

The primary conclusion that can be drawn from Tables G.1 and G.2 is that more dependable sampling analyses are needed to develop a better understanding of the effects of contaminants on condenser performance.

References

1. M. W. Urbanek, *Development of Direct Contact Heat Exchangers for Geothermal Brines*, Final Report, October 4, 1977–June 30, 1978, for Lawrence Berkeley Laboratory, LBL-8558.

2. M. W. Urbanek, *Experimental Testing of a Direct Contact Heat Exchanger for Geothermal Brine*, ORNL/SUB-79/13564/1 and ORNL/SUB-79/45736/1 (December 1979).

Appendix H

TUBE MATERIAL EFFECTS

As detailed in Sect. 2.2.3, smooth tubes of five different materials were tested in the ORNL two-tube condenser. Two were made of aluminum (A – 6061-T6 and Y – 2024-T3), one of copper (W – Type DHP, ASTM B-75), one of brass (X – Alloy 330, ASTM B251-67), and one of nickel (Z – ASTM B-161). Tube A was involved in Groups I, III, and V tests, but the other tubes were limited to Group I tests only.

One finding was that a light-colored powdery deposit built up on the cooling-water side (inside) of the aluminum tubes (A and Y) in a relatively short time (~1 d). However, the deposit was easily removed with a wire brush tube cleaner. No deposits were visible on the working-fluid side of the aluminum tubes used in the two-tube condenser. However, with the 40-tube condenser, brownish deposits were found on the outside of the aluminum tube bundle after direct-contact evaporator mode operation. Such deposits on the condensing side of the 40-tube bundle are shown in Fig. H.1.

A relatively smooth black deposit was found on the working-fluid side of the copper, brass, and nickel tubes after testing in the direct-contact evaporator mode. In each case the coating was tenacious, and removal required considerable effort. No water-side deposits were found in the non-aluminum tubes, even after extended exposure to cooling tower water.

In no case was there a measurable effect of either cooling water-side or working-fluid-side deposits on tube composite condensing performance. Furthermore, in agreement with analytical estimates of the relative size of the respective tube-wall conductances, no significant effect of tube-wall material on tube composite condensing performance was observed during these tests.

ORNL–PHOTO 7876–79

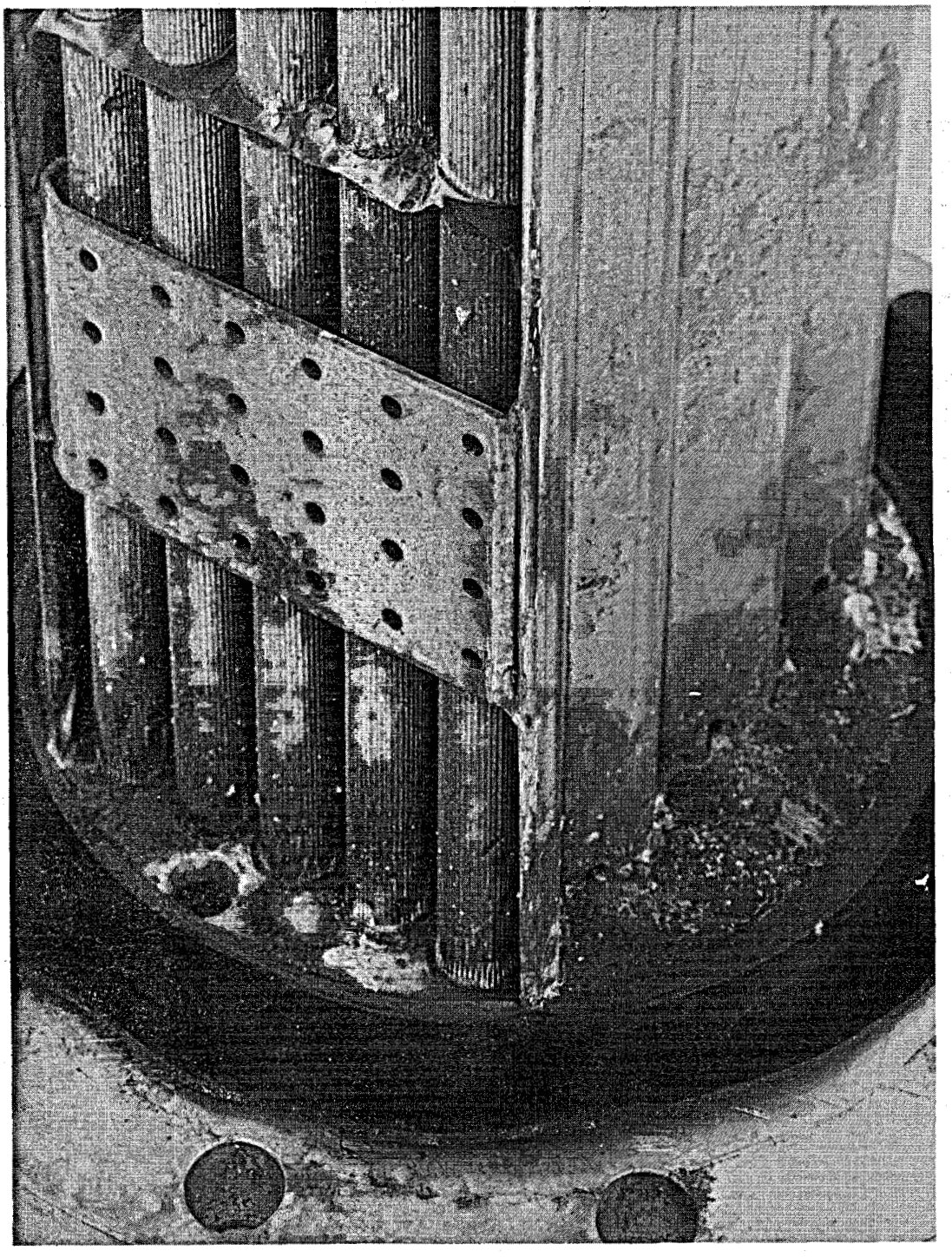

Fig. H.1. The ORNL 40-tube condenser – tube bundle after completion of Group IV tests.

Appendix I

POSTMORTEM EVALUATION OF ORNL 40-TUBE CONDENSER

After completion of the field-test series reported here, the 40-tube condenser was returned to ORNL, disassembled, and examined. Since significant shell-side fouling of the tube bundle was visible (Fig. H.1), the decision was made to remove a sample straight tube section for further evaluation in the single-tube laboratory condenser test apparatus. A section judged to have maximum visible fouling was removed from the bundle. Since such removal could not be accomplished without damage to the drainage sheets, the original sheet remnants were removed from the section and replaced by skirts (previously employed in single-tube tests) installed with Pliobond adhesive at the corresponding axial locations.

Initial tests were conducted in the "as received" condition (fouling intact) using Refrigerant-11 as the standard test fluid to provide baseline data. The outside surface of the section was then cleaned with a wire brush until all visible fouling was removed and a smooth, bright surface remained. Retesting of the cleaned section gave no distinguishable change in performance from that measured for the fouled version. The conclusion was reached that this result supported earlier evidence that surface deposits had no significant effect on the field-test performance results.

Appendix J

SI CONVERSION FACTORS

An attempt has been made to present all key tables and figures in dual units (ACU and SI). The following conversion factors may be used to convert from ACU to SI units:

To convert from	To	Multiply by
Btu/h	W	0.2929
Btu/h·ft^2	W/m^2	3.152
Btu/h·ft·°F	W/m·K	1.730
Btu/h·ft^2·°F	W/m^2·K	5.674
Btu/lb$_m$·°F	J/kg·K	4.184 x 10^3
ft	m	0.3048
ft^2	m^2	0.09290
ft/s	m/s	0.3048
gpm	m^3/s	6.309 x 10^{-5}
in.	m	0.02540
lb$_m$/h	kg/s	1.260 x 10^{-4}
lb$_m$/h·ft	Pa·s	4.134 x 10^{-4}
psia	Pa	6.895 x 10^3
Δ(°F)	Δ(K) or Δ(°C)	0.5556

Temperature conversion: $T(K) = 5/9 \times [T(°F) - 32] + 273.15$

$T(°C) = 5/9 \times [T(°F) - 32]$

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