

AN ABSTRACT OF THE THESIS OF

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Abstract approved:

 Dr. James G. Knudsen

The fouling characteristics of simulated cooling tower water flowing over a heated metallic surface has been studied. The bulk temperature of the water was maintained around 95°F. Mainly three different water qualities with respect to calcium hardness level were investigated. The pH was controlled by the addition of hydrochloric acid. The flow velocities ranged from 1.5 ft/sec to 6.0 ft/sec, and surface temperatures averaged between 150°F and 200 °F. Runs 102, 103 and 104 were particularly made to investigate the relative fouling behavior of three different metallic surfaces exposed to cooling tower water of the same quality.

For cooling tower water of pH of 7.5 and flow velocity of 4.0 ft/sec, the following equation relates the asymptotic fouling resistance to the surface temperature.

$$R_f^* = 3.6902 \times 10^6 \exp(-14308/T_s)$$

Similarly for cooling tower of pH 8.5 and flow velocity of 5.0 ft/sec, the following arrhenius relationship was obtained.

$$R_f^* = 0.3264 \exp(-4314.8/T_s)$$

For both values of pH of 7.5 and 8.5 for cooling tower water, it was shown that asymptotic fouling resistance decreased with increase of flow velocity. For a flow velocity of 4.0 ft/sec, it was shown that a minimum value of \bar{R}_f^* exists in the neighbourhood of pH of 8.0.

The results of the deposit analysis for runs made at an average pH of 8.5 indicate calcium, magnesium, silicon and carbonate as the major constituents. The chemical analysis of scales of runs made at an average pH of 7.5 indicate silicon, iron and copper as the chief constituents. Also it was found that inner layer of deposit contained higher amounts of magnesium, copper and silicon and the outer layer had higher percentage of calcium.

Fouling Characteristics of
Cooling Tower Water - pH Effect

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TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. GENERAL REVIEW AND LITERATURE SURVEY	3
Resistances to Heat Transfer	3
General Design Equation	4
Fouling Mechanism	5
Operating Variables	6
Scaling Models	9
III. EXPERIMENTAL EQUIPMENT	14
Piping Valves and Pumps	14
Cooling Tower System	17
Heat Exchanger System	18
HTRI Portable Fouling Research Units	19
IV. EXPERIMENTAL PROCEDURES	23
Experimental Program	23
Run Initiation	26
Process Monitoring	27
Run Termination	27
V. CALCULATION METHODS	29
Clean Condition	29
Fouled Condition	32
Computer Programs	32
Error Estimation	33
VI. RESULTS AND DISCUSSION	36
Run Description	36
Surface Temperature Effect	50
Velocity Effect	61
pH Effect	61
RSI Effect	63
Description of Photographs	64
VII. CONCLUSIONS	82
BIBLIOGRAPHY	84
APPENDICES	86

LIST OF FIGURES

Figure		Page
II-1A	Clean condition	3
II-1B	Fouled condition	3
III-1	Schematic flow diagram of experimental equipment	15
III-2	Heater rod	20
V-1	Cross-section of Test Section	30
VI-1A	R_f^* vs $1/T_s$ - pH = 7.5	53
VI-1B	R_f^* vs $1/T_s$ - pH = 8.5	54
VI-2A	R_f^* vs VELOCITY - pH = 7.5	57
VI-2B	R_f^* vs VELOCITY - pH = 8.5	58
VI-3	\bar{R}_f^* vs pH	60

LIST OF TABLES

Table		Page
III-1	HTRI HEATER ROD SPECIFICATIONS	22
IV-1	WATER STUDIED BY KNUDSEN AND CO-WORKERS ^{2,9}	24
IV-2	RUN PARTICULARS	25
VI-1A	AVERAGE OPERATING CONDITIONS TEST SECTION-1	37
VI-1B	AVERAGE OPERATING CONDITIONS TEST SECTION-2	38
VI-1C	AVERAGE OPERATING CONDITIONS TEST SECTION 3&4	39
VI-2	AVERAGE COOLING TOWER WATER QUALITY	40
VI-3	CHEMICAL ANALYSIS OF DEPOSIT COMPOSITIONS	41
VI-4	WATER CHARACTERIZATION INDEXES	43
VI-5	ASYMPTOTIC FOULING RESISTANCES	51
VI-6A	R_f^* vs $1/T_s$ pH = 7.5	52
VI-6B	R_f^* vs $1/T_s$ pH = 8.5	52
VI-7A	R_f^* vs VELOCITY pH = 7.5	56
VI-7B	R_f^* vs VELOCITY pH = 8.5	56
VI-8	\bar{R}_f^* vs pH	59
VI-9A	RSI vs CA + CO_3	62
VI-9B	RSI vs Mg + Si	62
VI-10	DESCRIPTION OF PHOTOGRAPHS	65

Fouling Characteristics of Cooling Tower Water - pH Effect

I. INTRODUCTION

This study is a continuation of a research program started at Oregon State University for better understanding of the fouling phenomenon in cooling tower water.

The fouling or scaling of heat transfer surfaces may be defined as the deposition of a thermally insulating material on to a heat transfer surface. In the case of water, the deposit may consist of inverse solubility salts, suspended solids, corrosion products, bio-organisms and chemicals which react at the heated surface.

Fouling is an extremely complex phenomena that involves combined heat, mass and momentum transfer in an unsteady state. But the aim of this experimental study has been to concentrate on precipitation fouling and efforts have been made to avoid all other causes like corrosion product fouling and bio-fouling.

The fouling phenomena has been titled as the "Major unresolved problem in heat transfer."¹⁶ As fouling deposits develop on a heat transfer surface, there is a reduction in the performance and efficiency of the heat exchange equipment and it can also lead directly to failure by corrosion or local hot-spot formation.

Thackery¹⁷ summarizes the overall annual cost of fouling of the heat transfer surfaces in the United Kingdom to be 300 to 500 million pounds. The above cost estimate justifies the additional research required in understanding the basic mechanisms of fouling and for the development of better antifouling treatments and practices.

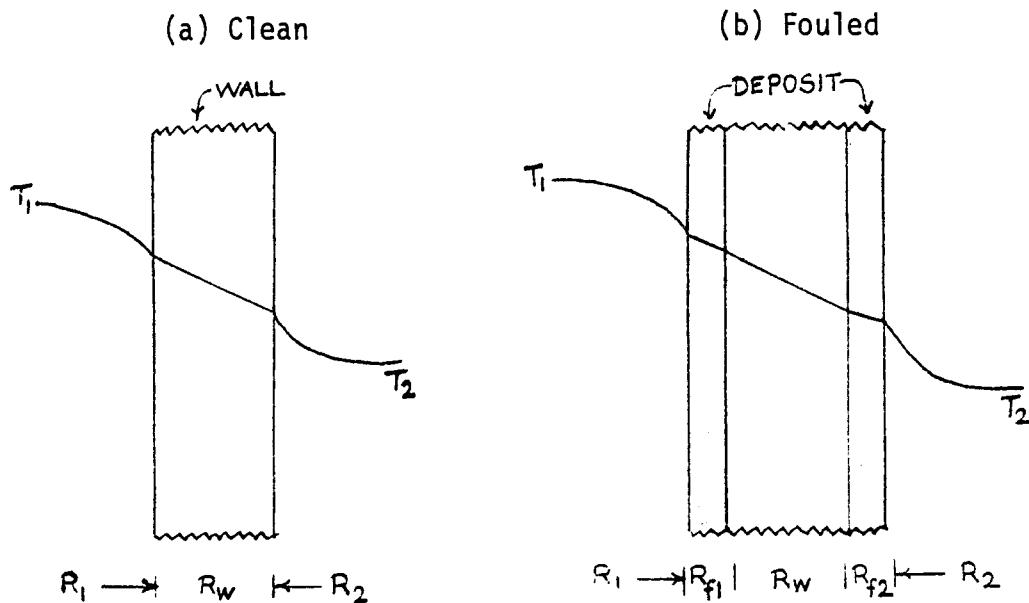
In cooling tower operations, crystallization of inverse solubility salts like calcium carbonate, calcium sulfate, magnesium silicate, etc., occur on heated surfaces. The most important variables that control the deposition process are flow velocity, surface temperature, fluid bulk temperature, water chemistry and surface conditions.¹⁶

II. GENERAL REVIEW AND LITERATURE SURVEY

Resistances to Heat Transfer

The effect of fouling in heat exchange equipments, e.g., heat exchanger is well illustrated by the following Figures II 1A&B*

HEAT EXCHANGER SURFACE



The various resistances encountered by heat flow from a fluid of higher temperature to a fluid of lower temperature are shown in the above figures for (a) clean condition, and (b) fouled condition. The resistances are additive and we can determine the overall heat transfer coefficient using equations (2-1) and (2-2) for clean and fouled conditions respectively.

*See Appendix A for Nomenclature

$$\frac{1}{U_c} = R_1 + R_w + R_2 \quad (2-1)$$

$$\frac{1}{U_f} = R_1 + R_{f1} + R_w + R_{f2} + R_2 \quad (2-2)$$

where

U = overall heat transfer coefficient

R_1 = thermal resistance of the hot fluid

R_2 = thermal resistance of the cold fluid

R_w = thermal resistance of the tube wall

R_{f1} = fouling factor for hot fluid

R_{f2} = fouling factor for cold fluid

subscripts

c = clean condition

f = fouled condition

General Design Equation

The overall heat transfer coefficient based on the outside surface area of a fouled heat transfer equipment is calculated by the following equation:

$$\frac{1}{U_o} = \frac{1}{h_o} + \frac{A_o}{A_i} \frac{1}{h_i} + R_{f_o} + R_{f_i} \frac{A_o}{A_i} + R_w \quad (2-3)$$

where

h = heat transfer film coefficient

R = heat transfer resistance

A = surface area

subscripts

o = outside

i = inside

f = fouled

w = wall

The designer utilizes elaborate and advanced techniques for estimating values of the heat transfer coefficients h_o and h_i , but proceeds to select some arbitrary values for the fouling resistances, such as those recommended by Tubular Exchangers Manufacturers Association (TEMA), which in most cases do not have any relevance with regard to the actual operating conditions. As a consequence the heat exchange equipment operates at an efficiency way below the normal efficiency. In some cases the allocation of exaggerated large fouling resistance values may lead to rapid deterioration of the equipment.

Thus it is a fact that better understanding of the fouling phenomenon is economically important. This study is part of the systematic research program initiated by Heat Transfer Research, Inc., (HTRI) to further understanding of this problem.

Fouling Mechanism

The mechanism of fouling for cooling tower water can vary according to the source and quality (hardness, pH, suspended solids, treatment type, etc.) of the particular water under consideration. The most predominant causes of fouling are summarized as follows.

In most instances fouling is associated with an induction period during which formation of micro-nucleation sites take place and no

appreciable fouling is recorded. The surface roughness of the material aids in providing additional nucleation sites for the deposits to initiate. Thus after the initial delay period, when sufficient nucleation sites have been established, the fouling resistance increases rapidly.

In the cooling water systems the temperature of the surface is higher than the fluid bulk temperature, and thus when water containing inverse solubility salts, e.g., CaSO_4 , CaCO_3 , Mg(OH)_2 , LiCO_3 , etc., is in contact with the hot surface where the solubility is greatly reduced, crystallization occurs. The deposition mechanism has been shown to be due to either mass transfer or surface chemical reaction.¹⁶ In some instances the mass transfer to the surface is fast and the controlling rate becomes the crystallization reaction at the surface. Formation of corrosion-products at the surface, sedimentation of suspended solids, occurrence of chemical reactions at the surface and adherence of bio-organisms present in the solution to the surface include some important modes of fouling.

Operating Variables

The variables that play a significant role on the fouling process are (1) flow velocity (2) surface temperature and fluid bulk temperature (3) water chemistry and (4) surface conditions.

Flow Velocity

Velocity has been seen to affect the fouling process with respect to both deposition and removal of the deposit. When the deposition is mass-transfer controlled, the velocity enters the deposition term

through the convective mass transfer to the surface. Thus an increase in flow velocity will increase the convective mass transfer coefficient which in turn increases the rate of diffusion of material to the surface. But for processes which are not mass-transfer controlled, increase of velocity tends to build up the shear stress which helps in the removal of deposit.

Surface and Fluid Bulk Temperatures

For a constant flux operation the temperature at the tube surface-scale interface increases as fouling proceeds and this temperature plays a vital role in the aging of the deposit. The aging process produces changes in the crystal and chemical structure and the increasing deposit temperature may strengthen the deposit with time. The fluid bulk temperature has an effect on the saturation concentration of the salts in solution.

Water Chemistry

The important water parameters that determine the type of fouling mechanism include concentrations of inverse solubility salts, alkalinites, hardnesses and pH. Various water parameters have been used to characterize the water chemistry.

The theoretically based Langelier Index⁷ is defined as the difference between the actual pH and the pH at which a given water would be saturated with CaCO_3 .

$$\text{LSI} = \text{pH} - \text{pH}_s \quad (2-4)$$

The equation for calculating pH_S was developed by Langlier

$$\text{pH}_S = \log \left(\frac{K_{s1}}{K_{s2}} \right) + E + 9.3 - \log (0.4 \text{CaH}) - \log (\text{m-alk})$$

K_{s1} = activity product of calcium carbonate (2-5)

K_{s2} = second dissociation constant

$$E = \frac{2.5 (\text{TS}/40000)^{0.5}}{1 + 5.3 (\text{TS}/40000)^{0.5} + 5.5 (\text{TS}/40000)}$$

CaH = calcium hardness in ppm as CaCO_3

m-alk = methyl orange alkalinity in ppm as CaCO_3

TS = total solids in ppm

The first term on the right-hand side of equation (2-5) was approximated by Lawson and Buswell⁸ by a curve fit procedure and is given as follows

$$10^{(-1.37864 + 1040.92 T_b - 75500/T_b^2)}$$

where

T_b = water bulk temperature

When the quantity $\text{pH} - \text{pH}_S$ is positive the system has a tendency to deposit scale, but when it is negative the system tends to dissolve CaCO_3 .

The Ryznar Index¹³ is an empirical index, which is based on a study of operating data with water having various saturation indexes. The stability index is defined as:

$$\text{RSI} = 2\text{pH}_S - \text{pH} \quad (2-6)$$

For this particular index, 6.5 is the nominal neutral point, values of 6 or less indicate CaCO_3 deposition and values of 7 or greater indicate corrosive tendency.

Surface Conditions

A rough surface provides numerous nucleation sites which help in initiating the deposition process. Thus a smooth surface will have a correspondingly longer induction period. In many instances it has been found that once the clean surface is wholly covered by the deposit then the ensuing fouling process is not in any way determined by the tube material or the surface conditions.

Scaling Models

A variety of models have been developed in an attempt to predict the asymptotic fouling resistance--time curve, which typically represents the deposition mode in cooling tower water. Most of these models include both a deposition and removal term. The asymptotic behaviour is sighted in cases where the removal rate becomes equal to a constant deposition rate.

$$\text{Rate of accumulation} = \text{Rate of deposition} - \text{Rate of removal}$$

$$\frac{dR_f}{d\theta} = \phi_d - \phi_r \quad (2-7)$$

Some parameters which are assumed to effect deposition include heat flux, velocity, water quality, sticking probability, surface temperature, concentration difference and initial deposition rate. The rate of removal might be influenced by shear stress, amount of deposit, deposition rate, toughness of deposit and concentration difference. The various fouling models include some or all of these parameters, and the variations are due mostly to the fact that different operating conditions and water were used.

McCabe and Robinson¹⁰ made the initial analytical analysis of fouling coupled with experimental study of deposition rates in evaporators operated at constant heat flux. They assumed that

$$\frac{1}{R_\theta} = \frac{1}{R_c + R_v} \quad (2-8)$$

where

R_θ = resistance to heat transfer at time θ

R_c = combined resistances of heating surface at clean condition

R_v = variable fouling resistance proportional to thickness of the layer of scale

The conclusion of McCabe and Robinson model predicts an unlimited increase in fouling resistance with time, due to the absence of a removal term in their equation.

Kern and Seaton⁴ were apparently the first to recognize the importance of shear stress τ , in the removal process. The deposition term proposed by their model is proportional to the product of foulant concentration and flow rate and the removal term is proportional to the shear stress and instantaneous thickness of the deposit.

$$\phi_d = K_1 C_b' W' \quad (2-9)$$

where

K_1 = proportionality constant

C_b' = foulant bulk concentration

W' = mass flow rate

$$\phi_r = k_2 \tau x_\theta \quad (2-10)$$

where

K_2 = proportionality constant

τ = shear stress

x_θ = instantaneous deposit thickness at time t

Watkinson and Epstein¹⁸ postulated that the deposition rate is proportional to the product of the mass flux normal to the surface and the sticking probability. The sticking probability is proportional to the adhesive force and inversely proportional to the hydrodynamic forces at the interface, and removal rate is similar to Kern and Seaton's model.

$$\phi_d = K_3 JS \quad (2-11)$$

and

$$J = K_m (c'_b - c'_s) \quad (2-12)$$

where

K_3 = proportionality constant

S = sticking probability

J = mass flux

K_m = convective mass transfer coefficient

c'_s = concentration of foulant at the interface

Taborek et al¹⁶ in a very comprehensive work utilized the Kern-Seaton concept of deposition and removal to develop a fouling model that also considered water chemistry and its effect on the fouling resistance. The deposition term is a function of the scale surface temperature in an Arrhenius-type crystallization reaction term and a water chemistry parameter.

$$\phi_d = K_4 P_d \Omega^n \exp (-E_a / R_g T_s) \quad (2-13)$$

where

K_4 = proportionality constant

P_d = residence time probability function

n = dimensionless empirical constant

E_a = activation energy of deposit reaction

R_g = gas constant

T_s = surface temperature

Ω = water quality term, function of LSI

The removal rate is proposed to be a function of the shear stress, thickness and bonding strength of deposit

$$\phi_r = K_5 \tau X_e^m / \psi \quad (2-14)$$

where

K_5 = proportionality constant

ψ = strength of deposit

A closed form solution for asymptotic fouling resistance R_f^* is possible when $m = 1$ in the removal term

$$R_f^* = \frac{K_6 P_d \Omega^n \exp (-E_a / R_g T_s)}{\tau / \psi} \quad (2-15)$$

When a constant flow velocity and water quality is maintained equation (2-15) reduces to

$$R_f^* = K_7 \exp (-E_a / R_g T_s) \quad (2-16)$$

where

K_6, K_7 = proportionality constants

Watkinson and Martinez¹⁹ assumed a Kern-Seaton type model and generalized Reitzer¹² deposition term,

$$K_R (c_b - c_s)^n / \varepsilon_f \text{ by using}$$

$$\frac{dx_\theta}{d\theta} = K_8 \exp \left(\frac{E_a}{R_g T_s} \right) \left(\frac{T_w - T_b}{1 + h x_\theta K_f} \right)^m - K_9 \tau x_\theta \quad (2-17)$$

where

T_w = tube wall temperature

T_b = bulk temperature

K_f = thermal conductivity of deposits

K_8, K_9 = proportionality constants

m = dimensionless empirical constant

The deposition term in equation (2-17) differs from those found in other models since it varies with time through the scale thickness, x_θ . The asymptotic fouling resistance can be obtained by setting $dx_\theta/d\theta = 0$, equating $R_f^* = x_\theta/K_f$ and replacing $\tau = fv^2 \varepsilon / 2$, resulting in

$$R_f^* (1 + hR_f^*)^m = K_{10} \exp \frac{-E}{R T_b^* + \frac{T_w - T_b^*}{1 + hR_f^*}} \frac{(T_w - T_b)^m}{fv^2} \quad (2-18)$$

where

f = friction factor

v = flow velocity

and superscript * refers to the asymptotic condition

III. EXPERIMENTAL EQUIPMENT

The equipment of this study was designed to simulate the operating conditions of a cooling tower system. The system can be subdivided into the following sections: (1) cooling tower system, (2) heat exchanger system, and (3) Heat Transfer Research, Inc., portable fouling research units (PFRU-I and PFRU-II). Auxiliary equipment includes piping, valves and pumps. (See Figure III-1)

Important conditions such as flow rate and temperature of the heated surface are easily brought to the desired level by making the appropriate adjustments in the flow and the power input to the heater rods. The choice to exercise the above control enables the study the effect of the crucial variables like flow velocity and surface temperature on the deposition characteristics.

Most of the existing parts of the equipment were built by previous investigators^{2,6,9,14} at Oregon State University. The system has been modified to accomodate a fourth test section and a continuous monitoring pH controller has been installed.

Piping, Valves and Pumps

To eliminate the effect of corrosion on the fouling characteristics as much as possible, non-corrosive materials are used. Equipment in direct contact with cooling tower water is either of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), glass, brass, copper or stainless steel.

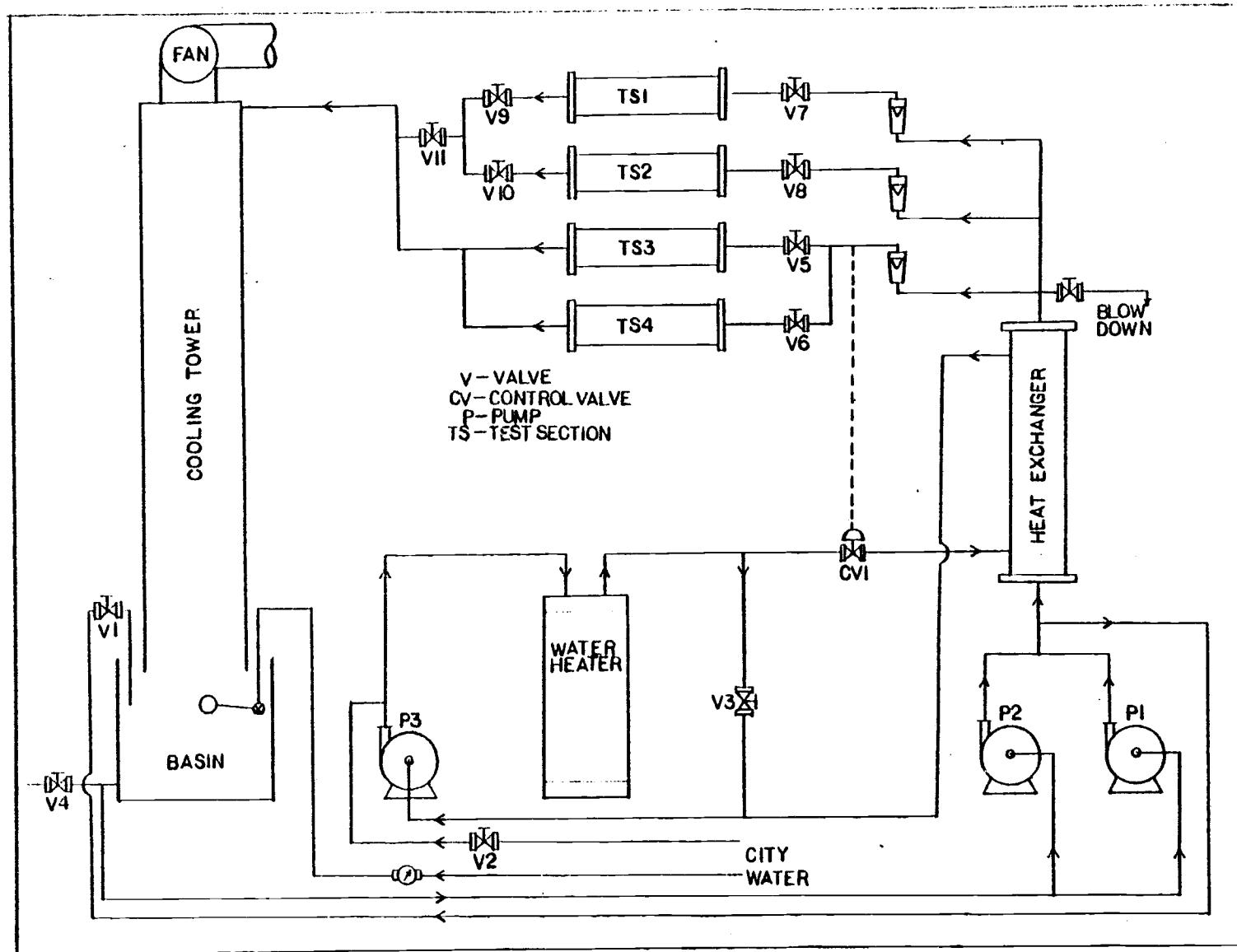


Figure III-1. Schematic flow diagram of experimental equipment

The piping is mostly 1 inch and 1½ inch CPVC, Schedule 80, with socket type fittings. CPVC piping is used for high temperature and pressure applications and PVC piping is used for low temperature and pressure applications.

A selected number of valves are labelled in Figure III-1. Valves 1 through 11 are manually operated and Control Valve CV1 is pneumatically operated. All valves are in the cooling tower water circulating loop except Valves 2, 3 and CV1.

Valves 1 and 5 are constructed of stainless steel, Control Valve CV1 of cast steel, Valves 2, 3 and 4 of brass and Valves 6 through 11 of CPVC.

Valve 1 along the bypass line regulates the total flow through the cooling tower water circulating loop. Valve 2 is always open to allow continuous city water supply pressure on the electric water heater. Valve 3 is partially open for a bypass of heated water if CV1 is closed. Valve 4 controls the blowdown rate. Valves 5 through 11 regulate the cooling tower water in and out of the test sections. Control Valve CV1 controls the heated water flow from the electric water heater to the heat exchangers.

Three pumps are used. Pumps 1 and 2 circulate the cooling tower water and Pump 3 circulates the heated water to the heat exchanger. Pump 1, a brass turbine pump, is driven by a 3 HP electric motor at a speed of 1750 rpm. It has a total pumping capacity of approximately 16 gpm. Pump 3, a rotary centrifugal pump, is also equipped with a 3 HP motor. Pump 2 is similar to Pump 1.

A centrifugal blower with a 3/4 HP electric motor running at a speed of 1725 rpm draws air through the tower.

Cooling Tower System

The cooling tower system consists of three major parts:

(1) basin, (2) spray cooling tower, and (3) blowdown unit. Fortified city water is supplied continuously to the basin to make up for evaporation and blowdown losses. Cooling water is circulated through the system, absorbing heat from the heat exchanger and heater rods then being cooled in the spray cooling tower. The blowdown rate is controlled manually on a regular basis to maintain a constant composition of the cooling tower water.

Basin

The basin is a cylindrical stainless steel tank 4 feet high, 34 inches in diameter and 1/8 inch thick. It serves as the cooling tower water supply tank.

Inlet streams to the basin consist of: (1) fortified city water, (2) water from the spray cooling tower, and (3) cooling tower water recycled by the bypass line. The well mixed cooling tower water is drawn out of the basin by Pumps 1 and 2; part of the water circulates through the system and part of it recycles back to the basin. The amount of fortified city water entering the system is measured by a positive displacement water meter.

The basin is filled to a depth of 34 inches--the level being controlled by a liquid level controller (Model 100 of Fluid Master, Inc.) sensitive to a water level change of 3/4 inch. The total volume of the cooling tower water in the system is about 135 gallons.

Spray Cooling Tower

The spray cooling tower is a 20 foot long cylindrical column, 2 feet in diameter made of 3/16 inch thick fiberglass reinforced plastic. It is mounted concentrically with and directly above the basin.

Warm cooling tower water from the system divides into four smaller streams at the top of the tower through 1/2 inch outlets beneath which is a distributor. Water falls through the tower in droplets, increasing the air-liquid interfacial surface area. Fresh air is drawn counter-current to the falling droplets.

Blowdown Unit

As the cooling tower water evaporates, the concentration of the mineral constituents increases due to the input of fortified city water being fed continuously to make up for the evaporative losses. In order to maintain a constant cooling tower water quality, system water must be purged at a rate which balances the input from fortified city water. A flowmeter shows the approximate blowdown rate. Discharged cooling tower water is stored in the blowdown storage tank and the total volume purged is recorded daily.

Heat Exchanger System

For the present study, the cooling tower water bulk temperature was maintained around 95°F for all runs. Since the heat from the test sections is not sufficient to maintain this temperature, an additional heat source is needed.

The heat exchanger system is a closed loop circulating system. City water, heated in a 40 gallon domestic electric water heater, is pumped to the shell side of two shell and tube (CPVC shell and copper tube) heat exchangers, co-currently with the flow in the tube side. A temperature controller (set point 95°F) regulates the heated water flow rate through the heat exchangers. A bypass line is provided to allow some flow even if control valve CV1 is closed.

HTRI Portable Fouling Research Units

The Portable Fouling Research Unit (PFRU) was developed by HTRI to provide a convenient means for cooling tower water studies. One such unit is on loan to Oregon State University. This unit, PFRU-I, houses test section 3. PFRU-II was donated to Oregon State University and houses test sections 1 and 2. The basic differences between the two models are that Model II has an automatic data acquisition system and flow rate control mechanism.

The critical component of the PFRU is the test section where the heater rod on which fouling occurs is located. For visual observation, a glass tube 18 3/4 inches long and 3/4 inch inside diameter is mounted horizontally with a cylindrical Plexiglas shield around it for protection. A heater rod, which normally has an outside diameter between 0.45 inch and 0.375 inch is inserted concentrically in the glass tube. Cooling tower water flows axially through the annular space between the heater rod and the glass tube.

Heater rods were supplied by HTRI. Figure III-2 shows a schematic diagram of a heater rod. An internal electric heater is

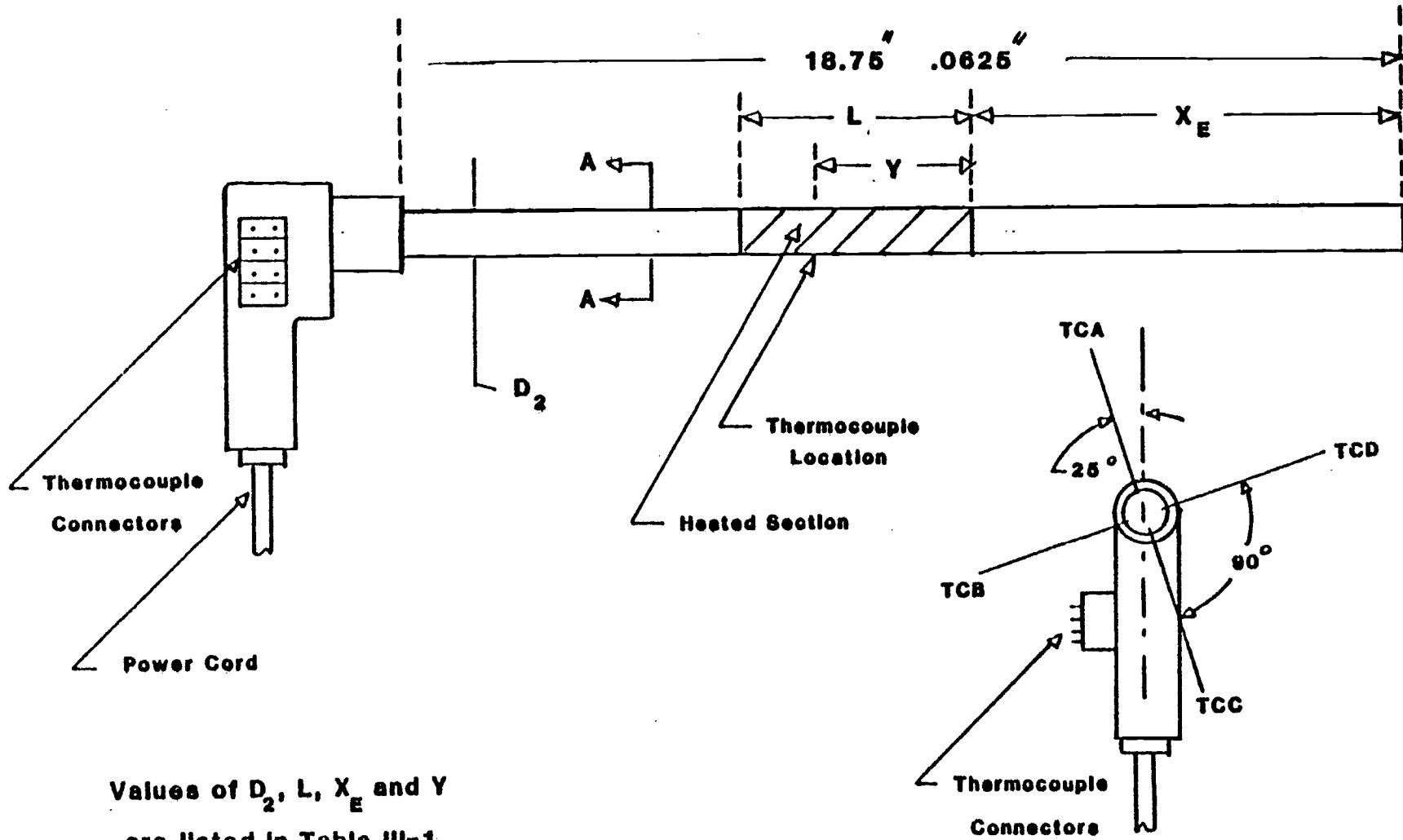


FIGURE III-2: HEATER ROD HEATED SECTION AND THERMOCOUPLE LOCATION

embedded in a 4.0 ± 0.2 inches long heated section to provide the desired heat flux.

Four chromel-constantan (Type E) thermocouples: TCA, TCB, TCC and TCD are located underneath the heated surface to measure the wall temperature at four different locations.

Figure III-2 also shows the relative location of the heated section and wall thermocouples.

The electric power input to the heater rod is regulated by a W10 Variac transformer.

Chromel-constantan thermocouples are also placed at the inlet of all three test sections and at the outlet of test section 3. The reference junction for all thermocouples is set at 150°F.

Thermocouple signals, values of the flow rates, pressure and power inputs are transformed to millivolt outputs which can be displayed and recorded on paper tape by the automatic data acquisition system (Digitec, Data-Logger 1000).

In order to prevent a heater rod from overheating when the flow stops inadvertently because of pump failure, a high temperature cut-off mechanism is provided. Maximum wall temperature is set at 350°F for test section 3 and 750°F for test sections 1 and 2.

Specifications for all heater rods used are listed in Table III-1. The thermal resistance between the embedded thermocouple and the metal x/k is determined using the Wilson plot.²⁰

Calibration equations for heat flux, flow rate and temperatures are given in Appendix B.

TABLE III-1. HTRI HEATER ROD SPECIFICATIONS

HEATER ROD NUMBER	ROD MATERIAL	ROD OUTSIDE DIAMETER D_2 (inch)	HEATED SECTION LENGTH L (inch)	ENTRANCE LENGTH X_E (inch)	DISTANCE Y (inch)	$k/x \cdot \text{Btu}/\text{ft}^2 \cdot \text{hr} \cdot {}^\circ\text{F}$			
						TCA	TCB	TCC	TCD
109	Copper Plated	0.420	3.90	9.33	3.0	137767.	147720.	15376.	43256.
115	Admiralty	0.4225	3.90	9.33	3.0	37881.	34961.	70095.	32499.
117	Admiralty	0.4208	3.90	9.33	3.0	30881.	-	33982.	17393.
124	Copper -Nickel (90-10)	0.4196	3.90	9.02	3.0	11701.	15677.	-	19040.
152	Copper Plated Admiralty 443	0.422	4.01	8.66	3.0	110974.	398304.	40198.	14546.
230	Carbon Steel Galvanized	0.423	3.86	8.56	3.0	16618.	19304.	14983.	46159.
231	Carbon Steel	0.416	3.86	8.56	3.0	28116.	22156.	29420	71604.
110	Stainless Steel	0.890	6.25	9.33	4.0	137.38	-	203.62	351.17

 k = thermal productivity of rod x = distance of thermocouple
below surface of the rod

IV. EXPERIMENTAL PROCEDURES

Experimental Program

The major objective of this experimental study was to investigate the effects of varying the pH of cooling tower water on asymptotic fouling resistance at different flow velocities. The pH controlled runs were made at different levels of calcium hardness, namely, around 150, 400, and 500 ppm CaCO_3 . Runs 102, 103 and 104 were particularly made to investigate the relative fouling behaviour of three different metallic surfaces exposed to cooling tower water of the same quality. Run 100 was an attempt made to study the fouling characteristics of cooling tower water flow on an enhanced heat transfer surface.

For most of the runs water velocities were around 3, 4, 5 and 6.0 ft/sec. The surface temperatures averaged between 150°F and 200°F for all the runs. Runs 102, 103 and 104 were carried out at a pH of 8.0. Each of the runs 108, 110, 111, 112, 113, 114, 115 and 116 had an average pH of 7.5. The rest of the runs were made around a pH of 8.5. Runs 101, 114 and 115 had calcium levels around 400 ppm. Runs 102, 103 and 104 were made at calcium levels around 500 ppm and the rest of the runs were carried out at a calcium level of 150 ppm. For the first few runs, namely, runs 98, 99, 100 and 101, the pH was not controlled by the addition of acid. The rest of the runs, i.e., runs starting from 102 till 116 were all done at a specified level of pH by the addition of hydrochloric acid.

TABLE IV-1. WATER STUDIED BY KNUDSEN AND CO-WORKERS^{2,9}

	Water Identification				City Water
	A	B	C	D	
Total Hardness (ppm CaCO ₃)	210	220	470	370 (800)	40
Calcium Hardness (ppm CaCO ₃)	150	150	400	270 (640)	30
m-Alkalinity (ppm CaCO ₃)	210	300	115	160 (600)	42
Chloride (ppm)	300	400	600	500	40
Silica (ppm SiO ₂)	105	110	115	150	20
pH	9	9	9	9	9

Note: Numbers in parenthesis refer to "effective" concentrations calculated by a mass balance.

TABLE IV-2. RUN PARTICULARS

RUN NUMBER	STARTING DATE	COMPLETION DATE	DURATION (DAYS)	TEST SECTION	HEATER ROD NUMBER
98	2/16/81	3/25/81	38	2	109
99	4/27/81	5/25/81	29	2	109
100	4/27/81	5/25/81	29	4	110
101	7/27/81	8/23/81	28	2	109
102	8/27/81	9/23/81	33	1	231
103	8/27/81	9/23/81	33	2	230
104	8/27/81	9/23/81	33	3	152
105	11/12/81	12/2/81	21	1	152
106	11/12/81	12/2/81	21	2	109
107	3/09/82	3/22/82	14	1	115
108	4/10/82	4/16/82	7	1	117
109	3/09/82	3/12/82	4	3	124
110	4/10/82	4/16/82	7	3	124
111	4/25/82	6/02/82	39	1	115
112	4/25/82	6/02/82	39	2	117
113	4/25/82	4/29/82	4	3	124
114	7/03/82	7/29/82	27	1	115
115	7/03/82	7/29/82	27	2	117
116	7/03/82	7/29/82	27	3	124

The different types of water studied previously by Knudsen and co-workers^{2,9} are listed in Table IV-1. Though the water used in this study was not completely identical with the types shown in IV-1, nevertheless it was possible to duplicate the major values.

Run Initiation

First the basin was filled with city water after which water was circulated through the cooling tower water system by switching on the pumps and the blower was turned on. Then the heat exchanger pump was turned on and the bulk water temperature controller adjusted to the desired set point. The circulation of water was continued until the calcium concentration increased to the desired level after which the blow-down (removal of water from basin) was started to maintain the desired quality. For the few runs which had a higher level of calcium, calcium chloride solution was added at a constant rate from a separate holding tank directly into the basin water. For the later set of runs pH was controlled at the desired level by introducing hydrochloric acid using the automatic pH monitor.

At this point the heater rods were fitted into the test sections, flow velocities were set and the desired surface temperatures obtained by adjusting the power input to the heaters through the variacs. The data logger was activated and set to record ten readings at two minute intervals for calibration purposes after which the data logger is set to register readings at five hour intervals for the remainder of the run.

Process Monitoring

One-liter water samples were collected daily from the basin and from the make-up water and the analysis was usually done the same day. Water samples were analysed for total hardness (TH), calcium hardness (CaH), methyl-orange alkalinity (m-alk), chloride (cl), conductivity, total solids (TS), silica (Si) and pH. The methods used for water analysis are listed in Appendix D. The blow-down rate is adjusted to maintain a constant water quality. The values of the daily cooling water measurements for all runs are listed and plotted in Appendix G.

The data logger output was collected daily and used to calculate the fouling resistance to heat transfer, R_f , for each of the thermocouples at every five-hour measurement cycle of the data logger. Flow rates and power levels were adjusted whenever they were found to deviate from their original set values.

During all the runs, microbial fouling was prevented by daily addition of 100 ml of commercial bleach, a 5.25% solution of sodium hypochlorite.

Run Termination

Most of the runs (except runs 109 and 113) were terminated when the fouling factor reached its asymptotic value as evident from the daily R_f calculation. For a couple of runs, the fouling deposit grew to a critical thickness to cause the wall temperature of the rod to rise to the point where the high-temperature cut-off was triggered,

thus terminating the run prematurely before the asymptotic fouling resistance value was reached.

The heater rods were removed from the test-sections after the shutdown and the deposit was scraped off the surface of the rod after it was thoroughly dry. The deposit thus collected was sent out for chemical analysis. If large solid pieces could be obtained from the sample they were sent to electron microscope facility to obtain electron-micrographs. The heater rods were re-used in subsequent runs after they were polished clean with fine steel wool.

V. CALCULATION METHODS

Clean Condition

Local Bulk Temperature

The local bulk temperature of the cooling tower water is calculated on the basis of an energy balance and is given by

$$T_b = \frac{PF \times Q_{mv} \times TBF}{V} + T_{in} \quad (5-1)$$

$$PF = \frac{100 \times 3600}{1055.056 \times AH} \quad (5-2)$$

$$TBF = \frac{AH}{62.37 \times 3600 \times AA} \quad (5-3)$$

$$V = \frac{WF}{7.4805 \times 60 \times AA} \quad (5-4)$$

where

AH = rod heated area ft²

AA = annular flow area ft²

PF = heat flux factor Btu/(hr - ft² - mv)

Q_{mv} = power transducer reading millivolts

T_{in} = water inlet temperature °F

TBF = bulk temperature factor (ft/sec)°F/(Btu/hr - ft²)

V = Flow velocity ft/sec

WF = Volumetric flow rate gallons per minute

or in the simplified form

$$T_b = \frac{(Q_{mv} \times 100) 60}{1055.056 \times 62.37 (W_F/7.4805)} + T_{in} \quad (5-5)$$

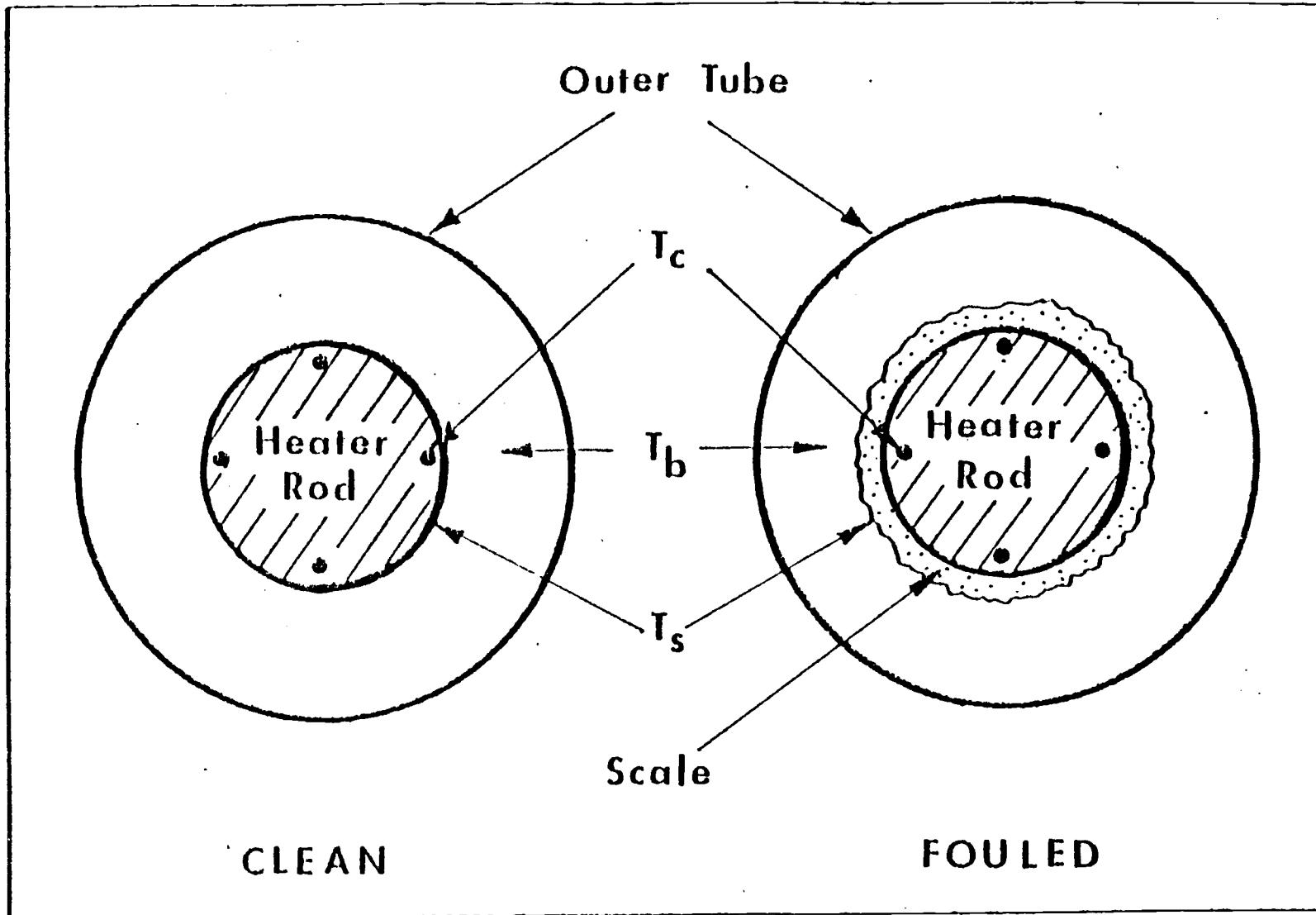


Figure V-1. Cross-section of Test Section

Local Surface Temperature

Under the assumptions of constant heat flux, bulk temperature and flow rate, the local surface temperature T_s can be calculated by

$$T_{sc} = T_w - h_{flux} (x/k) \quad (5-6)$$

$$h_{flux} = PF \times Q_{mv} = Q/AH \quad (5-7)$$

where

h_{flux} = heat flux from heated section Btu/hr - ft²

Q = power supplied Btu/hr

x/k = thermal resistance of tube ft² - hr - °F/Btu

T_w = wall temperature °F

and subscript c denotes clean conditions

Local Film Coefficient

The local heat transfer film coefficient h is calculated by

$$h_c = (Q/AH)/(T_{sc} - T_b) \quad (5-8)$$

The local film coefficient is also related to the flow velocity

$$h_c = K_c V_c^n \quad (5-9)$$

where

K = proportionality constant

n = 0.7 if $V > 4$ ft/sec

= 0.93 otherwise

and subscript c denotes clean conditions

An average of the ratio h_c/V_c^n of at least ten data points at the beginning of each run gives K_{avg}

$$K_{avg} = \sum_{j=1} h_{cj}/V_{cj}^n \quad (5-10)$$

The value of K_{avg} computed above remains constant provided the assumption of constant heat flux, bulk temperature and flow rate holds good.

Fouled Condition

The local bulk temperature is calculated using equation (5-1) and for a given velocity, the local film coefficient is given by

$$h = K_{avg} V^n \quad (5-11)$$

The local surface temperature T_s can then be calculated by

$$T_s = (h_{flux}/h) + T_b \quad (5-12)$$

Finally, the local fouling resistance R_f is calculated by

$$R_f = (T_w - T_s)/h_{flux} - x/k \quad (5-13)$$

Computer Programs

All of the calculations were carried out by using the CDC CYBER 170 Model 720 computer at the Oregon State University computer center. Modified versions of the programs written by Larry Lahm⁶ for calculation of h/V^n at the start of the run and for plotting the fouling resistance and cooling tower water quality were used. The run-results are shown in Appendix E, the fouling resistance vs time plots are given in Appendix H and the plots for cooling tower water quality can be found in Appendix G.

Error Estimation

The calibration equations for power input, flow rate and temperature can be found in Appendix B.

From equation (5-1) the relative error of the bulk temperature is

$$\frac{dT_{bc}}{T_{bc}} = Z_1 \frac{dQ_{mv}}{Q_{mv}} \pm Z_1 \frac{dW_F}{W_F} \pm \frac{Z_1}{Z_2} \frac{W_F}{Q_{mv}} \frac{T_{in}}{T_{in}} \frac{dT_{in}}{T_{in}} \quad (5-14)$$

where $Z_1 = \frac{Z_2 Q_{mv}}{Z_2 Q_{mv} + W_F T_{in}}$ (5-15)

$$Z_2 = \frac{100 \times 60 \times 7.4805}{1055.056 \times 62.37} \quad (5-16)$$

$$\frac{dW_F}{W_F} = \frac{FLOCAL(2)}{(W_{mv} - 50)} dW_{mv} \quad (5-17)$$

where

$FLOCAL(2)$ = constant, characteristic of flow transducer

W_{mv} = millivolt reading of flow transducer

Similarly from equations (5-6) and (5-8)

$$\frac{dT_{sc}}{T_{sc}} = \frac{(k/x) T_{wc}}{Z_3} \frac{dT_{wc}}{T_{wc}} \pm \frac{(Q/AH)_c}{Z_3} \frac{d(Q/AH)_c}{(Q/A)_c} \pm \frac{(Q/AH)_c}{Z_3} \frac{d(k/x)}{(k/x)} \quad (5-18)$$

$$Z_3 = T_{wc} (k/x) - (Q/AH)_c \quad (5-19)$$

$$\frac{dh_c}{h_c} = \frac{d(Q/AH)_c}{(Q/A)_c} \pm \frac{T_{sc}}{(T_{sc} - T_{bc})} \frac{dT_{sc}}{T_{sc}} \pm \frac{T_{bc}}{(T_{sc} - T_{bc})} \frac{dT_{bc}}{T_{bc}} \quad (5-20)$$

$$\frac{d(Q/AH)}{(Q/AH)_c} = \frac{dQ}{Q} \pm \frac{dD_2}{D_2} \pm \frac{dHL}{HL} \quad (5-21)$$

$$\frac{dQ}{Q} = \frac{dQ_{mv}}{Q_{mv}} \quad (5-22)$$

The relative errors of T_{in} and T_W can be calculated by the following equations

$$\frac{dT}{T} = \frac{0.949}{TC + 5.02} dTC \quad \text{if } TC < -1.0 \quad (5-23)$$

$$\frac{dT}{T} = \frac{0.8765}{TC + 4.72} dTC \quad \text{if } TC \geq -1.0 \quad (5-24)$$

where TC is the thermocouple output in millivolts

The relative error in surface temperature is obtained from the equation (5-12).

$$\frac{dT_s}{T_s} = \frac{(Q/AH)}{Z_4} \frac{d(Q/AH)}{(Q/AH)_c} \pm \frac{(Q/A)}{Z_4} \frac{dh}{h} \pm \frac{hT_b}{Z_4} \frac{dT_b}{T_b} \quad (5-25)$$

where

$$Z_4 = (Q/AH) + hT_b \quad (5-26)$$

Since the bulk temperature, flow velocity and heat flux are relatively constant during a run

$$\frac{d(Q/AH)}{(Q/AH)_c} = \frac{d(Q/AH)_c}{(Q/AH)_c} \quad (5-27)$$

$$\frac{dT_b}{T_b} = \frac{dT_{bc}}{T_{bc}} \quad (5-28)$$

$$\frac{dh}{h} = \frac{dh_c}{h_c} \quad (5-29)$$

Thus equation (5-25) can be rewritten as

$$\frac{dT_s}{T_s} = \frac{(Q/AH)_c}{Z_4} \frac{d(Q/AH)_c}{(Q/AH)_c} \pm \frac{(Q/AH)_c}{Z_4} \frac{dh_c}{h_c} + \frac{h_{T_b}}{Z_4} \frac{dT_{b_c}}{T_{b_c}} \quad (5-30)$$

From equation (5-13) the relative error of the fouling resistance is

$$\begin{aligned} \frac{dR_f}{R_f} &= \frac{(k/x)}{Z_5} T_w \frac{dT_w}{T_w} \pm \frac{(k/x)}{Z_5} T_s \frac{dT_s}{T_s} \\ &\pm \frac{(k/x)(T_w - T_s)}{Z_5} \frac{d(Q/AH)_c}{(Q/AH)_c} \pm \frac{(Q/AH)_c}{Z_5} \frac{d(k/x)}{(k/x)} \end{aligned} \quad (5-31)$$

$$\text{where } Z_5 = (k/x)(T_w - T_s) - (Q/AH) \quad (5-32)$$

Finally setting appropriate errors to each measured variable,

$$dQ = \pm 1.90 \text{ Btu/hr}$$

$$dD_2 = \pm 0.0005 \text{ inch}$$

$$dL = \pm 0.005 \text{ inch}$$

$$dY = \pm 0.005 \text{ inch}$$

$$dT_C = \pm 0.005 \text{ millivolts}$$

$$d(k/x) = \pm 50. \text{ Btu/ft}^2 \cdot \text{hr} \cdot {}^\circ\text{F}$$

The numerical value of the maximum relative error of the surface temperature and fouling resistance can be calculated by equations (5-30) and (5-31).

VI. RESULTS AND DISCUSSION

Run Descriptions

Runs 98, 99, 101

The runs 98, 99 and 101 were all made in test section 2 and heater rod 109 was used. The average velocities of the three runs were 6.139, 3.822, and 6.201 ft/sec, respectively. The average heat fluxes were 126108., 55874., and 97355 (Btu/hr-sq ft), respectively.

In run 98 an exponential rise in the fouling resistance vs time curves (Appendix 4) with no initial induction period is observed. There was a sudden decrease in the fouling resistance (about 30%) around 425 hours and this occurred due to a power failure during which part of the deposit on the heater rod could have flaked off. The peak that occurred around 400 hours could be the result of rising levels of total hardness and m-alkalinity values. The fouling resistance remained constant at the new lower level and showed a tendency to increase towards the end of the run which could be due to the increase in the value of m-alkalinity, and silica as the run neared its finish. The chemical analysis of the deposits taken from the rod and at rod surface shows average values of 20% magnesium, 40% silicon, 12% copper and 2.25% calcium. Thus it can be concluded that magnesium silicate deposited and this result was well correlated by the findings of Lee⁹ in his run 1. It can be noted that at the rod surface there was a higher percentage of magnesium and silicon and the analysis of

TABLE VI-1A. AVERAGE OPERATING CONDITIONS - TEST SECTION-1

RUN NUMBER	VELOCITY (ft/sec)	HEAT FLUX (BTU/hr/ft ²)	BULK TEMPERATURE (°F)	SURFACE TEMPERATURE (°F)				HEATER ROD
				TCA	TCB	TCC	TCD	
102	3.927 (0.123)	94377. (464.9)	97.6 (0.62)	176.9 (2.04)	177.8 (2.06)	182.8 (2.17)	196.8 (2.47)	231-CS
105	4.848 (0.133)	91521. (313.2)	92.4 (2.06)	162.6 (2.12)	158.8 (2.09)	-	160.0 (2.10)	152-CA
107	3.812 (0.248)	75695. (317.9)	98.9 (1.20)	159.4 (4.49)	160.0 (4.53)	163.6 (4.75)	159.0 (4.47)	115-A
108	4.025 (0.110)	77453. (612.4)	98.4 (0.83)	153.8 (1.41)	-	155.1 (1.44)	151.0 (1.36)	117-A
111	4.904 (0.195)	134971. (748.7)	98.3 (0.81)	189.7 (3.00)	189.6 (2.99)	197.1 (3.22)	187.6 (2.93)	115-A
114	5.989 (0.102)	100297. (471.4)	97.0 (0.62)	154.9 (0.90)	155.5 (0.90)	160.0 (0.94)	151.5 (0.87)	115-A

Note: Numbers in parenthesis are standard deviations

TABLE VI-1B. AVERAGE OPERATING CONDITIONS - TEST SECTION-2

RUN NUMBER	VELOCITY (ft/sec)	HEAT FLUX (BTU/hr/ft ²)	BULK TEMPERATURE (°F)	SURFACE TEMPERATURE (°F)				HEATER ROD
				TCA	TCB	TCC	TCD	
98	6.139 (0.129)	126108. (9715.7)	96.5 (0.47)	160.3 (4.41)	-	155.0 (4.05)	-	109-CU
99	3.822 (0.124)	55874. (558.9)	102.1 (3.24)	158.2 (5.91)	-	156.8 (5.81)	-	109-CU
101	6.201 (0.214)	97355. (11719.0)	97.2 (0.98)	153.8 (7.83)	154.1 (7.88)	-	156.8 (8.23)	109-CU
103	3.963 (0.130)	103664. (21872.4)	97.8 (0.80)	174.3 (17.04)	173.3 (16.83)	176.3 (17.47)	181.7 (18.65)	230-CSG
106	5.057 (0.106)	93361. (282.0)	92.4 (2.08)	169.4 (2.35)	-	156.5 (2.26)	159.3 (2.28)	109-CU
112	3.902 (0.125)	102441. (2728.1)	98.2 (0.79)	180.8 (3.41)	-	181.2 (3.42)	178.7 (3.32)	117-A
115	6.000 (0.097)	121716. (408.3)	97.3 (0.63)	170.5 (1.08)	-	170.3 (1.07)	166.1 (1.03)	117-A

Note: Numbers in parenthesis are standard deviations

TABLE VI-1C. AVERAGE OPERATING CONDITIONS - TEST SECTION - 3 & 4

RUN NUMBER	VELOCITY (ft/sec)	HEAT FLUX (Btu/hr/ft ²)	BULK TEMPERATURE (°F)	SURFACE TEMPERATURE (°F)				HEATER ROD
				TCA	TCB	TCC	TCD	
100	3.971 (0.102)	55557. (585.1)	105.3 (2.78)	172.0 (3.05)	-	314.2 (5.51)	240.5 (4.06)	110-SS
104	3.841 (0.139)	74238. (388.8)	97.3 (0.61)	160.3 (1.83)	-	160.3 (1.83)	172.2 (2.13)	152-CA
109	2.982 (0.058)	76195. (695.5)	99.0 (0.33)	201.4 (2.45)	-	-	196.7 (2.34)	124-CN
110	3.067 (0.060)	76173. (577.1)	98.8 (0.83)	195.6 (1.61)	-	-	-	124-CN
113	2.327 (0.073)	65565. (460.2)	99.0 (1.46)	180.8 (3.05)	-	-	-	124-CN
116	1.346 (0.233)	27801. (138.1)	97.4 (0.73)	177.1 (11.9)	-	-	-	124-CN

Note: Numbers in parenthesis indicate standard deviations

A - Admiralty
 CA - Copper plated admiralty 443
 CS - Carbon steel
 CSG - Galvanized carbon steel

CU - Copper plated
 CN - Copper-Nickel (90-10)
 SS - Stainless steel

TABLE VI-2. AVERAGE COOLING TOWER WATER QUALITY

RUN	TH	CaH	MgH	M-Alk	Cl	Si	pH	TS
98	209 (14.2)	149 (7.0)	61 (8.5)	143 (20.7)	190 (40.0)	104 (12.8)	8.3 (0.06)	559 (102.5)
99, 100	188 (13.8)	132 (14.1)	56 (2.2)	241 (26.6)	454 (39.3)	152 (21.4)	8.6 (0.05)	985 (60.1)
101	601 (46.4)	405 (25.7)	196 (20.9)	71 (38.4)	993 (122.3)	139 (9.3)	8.1 (0.17)	1517 (229)
102, 103, 104	616 (32.8)	511 (24.5)	105 (8.9)	36 (13.2)	997 (85.2)	133 (10.2)	7.9 (0.56)	1547 (162.2)
105, 106,	223 (10.3)	150 (6.4)	73 (4.9)	239 (12.2)	601 (38.8)	136 (4.8)	8.5 (0.46)	1207 (53.6)
107, 109	216 (9.6)	144 (5.8)	71 (6.0)	212 (18.1)	376 (39.8)	157 (7.5)	8.5 (0.08)	919 (67.2)
108, 110	239 (13.8)	161 (11.4)	77 (2.7)	53 (57.7)	507 (62.4)	140 (8.2)	7.5 (0.04)	1067 (165.8)
111, 112, 113	240 (11.9)	171 (8.8)	69 (3.6)	11 (2.2)	397 (36.5)	104 (9.7)	7.5 (0.06)	642 (122.4)
114, 115, 116	470 (18.2)	403 (19.0)	66 (4.8)	19 (6.0)	705 (36.7)	120 (9.2)	7.5 (0.02)	1121 (146.1)

Note: Numbers in parenthesis are standard deviations

TH = ppm CaCO_3 Cl = ppm NaCl CaH = ppm CaCO_3 Si = ppm SiO_2 MgH = ppm CaCO_3 TS = ppmM-Alk = ppm CaCO_3

TABLE VI-3. CHEMICAL ANALYSIS OF DEPOSIT COMPOSITIONS

RUNS	Ca % (as CaO)	Mg % (as MgO)	Si % (as SiO ₂)	Fe % (as Fe ₂ O ₃)	Cu % (as CuO)	Na % (as Na ₂ O)	CO ₃ % (as CO ₂)	S % (as SO ₃)	P O ₃ % (as P ₂ O ₅)	Zn % (as ZnO)
98-0	3.0	18.0	37.0	2.4	10.0	NP	PNR	NP	SA	NP
98-I	1.4	22.0	44.0	1.8	14.0	NP	NP	NP	SA	NP
99	44.0	5.0	7.0	SA	SA	NP	PNR	NP	SA	NP
100	Scale not analyzed									
101	SA	1.3	16.0	2.2	46.0	NP	SA	NP	SA	NP
102	-	-	9.0	82.5	-	-	-	-	-	6.3
103	-	-	29.0	24.0	-	-	-	-	-	40.6
104-0	1.7	5.1	40.0	6.0	5.6	NP	SA	NP	SA	NP
104-1	1.3	9.1	36.0	4.6	22.0	NP	SA	NP	SA	NP
105	10.0	6.6	23.0	3.8	23.0	NP	PNR	NP	SA	NP
106	14.0	7.3	23.0	3.2	16.0	NP	PNR	NP	SA	NP
107-0	47.0	2.3	SA	SA	SA	SA	34.0	SA	SA	NP
107-1	6.9	3.5	15.0	3.8	18.0	1.9	PNR	SA	SA	NP
108	SA	SA	17.0	3.3	56.0	1.4	SA	SA	SA	NP
109	46.0	3.4	1.7	SA	SA	SA	35.0	SA	SA	NP
110	SA	5.9	31.0	3.7	26.0	SA	SA	SA	SA	NP
111	1.0	1.8	41.0	4.3	11.0	NP	SA	SA	SA	NP
112	1.1	2.2	43.0	4.7	13.0	NP	SA	SA	SA	NP

TABLE VI-3. CHEMICAL ANALYSIS OF DEPOSIT COMPOSITIONS
(continued)

RUNS	Ca % (as CaO)	Mg % (as MgO)	Si % (as SiO ₂)	Fe % (as Fe ₂ O ₃)	Cu % (as CuO)	Na % (as Na ₂ O)	CO ₃ % (as CO ₂)	S % (as SO _c)	PO ₃ % (as P ₂ O ₅)	Zn % (as ZnO)
113	1.0	1.2	21.0	3.7	18.0	NP	SA	SA	SA	NP
114	SA	SA	9.1	2.9	82.0	NP	SA	SA	SA	NP
115	1.0	3.0	20.0	3.9	47.0	NP	SA	SA	SA	NP
116	1.4	1.8	20.0	3.8	29.0	NP	PNR	SA	SA	NP

NP - not present

O - outer layer of deposit

PNR - present but not reported

I - inner layer of deposit

SA - present in small amounts (<.1%)

TABLE VI-4. WATER CHARACTERIZATION INDEXES

RUN	pH	pH _S	LSI	RSI
98	8.3	7.31	0.99	6.33
99	8.6	7.11	1.49	5.62
100	8.6	7.08	1.52	5.56
101	8.1	7.22	0.88	6.34
102	8.0	7.30	0.70	6.60
103	8.0	7.30	0.70	6.60
104	8.0	7.30	0.70	6.60
105	8.5	7.16	1.34	5.83
106	8.5	7.16	1.34	5.83
107	8.5	7.16	1.34	5.81
108	7.5	7.72	-0.22	7.94
109	8.5	7.15	1.35	5.81
110	7.5	7.72	-0.22	7.93
111	7.5	8.36	-0.86	9.21
112	7.5	8.36	-0.86	9.21
113	7.5	8.19	-0.69	8.89
114	7.5	7.78	-0.28	8.07
115	7.5	7.78	-0.28	8.06
116	7.5	7.78	-0.28	8.06

the outer coating of the deposit shows a lower percentage of magnesium and silicon, but the calcium content was substantially doubled compared to the inner coating.

In run 99, the initial steep rise is followed by the approach of fouling resistance vs time curve to an asymptotic value. It was noted that at 496 hours there was a sharp rise in the fouling resistance and this could be explained by the rise of m-alkalinity values from 230 to 280 ppm, over a period of 48 hours. Also, in the later part of the run at 546 hours there was a rapid fall in the fouling resistance values after which the curves start rising. This corresponds to a change in the bulk temperature from 98.3°F to 86.3°F at 546 hours. The bulk temperature reached 98.3°F again at 564 hours. It was also noted that m-alkalinity values were much higher towards the end of the run. The chemical analysis of the deposit shows calcium (44.0%) to be the major constituent followed by silicon (7.0%) and magnesium (5.0%). The calcium was deposited due to the high level of m-alkalinity in the cooling tower water and this was substantiated by Lee's⁹ run 18 which had similar water quality.

The fouling resistance curves for run 101 show an ideal model of asymptotic behaviour, after the initial exponential rise. The asymptotic fouling resistance value was reached around 150 hours. There was a sudden drop in the values of fouling resistance (about 35%) starting from 580 hours and this happened due to a decrease in flow velocity from a value of 6.22 ft/sec to 4.90 ft/sec and the flow velocity remained at that lower value for the rest of the run. The standard deviation for heat flux has an unusually high value

(11719 Btu/hr-sq ft) for this run and this was a consequence of an increase in input power (27%) at 335 hours which increased the surface temperature by 10%, but did not show a considerable influence on the fouling resistance values. The cooling tower water quality plots for run 101 indicate that there was a shift in the chemical equilibrium which was shown by the increase in the total calcium and magnesium hardness and chloride levels that correspond to a decrease in the m-alkalinity and pH levels. The chemical analysis of the deposit reveals low calcium (1.0%) and magnesium (1.3%) contents and high contents of silica (16%) and copper (46%). This could explain the reason for the small variations in fouling resistance values that correspond to large variations in total and calcium hardness levels.

Runs 102, 103 and 104

The main objective of these runs was to compare the fouling behavior of carbon steel, galvanized steel and copper plated admiralty tube surfaces under the same conditions of water quality and velocity. The pattern of fouling on the carbon steel was the same for the other two but the fouling resistance was slightly higher due to the high percentage of iron oxide present in the scale. There was a steep increase in the fouling resistance value for all the runs at about 400 hours, corresponding to a sudden decrease in pH from a value of 8.0 to a value of 5.2, which occurred due to a malfunction in the solenoid valve controlling the flow of acid into the system. Also this kind of behaviour in the fouling resistance curve confirms the finding of the investigators Taborek et al,¹⁶ that a new

pseudo-asymptote at a higher level is established due to an acid leak into the water.

From the chemical analysis it was noted that the carbon steel rod deposit contained 82.5% of iron and only 9.0% of silicon and 6.3% zinc, whereas the galvanized steel rod deposit contained 29.0% of silicon, 24.0% of iron and 40.6% of zinc. The deposit on the carbon steel heater rod was substantially thicker and more porous compared to the deposits on the galvanized and admiralty rods. Also the carbon steel rod exhibited considerable attack of the base metal and pits were found to penetrate the surface as much as several mils. The deposits were largely the result of corrosion products with crystallization of calcium and magnesium compounds. The zinc constituent in the deposits of carbon steel rods is replaced by copper (5.6%) in the admiralty rod.

Runs 105, 106

The runs 105 and 106 had average velocities of 4.85 and 5.06 ft/sec and average heat flux values of 91521. and 93361 Btu/hr ft², respectively.

In both runs the power failures at 35 hours occurred after the fouling resistance values had shown a tendency to become constant after the initial rapid rise. There was one more power failure that occurred at 48 hours and the equipment was started at 82 hours. The decrease in the fouling values starting from 100 hours was due to the fall in pH value from 9.2 to 8.01. After 200 hours, fouling resistance values for both the runs showed a slow rise till the end of the run.

The deposit analysis for run 105 indicated 10% calcium, 6.6% magnesium, 23% silicon, 23% copper and 3.8% iron. Run 106 showed 14% calcium, 7.3% magnesium, 23% silicon, 16% copper and 3.2% iron. Both deposits contained small amounts (< 1%) of phosphate.

Runs 107 and 109

The runs 107 and 109 were made using heater rods 115 and 124, respectively. The average water velocity for the runs were 3.812 and 2.982 ft/sec and the average heat flux values were 75695 and 76195 (Btu/hr-ft²), respectively. Since the runs were made simultaneously, the runs shared a common water quality.

Run 107 is characterized by the well defined initial exponential rise of the fouling resistance values. There is a sudden decrease in the values of all the four fouling resistances at 120 hours which was due to the decrease of calcium level in the cooling tower.

Run 109 had to be terminated around 73 hours after the start when the wall temperatures reached a high level due to the rapid buildup of the deposit. The fouling resistance vs time curves show a steep linear increase of the fouling resistance values with time. The fouling resistance had reached a maximum value of 30.9 (ft²-hr-°F/Btu) which was the highest among the fouling resistance values recorded for all the runs.

The results of deposit analysis for runs 107 and 109 were found to be quite identical. The results for the analysis of the outer layer deposit for run 107 show 47.0% of calcium, 2.3% magnesium, less than 1.0% silicon and 34.0% of carbonate as the major constituents. The results for run 109 indicate 46.0% of calcium, 3.4% of magnesium,

1.7% silicon and 35.0% carbonate as the major constituents. We can also note the fact that the base deposit analysis for run 107 compares quite differently from the outer layer deposit analysis. The chief constituents of the base deposit were 6.9% calcium, 3.5% magnesium, 15.0% silicon, 3.8% iron, 18.0% copper and 1.9% sodium.

Runs 108 and 110

The runs 108 and 110 had duration of 144 hours and the average velocities were 4.025 and 3.067 ft/sec and the average heat flux values were 77453 and 76173 (Btu/hr-ft²), respectively. The pH was maintained around 7.5 throughout the length of the runs.

For run 108 there was small quantity of fouling deposit and the maximum value of fouling resistance encountered during the whole run was 1.22×10^{-4} (ft²-hr-°F/Btu). The run was terminated at 131 hours since the fouling resistance had reached the asymptotic value. The deposit analysis indicated the major constituents to be of copper (56.0%), silicon (17.0%), iron (3.3%), and sodium (1.4%). Calcium, magnesium, carbonate, sulfur and phosphate were found in small traces (< 1.0%).

In the heater rod 124 used for run 110 only the thermocouple in location A was functioning. From fouling resistance vs time curve we can note the initial exponential rise followed by a decrease in the fouling resistance values which could be due to the gradual decrease of the silica level in the latter part of the run. The major constituents reported in the deposit analysis were silicon (31.0%). copper (26.0%), magnesium (5.9%), and iron (3.7%). Calcium, sodium, carbonate, sulfur and phosphate were found in small traces (< 1.0%).

Runs 111, 112, 113

Runs 111, 112 and 113 had average velocities of 4.9, 3.9 and 2.33 ft/sec with average heat flux values of 134971., 102441. and 65565 (Btu/hr-ft²), respectively. The pH was maintained at 7.5 throughout the length of the runs.

Both the runs 111 and 112 had a steep initial increase in the fouling resistance values followed by a gradual increase up to their respective asymptotic values. There were two power failures, one occurring at 312 hours and the other at 747 hours. Run 111 had a decrease in velocity starting from 490 hours up to 540 hours. The fouling resistance values for run 112 rose exponentially when the run was continued after the second power failure. Also there was a sudden increase in the power input (14.0%) at 157 hours and as a consequence the values of fouling resistances decreased by 24.0%.

The results of deposit analysis of runs 111 and 112 were identical. For run 111, the rod deposit contained 41.0% silicon, 11.0% copper, 4.3% iron, 1.8% magnesium and 1.0% calcium. For run 112, the rod deposit contained 43.0% silicon, 13.0% copper, 4.7% iron, 2.2% magnesium and 1.1% calcium. The deposit of run 113 had similar composition of constituents except for silica 21.0% and copper 18.0%.

Runs 114, 115, 116

Runs 114, 115 and 116 were made at the same pH level of 7.5 as runs 111, 112 and 113. The purpose of making the runs 114, 115 and 116 was to study the effect of increasing the calcium hardness level (CaH was increased from 171 to 403) on the fouling deposit composition.

The runs 114, 115 and 116 were carried out at mean velocities of 5.989, 6.0 and 1.346 ft/sec and at mean heat flux values of 110297., 121716. and 27801., (Btu/hr-ft²), respectively.

There were two power failures that occurred during these runs, one at 120 hours and the other at 233 hours. Run 114 had an initial linear rise of the fouling resistance values up to the asymptotic level. Run 115 had an initial exponential rise of the R_f values followed by a gradual increase till the end of the run. The second power failure did not affect the fouling resistance values for run 115.

The chemical analysis of the deposit for run 114 indicates the presence of three major constituents, namely, 82.0% copper, 9.1% silicon, and 2.9% iron. The results for run 115 show 47.0% copper, 20.0% silicon, 3.9% iron, and 3.0% magnesium as the principal constituents. Run 116 had similar results to that of run 115 except for copper 29.0% and magnesium 1.8%. Thus it can be concluded that raising the CaH level for runs 114, 115 and 116 did not increase the amounts of calcium and magnesium in the fouling deposit.

Surface Temperature Effect

When a constant flow velocity and water quality is maintained the equation (2-15) for R_f^* suggested by Taborek et al¹⁶ reduces to the form of equation (2-16).

TABLE VI-5. ASYMPTOTIC FOULING RESISTANCES

RUN	TCA	$R_f^* \times 10^4$ (ft ² hr°F/Btu)	TCB	TCC	TCD	$\bar{R}_f^* \times 10^4$	METHOD
98	6.07	-		4.98	-	5.53	e
99	4.33	-		2.03	-	3.18	a
101	2.01	2.34		-	2.60	2.32	c
102	6.65	6.71		5.84	5.17	6.09	b
103	3.48	3.39		3.65	3.25	3.44	b
104	4.06	-		-	-	4.06	b
105	3.40	2.59		-	3.80	3.27	d
106	3.28	-		2.95	2.93	3.06	d
107	16.37	16.34		15.05	15.96	15.93	a
108	0.88	-		0.78	0.73	0.80	a
109	30.90	-		-	30.67	30.79	f
110	3.54	-		-	-	3.54	a
111	11.03	10.27		10.21	10.65	10.54	d
112	14.57	-		14.60	14.00	14.39	d
113	4.91	-		-	-	4.91	f
114	3.07	-		3.17	2.49	2.91	d
115	4.85	-		5.12	4.95	4.97	d

- METHOD:
- a) Average of last 5 values
 - b) Average of last 5 values, before pH drop
 - c) Average of last 5 values, before velocity drop
 - d) Average of last 5 values, after power failure
 - e) Average of last 5 values, before large drop
 - f) Maximum value reached

TABLE VI-6A. R_f^* vs $1/T_s$ pH=7.5

RUN	TC	$R_f^* \times 10^4$ (ft ² -hr-°F/Btu)	T _s (°R)	1/T _s (1/°R)
114	A	3.07	614.9	1.6263×10^{-3}
	C	3.17	620.0	1.6129×10^{-3}
	D	2.49	611.5	1.6353×10^{-3}
115	A	4.85	630.5	1.5860×10^{-3}
	C	5.12	630.3	1.5865×10^{-3}
	D	4.95	626.1	1.5972×10^{-3}

TABLE VI-6B. R_f^* vs $1/T_s$ pH=8.5

RUN	TC	$R_f^* \times 10^4$ (ft ² -hr-°F/Btu)	T _s (°R)	1/T _s (1/°R)
105	A	3.40	622.6	1.6062×10^{-3}
	B	2.59	618.8	1.6160×10^{-3}
	D	3.80	620.0	1.6129×10^{-3}
106	A	3.28	629.4	1.5888×10^{-3}
	C	2.96	616.5	1.6221×10^{-3}
	D	2.93	619.3	1.6147×10^{-3}

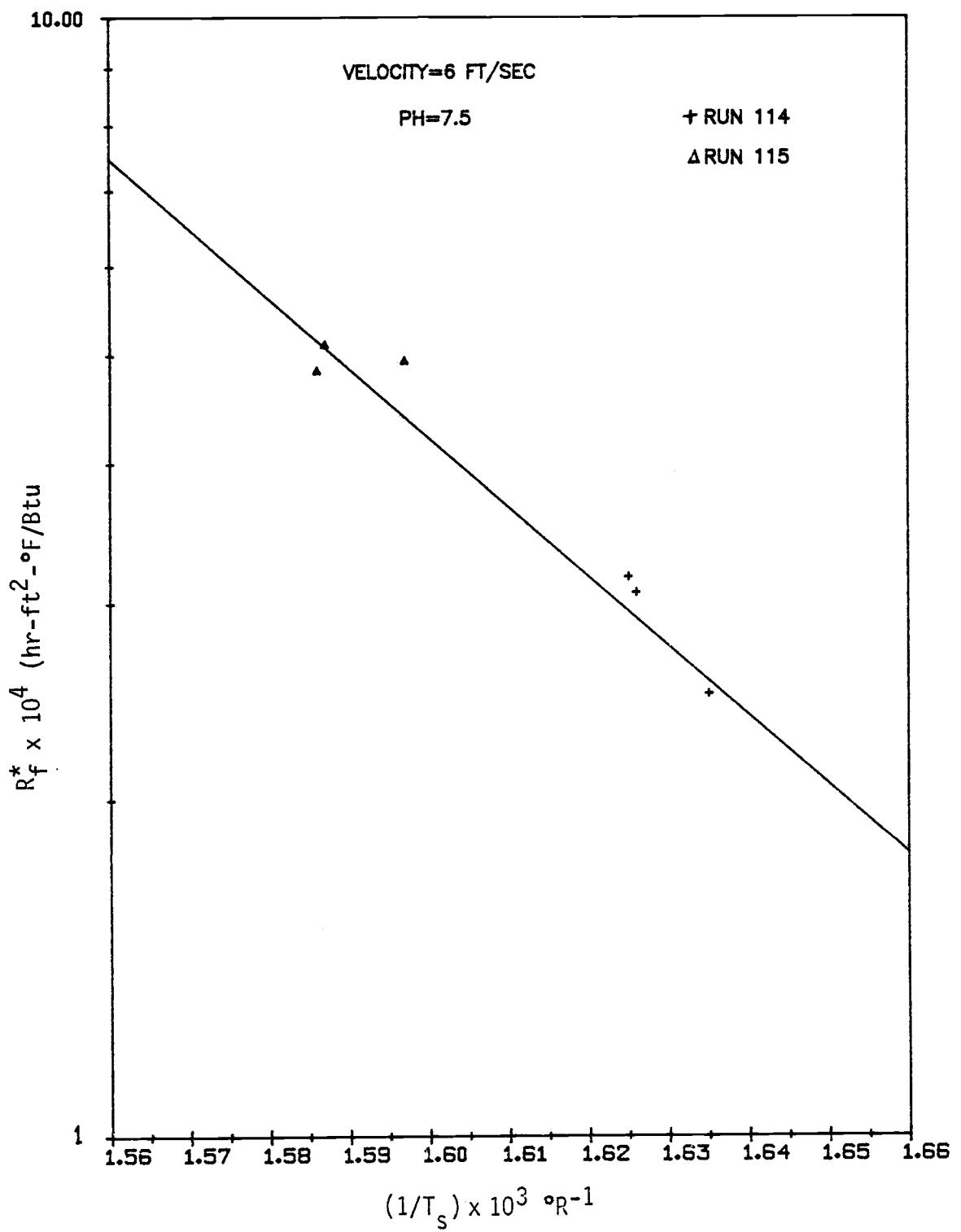


Figure VI-1A. R_f^* vs $1/T_s$ pH = 7.5

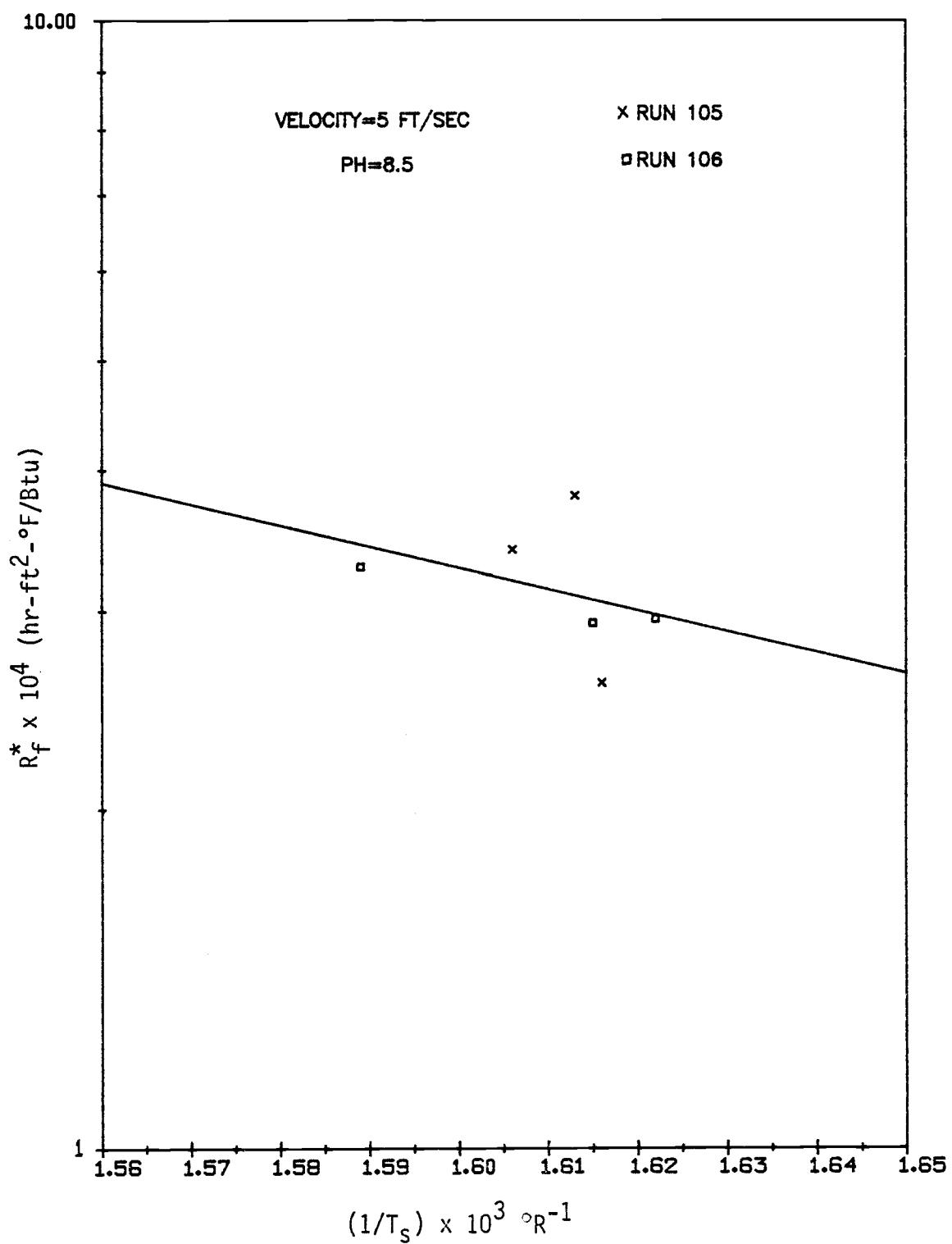


Figure VI-1B. R_f^* vs $1/T_s$ pH = 8.5

$$R_f^* = K_7 \exp (-E_a / R_g T_s) \quad (2-16)$$

where

E_a = activation energy of deposit reaction

R_g = gas constant

T_s = surface temperature

Equation (2-16) can be rewritten as

$$\ln (R_f^*) = \ln (a) + b (1/T_s)$$

a straight line is obtained and for the data of runs 114 and 115 (Table VI-6A) the following equation relating the asymptotic fouling resistance to the surface temperature was obtained from Figure VI-1A.

$$R_f^* = 3.6902 \times 10^6 \exp (-14308/T_s)$$

The runs 114 and 115 had an average pH of 7.5 and the deposit primarily consisted of Si, CuO and MgOSiO₂.

Similarly when $\ln (R_f^*)$ was plotted against $(1/T_s)$ for runs 105 and 106 (Table VI-6B) the following arrhenius type of equation was obtained (Figure VI-1B).

$$R_f^* = 0.3264 \exp (-4314.8/T_s)$$

The runs 105 and 106 had an average pH of 8.5 and the deposit primarily consisted of CaCO₃, MgOSiO₂ and CuO.

During the course of run 101, after the asymptotic fouling level was reached, at 335 hours, the power input to the heaters was increased by about 27% as a result of which the surface temperature

TABLE VI-7A. R_f^* vs VELOCITY pH=7.5

RUN	VELOCITY (ft/sec)	TC	$R_f^* \times 10^4$ (ft ² -hr-°F/Btu)	T _s °F
111	4.904	A	11.03	189.7
		B	10.27	189.6
		C	10.21	197.1
		D	10.65	187.6
112	3.902	A	14.57	180.8
		C	14.60	181.2
		D	14.00	178.7
113	2.327	A	4.91†	180.8

TABLE VI-7B. R_f^* vs VELOCITY pH=8.5

RUN	VELOCITY (ft/sec)	TC	$R_f^* \times 10^4$ (ft ² -hr-°F/Btu)	T _s °F
107	3.812	A	16.37	159.4
		B	16.34	160.0
		C	15.05	163.6
		D	15.96	159.0
109	2.982	A	30.90†	201.4
		D	30.67†	196.7

† - run stopped before R_f^* is reached

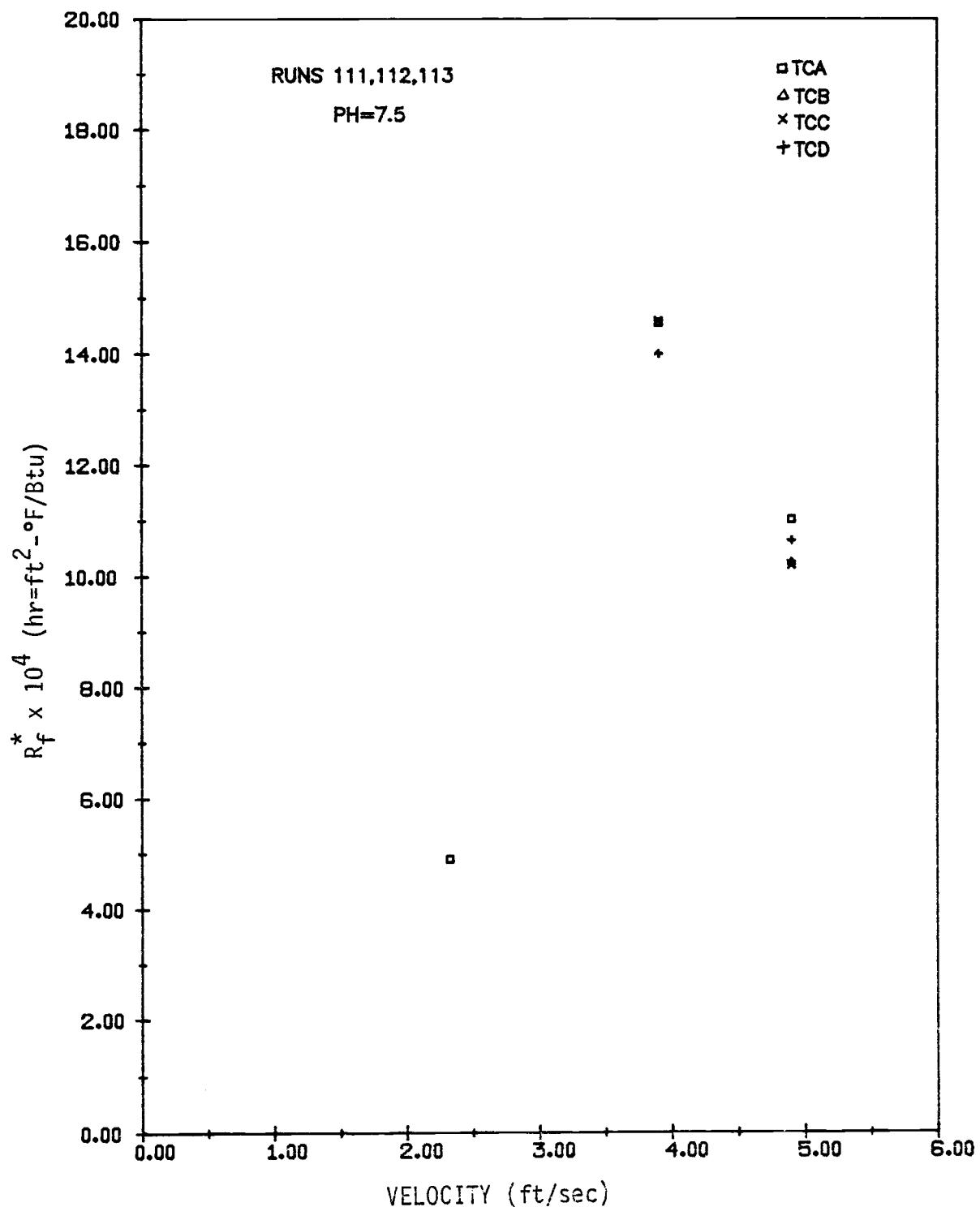


Figure VI-2A. R_f^* vs VELOCITY pH = 7.5

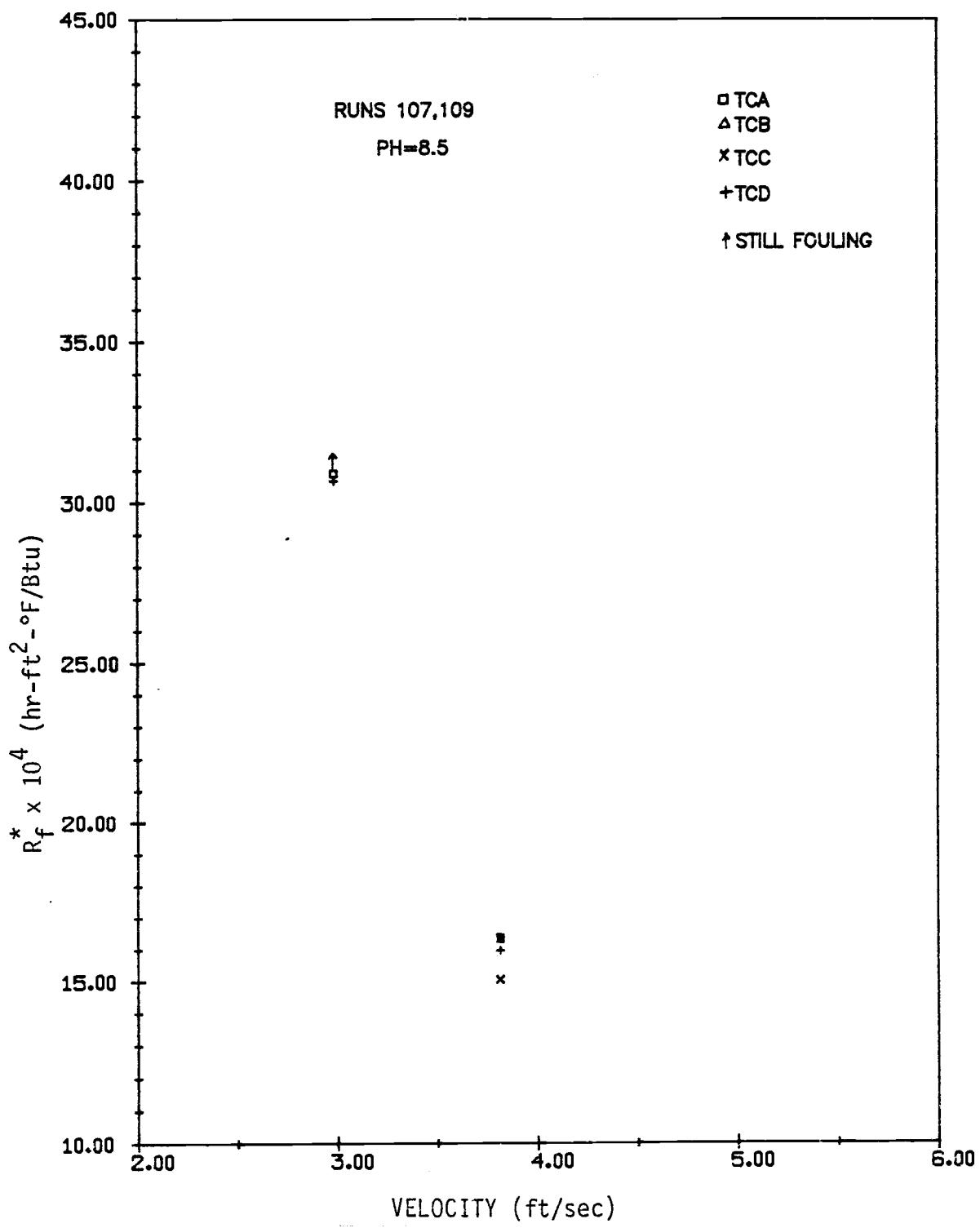


Figure VI-2B. R_f^* vs VELOCITY pH = 8.5

TABLE VI-8. \bar{R}_f^* vs pH

RUN	VELOCITY	pH	\bar{R}_f^* (ft ² -hr-°F/Btu)	T _S °F
111	4.0	7.5	14.39	191.0
112	5.0	7.5	10.54	180.2
104	4.0	8.0	4.06	159.1
105	5.0	8.5	3.27	160.5
106	5.0	8.5	3.06	161.7
107	4.0	8.5	15.93	160.5

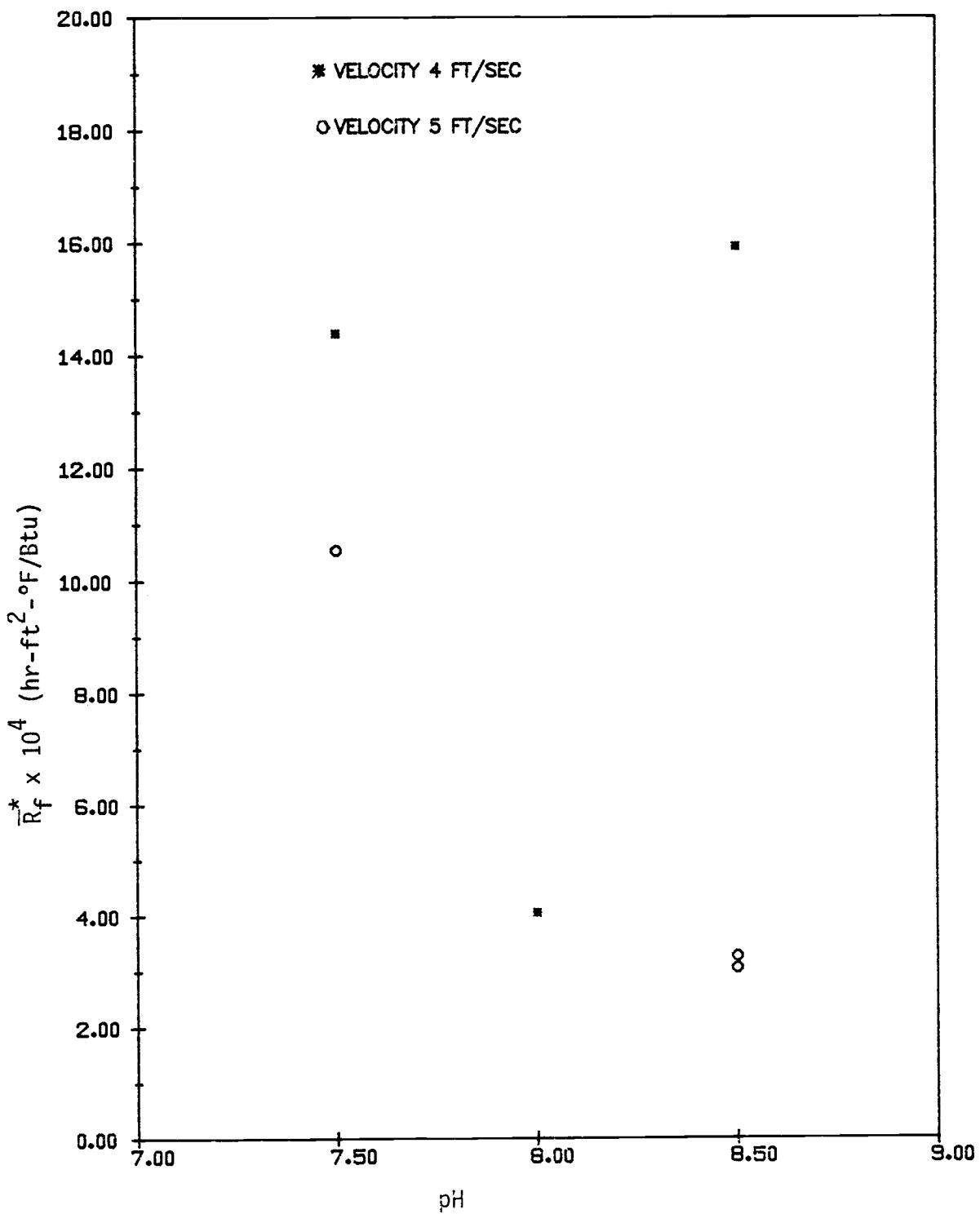


Figure VI-3. \bar{R}_f^* vs pH

increased by 13°F, but there was no appreciable effect on the fouling factor values.

Velocity Effect

The results of runs 111, 112 and 113 (Table VI-7A) at a pH of 7.5 were plotted as \bar{R}_f^* vs velocity in Figure VI-2A. Also the results of runs 107 and 109 (Table VI-7B) at a pH of 8.5 were plotted as \bar{R}_f^* vs velocity in Figure VI-2B. From both the Figures it can be concluded that asymptotic fouling resistance decreases with increase of velocity which is in agreement with the results of the earlier investigators.^{6,9} Though the Figures VI-2A and VI-2B include zero in their x-axis, in practice it is not possible to approach very low velocities if high surface temperatures are to be maintained.

During the course of run 101, after the asymptotic fouling level was reached, at 580 hours, the velocity dropped by about 21% and as an immediate consequence the fouling resistance values decreased on an average by 32%. But later in the run a secondary asymptote at a higher fouling level was established.

pH Effect

The Figure VI-3 shows \bar{R}_f^* plotted against average pH for velocities of 4.0 and 5.0 ft/sec, respectively, and the values are listed in Table VI-8. It is seen from the Figure VI-3 that there exists a minimum value of average asymptotic fouling resistance for a pH of 8.0 at an average water velocity of 4.0 ft/sec. The effect of flow velocity on the value of \bar{R}_f^* at pH levels of 7.5 and 8.5

TABLE VI-9A. RSI vs Ca+CO₃

RUN	M-Alk	pH	RSI	Ca+CO ₃
99	241	8.6	5.62	44+PNR
106	239	8.5	5.83	14+PNR
98	143	8.3	6.33	3+PNR
114	19	7.5	8.07	SA+SA

PNR - present but not reported

SA - present in small amount (< 1%)

TABLE VI-9B. RSI vs Mg+Si

RUN	M-Alk	pH	RSI	Mg+Si
98	143	8.3	6.33	18+37
104	36	8.0	6.60	5.1+40
115	19	7.5	8.06	3.0+20
114	19	7.5	8.07	SA+9.1

SA - present in small amount (< 1%)

can also be noted. The above observations positively suggest that for any given set of operating conditions an appropriate value of pH can be chosen to obtain a minimum fouling tendency.

The results of the deposit analysis of scales for runs made at an average pH of 8.5 indicate higher percentages of calcium and magnesium along with the presence of silicon, iron and copper. But the results of scale analysis for runs made at an average pH of 7.5 show lower percentages of calcium and magnesium along with the presence of silicon, iron and copper.

RSI Effect

The Ryznar index is an empirical index and the value of 6.5 is the nominal neutral point. Values of 6 or less indicate CaCO_3 deposition. This is found to be true by referring to the Table VI-9A for RSI values of 5.62 and 5.83 which correspond to 44% and 14% of calcium, respectively. Also from the Table VI-9A it is found that maximum of CaCO_3 was deposited at a RSI value of 5.62. A minimum amount of CaCO_3 was deposited at a RSI value of 8.07. Similar tendency was found for the deposition of magnesium silicate. From Table VI-9B it is seen that maximum amount of magnesium was deposited at an RSI value of 6.33. A minimum amount of magnesium was deposited at an RSI value of 8.07. Also it can be noted that the maximum percentage of magnesium was deposited at an m-alkalinity value of 143. At higher m-alkalinity values lesser amount of magnesium was deposited.

Description of Photographs

Background Information

The electron microscope is used to study particular details in the microstructure of a specimen. In large electron microscopes it is possible to obtain low magnifications down to 200X with a wide field of view or to magnify the image up to at least 200000X so as to observe the finest details of the specimen directly. The majority of the electron microscopes are constructed like a microscope for transmitted light. The electron microscope utilizes an electron source, condenser lenses, objective lens and projective lens and a magnified image of the specimen is obtained on a fluorescent screen or on a photographic plate or film.

The electron microprobe is an instrument used to determine the chemical composition of a selected area of the order of $1\mu\text{m}^2$ on a specimen surface. It is possible with the aid of electron microprobe to make spot analyses with high accuracy and determinations of the distribution of different elements in the specimen surface along a line or across a surface. The principle of the instrument is based upon making the electrons strike the prepared specimen surface and as a result of this impact x-rays are produced having wavelengths characteristic of the elements present in the area being analysed. The radiation emitted from the investigated portion is analysed by means of a built-in x-ray spectrometer and the intensity of the various wavelengths is recorded in a suitable manner.

TABLE VI-10. DESCRIPTION OF PHOTOGRAPHS

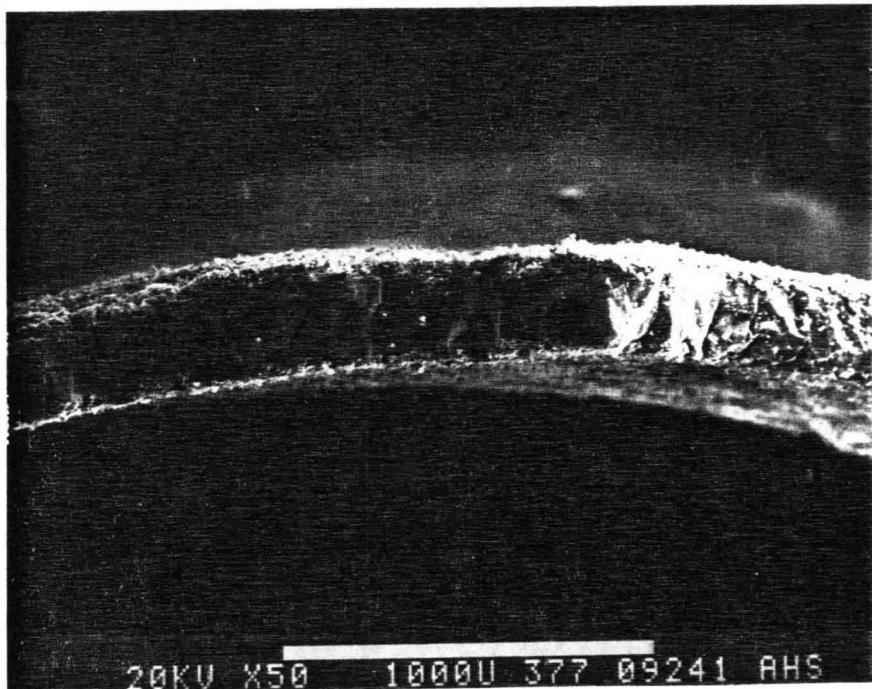
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2	99	SEM	EDGE	250X	
3	99	SEM	OUTER	50X	
4	99	SEM	INNER	100X	
5	107	SEM	EDGE	150X	
6	107	SEM	EDGE	1000X	
7	107	SEM	OUTER	50X	
8	107	SEM	OUTER	1000X	
9	107	SEM	INNER	150X	
10	107	SEM	INNER	5000X	
11	107	EMPX	EDGE		Ca
12	107	EMPX	EDGE		Cu
13	107	EMPX	EDGE		Si
14	109	SEM	EDGE	50X	
15	109	SEM	EDGE	150X	
16	109	SEM	OUTER	150X	
17	109	SEM	OUTER	1000X	
18	109	SEM	OUTER	5000X	
19	109	SEM	INNER	150X	
20	109	SEM	INNER	1000X	
21	109	EMPX	EDGE		Cu
22	109	EMPX	EDGE		Si
23	109	EMPX	EDGE		Mg
24	109	EMPX	EDGE		Cu
25	109	EMPX	EDGE		Si
26	109	BSE	EDGE	1200X	

SEM - Scanning Electron Micrograph

EMPX - Electron Micro Probe X-ray map

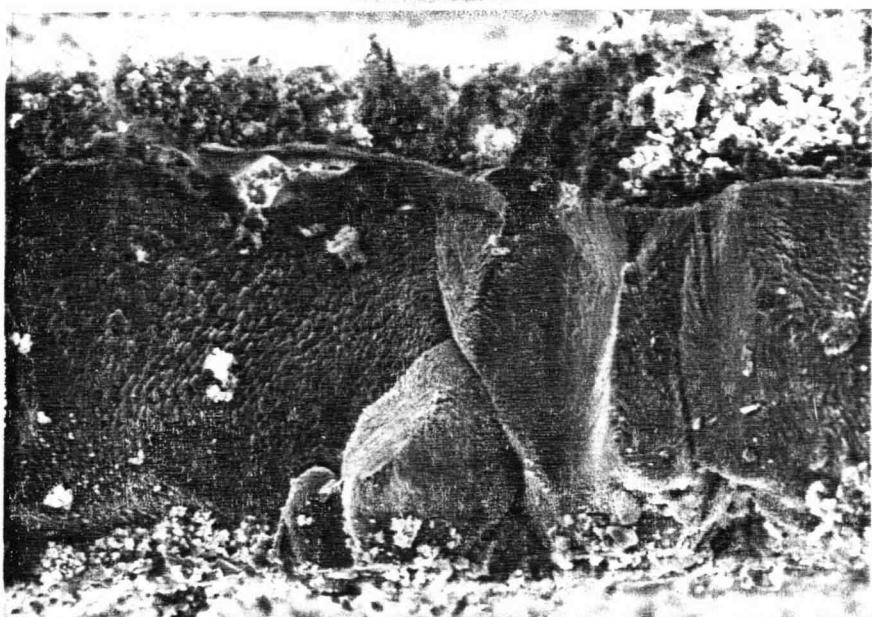
BSE - Back Scattered Electron micrograph

PHOTOGRAPHS OF RUN 99



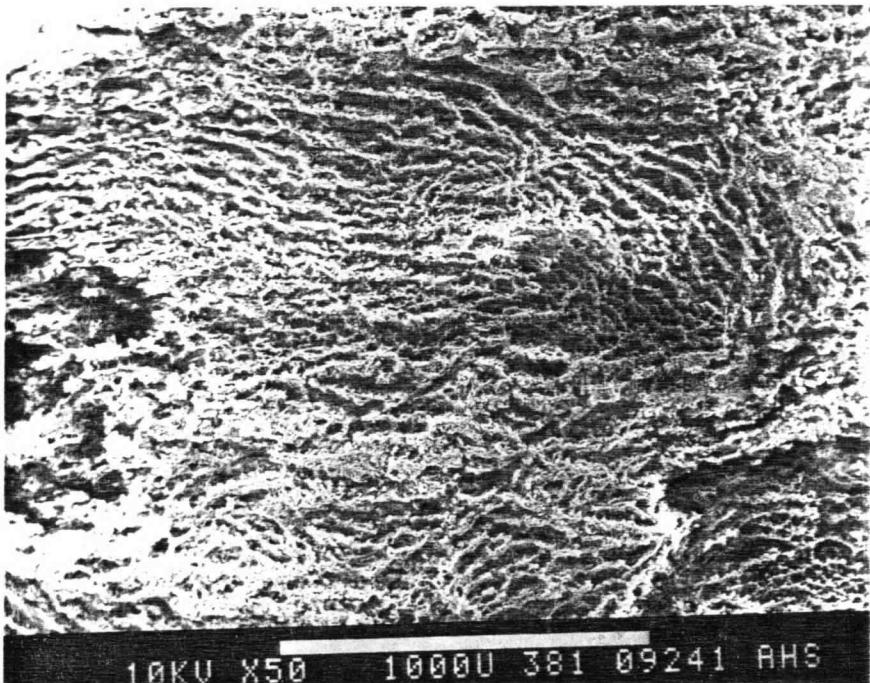
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PHOTO #1



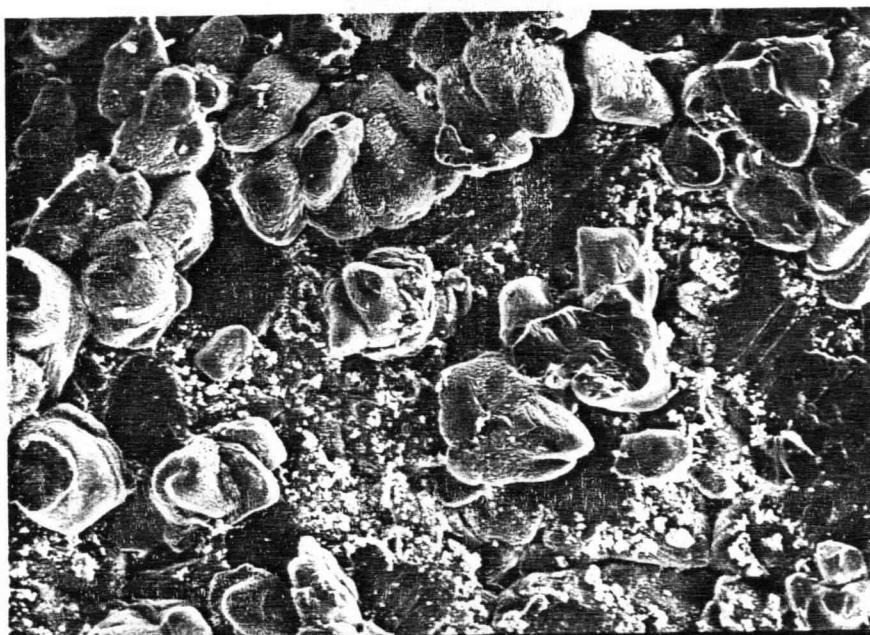
20KV X250 1000U 378 09241 RHS

PHOTO #2



10KV X50 10000 381 09241 AHS

PHOTO #3



20KV X100 1000 374 09241 AHS

PHOTO #4

PHOTOGRAPHS OF RUN 107



PHOTO #5

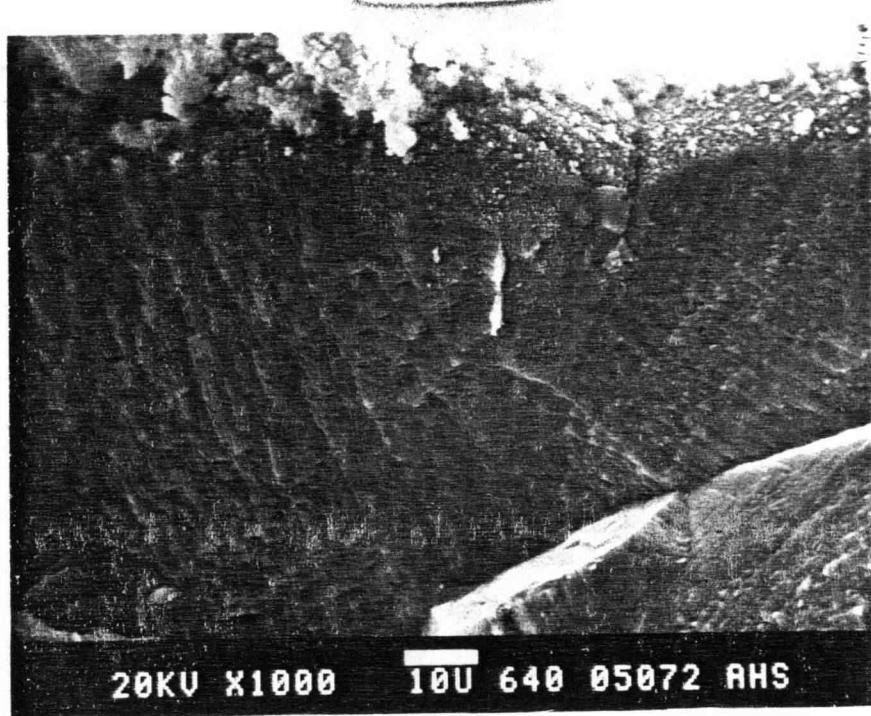
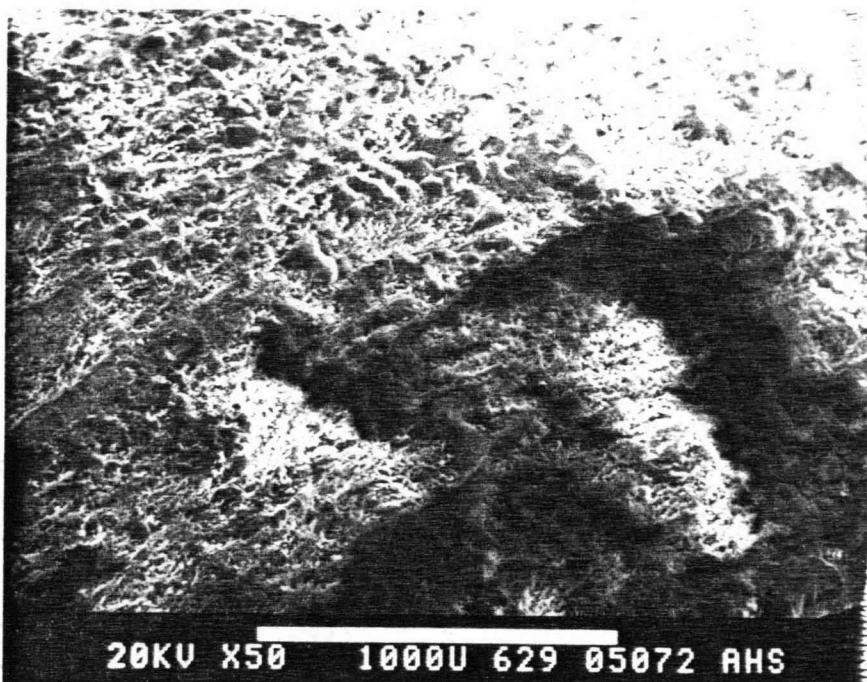
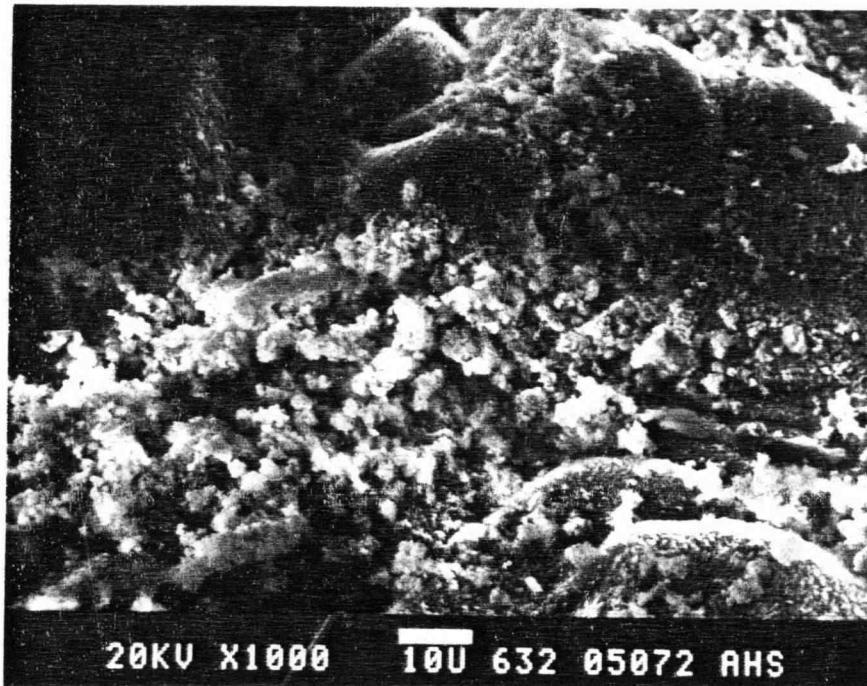


PHOTO #6



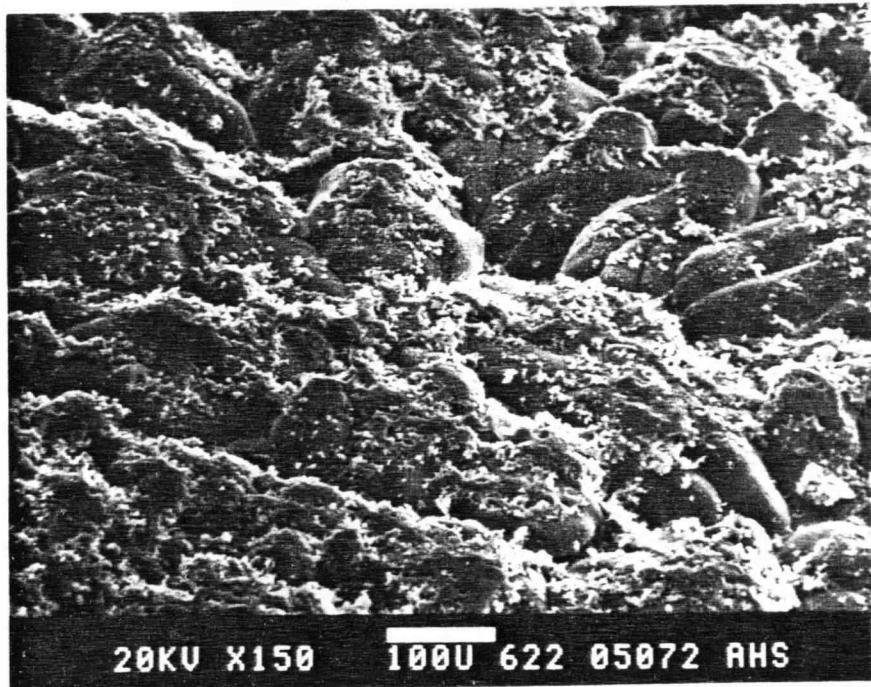
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PHOTO #7



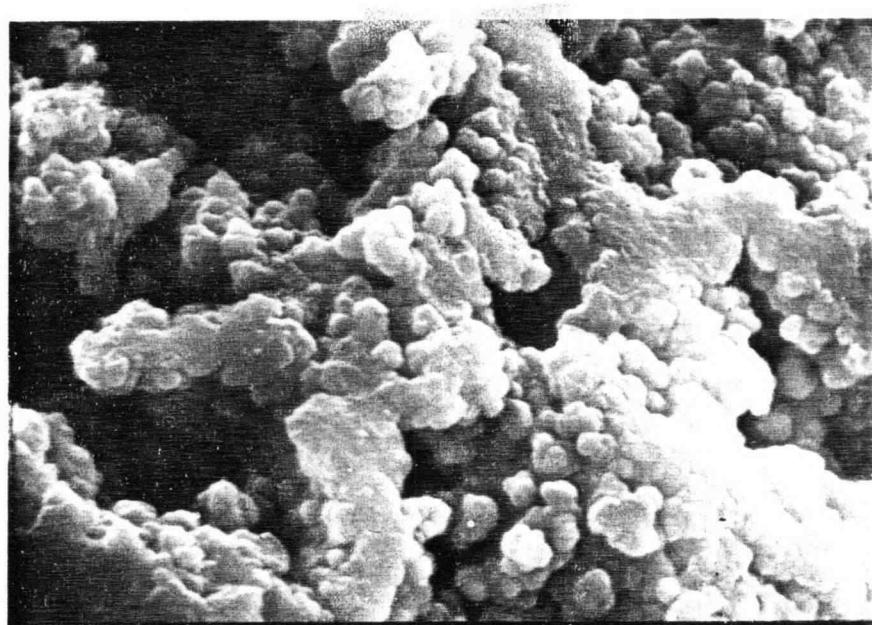
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PHOTO #8



20KV X150 100U 622 05072 RHS

PHOTO #9



20KV X5000 10U 628 05072 RHS

PHOTO #10

INNER SURFACE

Ca

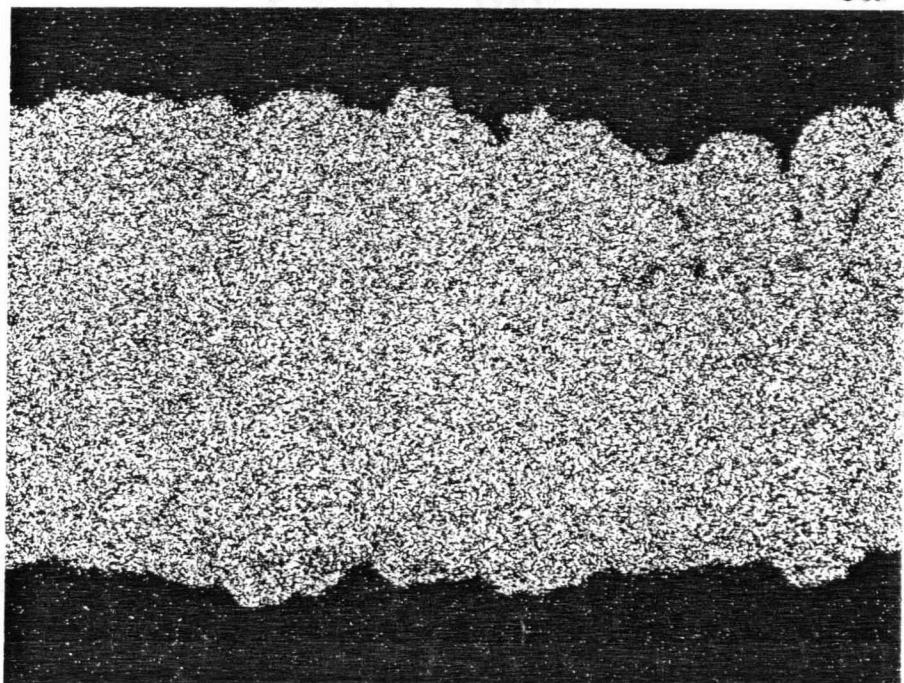


PHOTO #11

INNER SURFACE

Cu

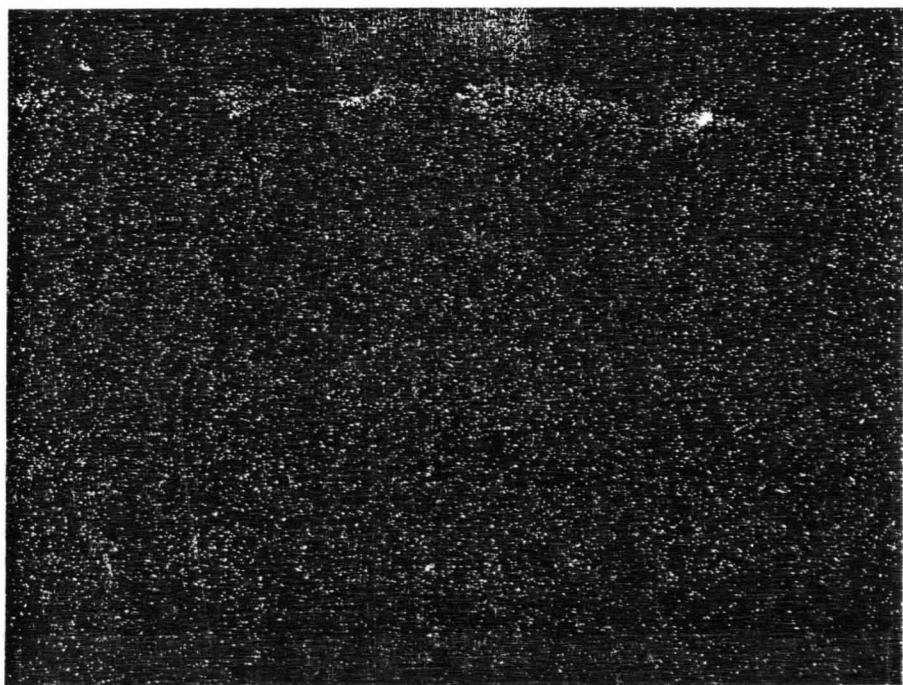


PHOTO #12

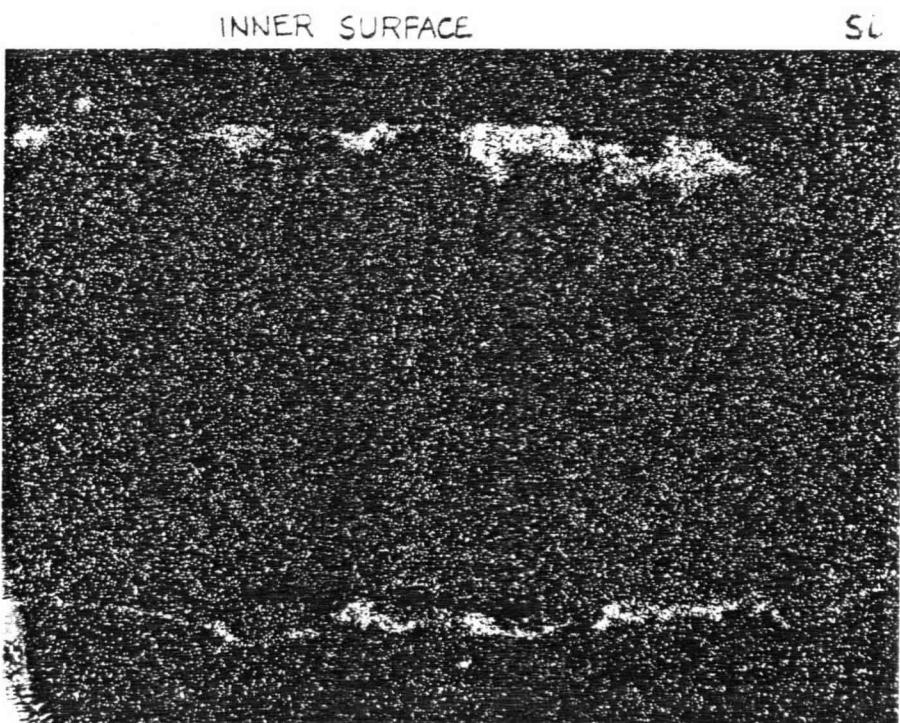


PHOTO #13

PHOTOGRAPHS OF RUN 109

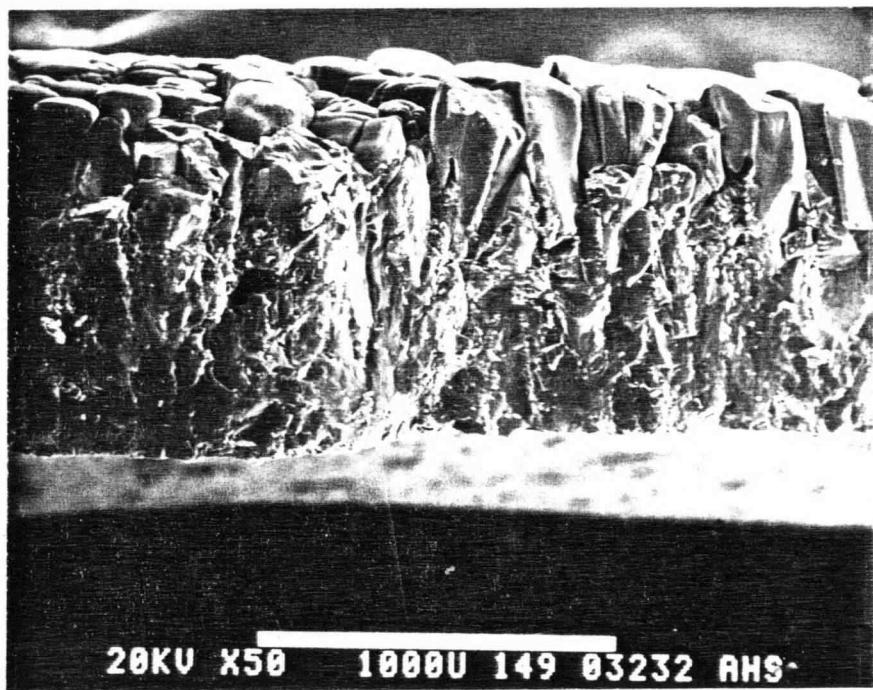
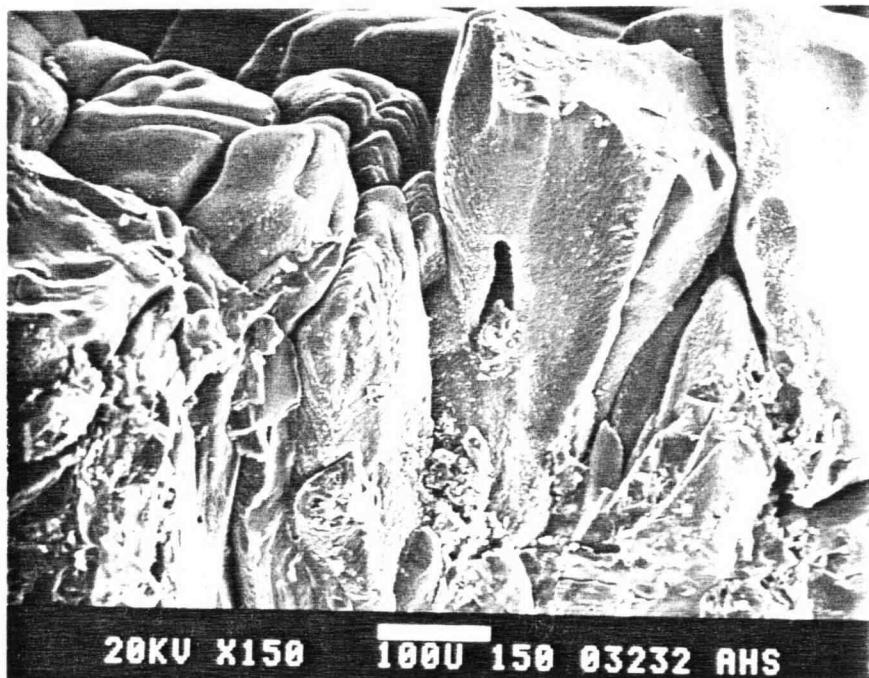
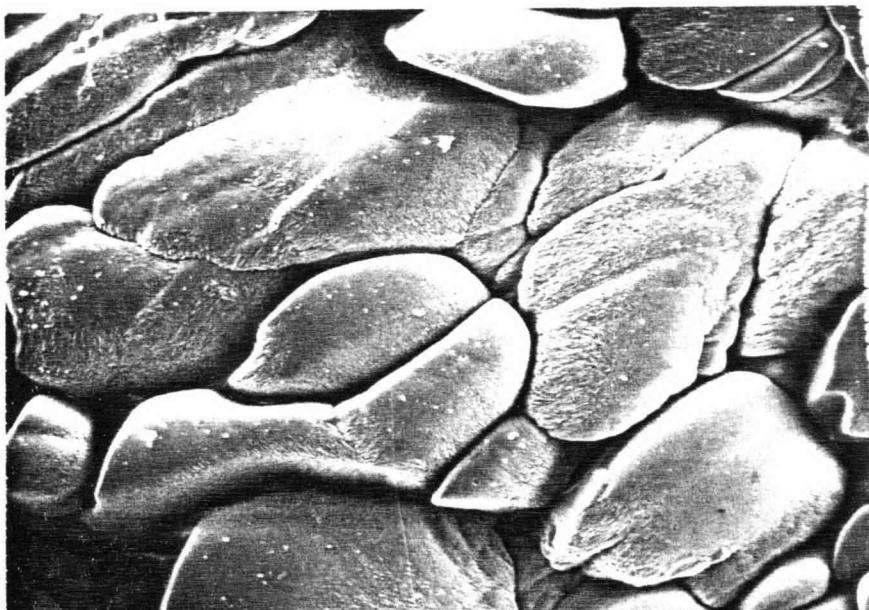


PHOTO #14



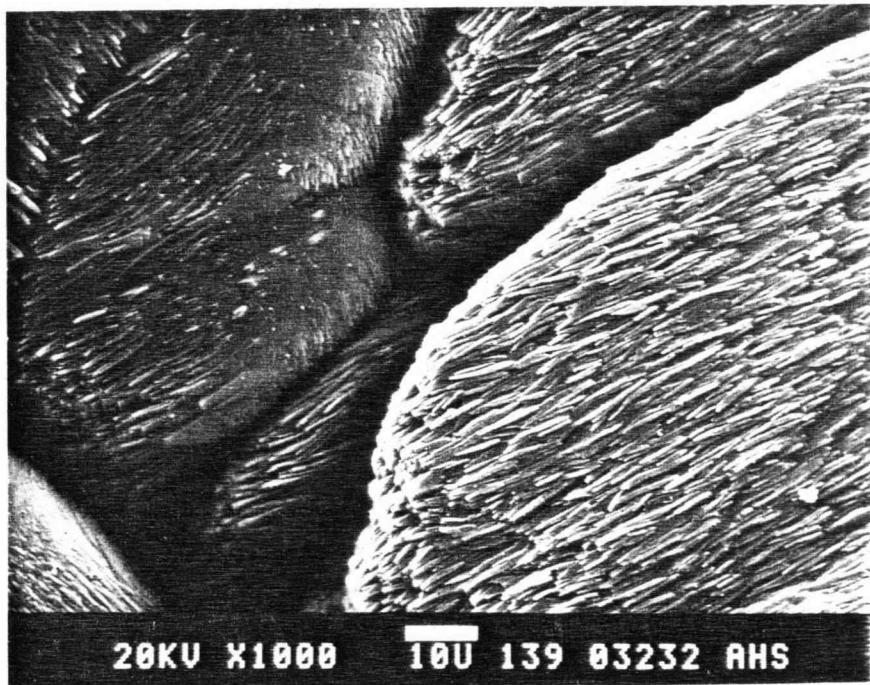
20KV X150 100U 150 03232 RHS

PHOTO #15



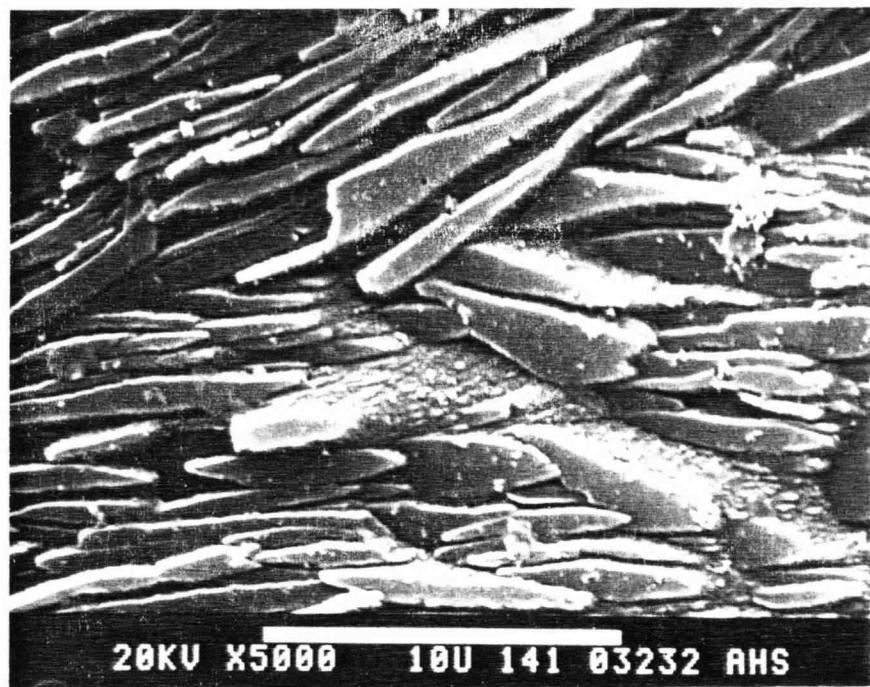
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PHOTO #16



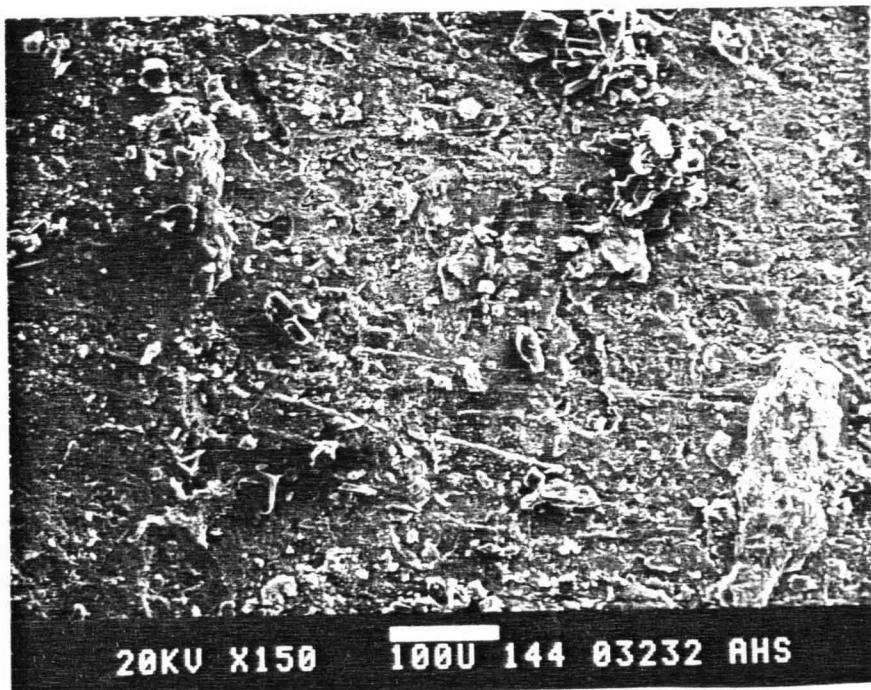
20KV X1000 10U 139 03232 RHS

PHOTO #17



20KV X5000 10U 141 03232 RHS

PHOTO #18



20KV X150 100U 144 03232 RHS

PHOTO #19



20KV X1000 100U 146 03232 RHS

PHOTO #20

OUTER SURFACE

Cu

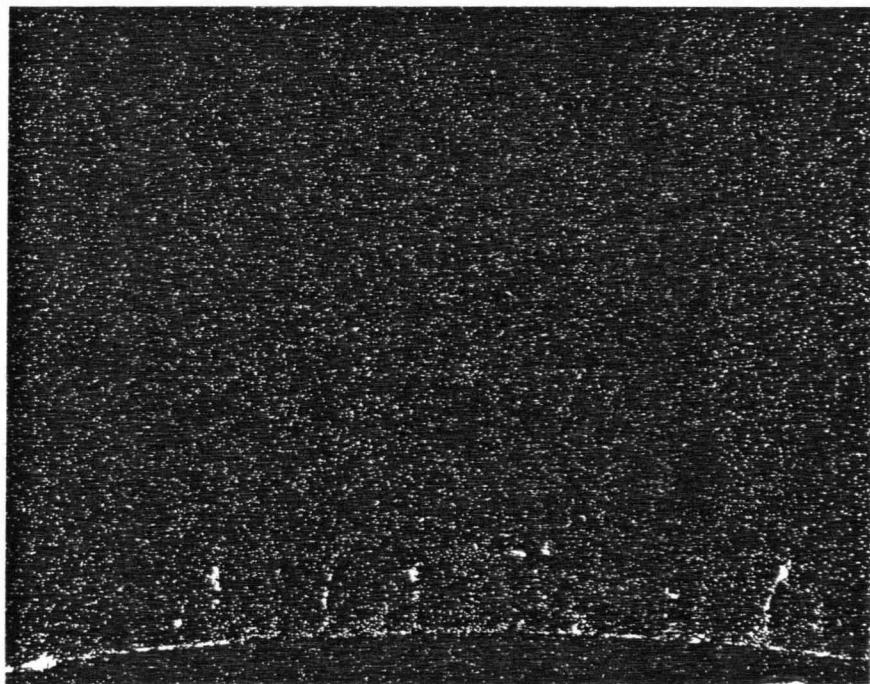


PHOTO #21

OUTER SURFACE

Si

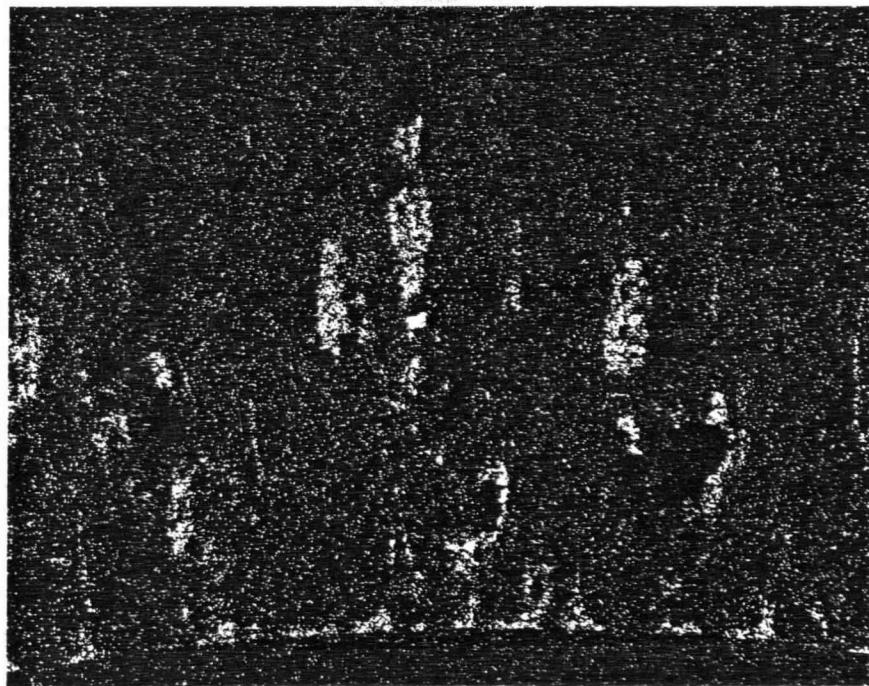


PHOTO #22

OUTER SURFACE

Mo

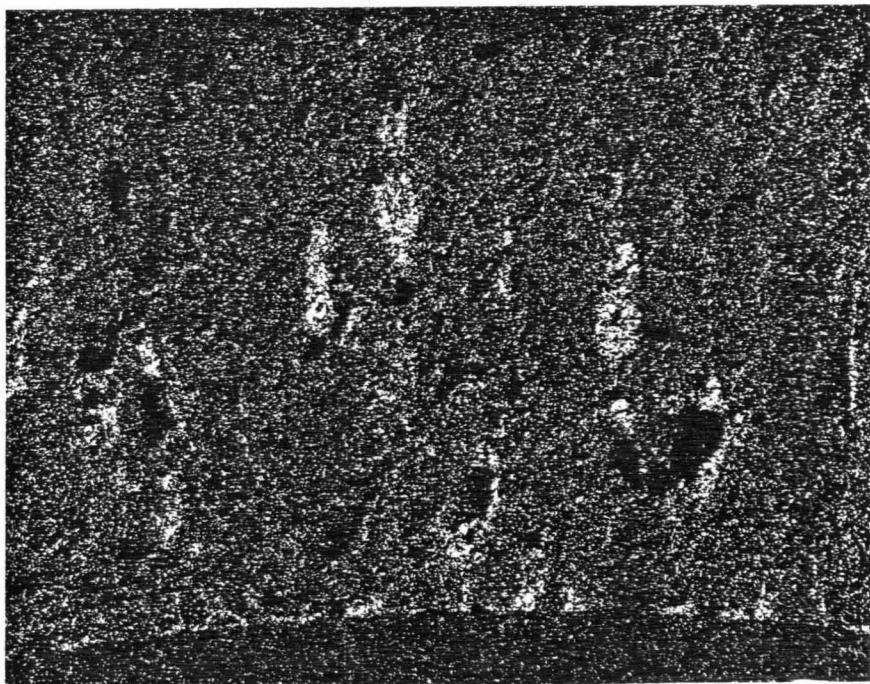


PHOTO #23

OUTER SURFACE

Cu

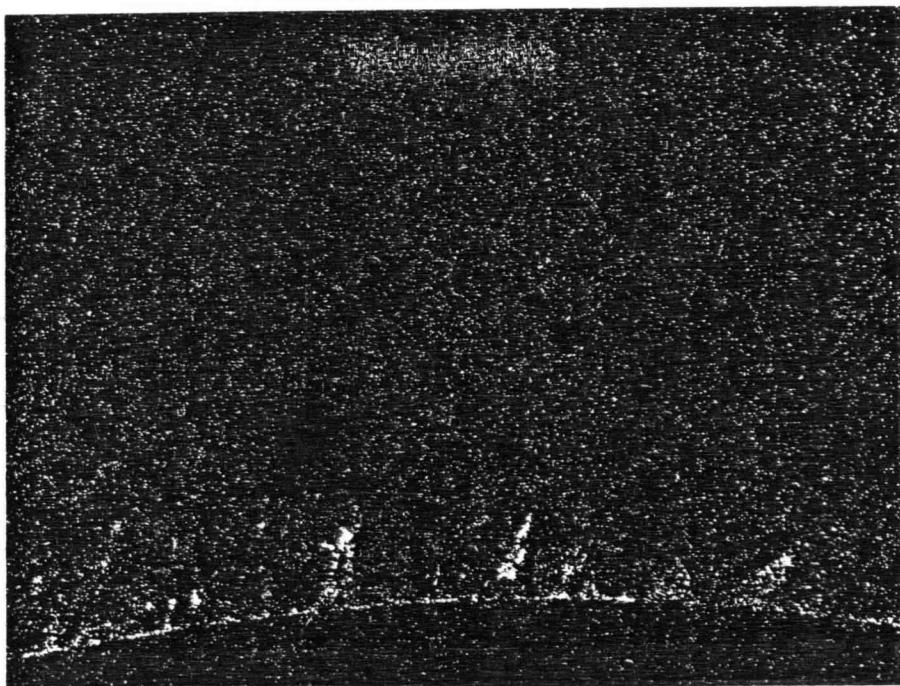


PHOTO #24

OUTER SURFACE

Si

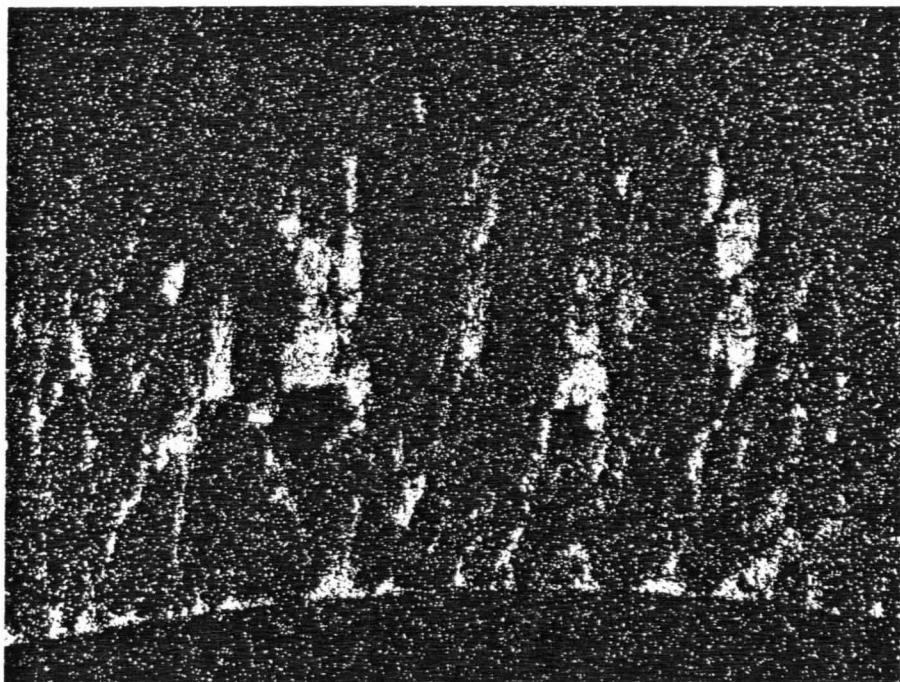


PHOTO # 25

OUTER SURFACE

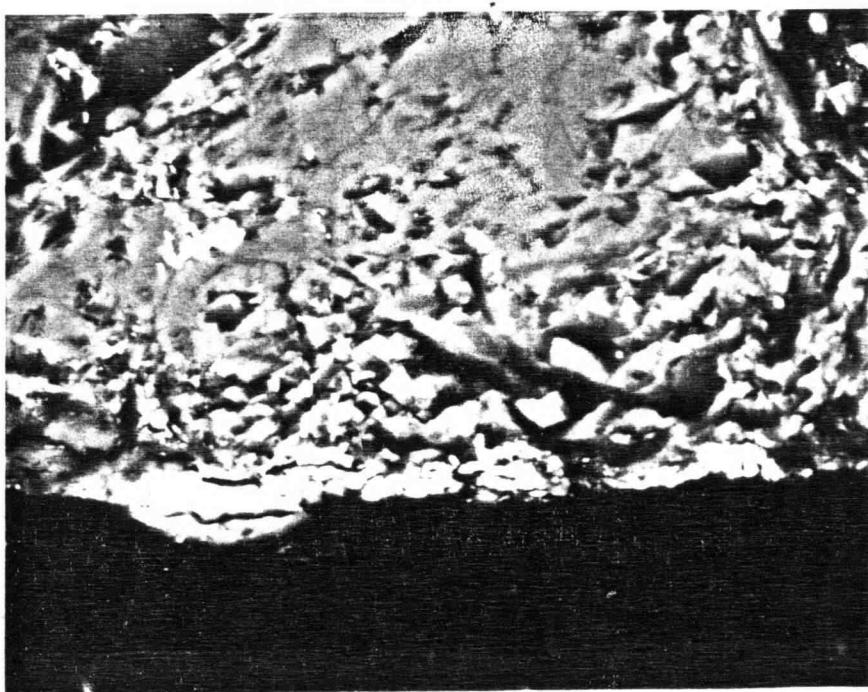


PHOTO # 26

PHOTOGRAPHS OF HEATER RODS

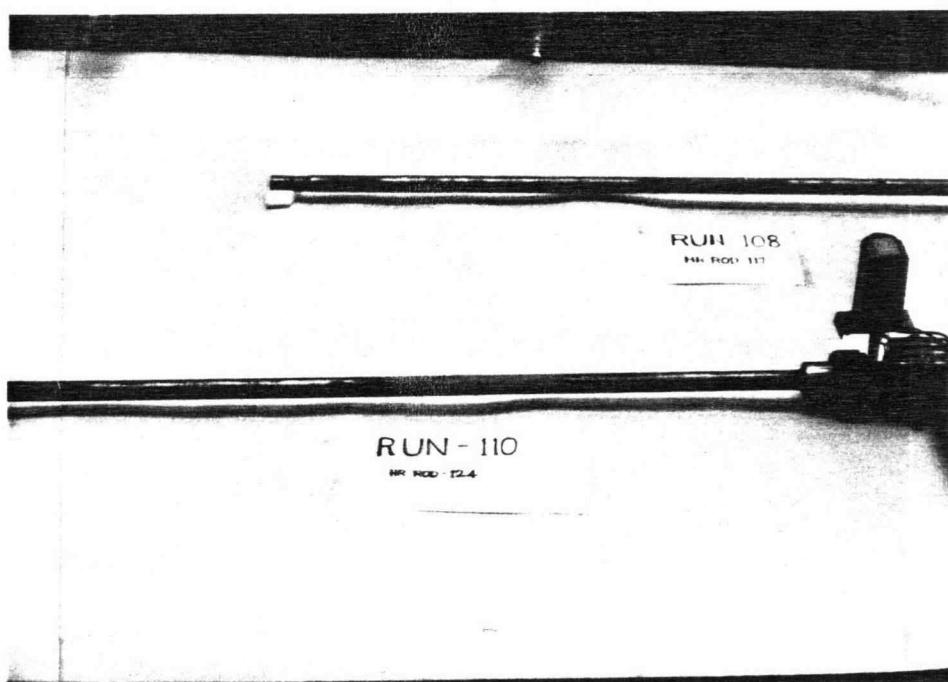


PHOTO # 27

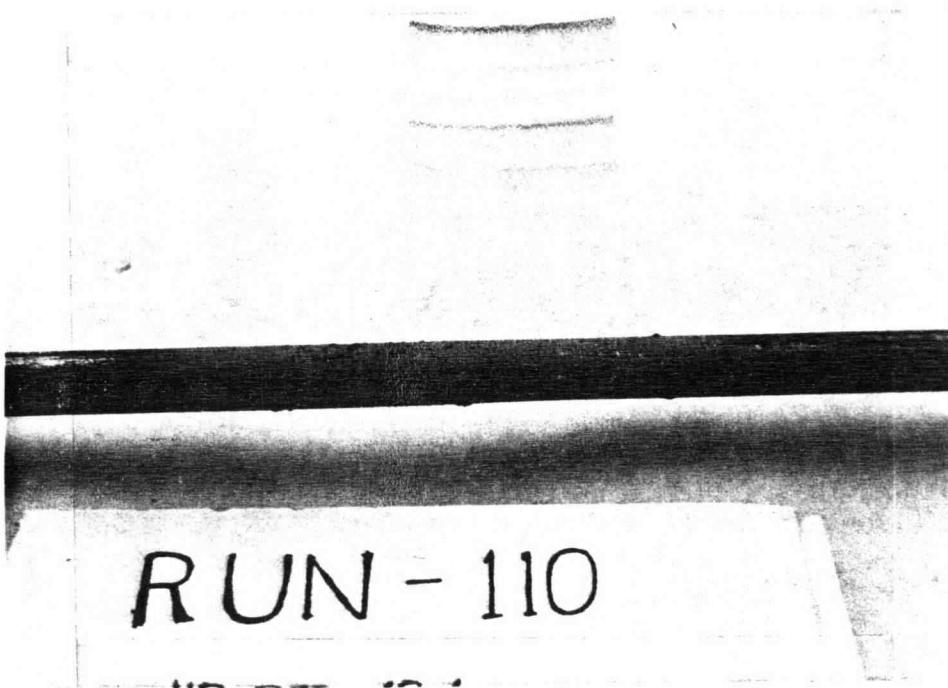


PHOTO # 28

Description

The photographs 1 and 2 of run 99 give the cross-sectional view of the fouling deposit at magnifications of 50 and 250, respectively. The section of the deposit in contact with the rod is denser and structurally stronger compared to the outer layer or the convex surface of the deposit. Photograph 3 shows the top layer of the deposit which is loosely formed and is characteristic of a fouling deposit layer exposed to flowing cooling tower water. Photograph 4 shows the inner layer of deposit or the concave surface in contact with the rod. It consists of some fractured particles. The thickness of this deposit is about 325 microns.

The photographs 5 and 6 portray edge views of the fouling deposit for run 107 which is similar in appearance to those of run 99. The cross-sectional view shows the dense inner layer and the loosely formed outer layer. From the deposit analysis table it can be noted that the layer immediately in contact with the rod surface for run 107 (107-I) consists of corrosion products like iron and copper and less of calcium. Photographs 7 and 8 resemble the outer layer view of photograph 3 of the deposit of run 99. Photographs 9 and 10 give views of the inner surface of the deposit at different magnifications which reveal the layer of corrosion products. The outer surface of the deposit formed on the heater rod has a wrinkled surface throughout its length as evident from the photographs 27 and 28. The formation of the wrinkled surface is a consequence of the constant momentum and the shearing force imparted by the flowing stream. Photographs 11, 12 and 13 indicate the

elemental x-ray maps for calcium, copper and silicon, respectively. From the density of the white spots present in the photographs we can conclude that calcium is present in the largest amount followed by silicon and copper. From photograph 11, it is clear that copper is found to be more concentrated near the inner surface of the deposit. It can also be stated that copper and silica exist in a combined state by comparing photographs 12 and 13 which show that the areas of concentration of the two elements coincide well.

Photographs 14 and 15 show the edge views of the fouling deposit for run 109 at magnifications of 50 and 150, respectively. The different pieces of the outer layer which are wedged in the main structure of the deposit really consist of very fine longitudinal crystals as evident from photographs 17 and 18. There is a strong possibility that these crystals could be aragonite form of calcium carbonate. The photographs 21 and 24 reveal that the inner surface of the deposit is lined with copper and that copper particles penetrate to a depth of approximately 200 microns. On comparing photographs 22 and 23, it becomes evident that elements magnesium and silicon are combined in a form of magnesium silicate. The numerous bright areas appearing in photograph 25 are confirmed to be copper bearing areas with the help of x-ray analysis as copper has a significantly higher atomic number than the other elements present in the remainder of the scale.

VII. CONCLUSIONS

1. For cooling tower water of pH of 7.5 and flow velocity of 4.0 ft/sec, the following equation relates the asymptotic fouling resistance to the surface temperature.

$$R_f^* = 3.6902 \times 10^6 \exp (-14308/T_s)$$

Similarly for cooling tower water of pH 8.5 and flow velocity of 5.0 ft/sec, the following equation relates the asymptotic fouling resistance to the surface temperature.

$$R_f^* = 0.3264 \exp (-4314.8/T_s)$$

2. For both the values of pH of 7.5 and 8.5 for cooling tower water, it was shown that asymptotic fouling resistance decreased with increase of flow velocity.
3. For a flow velocity of 4.0 ft/sec, it was shown that a minimum value of R_f^* exists in the neighborhood of pH of 8.0. Thus it can be concluded that for any given set of operating conditions an appropriate value of pH of cooling tower water can be found which would show a minimum fouling tendency.
4. The results of runs with carbon steel, galvanized steel and copper plated admiralty tube surfaces under the same conditions of water quality and velocity indicated similar fouling behaviour for

the three surfaces. The fouling resistance of carbon steel rod was higher due to the presence of iron oxide in the scale.

5. The results of the deposit analysis for runs made at an average pH of 8.5 indicate calcium, magnesium, silicon and carbonate as the major constituents. But the chemical analysis of scales of runs made at an average pH of 7.5 indicate silicon, iron and copper as the chief constituents.

6. It was found that maximum amount of CaCO_3 for all the runs made was deposited at an RSI value of 5.62 and the maximum percentage of magnesium was deposited at an RSI value of 6.33.

7. From the study of the electron micrographs it was shown that the fouling deposit is made up of various constituents, present in varying proportions, during its different stages of growth. In general it was found that the inner layer of deposit contained higher amounts of magnesium, copper and silicon compared to the outer layer. The outer layer had higher percentage of calcium compared to the inner layer.

BIBLIOGRAPHY

1. American Public Health Association. The American Waterworks Association and the Water Pollution Control Federation. Standard Methods for the Examination of Water and Wastewater, 13th Edition, Boyd Printing Company, New York (1971).
2. Coates, K. E. "Surface Temperature Effects on Fouling Characteristics of Cooling Tower Water," M.S. Thesis, Oregon State University (1975).
3. Hasson, D., Avriel, M., Resnick, W., Rozeman, T. and Windreich, S. "Mechanism of Calcium Carbonate Scale Deposition on Heat Transfer Surfaces," Industrial and Engineering Chemistry Fundamentals, 7, 59-65 (1968).
4. Kern, D. Q. and Seaton, R. E. "Surface Fouling--How to Calculate Limits," Chemical Engineering Progress, 55, 71-73 (June 1959).
5. Knudsen, J. G. "Apparatus and Techniques for Measurement of Fouling of Heat Transfer Surfaces," in Fouling of Heat Transfer Equipment, Somerscales, E. F. C. and Knudsen, J. G., eds., Hemisphere, New York, pp. 57-81.
6. Lahm, L. "Effects of Water Quality, Velocity and Surface Temperature on the Scaling Characteristics of Cooling Tower Water," M.S. Thesis, Oregon State University (1982).
7. Langelier W. F. "Chemical Equilibria in Water Treatment," Journal of the American Water Works Association, 28, 1500-1521 (1936).
8. Lawson, T. E., Buswell, A. M. "Calcium Carbonate Saturation Index and Alkalinity Interpretations," Journal of the American Water Works Association, 34, 1667-1684 (1942).
9. Lee, S. H. "Deposition Characteristics of Magnesium Silicate and Calcium Carbonate in Cooling Tower Water," M.S. Thesis, Oregon State University (1979).
10. McCabe, W. L. and Robinson, C. S. "Evaporator Scale Formation," Industrial and Engineering Chemistry, 16, 478-479 (1924).
11. Morse, R. W. "Alkalinity Effects on the Scaling of Simulated Cooling Tower Water," M.S. Thesis, Oregon State University (1975).

12. Reitzer, B. J. "Rate of Scale Formation in Tubular Heat Exchanges," Industrial and Engineering Chemistry Process Design and Development, 3, 345-348 (1964).
13. Ryznar, J. W. "A New Index for Determining the Amount of Calcium Carbonate Scale Formed by a Water," Journal of the American Water Works Association, 36, 472-486 (1944).
14. Story, M. K. "Surface Temperature Effects on Fouling Characteristics of Cooling Tower Water," M.S. Thesis, Oregon State University (1975).
15. Suitor, J. W., Marner, W. J. and Ritter, R. B. "The History and Status of Research in Fouling of Heat Exchangers in Cooling Water Service," presented at the 16th National Heat Transfer Conference (August 1976).
16. Taborek, J., Aoki, T., Ritter, R. B., Palen, J. W. and Knudsen, J. G. "Fouling--The Major Unresolved Problem in Heat Transfer," Chemical Engineering Progress, 68, 59-67 (February 1972) and 68, 69-78 (July 1972).
17. Thackery, P. A. "The Cost of Fouling in Heat Exchange Plant," Effluent and Water Treatment Journal, 111-115 (March 1980).
18. Watkinson, A. P. and Epstein, N. "Particulate Fouling of Sensible Heat Exchangers," Proc. of the Fourth International Heat Transfer Conference, Vol. 1, Paris (1970).
19. Watkinson, A. P. and Martinez, O. "Scaling of Heat Exchangers by Calcium Carbonate," ASME Journal of Heat Transfer, 97, 504-508 (1975).
20. Wilson, E. E. "A Basis for Rational Design of Heat Transfer Apparatus," Transactions ASME, 37, 47 (1915).

APPENDICES

- APPENDIX A: Nomenclature
- APPENDIX B: Calibration Equations
- APPENDIX C: Raw Data for All Runs
- APPENDIX D: Chemical Analysis Procedures
- APPENDIX E: Listing of Results for All Runs
- APPENDIX F: Model Calculations
- APPENDIX G: Cooling Tower Water Quality
- APPENDIX H: R_f vs Time Plots

APPENDIX A

NOMENCLATURE

<u>Symbol</u>	<u>Definition</u>	<u>Unit</u>
A	Surface area	ft ²
AA	Area of flow in an omnulus	ft ²
AH	Area of heated cross-section over the rod	ft ²
C _b , C _{b'}	Bulk foulant concentration	lbmole/ft ³
C _s , C _{s'}	Concentration of foulant at interface	lbmole/ft ³
CaH	Calcium hardness	ppm CaCO ₃
C1	Chloride concentration	ppm NaCl
D ₁	Inside diameter of glass tube	inches
D ₂	Outside diameter of heater rod	inches
dR _f /dθ	Rate of change of fouling resistance	ft ² -F°/Btu
dX _θ /dθ	Rate of change of thickness of deposit	ft/hr
E	Variable defined in Equation (2-5)	
E _a	Activation energy of deposit reaction	Btu/lbmole
FLOCAL	Characteristic constant of flow-meter transducer	
h	Local heat transfer film coefficient	Btu/ft ² -hr-°F
h _{flux}	Heat flux from heated section	Btu/ft ² -hr
J	Mass flux	lbm/hr
k	Thermal conductivity of rod material	Btu/ft-hr-°F
K _f	Thermal conductivity of deposit	Btu/ft-hr-°F
K _m	Convective mass-transfer coefficient	ft/hr
K, K ₁ ..., K ₁₀	Proportionality constants	
L	Length of heated section of rod	inches
m, n	Empirical constants	

<u>Symbol</u>	<u>Definition</u>	<u>Unit</u>
m-alk	Methyl orange alkalinity	ppm CaCO_3
p-alk	Phenophthalein alkalinity	ppm CaCO_3
P_d	Residence time probability distribution	
PF	Variable defined in Equation (5-2)	
pH	Acidity	
pH _s	pH of water saturated with CaCO_3	
Q	Rate of power supply	Btu/hr
Q _{mv}	Power transducer reading	millivolt
R ₁ , R ₂	Thermal resistance of fluid	$\text{ft}^2\text{-hr-}^\circ\text{F/Btu}$
R _f	Fouling resistance to heat transfer	$\text{ft}^2\text{-hr-}^\circ\text{F/Btu}$
R _f [*]	Asymptotic fouling resistance	$\text{ft}^2\text{-hr-}^\circ\text{F/Btu}$
R̄ _f [*]	Average asymptotic fouling resistance of functioning thermocouples	$\text{ft}^2\text{-hr-}^\circ\text{F/Btu}$
R _g	Gas constant	Btu/lbmole°R
S	Sticking probability	
Si	Silica concentration	ppm SiO_2
T	Temperature	°F
TBF	Variable defined in Equation (5-3)	
TC	Thermocouple	millivolt
TC	Thermocouple output	millivolt
TH	Total hardness	ppm CaCO_3
TIN	Inlet temperature reading	millivolt
TW	Wall temperature reading	millivolt
TS	Total solids	ppm
U	Overall heat transfer coefficient	$\text{Btu}/\text{ft}^2\text{-hr}$
V	Flow velocity	ft/sec
W'	Mass flow rate	lbm/hr
W _f	Volumetric flow rate	gpm
W _{mv}	Flow transducer reading	millivolt
x/k	Thermal resistance of tube wall	$\text{ft}^2\text{-hr-}^\circ\text{F/Btu}$

<u>Symbol</u>	<u>Definition</u>	<u>Unit</u>
x_E	Entrance length of test-section	inches
y	Length defined in Figure III-2	inches
$z \dots z_5$	Variables defined in section-V	

<u>Subscript</u>	<u>Definition</u>
avg	Average value
b	Bulk condition
c	Clean condition
f	Fouled condition
F	Flow
i	Inside of tube
in	Inlet of test section
mv	Millivolt
o	Outlet of test section
s	Fouling deposit surface
w	Tube wall

<u>Abbreviation</u>	<u>Meaning</u>
A	Admiralty
BSE	Back scattered electron micrograph
CA	Copper plated admiralty 443
CPVC	Chlorinated polyvinyl chloride
CN	Copper-Nickel (90-10)
CS	Carbon steel
CSG	Galvanized carbon steel
CU	Copper plated
CV	Control valve
EMPX	Electron microprobe x-ray map
HTRI	Heat Transfer Research Institute
LSI	Langelier Saturation Index
PFRU	Portable Fouling Research Unit
PVC	Polyvinyl chloride

<u>Abbreviation</u>	<u>Meaning</u>
RSI	Ryznar Saturation Index
SEM	Scanning Electron Micrograph
SS	Stainless steel

<u>Greek Letter</u>	<u>Definition</u>	<u>Unit</u>
θ	Time	hr
ϕ_d	Rate of deposition of foulant	$ft^2\text{-F}^\circ/\text{Btu}$
ϕ_r	Rate of removal of foulant	$ft^2\text{-F}^\circ/\text{Btu}$
τ	Shear stress	$1bf/ft^2$
Ψ	Strength of deposit	$1bf/ft^2$
Ω	Water quality term	
λ	Density of fouling deposit	$1bm/ft^3$

APPENDIX B

CALIBRATION EQUATIONS

Wattmeter transducer

$$Q = 100 \times Q_{mv}$$

where

Q = power input in watts

Q_{mv} = wattmeter transducer reading in millivolts

Flow meter transducer

$$W_F = FLOCAL(1) (mv - 50)^{FLOCAL(2)}$$

where

W_F = volumetric flow rate of water • gpm

FLOCAL(1) characteristic constants of the flow meter transducer

FLOCAL(2)

Chromel-constantan thermocouple (type E) = reference temperature 105°F

$$T = 32.583 (TC + 5.02)^{0.949} \quad TC < -1.0$$

$$T = 38.529 (TC + 4.72)^{0.8765} \quad TC \geq -1.0$$

where

T = temperature in °F

TC = thermocouple output in millivolt

APPENDIX C

RAW DATA FOR ALL RUNS

NOMENCLATURE

TIN: water inlet temperature (millivolts)

TOUT: water outlet temperature (millivolts)

TWA: local wall temperature at location A (millivolts)

TWB: local wall temperature at location B (millivolts)

TWC: local wall temperature at location C (millivolts)

TWD: local wall temperature at location D (millivolts)

HEAT: power input to heater rod (millivolts)

FLOW: flow rate (millivolts)

DAY: days elapsed (days)

TIME: total hours elapsed (24-hr clock)

Note: 0.0 denotes no data

RAW DATA RUN 98

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1800	-1.95		.57		.65		12.31	122.34
1	2000	-1.92		.58		.60		12.05	121.13
1	2120	-1.92		.58		.58		12.06	120.64
1	2200	-1.93		.58		.57		12.05	123.09
1	0000	-1.96		.59		.56		12.05	123.48
1	0200	-1.94		.62		.56		12.03	121.67
1	0400	-1.93		.67		.58		12.08	120.87
1	0600	-1.93		.67		.58		12.07	120.90
1	0800	-1.92		.71		.59		12.09	125.72
1	1000	-1.90		.72		.60		12.08	120.11
1	1200	-1.92		.74		.61		12.10	120.84
1	1400	-1.92		.77		.62		12.09	122.80
1	1503	-1.90		.78		.65		12.05	118.97
1	1900	-1.94		.87		.70		12.01	119.76
1	0000	-1.95		.93		.76		12.04	122.30
1	0500	-1.95		1.06		.91		12.27	120.21
3	1500	-1.93		1.22		.97		12.25	124.15
3	2000	-1.96		1.34		1.01		12.20	119.88
4	0100	-1.95		1.41		1.05		12.24	123.08
4	0600	-1.94		1.50		1.14		12.25	123.02
4	1100	-1.91		1.52		1.25		12.25	125.81
4	1600	-1.95		1.76		1.25		12.25	121.11
4	2100	-1.93		1.80		1.28		12.21	125.46
5	0200	-1.91		1.84		1.34		12.19	122.00
5	0700	-1.91		1.90		1.40		12.23	124.27
5	1200	-1.95		1.97		1.39		12.25	122.35
5	1700	-1.91		1.99		1.47		12.25	121.29
6	2200	-1.94		2.08		1.48		12.24	121.97
6	0300	-1.94		2.09		1.47		12.23	122.15
6	0800	-1.92		2.12		1.50		12.22	122.70
6	1300	-1.92		2.16		1.52		12.26	121.01
6	1400	-1.95		2.23		1.52		12.26	123.89
6	2300	-1.94		2.23		1.53		12.25	123.27
7	0400	-1.92		2.27		1.53		12.22	123.95
7	0900	-1.92		2.30		1.53		12.24	121.15
7	1400	-1.93		2.33		1.51		12.22	120.72
7	1900	-1.96		2.35		1.50		12.25	121.70
8	0000	-1.95		2.36		1.49		12.24	121.94
9	0500	-1.95		2.37		1.47		12.23	121.19
8	1000	-1.94		2.38		1.47		12.27	122.95

DAY	TIME	TIN	TOUT	TWA	TWR	TWC	TWD	HEAT	FLOW
8	1500	-1.95		2.41		1.46		12.28	121.97
8	2000	-1.94		2.42		1.46		12.24	121.80
9	0100	-1.93		2.42		1.45		12.21	127.36
9	0600	-1.93		2.44		1.42		12.24	122.71
9	1100	-1.92		2.47		1.44		12.28	121.11
9	1600	-1.93		2.47		1.43		12.27	122.56
9	2100	-1.93		2.48		1.43		12.22	122.94
10	0200	-1.91		2.49		1.39		12.22	123.61
10	0700	-1.91		2.50		1.43		12.23	124.02
10	1200	-1.92		2.51		1.42		12.26	123.15
10	1700	-1.93		2.49		1.42		12.26	122.29
10	2200	-1.93		2.51		1.45		12.27	122.66
11	0300	-1.92		2.51		1.46		12.22	123.52
11	0800	-1.90		2.56		1.49		12.26	121.67
11	1300	-1.92		2.54		1.52		12.28	120.34
11	1800	-1.95		2.54		1.51		12.25	125.38
11	2300	-1.93		2.55		1.52		12.23	121.73
12	0400	-1.91		2.58		1.54		12.24	122.84
12	0900	-1.93		2.58		1.56		12.28	120.49
12	1400	-1.94		2.58		1.57		12.28	122.27
12	1900	-1.91		2.65		1.61		12.28	125.38
13	0000	-1.91		2.67		1.65		12.26	121.83
13	0500	-1.91		2.68		1.67		12.26	126.24
13	1000	-1.94		2.69		1.79		12.27	125.78
13	1500	-1.94		2.67		1.86		12.26	127.33
13	2000	-1.92		2.68		1.90		12.25	122.75
14	0100	-1.92		2.68		1.95		12.25	125.13
14	0600	-1.91		2.69		1.98		12.27	123.89
14	1100	-1.95		2.67		1.95		12.24	123.66
14	1600	-1.93		2.67		2.00		12.26	125.46
14	2100	-1.94		2.66		2.02		12.26	122.38
15	0200	-1.91		2.68		2.06		12.23	122.64
15	0700	-1.91		2.69		2.13		12.27	124.92
15	1200	-1.92		2.68		2.16		12.27	122.91
15	1700	-1.95		2.65		2.15		12.26	125.83
15	2200	-1.92		2.67		2.17		12.26	123.10
16	0300	-1.92		2.68		2.18		12.23	122.96
16	0800	-1.92		2.71		2.21		12.28	122.27
16	1300	-1.94		2.70		2.22		12.28	122.52
16	1800	-1.91		2.75		2.31		12.26	122.75
16	2300	-1.95		2.71		2.33		12.24	127.46
17	0400	-1.95		2.71		2.37		12.23	123.48
17	0900	-1.95		2.93		2.59		12.41	116.56
17	1400	-1.95		2.91		2.56		12.27	119.19
17	1900	-1.93		2.87		2.52		12.26	124.28
18	0400	-1.91		2.90		2.55		12.27	122.45

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
18	1400	-1.97		2.88		2.50		12.28	126.30
18	1900	-1.96		2.83		2.46		12.23	124.22
19	0000	-1.94		2.86		2.47		12.24	123.92
19	0500	-1.93		2.85		2.44		12.21	124.00
19	1000	-1.94		2.87		2.43		12.26	122.35
19	1500	-1.92		2.88		2.41		12.29	127.63
19	2000	-1.91		2.88		2.39		14.29	124.72
20	0100	-1.93		2.86		2.35		14.28	125.18
20	0600	-1.92		2.87		2.34		14.33	126.76
20	1100	-1.91		2.86		2.31		14.31	123.69
20	1600	-1.92		2.86		2.28		14.32	124.96
20	2100	-1.93		2.85		2.25		14.30	127.06
21	0200	-1.91		2.87		2.26		14.30	130.51
21	0700	-1.94		2.86		2.24		14.31	125.60
21	1200	-1.92		2.88		2.24		14.31	123.59
21	1700	-1.95		2.84		2.21		14.32	127.91
21	2200	-1.94		2.87		2.23		14.34	126.13
22	0300	-1.93		2.89		2.23		14.34	125.77
22	0400	-1.92		2.91		2.23		14.36	127.35
22	1300	-1.96		2.88		2.19		14.37	124.25
22	1800	-1.97		2.86		2.17		14.34	126.19
22	2300	-1.95		2.87		2.16		14.33	123.75
23	0400	-1.92		2.89		2.18		14.33	125.19
23	0900	-1.94		2.87		2.15		14.36	125.97
23	1400	-1.95		2.86		2.12		14.34	123.69
23	1900	-1.95		2.85		2.13		14.33	123.19
24	0000	-1.95		2.84		2.11		14.32	124.87
24	0500	-1.96		2.84		2.10		14.31	128.83
24	1000	-1.94		2.88		2.14		14.38	130.26
24	1500	-1.97		2.84		2.18		14.35	124.42
24	2000	-1.98		2.83		2.09		14.33	125.45
25	0100	-1.92		2.88		2.14		14.33	125.73
25	0600	-1.94		2.88		2.13		14.34	126.44
25	1100	-1.95		2.90		2.15		14.39	122.50
25	1600	-1.97		2.86		2.12		14.37	124.74
25	2100	-1.94		2.87		2.12		14.34	125.13
26	0200	-1.93		2.87		2.12		14.33	126.31
26	0700	-1.94		2.88		2.12		14.36	127.52
26	1200	-1.92		2.88		2.13		14.39	124.46
26	1700	-1.93		2.86		2.10		14.35	126.52
26	2200	-1.92		2.88		2.13		14.36	123.88
27	0300	-1.93		2.87		2.11		14.36	129.42
27	0800	-1.92		2.87		2.11		14.35	127.12
27	1300	-1.93		2.87		2.10		14.36	128.18
27	1800	-1.94		2.85		2.08		14.34	126.15
27	2300	-1.95		2.86		2.08		14.35	130.56

DAY	TIME	TIN	TOUT	TWA	TWN	TWC	TWD	HEAT	FLOW
29	0400	-1.93		2.87		2.10		14.35	124.84
28	0900	-1.90		2.91		2.12		14.39	127.20
28	1400	-1.93		2.89		2.09		14.36	131.19
28	1900	-1.92		2.87		2.10		14.39	128.17
29	0000	-1.92		2.88		2.09		14.34	126.65
29	0500	-1.92		2.88		2.10		14.35	125.58
29	1000	-1.91		2.90		2.11		14.38	129.65
29	1500	-1.94		2.89		2.09		14.39	124.51
29	2000	-1.93		2.88		2.08		14.36	126.27
30	0100	-1.92		2.90		2.10		14.35	130.41
30	0600	-1.91		2.92		2.12		14.38	125.97
30	1100	-1.95		2.89		2.08		14.36	127.42
30	1600	-1.95		2.88		2.07		14.37	125.56
30	2100	-1.95		2.88		2.06		14.33	133.02
31	1001	-1.94		2.91		2.09		14.38	126.71
31	1500	-1.95		2.90		2.08		14.40	131.06
31	2000	-1.94		2.92		2.09		14.35	128.03
32	0100	-1.93		2.93		2.11		14.35	128.81
32	0600	-1.93		2.95		2.12		14.37	125.75
32	1100	-1.93		2.95		2.13		14.38	126.61
32	1600	-1.92		2.96		2.13		14.39	125.56
32	2100	-1.93		2.95		2.11		14.33	126.14
33	0200	-1.92		2.95		2.12		14.33	129.24
33	0700	-1.90		2.98		2.15		14.37	125.53
33	1200	-1.93		2.97		2.13		14.35	125.36
33	1700	-1.93		2.97		2.14		14.22	129.81
33	2200	-1.92		2.98		2.14		14.18	129.78
34	0300	-1.92		2.99		2.15		14.08	126.55
34	0800	-1.93		2.97		2.14		14.03	126.46
34	1300	-1.94		2.97		2.13		14.01	126.13
34	1800	-1.96		2.94		2.10		13.99	129.89
34	2300	-1.92		2.97		2.13		13.99	127.10
35	0400	-1.92		2.97		2.13		13.98	125.83
35	0900	-1.92		2.97		2.13		13.90	130.80
35	1400	-1.93		2.97		2.13		13.83	126.60
35	1900	-1.94		2.95		2.11		13.83	129.33
36	0000	-1.94		2.95		2.12		13.94	129.67
36	0500	-1.93		2.96		2.12		13.94	131.93
36	1000	-1.94		2.94		2.13		13.65	127.19
36	1500	-1.93		2.95		2.12		13.95	125.58
36	2000	-1.95		2.92		2.09		13.90	125.67
37	0100	-1.92		2.95		2.13		13.63	128.44
37	0600	-1.92		2.95		2.13		13.62	125.20
37	1100	-1.93		2.93		2.11		13.73	128.99
37	1600	-1.93		2.96		2.12		13.71	126.10
37	2100	-1.93		2.98		2.15		13.68	130.97

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
38	0200	-1.94		3.00		2.15		13.71	127.76
38	0700	-1.94		2.99		2.15		13.70	129.24
38	1200	-1.94		3.01		2.17		13.73	129.33
38	1700	-1.94		3.02		2.17		13.73	132.24

RAW DATA: RUN 99

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1649	-1.90		-.01		.04		5.83	81.99
1	1700	-1.89		.01		.08		5.82	82.22
1	1730	-1.83		.04		.09		5.80	81.63
1	1800	-1.79		.04		.14		5.91	82.80
1	1830	-1.75		.05		.17		5.97	81.68
1	1900	-1.72		.10		.18		5.91	82.01
1	1930	-1.71		.09		.18		5.86	82.82
1	2000	-1.69		.12		.20		5.83	82.93
1	2030	-1.68		.13		.20		5.82	83.91
1	2100	-1.66		.12		.21		5.82	84.60
1	2130	-1.67		.12		.20		5.82	82.28
1	2200	-1.66		.15		.21		5.80	82.52
1	2230	-1.65		.16		.22		5.80	84.47
1	2300	-1.65		.15		.21		5.79	83.30
1	2330	-1.64		.14		.24		5.79	83.94
2	0000	-1.63		.15		.23		5.79	85.18
2	0100	-1.63		.17		.23		5.79	82.60
2	0200	-1.62		.15		.25		5.78	85.05
2	0400	-1.63		.17		.24		5.79	82.80
2	0700	-1.63		.35		.41		5.81	78.61
2	1100	-1.63		.37		.40		5.82	79.27
2	1300	-1.60		.39		.42		5.83	79.05
2	1600	-1.55		.48		.46		5.82	78.95
2	1900	-1.52		.50		.48		5.81	79.74
2	2200	-1.56		.48		.46		5.82	79.34
2	2300	-1.57		.48		.49		5.81	79.37
3	0000	-1.57		.49		.47		5.81	79.55
3	0100	-1.58		.50		.47		5.80	80.09
3	0200	-1.59		.47		.47		5.80	79.61
3	0221	-1.59		.49		.49		5.80	79.56
3	0300	-1.58		.49		.45		5.80	80.46
3	0800	-1.61		.54		.46		5.81	80.78
3	1300	-1.59		.59		.51		5.83	81.62
3	1800	-1.52		.67		.57		5.82	81.77
3	2300	-1.52		.68		.54		5.81	81.02
4	0400	-1.55		.70		.56		5.80	80.01
4	0900	-1.57		.72		.56		5.83	80.82
4	1400	-1.56		.79		.58		5.83	80.34
4	1547	-1.53		.81		.59		5.82	82.36
4	2000	-1.55		.86		.60		5.80	81.83
5	0100	-1.59		.90		.61		5.80	81.83

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
5	0600	-1.62		.94		.62		5.78	79.65
5	1100	-1.70		.95		.62		5.81	78.61
5	1600	-1.70		1.02		.63		5.81	78.80
5	2100	-1.67		1.10		.69		5.80	78.93
6	0200	-1.67		1.14		.87		5.79	79.30
6	0700	-1.68		1.20		.95		5.80	78.78
6	1200	-1.67		1.21		.98		5.80	78.49
6	1700	-1.66		1.22		1.00		5.80	80.45
6	2200	-1.68		1.21		1.02		5.78	78.88
7	0300	-1.69		1.21		.99		5.78	78.75
7	0800	-1.70		1.23		.99		5.79	78.42
7	1300	-1.69		1.25		1.01		5.79	80.60
7	1800	-1.69		1.25		1.03		5.79	77.69
7	2300	-1.70		1.26		1.00		5.79	78.67
8	0400	-1.73		1.24		1.00		5.78	78.49
8	0900	-1.77		1.25		1.01		5.80	77.70
8	1400	-1.81		1.23		.99		5.80	77.43
8	1900	-1.78		1.23		.99		5.78	77.55
9	0000	-1.76		1.27		1.01		5.78	78.96
9	0500	-1.76		1.27		1.00		5.78	77.47
9	1000	-1.75		1.30		1.04		5.81	78.59
9	1500	-1.75		1.32		1.04		5.80	79.40
9	2000	-1.73		1.32		1.05		5.78	79.42
10	0100	-1.73		1.32		1.04		5.78	78.30
10	0600	-1.76		1.31		1.02		5.78	77.81
10	1100	-1.78		1.32		1.02		5.81	78.71
10	1600	-1.79		1.34		1.03		5.80	76.71
10	2100	-1.73		1.36		1.05		5.78	77.02
11	0200	-1.71		1.41		1.06		5.78	77.68
11	0700	-1.72		1.40		1.08		5.79	78.68
11	1200	-1.75		1.39		1.07		5.80	77.78
11	1700	-1.74		1.39		1.10		5.79	79.11
11	2200	-1.73		1.41		1.09		5.79	79.31
12	0300	-1.71		1.43		1.09		5.77	78.02
12	0800	-1.71		1.42		1.11		5.80	77.72
12	1300	-1.69		1.45		1.12		5.80	78.35
12	1800	-1.68		1.46		1.12		5.79	78.93
12	2300	-1.66		1.48		1.12		5.79	78.58
13	0400	-1.68		1.44		1.11		5.78	78.14
13	0900	-1.70		1.44		1.09		5.80	78.05
13	1400	-1.69		1.46		1.09		5.79	78.34
13	1900	-1.68		1.46		1.10		5.78	78.71
14	0000	-1.68		1.45		1.10		5.79	79.36
14	0500	-1.71		1.43		1.07		5.79	79.39
14	1000	-1.72		1.40		1.05		5.78	78.47
14	1500	-1.68		1.50		1.13		5.92	79.17

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
14	2000	-1.67		1.51		1.15		5.92	79.96
15	0100	-1.68		1.49		1.13		5.92	78.40
15	0600	-1.67		1.50		1.14		5.93	78.53
15	1100	-1.71		1.48		1.12		5.93	78.25
15	1600	-1.72		1.45		1.10		5.95	78.68
15	2100	-1.67		1.49		1.12		5.91	80.42
15	2200	-1.68		1.48		1.12		5.93	79.20
16	0300	-1.68		1.45		1.11		5.91	79.47
16	0800	-1.71		1.46		1.10		5.93	78.42
16	1300	-1.71		1.45		1.10		5.93	78.65
16	1800	-1.77		1.42		1.05		5.92	79.52
16	2300	-1.76		1.41		1.06		5.92	79.60
17	0400	-1.76		1.42		1.06		5.91	79.14
17	0900	-1.77		1.41		1.05		5.93	79.74
17	1400	-1.77		1.42		1.06		5.93	80.75
17	1900	-1.73		1.45		1.09		5.92	80.70
18	0000	-1.72		1.47		1.09		5.91	79.65
18	0500	-1.72		1.45		1.10		5.91	81.13
18	1000	-1.76		1.44		1.08		5.93	80.92
18	1500	-1.74		1.46		1.10		5.92	79.51
18	2000	-1.77		1.43		1.08		5.91	79.30
19	0100	-1.78		1.43		1.07		5.90	79.79
19	0600	-1.79		1.41		1.06		5.90	79.08
19	1100	-1.80		1.44		1.07		5.92	78.37
19	1600	-1.87		1.39		1.02		5.90	76.74
19	2100	-1.84		1.41		1.04		5.89	78.17
20	0200	-1.85		1.39		1.03		5.89	77.25
20	0700	-1.87		1.39		1.01		5.89	77.43
20	1200	-1.83		1.42		1.05		5.90	78.00
21	0300	-1.78		1.45		1.09		5.89	78.41
21	0800	-1.80		1.43		1.06		5.89	78.30
21	1300	-1.77		1.45		1.09		5.89	78.36
21	1800	-1.75		1.45		1.10		5.89	80.10
21	2300	-1.74		1.46		1.11		5.89	80.42
22	0400	-1.75		1.45		1.09		5.89	80.03
22	0900	-1.77		1.45		1.08		5.91	78.61
22	1400	-1.82		1.40		1.04		5.90	80.51
22	1900	-1.82		1.51		1.12		5.88	79.62
23	0000	-1.82		1.53		1.15		5.88	80.36
23	0500	-1.84		1.55		1.15		5.88	79.60
23	1000	-1.88		1.54		1.14		5.91	78.96
23	1500	-1.85		1.58		1.17		5.90	79.23
23	2000	-1.82		1.59		1.17		5.88	79.68
24	0100	-1.83		1.59		1.17		5.89	80.15
24	0600	-1.86		1.56		1.14		5.89	79.34
24	1100	-1.82		1.59		1.18		5.90	81.71

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
24	2157	-2.23		1.06		.74		6.01	78.57
24	2200	-2.22		1.07		.75		6.00	78.30
24	2203	-2.21		1.07		.76		6.00	79.00
24	2300	-2.05		1.18		.87		5.93	79.46
25	0400	-1.84		1.42		1.03		5.89	82.26
25	0900	-1.82		1.50		1.10		5.92	81.30
25	1400	-1.82		1.53		1.13		5.91	80.98
25	1900	-1.81		1.57		1.17		5.90	81.50
26	0000	-1.81		1.60		1.19		5.89	81.05
26	0500	-1.83		1.60		1.18		5.89	80.95
26	1000	-1.85		1.62		1.19		5.91	80.59
26	1500	-1.79		1.66		1.24		5.90	82.32
26	2000	-1.73		1.71		1.29		5.90	81.98
27	0100	-1.74		1.72		1.29		5.89	81.83
27	0600	-1.76		1.72		1.28		5.89	82.18
27	1100	-1.73		1.75		1.31		5.90	83.21
27	1600	-1.69		1.77		1.35		5.90	84.14
27	2100	-1.68		1.78		1.36		5.88	82.35
28	0200	-1.67		1.80		1.37		5.89	82.71
28	0700	-1.69		1.78		1.36		5.88	82.42
28	1200	-1.68		1.80		1.37		5.89	82.43
28	1700	-1.67		1.81		1.38		5.89	82.81
28	2200	-1.70		1.79		1.36		5.88	84.10
29	0300	-1.72		1.77		1.34		5.88	82.97
29	0800	-1.75		1.76		1.33		5.89	82.10
29	1300	-1.72		1.78		1.36		5.89	84.03

RAW DATA! RUN 100

DAY	TIME	TIN	TOUT	THA	TWB	TWC	TWD	HEAT	FLOW
1	1649	-1.82		17.00	17.37	9.36	19.95	136.95	
1	1700	-1.81		16.98	17.37	9.39	19.97	137.28	
1	1730	-1.75		17.04	17.46	9.54	19.99	137.43	
1	1800	-1.71		17.11	17.52	9.65	19.99	138.30	
1	1830	-1.67		17.18	17.59	9.61	19.99	137.97	
1	1900	-1.64		17.21	17.62	9.71	19.98	138.35	
1	1930	-1.63		17.21	17.61	9.71	19.97	137.99	
1	2000	-1.61		17.25	17.64	9.74	19.95	138.16	
1	2030	-1.60		17.27	17.65	9.84	19.94	138.06	
1	2100	-1.58		17.28	17.67	9.92	19.98	138.33	
1	2130	-1.59		17.28	17.67	9.95	19.93	137.52	
1	2200	-1.57		17.29	17.69	9.93	19.98	137.37	
1	2230	-1.57		17.29	17.70	9.98	19.99	137.84	
1	2300	-1.57		17.27	17.69	10.01	19.96	137.77	
1	2330	-1.56		17.28	17.71	10.13	19.98	138.55	
2	0000	-1.55		17.28	17.73	10.14	19.98	137.33	
2	0100	-1.55		17.27	17.74	10.17	19.96	136.98	
2	0200	-1.54		17.26	17.77	10.29	19.97	138.09	
2	0400	-1.55		17.24	17.80	10.30	19.96	137.59	
2	0700	-1.55		17.21	17.83	10.05	19.90	138.45	
2	1100	-1.56		17.23	17.87	10.21	19.91	139.44	
2	1300	-1.53		17.27	17.94	10.18	19.88	136.52	
2	1600	-1.47		17.36	18.04	10.27	19.86	136.30	
2	1900	-1.44		17.47	18.17	10.51	19.86	136.78	
2	2200	-1.48		17.47	18.18	10.49	19.84	137.49	
2	2300	-1.49		17.47	18.19	10.57	19.84	136.71	
3	0000	-1.49		17.49	18.21	10.64	19.84	136.33	
3	0100	-1.50		17.50	18.22	10.59	19.84	137.69	
3	0200	-1.51		17.48	18.21	10.64	19.82	137.43	
3	0221	-1.51		17.49	18.21	10.63	19.82	135.77	
3	0300	-1.50		17.51	18.24	10.67	19.82	127.84	
3	0800	-1.53		17.51	18.24	10.49	19.75	128.20	
3	1300	-1.50		17.51	18.26	10.38	19.71	136.55	
3	1800	-1.45		17.59	18.36	10.65	19.72	133.41	
3	2300	-1.44		17.53	18.38	10.75	19.74	127.43	
4	0400	-1.47		17.51	18.31	10.81	19.66	136.67	
4	1900	-1.49		17.46	18.26	10.51	19.63	129.38	
4	1400	-1.48		17.46	18.26	10.47	19.62	129.24	
4	1547	-1.46		17.47	18.27	10.54	19.61	137.75	
4	2100	-1.47		17.44	18.25	10.73	19.59	136.95	
5	0100	-1.51		17.42	18.24	10.74	19.60	129.65	

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
5	0600	-1.55		17.39	18.19	10.76	19.59	136.21	
5	1100	-1.52		17.32	18.13	10.45	19.56	136.53	
5	1600	-1.64		17.25	18.07	10.48	19.55	136.96	
5	2100	-1.59		17.26	18.07	10.64	19.52	128.82	
6	0200	-1.59		17.26	18.04	10.67	19.50	136.26	
6	0700	-1.60		17.26	18.04	10.55	19.48	136.45	
6	1200	-1.59		17.24	18.03	10.63	19.47	127.02	
6	1700	-1.57		17.22	18.02	10.64	19.44	135.99	
6	2200	-1.60		17.16	17.95	10.67	19.40	135.63	
7	0300	-1.61		17.17	17.95	10.73	19.41	135.70	
7	0800	-1.62		17.15	17.93	10.58	19.39	135.87	
7	1300	-1.61		17.14	17.92	10.62	19.36	136.08	
7	1800	-1.61		17.11	17.90	10.61	19.35	136.38	
7	2300	-1.62		17.12	17.90	10.66	19.35	126.93	
8	0400	-1.65		17.07	17.86	10.66	19.34	135.75	
8	0900	-1.69		17.04	17.82	10.39	19.32	132.47	
8	1400	-1.73		16.99	17.78	10.33	19.29	135.61	
8	1900	-1.70		16.98	17.77	10.53	19.29	126.12	
9	0000	-1.68		17.01	17.81	10.67	19.29	125.95	
9	0500	-1.69		17.00	17.80	10.63	19.27	126.62	
9	1000	-1.67		16.99	17.79	10.36	19.25	126.24	
9	1500	-1.67		17.14	17.94	10.42	19.38	129.93	
9	2000	-1.65		17.14	17.94	10.70	19.39	135.31	
10	0100	-1.65		17.14	17.94	10.68	19.38	128.71	
10	0600	-1.69		17.12	17.91	10.68	19.39	134.45	
10	1100	-1.70		17.11	17.90	10.37	19.36	128.93	
10	1600	-1.71		17.09	17.88	10.40	19.36	127.69	
10	2100	-1.66		17.13	17.92	10.65	19.37	132.76	
11	0200	-1.63		17.14	17.94	10.67	19.36	126.16	
11	0700	-1.64		17.13	17.93	10.43	19.34	131.79	
11	1200	-1.68		17.09	17.89	10.43	19.34	133.52	
11	1700	-1.67		17.59	18.38	10.65	19.81	133.39	
11	2200	-1.65		17.59	18.38	10.75	19.79	125.24	
12	0300	-1.63		17.59	18.38	10.93	19.75	125.36	
12	0800	-1.63		17.59	18.37	10.64	19.74	125.37	
12	1300	-1.61		17.61	18.39	10.65	19.73	126.88	
12	1800	-1.60		17.63	18.41	10.82	19.74	134.05	
12	2300	-1.58		17.63	18.41	10.35	19.74	124.53	
13	0400	-1.60		17.59	18.38	10.88	19.74	134.28	
13	0900	-1.62		17.58	18.36	10.76	19.73	134.40	
13	1400	-1.61		17.59	18.37	10.85	19.73	126.26	
13	1900	-1.60		17.57	18.35	10.83	19.73	124.97	
14	0000	-1.60		17.59	18.36	10.79	19.72	127.19	
14	0500	-1.63		17.55	18.32	10.77	19.71	133.76	
14	1000	-1.64		17.53	18.30	10.88	19.69	132.03	
14	1500	-1.60		17.86	18.63	10.94	19.97	133.84	

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
14	2000	-1.59		17.85	18.62	10.88	19.93	132.17	
15	0100	-1.60		17.86	18.63	10.99	19.95	133.42	
15	0600	-1.59		17.86	18.63	10.90	19.90	125.20	
15	1100	-1.63		17.81	18.57	10.68	19.90	133.30	
15	1600	-1.65		17.82	18.58	10.73	19.91	125.57	
15	2100	-1.59		17.80	18.58	10.94	19.87	133.79	
15	2200	-1.60		17.86	18.61	10.86	19.90	133.85	
16	0300	-1.60		17.85	18.61	11.01	19.90	133.85	
16	0800	-1.63		17.88	18.62	10.77	19.92	124.45	
16	1300	-1.63		17.86	18.61	10.72	19.89	123.81	
16	1800	-1.69		17.78	18.51	10.82	19.86	133.73	
16	2300	-1.68		17.84	18.56	10.79	19.90	125.61	
17	0400	-1.68		17.83	18.55	10.95	19.88	131.79	
17	0900	-1.69		17.82	18.54	10.69	19.88	130.49	
17	1400	-1.69		17.80	18.52	10.65	19.84	130.54	
17	1900	-1.65		17.80	18.52	10.75	19.81	124.36	
18	0000	-1.65		17.81	18.54	10.87	19.82	125.65	
18	0500	-1.65		17.82	18.54	10.92	19.82	133.31	
18	1000	-1.69		17.81	18.53	10.65	19.83	133.67	
18	1500	-1.67		17.80	18.53	10.68	19.81	134.84	
18	2000	-1.69		17.77	18.49	10.83	19.79	125.80	
19	0100	-1.70		17.84	18.56	10.90	19.85	134.12	
19	0600	-1.71		17.83	18.54	10.84	19.84	133.91	
19	1100	-1.72		17.79	18.49	10.64	19.81	132.20	
19	1600	-1.79		17.73	18.44	10.61	19.78	133.02	
19	2100	-1.75		17.74	18.45	10.82	19.79	134.15	
20	0200	-1.77		17.86	18.57	10.91	19.87	133.94	
20	0700	-1.79		17.85	18.57	10.82	19.84	133.39	
20	1200	-1.75		17.87	18.58	10.81	19.82	124.36	
21	0300	-1.70		17.89	18.61	10.93	19.81	133.91	
21	0800	-1.72		17.87	18.59	10.90	19.80	133.45	
21	1300	-1.69		17.89	18.61	10.92	19.79	133.81	
21	1800	-1.66		17.89	18.62	10.90	19.77	124.07	
21	2300	-1.66		18.05	18.77	10.92	19.90	124.14	
22	0400	-1.67		18.05	18.77	10.97	19.90	133.05	
22	0900	-1.69		17.99	18.71	10.73	19.86	133.52	
22	1400	-1.74		17.95	18.67	10.69	19.86	136.32	
22	1900	-1.75		17.96	18.68	10.87	19.86	136.83	
23	0000	-1.75		18.00	18.73	10.98	19.88	127.71	
23	0500	-1.76		17.99	18.71	10.94	19.93	136.94	
23	1000	-1.80		17.93	18.65	10.62	19.81	136.66	
23	1500	-1.77		17.94	18.66	10.67	19.81	136.70	
23	2000	-1.74		17.97	18.70	10.90	19.83	137.31	
24	0100	-1.75		18.13	18.95	11.02	19.97	128.60	
24	0600	-1.78		18.10	18.82	10.92	19.93	135.25	
24	1100	-1.75		18.11	18.84	10.85	19.91	129.02	

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
24	2157	-1.29		19.56		20.18	11.39	20.19	134.86
24	2200	-1.59		19.13		19.77	11.13	20.17	134.35
24	2203	-1.94		18.74		19.39	10.85	20.16	133.20
24	2300	-1.98		18.42		19.12	10.77	20.00	131.08
25	0400	-1.76		18.15		18.83	10.80	19.81	133.32
25	0900	-1.74		18.07		18.76	10.53	19.76	130.49
25	1400	-1.74		18.15		18.82	10.60	19.84	129.27
25	1900	-1.73		18.15		18.83	10.71	19.85	131.86
26	0000	-1.73		18.16		18.83	10.80	19.86	132.58
26	0500	-1.76		18.13		18.80	10.70	19.83	130.41
26	1000	-1.78		17.99		18.67	10.46	19.79	134.06
26	1500	-1.72		18.05		18.73	10.53	19.77	132.66
26	2000	-1.66		18.12		18.80	10.77	19.79	134.42
27	0100	-1.66		18.07		18.76	10.73	19.77	131.26
27	0600	-1.69		18.06		18.74	10.73	19.78	131.94
27	1100	-1.66		18.06		18.75	10.68	19.77	136.39
27	1600	-1.61		18.09		18.79	10.74	19.77	129.41
27	2100	-1.60		18.22		18.92	10.87	19.86	129.09
28	0200	-1.60		18.23		18.93	10.90	19.87	130.46
28	0700	-1.61		18.20		18.91	10.90	19.85	126.68
28	1200	-1.60		18.19		18.90	10.84	19.85	132.36
28	1700	-1.60		18.18		18.89	10.81	19.84	127.47
28	2200	-1.63		18.16		18.88	10.86	19.86	128.25
29	0300	-1.65		18.14		18.86	10.86	19.86	135.04
29	0800	-1.67		18.11		18.83	10.69	19.83	128.93
29	1300	-1.65		18.11		18.83	10.76	19.82	136.08

RAW DATA: RUN 101

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1431	-1.92		-.09	-.09		.05	9.11	130.17
1	1500	-1.92		-.10	-.10		.08	9.09	127.17
1	1600	-1.92		-.09	-.07		.08	9.07	130.32
1	1700	-1.92		-.06	-.05		.10	9.05	126.18
1	1800	-1.91		-.06	-.05		.13	9.04	129.18
1	1900	-1.91		-.03	-.05		.12	9.02	129.58
1	2000	-1.91		-.03	0.00		.13	9.01	128.75
1	2100	-1.91		-.01	-.02		.17	9.01	131.41
1	2200	-1.87		.02	.06		.22	9.14	129.58
1	2300	-1.85		.06	.07		.25	9.13	129.86
2	0000	-1.89		.03	.05		.25	9.11	127.24
2	0100	-1.89		.07	.07		.24	9.12	130.98
2	0200	-1.90		.07	.06		.23	9.12	128.81
2	0300	-1.89		.06	.08		.28	9.11	127.91
2	0400	-1.88		.08	.11		.29	9.12	126.74
2	0500	-1.90		.08	.09		.26	9.12	127.37
2	0600	-1.88		.12	.12		.27	9.13	127.35
2	0700	-1.89		.11	.11		.30	9.13	125.53
2	0800	-1.89		.10	.13		.33	9.15	128.28
2	0900	-1.91		.11	.14		.34	9.16	131.79
2	1200	-1.91		.12	.14		.33	9.15	126.79
2	1700	-1.92		.15	.16		.38	9.15	128.72
2	2200	-1.89		.18	.23		.41	9.14	125.48
3	0300	-1.91		.21	.23		.41	9.11	124.30
3	0700	-1.90		.21	.26		.44	9.13	127.91
3	1600	-1.92		.23	.26		.48	9.14	128.57
3	2100	-1.91		.24	.29		.51	9.13	126.01
4	0200	-1.89		.29	.34		.50	9.11	125.99
4	0700	-1.93		.27	.31		.50	9.12	127.16
4	1200	-1.94		.28	.31		.54	9.16	125.76
4	1700	-1.91		.31	.35		.58	9.15	131.17
4	2200	-1.90		.35	.38		.62	9.14	127.09
5	0300	-1.91		.38	.44		.65	9.11	126.14
5	0800	-1.90		.40	.47		.67	9.11	125.38
5	1300	-1.93		.39	.45		.67	9.15	128.90
5	1457	-1.92		.41	.46		.69	9.16	129.97
5	1900	-1.91		.40	.47		.70	9.13	130.35
6	0000	-1.89		.44	.50		.72	9.11	126.03
6	0500	-1.89		.44	.53		.74	9.11	124.93
6	1000	-1.91		.44	.51		.73	9.13	125.39
6	1500	-1.92		.48	.57		.79	9.15	124.38

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
6	2000	-1.90		.50	.59		.82	9.12	127.02
7	0100	-1.88		.50	.60		.82	9.11	124.51
7	0600	-1.89		.50	.61		.81	9.12	127.47
7	1100	-1.89		.49	.61		.85	9.10	124.91
7	1600	-1.91		.48	.58		.81	9.11	129.30
7	2100	-1.90		.48	.60		.84	9.12	125.25
8	0200	-1.89		.49	.63		.83	9.11	122.76
8	0700	-1.89		.49	.62		.82	9.12	124.01
8	1200	-1.90		.47	.61		.84	9.15	124.49
8	1700	-1.90		.50	.62		.84	9.14	126.49
8	2200	-1.91		.46	.61		.83	9.12	126.63
9	0300	-1.90		.47	.59		.83	9.11	124.61
9	0800	-1.90		.48	.61		.83	9.15	124.10
9	1300	-1.92		.47	.59		.83	9.17	124.97
9	1800	-1.93		.44	.58		.81	9.13	125.86
9	2300	-1.91		.45	.59		.82	9.13	128.69
10	0400	-1.89		.47	.58		.82	9.12	127.58
10	0900	-1.90		.47	.59		.83	9.15	127.74
10	1400	-1.92		.46	.59		.81	9.17	127.18
10	1900	-1.90		.46	.59		.80	9.15	125.79
11	0000	-1.89		.47	.58		.80	9.13	126.98
11	0500	-1.88		.48	.59		.83	9.13	128.41
11	1000	-1.88		.48	.59		.83	9.16	124.12
11	1500	-1.92		.45	.57		.80	9.17	129.04
11	2000	-1.91		.45	.56		.80	9.13	127.06
12	0100	-1.89		.46	.58		.78	9.13	126.29
12	0600	-1.87		.47	.60		.80	9.12	128.11
12	1100	-1.91		.47	.58		.82	9.12	128.06
12	1600	-1.92		.44	.56		.79	9.16	129.95
12	2100	-1.91		.44	.57		.79	9.15	130.61
13	0200	-1.88		.46	.58		.78	9.13	131.52
13	0700	-1.88		.45	.58		.79	9.12	129.17
13	1200	-1.91		.44	.56		.78	9.15	128.24
13	1700	-1.91		.44	.55		.75	9.15	130.20
13	2200	-1.91		.41	.53		.75	9.14	132.29
14	0300	-1.90		.41	.52		.74	9.07	129.57
14	0800	-1.88		.44	.55		.76	9.09	127.07
14	1300	-1.91		.42	.54		.76	9.12	129.26
14	1800	-1.91		.43	.54		.74	9.12	133.03
14	2300	-1.91		.42	.54		.77	9.11	127.83
15	0400	-1.90		.43	.54		.76	9.09	130.80
15	0900	-1.88		.46	.57		.79	9.13	130.88
15	1235	-1.92	1.06	1.18		1.47	11.63	128.46	
15	1700	-1.91	1.08	1.19		1.49	11.63	133.04	
15	2200	-1.99	1.11	1.23		1.50	11.61	130.18	
15	0300	-1.88	1.12	1.24		1.52	11.57	131.74	

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
16	0800	-1.89		1.12	1.27		1.55	11.62	131.71
16	1300	-1.91		1.12	1.24		1.54	11.63	128.67
16	1800	-1.90		1.12	1.26		1.54	11.61	131.19
16	2300	-1.87		1.13	1.26		1.55	11.58	129.04
17	0400	-1.90		1.12	1.24		1.55	11.59	128.85
17	0900	-1.89		1.16	1.28		1.56	11.62	125.89
17	1400	-1.91		1.13	1.26		1.56	11.65	127.00
17	1900	-1.91		1.12	1.27		1.56	11.60	128.51
18	0000	-1.89		1.15	1.29		1.57	11.60	127.00
18	0500	-1.89		1.16	1.29		1.57	11.59	127.66
18	1000	-1.88		1.18	1.31		1.62	11.60	126.48
18	1500	-1.91		1.16	1.29		1.58	11.60	125.88
18	2000	-1.91		1.15	1.28		1.56	11.59	132.32
19	0100	-1.88		1.19	1.33		1.61	11.58	127.12
19	0600	-1.87		1.20	1.34		1.62	11.60	125.06
19	1100	-1.88		1.22	1.35		1.65	11.62	128.50
19	1600	-1.91		1.18	1.33		1.62	11.61	126.46
19	2100	-1.89		1.19	1.33		1.61	11.57	127.71
20	0200	-1.89		1.19	1.34		1.63	11.58	125.79
20	0700	-1.88		1.20	1.34		1.63	11.58	127.27
20	1200	-1.89		1.19	1.35		1.63	11.57	125.89
20	1700	-1.90		1.19	1.33		1.61	11.58	126.92
20	2200	-1.89		1.21	1.35		1.63	11.57	126.31
21	0300	-1.89		1.20	1.34		1.60	11.54	123.13
21	0800	-1.89		1.20	1.34		1.64	11.54	128.15
21	1300	-1.91		1.20	1.33		1.62	11.56	129.43
21	1800	-1.92		1.18	1.32		1.61	11.60	129.65
21	2300	-1.91		1.18	1.32		1.61	11.58	131.08
22	0400	-1.89		1.19	1.33		1.62	11.57	125.18
22	0900	-1.89		1.20	1.34		1.64	11.62	127.93
22	1400	-1.92		1.18	1.32		1.61	11.63	127.51
22	1900	-1.91		1.18	1.31		1.60	11.62	131.84
23	0000	-1.90		1.19	1.32		1.61	11.60	129.66
23	0500	-1.88		1.21	1.34		1.64	11.58	131.14
23	1000	-1.89		1.20	1.35		1.64	11.62	125.52
23	1500	-1.90		1.20	1.35		1.62	11.64	129.59
23	2000	-1.88		1.20	1.34		1.63	11.58	130.01
24	0100	-1.88		1.20	1.35		1.64	11.58	127.73
24	0600	-1.89		1.20	1.34		1.64	11.57	127.09
24	1100	-1.89		1.21	1.35		1.65	11.61	127.24
24	1600	-1.89		1.23	1.37		1.67	11.60	127.11
24	2100	-1.90		1.24	1.37		1.68	11.57	127.89
25	0200	-1.88		1.25	1.40		1.68	11.58	127.64
25	0700	-1.90		1.23	1.38		1.66	11.58	128.73
25	1200	-1.90		1.24	1.39		1.68	11.60	125.93
25	1700	-1.91		1.23	1.39		1.68	11.59	126.93

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
25	2000	-1.91		1.34	1.50		1.78	11.56	115.18
26	0100	-1.88		1.37	1.53		1.80	11.56	113.61
26	0600	-1.89		1.37	1.54		1.82	11.55	113.68
26	1100	-1.89		1.40	1.55		1.86	11.59	98.54
26	1600	-1.92		1.36	1.53		1.81	11.59	116.10
26	2100	-1.56		1.72	1.88		2.16	11.57	116.04
27	0200	-1.86		1.49	1.66		1.96	11.56	115.32
27	0700	-1.87		1.50	1.67		1.97	11.55	113.49
27	1200	-1.90		1.49	1.66		1.94	11.57	114.54
27	1700	-1.91		1.47	1.64		1.92	11.58	115.15
27	2200	-1.89		1.48	1.65		1.93	11.57	113.96
28	0300	-1.88		1.46	1.63		1.93	11.55	116.18
28	0800	-1.87		1.47	1.63		1.92	11.55	114.90
28	1300	-1.91		1.43	1.60		1.90	11.58	114.09

RAW DATA: RUN 102

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1326	-2.08		.16	.21	.35	.65	9.66	83.34
1	1400	-1.96		.22	.24	.41	.68	9.69	91.41
1	1500	-1.31		.29	.32	.49	.70	9.64	83.62
1	1600	-1.92		.32	.33	.52	.70	9.67	90.99
1	1700	-1.93		.34	.34	.55	.71	9.64	90.28
1	1800	-1.92		.38	.39	.62	.74	9.63	91.70
1	1900	-1.92		.41	.42	.63	.75	9.61	91.98
1	2000	-1.91		.43	.44	.66	.77	9.60	91.26
1	2100	-1.90		.43	.46	.70	.79	9.60	90.72
1	2200	-1.91		.46	.50	.73	.81	9.62	90.56
1	2300	-1.30		.50	.53	.75	.83	9.60	91.01
2	0000	-1.90		.51	.56	.77	.84	9.59	91.43
2	0114	-1.90		.51	.56	.77	.84	9.58	90.31
2	0300	-1.89		.58	.64	.83	.91	9.59	91.24
2	0400	-1.88		.66	.75	.94	1.05	9.60	89.53
2	1300	-1.91		.76	.83	1.03	1.19	9.68	90.35
2	1800	-1.91		.85	.95	1.16	1.36	9.71	92.08
2	2300	-1.86		.94	1.06	1.32	1.53	9.73	91.49
3	0400	-1.88		1.03	1.19	1.47	1.65	9.70	89.74
3	0900	-1.89		1.13	1.34	1.68	1.77	9.68	89.86
3	1400	-1.91		1.40	1.60	1.91	1.94	9.70	90.93
3	1900	-1.91		1.79	1.84	2.06	2.06	9.69	91.31
4	0000	-1.90		2.03	2.07	2.16	2.14	9.67	90.98
4	0500	-1.89		2.15	2.18	2.23	2.19	9.69	89.48
4	1000	-1.89		2.15	2.18	2.23	2.19	9.69	89.48
4	1500	-1.91		2.25	2.34	2.28	2.25	9.70	90.77
4	2000	-1.90		2.30	2.41	2.31	2.28	9.69	91.69
5	0100	-1.88		2.37	2.47	2.34	2.32	9.68	90.30
5	0600	-1.88		2.42	2.52	2.39	2.37	9.71	89.51
5	1100	-1.92		2.47	2.57	2.41	2.43	9.72	91.07
5	1600	-1.92		2.52	2.62	2.45	2.48	9.72	92.05
5	1804	-1.91		2.52	2.62	2.45	2.48	9.68	89.27
5	2100	-1.89		2.53	2.63	2.45	2.51	9.66	89.25
6	0200	-1.89		2.61	2.69	2.46	2.60	9.71	89.11
6	0700	-1.89		2.63	2.72	2.47	2.64	9.73	88.48
6	1200	-1.91		2.62	2.72	2.46	2.66	9.72	89.48
6	1514	-1.90		2.57	2.69	2.41	2.62	9.70	93.81
6	2000	-1.88		2.65	2.77	2.48	2.70	9.70	90.23
7	0100	-1.88		2.64	2.75	2.47	2.69	9.67	89.29
7	0600	-1.89		2.66	2.77	2.47	2.70	9.68	91.12
7	1110	-1.91		2.67	2.79	2.48	2.71	9.69	89.37

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
7	1600	-1.92		2.63	2.80	2.49	2.72	9.69	89.49
7	2100	-1.90		2.72	2.85	2.50	2.73	9.65	93.60
8	0600	-1.90		2.72	2.85	2.54	2.75	9.67	88.93
8	1130	-1.90		2.75	2.88	2.57	2.79	9.71	88.13
8	1500	-1.92		2.78	2.91	2.59	2.81	9.70	89.09
8	2000	-1.91		2.77	2.88	2.58	2.80	9.65	89.89
9	0100	-1.89		2.65	2.97	2.66	2.88	9.76	89.69
9	0600	-1.88		2.85	2.97	2.66	2.89	9.77	89.31
9	1100	-1.89		2.65	2.98	2.66	2.89	9.76	88.74
9	1600	-1.92		2.86	2.98	2.67	2.90	9.76	89.51
9	2100	-1.90		2.66	2.98	2.66	2.91	9.71	93.33
10	0200	-1.90		2.88	2.99	2.69	2.94	9.72	89.49
10	0700	-1.88		2.89	3.01	2.71	2.98	9.73	88.91
10	1200	-1.92		2.92	3.02	2.72	3.01	9.75	89.30
10	1700	-1.91		2.93	3.05	2.74	3.03	9.73	88.97
10	2200	-1.90		2.94	3.06	2.76	3.04	9.73	91.18
11	0300	-1.90		2.95	3.06	2.77	3.05	9.74	89.12
11	0800	-1.89		2.96	3.08	2.79	3.07	9.74	89.63
11	1300	-1.92		2.97	3.08	2.80	3.07	9.74	89.74
11	1800	-1.91		2.93	3.09	2.81	3.07	9.72	91.41
11	2300	-1.91		2.99	3.11	2.82	3.10	9.72	89.30
12	0400	-1.89		3.03	3.12	2.84	3.12	9.71	91.15
12	0900	-1.89		3.03	3.14	2.87	3.14	9.75	93.41
12	1400	-1.91		3.05	3.16	2.89	3.16	9.74	90.58
12	1900	-1.91		3.05	3.15	2.89	3.15	9.71	92.17
13	0000	-1.89		3.06	3.16	2.90	3.16	9.71	90.48
13	0500	-1.89		3.06	3.16	2.91	3.17	9.71	90.75
13	1000	-1.90		3.07	3.19	2.93	3.18	9.73	89.73
13	1414	-1.91		3.13	3.21	2.98	3.25	9.72	87.00
13	1600	-1.92		3.18	3.25	3.04	3.29	9.63	86.72
13	1630	-1.91		3.19	3.25	3.05	3.29	9.61	86.86
13	1700	-1.91		3.19	3.26	3.06	3.30	9.60	83.93
13	2200	-1.87		3.23	3.33	3.11	3.34	9.55	97.69
14	0300	-1.88		3.24	3.30	3.12	3.33	9.53	95.81
14	0800	-1.88		3.28	3.34	3.16	3.39	9.54	85.12
14	1300	-1.87		3.32	3.39	3.22	3.43	9.55	86.40
14	1800	-1.90		3.31	3.37	3.21	3.42	9.54	86.03
14	2147	-1.92		3.35	3.42	3.24	3.48	9.72	83.63
14	2300	-1.93		3.35	3.42	3.24	3.48	9.70	89.32
15	0400	-1.89		3.37	3.40	3.24	3.50	9.70	83.05
15	0900	-1.89		3.38	3.42	3.26	3.51	9.71	83.71
15	1400	-1.91		3.40	3.44	3.29	3.54	9.72	88.91
15	1900	-1.91		3.38	3.42	3.27	3.52	9.67	83.21
15	2333	-1.90		3.52	3.57	3.42	3.66	9.77	84.79
16	0400	-1.87		3.55	3.61	3.45	3.69	9.75	83.14
16	1050	-1.90		3.54	3.60	3.44	3.68	9.71	92.75

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
16	1500	-1.91		3.55	3.63	3.47	3.70	9.75	84.42
16	1543	-1.91		3.48	3.56	3.39	3.63	9.73	90.53
16	2000	-1.90		3.46	3.55	3.38	3.60	9.69	88.21
17	0100	-1.88		3.45	3.56	3.40	3.62	9.70	90.22
17	0600	-1.88		3.47	3.56	3.39	3.60	9.69	88.53
17	1100	-1.91		3.45	3.56	3.39	3.60	9.70	88.27
17	1252	-1.87		3.54	3.65	3.49	3.70	9.85	86.32
17	1535	-1.94		3.55	3.67	3.49	3.69	9.72	87.95
17	1700	-1.91		3.53	3.67	3.50	3.69	9.69	88.92
17	2200	-1.89		3.54	3.68	3.51	3.70	9.68	88.16
18	0300	-1.88		3.55	3.68	3.50	3.69	9.66	88.66
18	0800	-1.88		3.50	3.64	3.45	3.64	9.68	85.72
18	1300	-1.92		3.53	3.73	3.52	3.74	9.78	87.02
18	1800	-1.92		3.85	3.95	3.73	4.01	9.76	89.55
18	2300	-1.88		4.07	4.16	3.92	4.25	9.73	87.90
19	0400	-1.88		4.77	4.82	4.59	4.93	9.69	85.38
19	0900	-1.90		4.38	5.03	4.81	5.14	9.70	84.66
19	1400	-1.93		5.49	5.15	4.94	5.27	9.71	86.62
19	1900	-1.92		5.18	5.25	5.03	5.39	9.66	87.92
20	0000	-1.90		5.24	5.33	5.11	5.45	9.64	84.83
20	0500	-1.88		5.42	5.48	5.29	5.62	9.66	85.98
20	1000	-1.89		5.58	5.64	5.46	5.81	9.66	87.45
20	1500	-1.93		5.67	5.73	5.55	5.89	9.69	87.22
20	2200	-1.89		5.74	5.82	5.63	5.97	9.65	83.29
21	0300	-1.89		5.86	5.95	5.77	6.08	9.62	84.35
21	0800	-1.90		5.96	6.02	5.86	6.17	9.67	83.42
21	1300	-1.92		6.03	6.08	5.92	6.22	9.68	87.20
21	1600	-1.92		6.06	6.12	5.96	6.27	9.67	86.67
21	2300	-1.89		6.08	6.14	5.98	6.28	9.66	84.73
22	0400	-1.89		6.10	6.16	6.00	6.30	9.66	87.53
22	0900	-1.89		6.12	6.18	6.02	6.29	9.67	87.68
22	1400	-1.93		6.13	6.19	6.03	6.33	9.67	86.47
22	1900	-1.89		6.19	6.25	6.09	6.39	9.74	86.42
23	0000	-1.89		6.23	6.26	6.11	6.40	9.72	84.13
23	0500	-1.88		6.21	6.27	6.11	6.40	9.73	84.44
23	1000	-1.91		6.22	6.28	6.12	6.39	9.74	83.97
23	1500	-1.91		6.23	6.29	6.13	6.38	9.74	83.23
23	2000	-1.90		6.22	6.28	6.12	6.38	9.71	84.38
24	0100	-1.88		6.23	6.30	6.13	6.38	9.72	84.27
24	0600	-1.89		6.24	6.32	6.16	6.44	9.74	84.61
24	1100	-1.90		6.24	6.33	6.17	6.45	9.73	87.20
24	1600	-1.91		6.23	6.32	6.16	6.42	9.71	83.56
24	2100	-1.91		6.23	6.31	6.15	6.41	9.69	85.37
25	0200	-1.90		6.23	6.32	6.17	6.41	9.69	88.53
25	0700	-1.39		6.24	6.32	6.17	6.41	9.69	97.10
25	1200	-1.90		6.24	6.34	6.18	6.41	9.69	85.84

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
25	1700	-1.91		6.24	6.34	6.17	6.42	9.70	84.84
25	2200	-1.90		6.24	6.34	6.17	6.41	9.69	86.24
26	0300	-1.90		6.26	6.36	6.19	6.42	9.71	85.83
26	0800	-1.90		6.26	6.37	6.20	6.42	9.70	87.63
26	1300	-1.91		6.28	6.39	6.22	6.46	9.71	84.80
26	1800	-1.89		6.29	6.39	6.23	6.49	9.69	84.47
26	2300	-1.91		6.29	6.40	6.24	6.50	9.70	87.39
27	0300	-1.90		6.35	6.43	6.27	6.55	9.70	83.33
27	0800	-1.90		6.37	6.46	6.29	6.57	9.72	86.83
27	1300	-1.93		6.36	6.47	6.29	6.57	9.73	86.89
27	1800	-1.92		6.39	6.48	6.33	6.59	9.69	89.81
27	2300	-1.91		6.38	6.47	6.32	6.58	9.70	91.03
28	0400	-1.90		6.38	6.48	6.33	6.59	9.69	87.81
28	0900	-1.91		6.39	6.50	6.37	6.60	9.70	86.87
28	1400	-1.93		6.41	6.54	6.39	6.61	9.73	89.75
28	1900	-1.89		6.43	6.55	6.41	6.65	9.68	88.22
29	0400	-1.90		6.42	6.54	6.41	6.65	9.66	90.17
29	0500	-1.90		6.44	6.56	6.45	6.67	9.69	87.56
29	1000	-1.90		6.45	6.58	6.48	6.68	9.71	86.74
29	1500	-1.93		6.46	6.60	6.49	6.69	9.71	90.72
29	2000	-1.93		6.45	6.59	6.49	6.68	9.69	89.18
30	0100	-1.91		6.46	6.61	6.51	6.69	9.68	86.22
30	0600	-1.92		6.45	6.62	6.52	6.71	9.70	90.38
30	1100	-1.91		6.50	6.68	6.55	6.73	9.70	83.68
30	1600	-1.93		6.49	6.68	6.55	6.72	9.68	86.82
30	2100	-1.92		6.51	6.68	6.57	6.73	9.67	91.52
31	0200	-1.92		6.50	6.69	6.57	6.73	9.67	87.51
31	0700	-1.90		6.52	6.72	6.61	6.75	9.69	91.67
31	1200	-1.91		6.53	6.73	6.63	6.76	9.69	87.91
31	1700	-1.91		6.55	6.75	6.64	6.78	9.68	89.81
31	2200	-1.92		6.55	6.77	6.65	6.78	9.68	91.45
32	0300	-1.92		6.56	6.78	6.66	6.79	9.66	89.28
32	0800	-1.93		6.57	6.80	6.68	6.80	9.66	88.59
32	1300	-1.92		6.60	6.84	6.71	6.83	9.67	87.13
32	1800	-1.94		6.61	6.86	6.72	6.85	9.67	93.91
32	2300	-1.91		6.62	6.88	6.75	6.87	9.66	87.48
33	0400	-1.92		6.67	6.91	6.79	6.91	9.71	91.45
33	0900	-1.91		6.69	6.94	6.82	6.94	9.74	89.49

RAW DATA: RUN 103

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1326	-2.08		.74	.68	.79	.82	10.67	84.12
1	1400	-1.96		.90	.92	.96	1.00	10.62	86.37
1	1500	-1.91		1.04	1.01	1.13	1.11	10.58	84.05
1	1600	-1.92		1.12	1.10	1.22	1.15	10.63	86.72
1	1700	-1.93		1.17	1.14	1.27	1.17	10.61	84.19
1	1800	-1.92		1.21	1.18	1.31	1.25	10.60	84.97
1	1900	-1.92		1.25	1.24	1.36	1.24	10.61	88.78
1	2000	-1.91		1.30	1.29	1.41	1.31	10.62	86.14
1	2100	-1.90		1.34	1.32	1.47	1.35	10.62	86.89
1	2200	-1.91		1.37	1.35	1.51	1.38	10.64	88.34
1	2300	-1.90		1.39	1.37	1.52	1.42	10.63	85.11
2	0000	-1.90		1.42	1.40	1.55	1.43	10.61	85.36
2	0014	-1.90		1.42	1.40	1.55	1.43	10.61	86.24
2	0300	-1.89		1.55	1.51	1.70	1.56	10.67	84.51
2	0800	-1.88		1.62	1.61	1.79	1.62	10.68	83.23
2	1300	-1.91		1.65	1.66	1.85	1.66	10.71	86.87
2	1800	-1.91		1.71	1.72	1.91	1.72	10.68	85.93
2	2300	-1.88		1.74	1.75	1.95	1.75	10.66	86.11
3	0400	-1.88		1.78	1.79	2.01	1.80	10.67	83.70
3	0900	-1.89		1.80	1.80	2.03	1.81	10.66	83.44
3	1400	-1.91		1.73	1.79	2.03	1.79	10.67	85.45
3	1900	-1.91		1.73	1.79	2.02	1.80	10.67	86.06
4	0000	-1.90		1.73	1.77	2.02	1.79	10.68	86.03
4	0500	-1.89		1.76	1.77	2.00	1.79	10.65	84.61
4	1000	-1.89		1.76	1.76	2.00	1.80	10.65	85.23
4	1500	-1.91		1.76	1.75	1.99	1.79	10.67	84.43
4	2000	-1.90		1.75	1.73	1.97	1.79	10.65	84.52
5	0100	-1.89		1.76	1.72	1.97	1.79	10.65	86.31
5	0600	-1.88		1.76	1.75	1.98	1.80	10.69	84.54
5	1100	-1.92		1.76	1.74	1.97	1.79	10.72	84.22
5	1600	-1.92		1.77	1.74	1.98	1.80	10.71	86.71
5	1804	-1.91		1.77	1.74	1.98	1.79	10.67	83.27
5	2100	-1.89		1.78	1.74	1.98	1.79	10.68	83.03
6	0200	-1.89		1.80	1.77	2.00	1.80	10.72	83.03
6	0700	-1.89		1.80	1.77	2.00	1.82	10.76	84.82
6	1200	-1.91		1.80	1.76	1.99	1.82	10.75	83.92
6	1510	-1.90		1.72	1.68	1.91	1.75	10.75	85.74
6	2000	-1.88		1.82	1.78	2.01	1.84	10.75	81.70
7	0100	-1.88		1.80	1.76	1.98	1.82	10.72	83.86
7	0600	-1.89		1.80	1.75	1.98	1.82	10.73	81.43
7	1110	-1.91		1.80	1.74	1.98	1.82	10.76	83.72

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
7	1600	-1.92		1.80	1.75	1.98	1.82	10.77	82.20
7	2100	-1.90		1.80	1.73	1.97	1.82	10.72	83.24
8	0600	-1.90		1.81	1.75	1.98	1.84	10.72	83.99
8	1030	-1.90		1.83	1.76	1.99	1.85	10.75	79.80
8	1500	-1.92		1.82	1.76	1.99	1.85	10.72	82.54
8	2000	-1.91		1.82	1.75	1.98	1.85	10.66	83.97
9	0100	-1.89		1.84	1.78	2.00	1.87	10.65	81.79
9	0600	-1.88		1.85	1.77	2.00	1.88	10.69	83.84
9	1100	-1.89		1.85	1.78	2.02	1.89	10.69	82.24
9	1600	-1.92		1.86	1.78	2.01	1.89	10.69	81.87
9	2100	-1.90		1.85	1.77	2.00	1.88	10.64	83.39
10	0200	-1.90		1.85	1.77	2.01	1.89	10.66	82.52
10	0700	-1.88		1.86	1.78	2.01	1.88	10.66	83.50
10	1200	-1.92		1.85	1.77	2.01	1.89	10.67	84.84
10	1700	-1.91		1.87	1.79	2.02	1.90	10.66	82.09
10	2200	-1.90		1.88	1.80	2.02	1.91	10.67	85.33
11	0300	-1.90		1.88	1.81	2.03	1.92	10.67	85.02
11	0800	-1.89		1.89	1.80	2.03	1.92	10.67	84.43
11	1300	-1.92		1.89	1.80	2.03	1.93	10.68	81.96
11	1800	-1.91		1.90	1.81	2.04	1.93	10.67	85.53
11	2300	-1.91		1.91	1.82	2.06	1.95	10.67	84.20
12	0400	-1.89		1.92	1.82	2.06	1.96	10.65	84.60
12	0900	-1.89		1.95	1.85	2.08	1.97	10.68	83.68
12	1400	-1.91		1.96	1.86	2.09	1.99	10.69	84.41
12	1900	-1.91		1.95	1.87	2.09	1.99	10.66	84.88
13	0000	-1.89		1.98	1.87	2.11	2.01	10.65	85.84
13	0500	-1.89		1.98	1.89	2.12	2.01	10.65	83.36
13	1000	-1.90		2.00	1.90	2.13	2.03	10.67	84.32
13	1414	-1.91		2.09	2.01	2.29	2.16	10.63	83.03
13	1600	-1.92		2.11	2.03	2.30	2.17	10.55	84.62
13	1630	-1.91		2.11	2.03	2.31	2.18	10.53	82.85
13	1700	-1.91		2.12	2.04	2.31	2.18	10.53	84.63
13	2200	-1.87		2.14	2.05	2.33	2.19	10.43	84.50
14	0300	-1.88		2.15	2.06	2.33	2.20	10.48	83.89
14	0800	-1.88		2.16	2.07	2.35	2.22	10.49	83.88
14	1300	-1.87		2.20	2.12	2.39	2.26	10.50	81.61
14	1800	-1.90		2.22	2.14	2.40	2.27	10.49	83.23
14	2147	-1.90		2.30	2.21	2.49	2.35	10.67	83.69
14	2300	-1.90		2.30	2.21	2.49	2.35	10.67	83.15
15	0400	-1.89		2.32	2.23	2.51	2.37	10.67	81.57
15	0900	-1.89		2.34	2.24	2.52	2.39	10.70	83.28
15	1400	-1.91		2.35	2.25	2.53	2.40	10.71	81.99
15	1900	-1.91		2.34	2.25	2.52	2.39	10.67	84.15
15	2333	-1.90		2.45	2.35	2.63	2.50	10.67	73.77
16	0400	-1.97		2.48	2.37	2.65	2.52	10.66	80.27
16	1050	-1.90		2.49	2.39	2.67	2.54	10.69	78.55

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
16	1500	-1.91		2.51	2.41	2.68	2.56	10.71	78.15
16	1543	-1.91		2.44	2.33	2.60	2.48	10.68	81.30
16	2000	-1.90		2.44	2.34	2.60	2.49	10.65	81.72
17	0100	-1.88		2.46	2.35	2.62	2.51	10.66	83.13
17	0600	-1.88		2.45	2.35	2.61	2.50	10.66	83.07
17	1100	-1.91		2.44	2.34	2.61	2.49	10.66	83.45
17	1252	-1.87		2.65	2.54	2.82	2.70	10.80	75.37
17	1535	-1.94		2.52	2.41	2.69	2.57	10.70	82.87
17	1700	-1.91		2.54	2.44	2.72	2.59	10.69	80.66
17	2200	-1.89		2.60	2.50	2.77	2.64	10.67	78.03
18	0300	-1.88		2.64	2.53	2.82	2.67	10.65	78.43
18	0800	-1.88		2.70	2.60	2.88	2.75	10.65	81.14
18	1300	-1.92		2.76	2.65	2.92	2.81	10.66	80.52
18	1800	-1.92		3.08	2.95	3.21	3.14	10.65	81.18
18	2300	-1.88		3.26	3.11	3.39	3.31	10.64	80.22
19	0400	-1.88		4.19	4.00	4.28	4.23	10.62	79.19
19	0900	-1.90		4.47	4.29	4.55	4.51	10.65	79.08
19	1400	-1.93		4.45	4.24	4.49	4.47	10.66	79.61
19	1900	-1.92		4.43	4.23	4.48	4.47	10.63	82.61
20	0000	-1.90		4.38	4.19	4.45	4.45	10.62	81.62
20	0500	-1.88		4.61	4.42	4.67	4.68	10.60	82.22
20	1000	-1.89		5.16	5.02	5.30	5.25	10.61	81.72
20	1500	-1.93		5.20	5.07	5.32	5.25	10.64	79.86
20	2200	-1.89		5.18	5.07	5.30	5.21	10.62	82.01
21	0300	-1.89		5.46	5.34	5.53	5.46	10.59	80.30
21	0800	-1.90		5.37	5.28	5.43	5.29	10.63	81.15
21	1300	-1.92		5.33	5.23	5.38	5.25	10.64	81.06
21	1800	-1.92		5.28	5.17	5.33	5.12	10.60	80.80
21	2300	-1.89		5.27	5.16	5.31	5.10	10.63	81.71
22	0400	-1.89		5.23	5.17	5.33	5.14	10.62	81.02
22	0900	-1.89		5.23	5.17	5.33	5.14	10.63	80.78
22	1400	-1.93		5.23	5.10	5.25	5.07	10.64	82.21
22	1900	-1.89		5.34	5.21	5.38	5.19	10.60	82.31
23	0000	-1.89		5.33	5.18	5.31	5.15	10.60	79.33
23	0500	-1.88		5.23	5.16	5.31	5.14	10.62	79.82
23	1000	-1.91		5.26	5.13	5.30	5.13	10.62	80.26
23	1500	-1.91		5.24	5.09	5.27	5.12	10.63	82.25
23	2100	-1.90		5.20	5.05	5.24	5.09	10.60	81.56
24	0100	-1.98		5.25	5.09	5.29	5.14	10.67	79.30
24	0600	-1.89		5.25	5.09	5.29	5.15	10.67	79.42
24	1100	-1.90		5.24	5.08	5.28	5.14	10.65	79.74
24	1600	-1.91		5.15	4.98	5.18	5.04	10.63	83.85
24	2100	-1.91		5.05	4.94	5.17	5.02	10.63	83.35
25	0200	-1.90		5.06	4.90	5.13	4.98	10.68	81.63
25	0700	-1.89		5.07	4.91	5.15	5.00	10.62	83.00
25	1200	-1.90		5.05	4.90	5.14	4.99	10.62	80.98

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
25	1700	-1.91		5.04	4.89	5.13	4.99	10.63	81.60
25	2200	-1.90		5.01	4.84	5.09	4.96	10.63	80.46
26	0300	-1.90		5.04	4.87	5.11	4.99	10.63	81.21
26	0800	-1.90		5.05	4.88	5.13	4.99	10.63	82.00
26	1300	-1.91		5.12	4.96	5.19	5.06	10.64	80.26
26	1800	-1.89		5.14	5.00	5.21	5.10	10.62	80.43
26	2300	-1.91		5.14	4.98	5.21	5.09	10.63	79.65
27	0300	-1.90		5.12	4.97	5.20	5.07	10.62	81.86
27	0800	-1.90		5.15	5.01	5.25	5.13	10.64	81.45
27	1300	-1.93		5.17	5.04	5.26	5.15	10.64	84.09
27	1800	-1.92		5.16	5.03	5.26	5.16	10.62	81.85
27	2300	-1.91		5.19	5.06	5.28	5.18	10.63	82.01
28	0400	-1.90		5.21	5.08	5.30	5.19	10.62	82.49
28	0900	-1.91		5.22	5.09	5.31	5.20	10.62	81.62
28	1400	-1.93		5.24	5.10	5.33	5.23	10.64	80.91
28	1900	-1.89		5.24	5.11	5.34	5.24	10.61	84.64
29	0000	-1.90		5.23	5.09	5.32	5.21	10.60	82.74
29	0500	-1.90		5.24	5.10	5.33	5.23	10.63	80.59
29	1000	-1.90		5.27	5.12	5.36	5.26	10.64	81.23
29	1500	-1.93		5.25	5.12	5.36	5.26	10.64	83.15
29	2000	-1.93		5.24	5.11	5.34	5.25	10.62	82.47
30	0100	-1.91		5.25	5.11	5.35	5.25	10.63	82.89
30	0600	-1.92		5.27	5.13	5.36	5.27	10.64	83.85
30	1100	-1.91		5.23	5.15	5.39	5.30	10.64	83.79
30	1600	-1.93		5.29	5.15	5.39	5.29	10.64	81.64
30	2100	-1.92		5.29	5.15	5.38	5.29	10.61	84.37
31	0200	-1.92		5.29	5.14	5.38	5.28	10.60	84.06
31	0700	-1.90		5.33	5.17	5.42	5.33	10.62	84.86
31	1200	-1.91		5.23	5.15	5.39	5.30	10.60	85.11
31	1700	-1.91		5.29	5.15	5.38	5.30	10.59	83.45
31	2200	-1.92		5.29	5.14	5.38	5.29	10.61	82.81
32	0300	-1.92		5.31	5.16	5.41	5.31	10.58	84.05
32	0800	-1.93		5.34	5.19	5.43	5.33	10.58	81.46
32	1300	-1.92		5.36	5.21	5.45	5.37	10.59	83.00
32	1800	-1.94		5.36	5.19	5.45	5.36	10.59	84.46
32	2300	-1.91		5.38	5.22	5.47	5.38	10.59	85.54
33	0400	-1.92		5.45	5.28	5.54	5.46	10.68	83.28
33	0900	-1.91		5.50	5.33	5.59	5.50	10.72	82.73

RAW DATA: RUN 104

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1326	-2.08	0.00	.13		.15	.72	8.06	69.81
1	1400	-1.96	0.00	.19		.21	.76	7.99	70.20
1	1500	-1.91	0.00	.22		.22	.79	7.95	70.18
1	1600	-1.92	0.00	.21		.24	.82	7.96	70.17
1	1700	-1.93	0.00	.22		.20	.79	7.92	70.06
1	1800	-1.92	0.00	.24		.23	.83	7.87	69.87
1	1900	-1.92	0.00	.26		.23	.86	7.95	70.15
1	2000	-1.91	0.00	.27		.28	.90	7.95	69.91
1	2100	-1.90	0.00	.30		.27	.93	7.95	69.89
1	2200	-1.91	0.00	.33		.29	.95	7.97	69.87
1	2300	-1.90	0.00	.34		.28	.96	7.95	69.54
2	0000	-1.90	0.00	.35		.29	1.02	7.93	69.58
2	0014	-1.90	0.00	.35		.30	1.00	7.93	69.56
2	0300	-1.89	0.00	.43		.34	1.10	8.00	69.38
2	0800	-1.88	0.00	.52		.41	1.22	7.99	69.12
2	1300	-1.91	0.00	.59		.47	1.33	8.07	68.38
2	1800	-1.91	0.00	.66		.50	1.41	8.07	69.19
2	2300	-1.88	0.00	.74		.55	1.49	8.06	69.15
3	0400	-1.88	0.00	.79		.57	1.54	8.06	69.19
3	0900	-1.89	0.00	.83		.62	1.59	8.06	68.57
3	1400	-1.91	0.00	.85		.63	1.62	8.06	68.64
3	1900	-1.91	0.00	.87		.64	1.62	8.08	68.98
4	0000	-1.90	0.00	.89		.67	1.67	8.07	68.68
4	0500	-1.89	0.00	.90		.65	1.65	8.05	68.66
4	1000	-1.89	0.00	.89		.68	1.68	8.05	68.87
4	1500	-1.91	0.00	.89		.67	1.64	8.06	68.93
4	2000	-1.90	0.00	.87		.68	1.64	8.06	69.23
5	0100	-1.88	0.00	.89		.69	1.63	8.04	69.08
5	0600	-1.88	0.00	.92		.74	1.71	8.11	68.47
5	1100	-1.92	0.00	.91		.75	1.69	8.12	68.51
5	1600	-1.92	0.00	.89		.72	1.66	8.05	68.29
5	1804	-1.91	0.00	.86		.72		8.02	68.73
5	2100	-1.89	0.00	.89		.73		8.02	68.65
6	0200	-1.89	0.00	.90		.76		8.09	68.54
6	0700	-1.89	0.00	.90		.79		8.10	68.26
6	1200	-1.91	0.00	.88		.79		8.10	68.47
6	1510	-1.90	0.00	.76		.67		8.09	71.21
6	2000	-1.88	0.00	.90		.81		8.09	68.89
7	0100	-1.88	0.00	.89		.81		8.08	68.72
7	0600	-1.89	0.00	.89		.82		8.08	68.58
7	1110	-1.91	0.00	.88		.86		8.09	68.30

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
7	1600	-1.92	0.00	.87		.88		8.11	68.66
7	2100	-1.90	0.00	.87		.98		8.07	69.02
8	0600	-1.90	0.00	.90		1.25		8.07	68.54
8	1030	-1.90	0.00	.90		1.23		8.09	68.00
8	1500	-1.92	0.00	.90		1.21		8.10	68.50
8	2000	-1.91	0.00	.89		1.22		8.07	68.47
9	0100	-1.89	0.00	.91		1.24		8.06	68.60
9	0600	-1.88	0.00	.92				8.07	68.38
9	1100	-1.89	0.00	.94				8.07	68.46
9	1600	-1.92	0.00	.91				8.08	68.71
9	2100	-1.90	0.00	.91				8.04	68.63
10	0200	-1.90	0.00	.91				8.05	68.64
10	0700	-1.88	0.00	.93				8.05	69.13
10	1200	-1.92	0.00	.90				8.05	69.04
10	1700	-1.91	0.00	.90				8.06	69.02
10	2200	-1.90	0.00	.91				8.06	68.95
11	0300	-1.90	0.00	.93				8.06	69.76
11	0800	-1.89	0.00	.94				8.06	69.29
11	1300	-1.92	0.00	.93				8.06	69.49
11	1800	-1.91	0.00	.94				8.06	69.53
11	2300	-1.91	0.00	.94				8.05	69.30
12	0400	-1.89	0.00	.97				8.06	69.66
12	0900	-1.89	0.00	1.00				8.08	69.55
12	1400	-1.91	0.00	.99				8.08	69.60
12	1900	-1.91	0.00	.99				8.07	69.98
13	0000	-1.89	0.00	1.02				8.06	69.95
13	0500	-1.89	0.00	1.04				8.06	69.73
13	1000	-1.90	0.00	1.06				8.07	69.59
13	1414	-1.91	0.00	1.20				8.06	69.30
13	1600	-1.92	0.00	1.25				8.01	69.73
13	1630	-1.91	0.00	1.26				7.99	69.76
13	1700	-1.91	0.00	1.26				8.00	69.40
13	2200	-1.87	0.00	1.30				7.96	69.59
14	0300	-1.88	0.00	1.32				7.95	69.21
14	0800	-1.88	0.00	1.32				7.94	68.22
14	1300	-1.87	0.00	1.35				7.94	69.53
14	1800	-1.90	0.00	1.34				7.94	69.42
14	2147	-1.90	0.00	1.39				8.03	69.61
14	2300	-1.90	0.00	1.38				8.03	69.64
15	0400	-1.89	0.00	1.40				8.02	69.40
15	0900	-1.89	0.00	1.40				8.04	69.59
15	1400	-1.91	0.00	1.40				8.05	69.65
15	1900	-1.91	0.00	1.39				8.03	70.14
15	2333	-1.90	0.00	1.54				8.02	66.73
16	0400	-1.87	0.00	1.63				8.03	67.75
16	1050	-1.90	0.00	1.59				8.10	66.67

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
16	1500	-1.91	0.00	1.57				8.09	66.67
16	1543	-1.91	0.00	1.43				8.06	69.77
16	2000	-1.90	0.00	1.44				8.04	69.75
17	0100	-1.88	0.00	1.46				8.02	69.39
17	0600	-1.88	0.00	1.45				8.02	69.71
17	1100	-1.91	0.00	1.44				8.03	69.57
17	1252	-1.87	0.00	1.50				8.12	68.42
17	1535	-1.94	0.00	1.41				8.05	67.65
17	1700	-1.91	0.00	1.44				8.03	66.77
17	2200	-1.89	0.00	1.46				8.01	67.27
18	0300	-1.88	0.00	1.50				8.00	66.53
18	0800	-1.88	0.00	1.36				8.02	67.02
18	1300	-1.92	0.00	1.32				8.02	66.80
18	1800	-1.92	0.00	1.50				8.03	66.56
18	2300	-1.88	0.00	1.67				8.02	66.76
19	0400	-1.88	0.00	2.39				8.00	66.52
19	0900	-1.90	0.00	2.68				8.03	66.63
19	1400	-1.93	0.00	2.67				8.04	66.24
19	1900	-1.92	0.00	2.67				8.02	66.43
20	0000	-1.90	0.00	2.70				8.00	66.40
20	0500	-1.88	0.00	2.86				8.02	66.41
20	1000	-1.89	0.00	3.24				8.03	66.58
20	1500	-1.93	0.00	3.27				8.05	66.74
20	2200	-1.89	0.00	3.33				8.04	66.80
21	0300	-1.89	0.00	3.58				8.01	66.44
21	0800	-1.90	0.00	3.64				8.04	66.63
21	1300	-1.92	0.00	3.63				8.04	66.83
21	1800	-1.92	0.00	3.60				8.03	67.10
21	2300	-1.89	0.00	3.63				8.03	66.60
22	0400	-1.89	0.00	3.66				8.02	66.72
22	0900	-1.89	0.00	3.67				8.04	66.41
22	1400	-1.93	0.00	3.64				8.04	66.30
22	1900	-1.89	0.00	3.76				8.01	66.27
23	0000	-1.89	0.00	3.76				8.01	66.23
23	0500	-1.88	0.00	3.76				8.03	66.15
23	1000	-1.91	0.00	3.74				8.02	66.08
23	1500	-1.91	0.00	3.72				8.03	66.47
23	2000	-1.90	0.00	3.72				8.01	66.45
24	0100	-1.88	0.00	3.76				8.07	66.04
24	0600	-1.89	0.00	3.77				8.06	66.41
24	1100	-1.90	0.00	3.76				8.06	66.57
24	1600	-1.91	0.00	3.73				8.04	66.04
24	2100	-1.91	0.00	3.73				8.03	65.83
25	0200	-1.90	0.00	3.74				8.03	66.30
25	0700	-1.89	0.00	3.75				8.03	66.31
25	1200	-1.90	0.00	3.74				8.03	66.29

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
25	1700	-1.91	0.00	3.73				8.04	66.25
25	2200	-1.90	0.00	3.73				8.03	65.94
26	0300	-1.90	0.00	3.73				8.03	65.97
26	0800	-1.90	0.00	3.73				8.03	66.17
26	1300	-1.91	0.00	3.75				8.04	65.58
26	1800	-1.89	0.00	3.77				8.02	65.94
26	2300	-1.91	0.00	3.76				8.03	65.96
27	0300	-1.90	0.00	3.73				8.03	67.04
27	0800	-1.90	0.00	3.76				8.05	67.33
27	1300	-1.93	0.00	3.74				8.03	67.42
27	1800	-1.92	0.00	3.73				8.01	67.45
27	2300	-1.91	0.00	3.75				8.02	67.18
28	0400	-1.90	0.00	3.76				8.02	66.60
28	0900	-1.91	0.00	3.77				8.02	67.13
28	1400	-1.93	0.00	3.75				8.04	67.31
28	1900	-1.89	0.00	3.76				8.01	66.96
29	0000	-1.90	0.00	3.74				8.00	68.00
29	0500	-1.90	0.00	3.76				8.02	67.09
29	1000	-1.90	0.00	3.77				8.03	67.25
29	1500	-1.93	0.00	3.74				8.02	66.85
29	2000	-1.93	0.00	3.73				8.02	67.17
30	0100	-1.91	0.00	3.74				8.01	67.82
30	0600	-1.92	0.00	3.75				8.02	66.93
30	1100	-1.91	0.00	3.76				8.03	67.16
30	1600	-1.93	0.00	3.72				8.01	67.48
30	2100	-1.92	0.00	3.72				8.00	67.60
31	0200	-1.92	0.00	3.71				8.00	67.41
31	0700	-1.90	0.00	3.75				8.01	67.97
31	1200	-1.91	0.00	3.74				8.01	67.35
31	1700	-1.91	0.00	3.73				8.00	67.89
31	2200	-1.92	0.00	3.71				8.01	67.06
32	0300	-1.92	0.00	3.71				7.99	67.31
32	0800	-1.93	0.00	3.71				7.99	67.23
32	1300	-1.92	0.00	3.71				7.99	67.69
32	1800	-1.94	0.00	3.69				8.00	67.71
32	2300	-1.91	0.00	3.71				7.99	67.97
33	0400	-1.92	0.00	3.78				8.10	67.82
33	0900	-1.91	0.00	3.82				8.12	67.23

RAW DATA: RUN 105

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1202	-2.24		.37	.19		.45	9.91	101.69
1	1300	-2.14		.40	.21		.48	9.84	105.64
1	1400	-2.10		.43	.20		.52	9.81	105.79
1	1412	-2.09		.50	.31		.59	9.91	105.22
1	1600	-2.07		.55	.37		.63	9.86	106.88
1	1800	-2.06		.70	.48		.76	9.91	105.17
1	2000	-2.03		.86	.60		.90	9.88	107.95
1	2143	-2.01		1.00	.72		1.07	9.89	109.20
2	0200	-2.02		1.26	.91		1.41	9.87	106.30
2	0700	-2.03		1.37	.97		1.59	9.91	106.45
2	1200	-2.09		1.34	.93		1.56	9.90	107.85
2	1700	-2.03		1.36	.96		1.60	9.90	106.41
2	2200	-1.99		1.36	.96		1.59	9.89	108.95
2	2253	-1.98		1.43	1.02		1.67	9.93	105.18
3	1153	-2.11		1.34	.92		1.58	9.93	108.05
4	2142	-2.09		1.53	1.13		1.74	9.94	98.66
5	0200	-2.07		1.65	1.25		1.83	9.80	98.58
5	0700	-2.09		1.73	1.34		1.90	9.81	100.97
5	1200	-2.15		1.68	1.31		1.86	9.81	98.45
5	1700	-2.07		1.76	1.38		1.93	9.90	98.82
5	2200	-2.07		1.70	1.35		1.89	9.89	99.53
6	0300	-2.06		1.48	1.14		1.67	9.86	104.61
6	0800	-2.06		1.45	1.11		1.63	9.88	104.61
6	1300	-2.06		1.40	1.06		1.59	9.89	108.40
6	1800	-2.09		1.39	1.03		1.58	9.95	107.99
6	2215	-2.08		1.40	1.04		1.60	9.96	106.32
7	0300	-2.08		1.37	1.01		1.56	9.92	104.95
7	0800	-2.11		1.35	.98		1.55	9.95	104.13
7	1300	-2.08		1.35	.98		1.55	9.96	106.11
7	1800	-2.10		1.33	.96		1.54	9.94	104.56
7	2300	-2.08		1.33	.96		1.54	9.93	103.29
8	0400	-2.08		1.31	.94		1.52	9.91	107.05
8	0900	-2.09		1.30	.93		1.51	9.95	105.67
8	1400	-2.08		1.31	.93		1.52	9.95	104.90
8	1900	-2.03		1.32	.94		1.52	9.92	109.97
9	0000	-2.03		1.31	.94		1.52	9.92	112.12
9	0500	-2.02		1.30	.93		1.50	9.92	109.27
9	1000	-2.07		1.25	.88		1.46	9.94	107.90
9	1500	-2.08		1.24	.87		1.45	9.93	109.27
9	2000	-2.02		1.28	.91		1.49	9.92	110.72
10	0100	-2.01		1.29	.92		1.50	9.93	106.73

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
10	0600	-2.00		1.28	.91		1.49	9.92	108.51
10	1100	-2.00		1.29	.91		1.49	9.94	111.66
10	1600	-2.00		1.26	.89		1.47	9.93	108.58
10	2100	-2.02		1.22	.85		1.44	9.90	111.14
11	0200	-2.03		1.23	.86		1.45	9.92	105.08
11	0700	-2.04		1.23	.86		1.45	9.92	108.52
11	1200	-2.04		1.25	.87		1.46	9.93	105.76
11	1700	-2.02		1.26	.89		1.48	9.92	105.93
11	2200	-2.01		1.28	.89		1.49	9.91	106.76
12	0300	-2.01		1.27	.89		1.49	9.90	107.13
12	0800	-2.05		1.26	.88		1.49	9.94	105.51
12	1300	-2.09		1.25	.86		1.47	9.94	107.70
12	1800	-2.07		1.28	.89		1.50	9.91	107.97
12	2300	-2.06		1.30	.91		1.52	9.91	104.37
13	0400	-2.06		1.30	.91		1.52	9.90	103.90
13	0900	-2.08		1.30	.91		1.53	9.92	105.04
13	1400	-2.09		1.31	.92		1.53	9.93	104.94
13	1900	-2.09		1.30	.91		1.52	9.90	105.30
14	0000	-1.85		1.51	1.11		1.73	9.89	103.60
14	0500	-1.85		1.55	1.15		1.77	9.91	105.10
14	1000	-1.84		1.58	1.19		1.81	9.92	104.50
14	1500	-2.03		1.44	1.04		1.66	9.92	105.32
14	2000	-2.09		1.39	.99		1.61	9.87	102.15
15	0100	-2.08		1.40	1.00		1.62	9.89	103.94
15	0600	-2.11		1.38	.98		1.61	9.90	106.76
15	1100	-2.09		1.38	.99		1.62	9.87	104.65
15	1600	-2.06		1.42	1.01		1.64	9.88	107.70
15	2100	-2.12		1.39	.98		1.61	9.90	105.42
16	0200	-2.14		1.37	.97		1.60	9.88	103.65
16	0700	-2.18		1.35	.95		1.58	9.89	105.96
16	1200	-2.14		1.38	.98		1.62	9.89	105.10
16	1700	-2.10		1.43	1.02		1.67	9.90	103.46
16	2200	-2.14		1.40	.99		1.64	9.89	105.09
17	0300	-2.18		1.37	.96		1.62	9.88	101.59
17	0800	-2.21		1.36	.94		1.60	9.87	104.77
17	1300	-2.16		1.40	.98		1.63	9.87	104.29
17	1800	-2.15		1.42	1.00		1.66	9.88	105.04
17	2300	-2.18		1.40	.98		1.63	9.87	105.81
18	0400	-2.20		1.38	.97		1.62	9.85	106.86
18	0900	-2.19		1.41	.99		1.65	9.89	103.05
18	1400	-2.12		1.46	1.04		1.70	9.87	106.36
18	1900	-2.13		1.47	1.05		1.72	9.89	105.94
19	0000	-2.14		1.46	1.04		1.70	9.88	105.18
19	0500	-2.17		1.45	1.03		1.69	9.87	105.88
19	1000	-2.16		1.48	1.05		1.72	9.92	104.95
19	1500	-2.11		1.51	1.09		1.76	9.90	106.05

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
19	2000	-2.11		1.52	1.09		1.76	9.88	103.34
20	0100	-1.87		1.71	1.28		1.95	9.86	109.90
20	0600	-2.07		1.55	1.13		1.80	9.89	106.54
20	1100	-2.08		1.55	1.13		1.79	9.90	112.34
20	1600	-2.04		1.59	1.15		1.82	9.91	109.37
20	2100	-2.04		1.59	1.16		1.83	9.89	111.88
21	0200	-2.00		1.65	1.21		1.89	9.95	108.99
21	0700	-2.00		1.67	1.23		1.92	9.98	109.32
21	1200	-2.02		1.66	1.22		1.91	9.96	108.48

RAW DATA1 RUN 106

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1202	-2.24		.63		.35	.32	9.78	99.19
1	1300	-2.14		.72		.41	.43	9.73	101.61
1	1400	-2.10		.80		.49	.45	9.73	101.44
1	1412	-2.09		.80		.49	.45	9.79	104.49
1	1600	-2.07		1.02		.69	.64	9.86	103.67
1	1800	-2.06		1.21		.83	.79	9.91	105.17
1	2000	-2.03		1.40		1.02	.97	9.79	104.23
1	2143	-2.01		1.58		1.18	1.13	9.81	103.50
2	0200	-2.02		1.82		1.38	1.34	9.81	105.37
2	0700	-2.03		1.87		1.45	1.41	9.85	104.17
2	1200	-2.09		1.79		1.39	1.35	9.84	103.01
2	1700	-2.03		1.77		1.38	1.36	9.85	106.77
2	2200	-1.99		1.73		1.35	1.33	9.86	103.88
2	2253	-1.98		1.77		1.38	1.43	9.83	100.77
3	1153	-2.11		1.76		1.38	1.42	9.82	95.31
4	2142	-2.09		1.62		1.22	1.29	9.81	104.26
5	0200	-2.07		1.72		1.31	1.36	9.73	102.05
5	0700	-2.09		1.79		1.38	1.39	9.76	100.93
5	1200	-2.15		1.74		1.35	1.35	9.75	100.88
5	1700	-2.07		1.79		1.41	1.39	9.78	102.56
5	2200	-2.07		1.75		1.38	1.37	9.78	104.38
6	0300	-2.06		1.68		1.32	1.28	9.76	107.11
6	0800	-2.06		1.62		1.26	1.23	9.79	107.27
6	1300	-2.06		1.58		1.21	1.19	9.80	102.19
6	1800	-2.09		1.53		1.15	1.13	9.78	105.68
6	2215	-2.08		1.55		1.18	1.15	9.78	101.91
7	0300	-2.08		1.53		1.16	1.13	9.75	102.23
7	0800	-2.11		1.51		1.13	1.11	9.78	105.66
7	1300	-2.08		1.50		1.14	1.11	9.79	103.15
7	1800	-2.10		1.49		1.13	1.10	9.77	104.19
7	2300	-2.08		1.49		1.13	1.10	9.76	104.83
8	0400	-2.08		1.49		1.12	1.09	9.75	105.74
8	0900	-2.09		1.47		1.10	1.06	9.78	102.33
8	1400	-2.08		1.48		1.11	1.07	9.78	106.22
8	1900	-2.03		1.53		1.17	1.14	9.75	105.89
9	0000	-2.03		1.54		1.17	1.13	9.77	99.90
9	0500	-2.02		1.53		1.16	1.13	9.77	100.03
9	1000	-2.07		1.48		1.11	1.07	9.80	103.30
9	1500	-2.08		1.47		1.10	1.06	9.78	101.95
9	2000	-2.02		1.51		1.14	1.11	9.77	101.69
10	0100	-2.01		1.51		1.15	1.11	9.78	103.58

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
10	0600	-2.00		1.50		1.15	1.10	9.77	106.04
10	1100	-2.00		1.51		1.15	1.11	9.79	103.71
10	1600	-2.00		1.48		1.13	1.08	9.78	105.92
10	2100	-2.02		1.45		1.10	1.05	9.76	106.41
11	0200	-2.03		1.45		1.09	1.05	9.76	106.79
11	0700	-2.04		1.46		1.09	1.05	9.78	106.44
11	1200	-2.04		1.46		1.11	1.06	9.78	108.04
11	1700	-2.02		1.48		1.12	1.08	9.77	104.70
11	2200	-2.01		1.49		1.13	1.07	9.78	102.45
12	0300	-2.01		1.49		1.13	1.09	9.76	107.10
12	0800	-2.05		1.50		1.13	1.08	9.80	106.11
12	1300	-2.09		1.47		1.11	1.05	9.80	106.84
12	1800	-2.07		1.50		1.14	1.08	9.78	108.07
12	2300	-2.06		1.53		1.15	1.11	9.77	107.26
13	0400	-2.06		1.52		1.15	1.11	9.77	106.74
13	0900	-2.08		1.51		1.15	1.10	9.79	106.79
13	1400	-2.09		1.53		1.16	1.12	9.79	107.23
13	1900	-2.09		1.53		1.16	1.11	9.77	102.10
14	0000	-1.85		1.74		1.36	1.32	9.76	104.73
14	0500	-1.84		1.76		1.39	1.33	9.77	107.02
14	1000	-1.84		1.78		1.41	1.35	9.78	105.13
14	1500	-2.03		1.63		1.25	1.21	9.79	105.56
14	2000	-2.09		1.58		1.20	1.15	9.74	105.83
15	0100	-2.08		1.59		1.21	1.17	9.77	107.07
15	0600	-2.11		1.57		1.20	1.16	9.79	103.39
15	1100	-2.09		1.58		1.21	1.18	9.75	102.76
15	1600	-2.06		1.61		1.23	1.19	9.76	107.84
15	2100	-2.12		1.59		1.21	1.15	9.78	103.70
16	0200	-2.14		1.58		1.20	1.15	9.76	104.01
16	0700	-2.18		1.56		1.19	1.13	9.77	105.94
16	1200	-2.14		1.59		1.21	1.17	9.76	104.08
16	1700	-2.10		1.64		1.26	1.21	9.78	104.18
16	2200	-2.14		1.61		1.23	1.19	9.77	104.31
17	0300	-2.18		1.59		1.21	1.16	9.76	105.89
17	0800	-2.21		1.57		1.19	1.13	9.75	105.70
17	1300	-2.16		1.61		1.23	1.18	9.74	104.02
17	1800	-2.15		1.63		1.25	1.20	9.76	106.04
17	2300	-2.18		1.60		1.23	1.18	9.75	102.16
18	0400	-2.20		1.60		1.21	1.17	9.73	103.81
18	0900	-2.19		1.63		1.24	1.19	9.76	103.75
18	1400	-2.12		1.68		1.30	1.24	9.75	104.22
18	1900	-2.13		1.70		1.31	1.26	9.78	104.49
19	0000	-2.14		1.67		1.29	1.24	9.75	105.74
19	0500	-2.17		1.67		1.28	1.22	9.75	103.88
19	1000	-2.16		1.70		1.31	1.25	9.78	104.21
19	1500	-2.11		1.73		1.34	1.29	9.77	107.43

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
19	2000	-2.11		1.74		1.35	1.30	9.76	107.04
20	0100	-1.87			2.04	1.64	1.59	9.75	102.37
20	0600	-2.07			1.88	1.49	1.43	9.77	102.47
20	1100	-2.08			1.88	1.49	1.43	9.79	102.54
20	1600	-2.04			1.91	1.51	1.46	9.79	100.55
20	2100	-2.03			1.91	1.52	1.46	9.77	103.99
21	0200	-2.00			1.93	1.54	1.49	9.76	102.56
21	0700	-2.00			1.96	1.56	1.51	9.79	103.23
21	1200	-2.02			1.95	1.55	1.50	9.78	105.31

RAW DATA: RUN 107

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	2208	-1.86		.40	.42	.52	.40	7.97	88.24
1	2215	-1.86		.42	.41	.52	.39	8.01	89.96
1	2300	-1.85		.40	.42	.51	.38	7.96	88.04
2	0600	-1.85		.41	.42	.54	.40	7.93	88.48
2	0100	-1.85		.42	.44	.57	.41	7.92	90.55
2	0158	-1.85		.44	.46	.59	.42	7.89	88.34
2	0600	-1.86		.55	.56	.69	.52	7.97	90.91
2	1100	-1.87		.66	.68	.79	.63	7.97	88.69
2	1600	-1.88		.78	.80	.91	.75	7.97	86.66
2	2100	-1.85		.88	.89	.98	.83	7.95	87.44
3	0200	-1.85		1.07	1.11	1.14	.99	7.98	88.75
3	0700	-1.85		1.40	1.44	1.38	1.25	8.01	87.98
3	1200	-1.84		1.78	1.81	1.74	1.65	8.00	85.74
3	1700	-1.87		2.08	2.11	2.03	1.97	7.99	86.23
3	2200	-1.87		2.38	2.40	2.31	2.27	8.00	85.86
4	0300	-1.85		2.77	2.78	2.69	2.66	7.98	83.07
4	0800	-1.88		3.01	3.03	2.92	2.92	8.00	81.60
4	1300	-1.87		3.22	3.24	3.12	3.12	8.01	81.67
4	1800	-1.86		3.38	3.40	3.27	3.29	7.98	82.39
4	2300	-1.87		3.57	3.58	3.44	3.47	8.00	82.52
5	0400	-1.85		3.75	3.77	3.62	3.65	8.00	80.47
5	0900	-1.85		3.90	3.92	3.75	3.81	8.02	82.74
5	1400	-1.86		4.05	4.07	3.90	3.96	8.02	82.44
5	1900	-1.86		4.05	4.07	3.89	3.95	8.02	88.03
6	0000	-1.86		4.20	4.22	4.02	4.10	8.02	87.52
6	0500	-1.85		4.36	4.38	4.18	4.26	8.00	87.07
6	1000	-1.85		4.52	4.54	4.32	4.42	8.00	87.70
6	1500	-1.87		4.64	4.66	4.43	4.54	7.99	87.45
6	2000	-1.86		4.81	4.81	4.57	4.69	7.99	86.70
6	2326	-1.80		4.92	4.93	4.68	4.81	7.98	83.24
7	0400	-1.73		5.22	5.25	5.00	5.12	7.98	78.21
7	0900	-1.74		5.28	5.30	5.05	5.18	7.99	78.59
7	1400	-1.71		5.33	5.35	5.09	5.22	8.00	78.91
7	1900	-1.70		5.33	5.36	5.11	5.24	7.99	78.47
8	0000	-1.75		5.31	5.34	5.08	5.20	7.97	79.15
8	0500	-1.86		5.34	5.38	5.11	5.23	7.97	77.02
8	1000	-1.87		5.35	5.38	5.12	5.25	8.00	77.61
8	1500	-1.89		5.33	5.36	5.10	5.23	7.99	77.01
8	2000	-1.89		5.33	5.35	5.08	5.21	7.98	77.14
9	0100	-1.88		5.32	5.35	5.08	5.21	7.96	77.87
9	0600	-1.86		5.37	5.41	5.14	5.26	7.98	77.99

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
9	1400	-1.89		5.05	5.09	4.83	4.95	8.00	85.39
9	1900	-1.89		5.00	5.03	4.77	4.89	7.98	86.71
10	0600	-1.84		4.99	5.03	4.77	4.88	7.97	85.62
10	0500	-1.86		4.97	5.00	4.73	4.86	7.97	85.23
10	1000	-1.87		4.99	5.02	4.75	4.88	8.01	85.16
10	1500	-1.89		4.96	4.99	4.72	4.85	7.99	86.05
10	2100	-1.85		5.08	5.12	4.84	4.97	7.94	83.25
11	0200	-1.84		5.00	5.03	4.76	4.89	7.94	82.34
11	0700	-1.85		5.00	5.03	4.75	4.89	7.96	82.03
11	1200	-1.87		5.01	5.03	4.75	4.89	7.97	84.87
11	1700	-1.87		4.94	4.95	4.67	4.82	7.95	85.82
11	2200	-1.84		4.98	4.99	4.71	4.86	7.95	84.66
12	0300	-1.84		4.90	4.92	4.64	4.78	7.93	89.37
12	0800	-1.85		4.91	4.93	4.65	4.80	7.96	91.28
12	1300	-1.88		4.87	4.89	4.61	4.76	7.95	89.49
12	1800	-1.89		4.88	4.89	4.61	4.75	7.95	89.30
12	2300	-1.87		4.90	4.91	4.63	4.77	7.95	89.66
13	0400	-1.85		4.92	4.93	4.65	4.80	7.96	88.64
13	0900	-1.86		4.92	4.94	4.65	4.80	7.95	88.15
13	1400	-1.87		4.97	4.98	4.69	4.84	8.03	89.61
13	1900	-1.88		4.96	4.98	4.69	4.84	8.04	90.37
14	0000	-1.85		4.99	5.01	4.72	4.87	8.04	89.54
14	0500	-1.85		5.01	5.03	4.73	4.88	8.06	91.70
14	1000	-1.89		4.98	5.00	4.70	4.86	8.07	89.49
14	1500	-1.87		4.96	4.97	4.68	4.83	8.05	90.57
14	2000	-1.86		4.93	4.95	4.66	4.81	8.03	90.98

RAW DATA: RUN 108

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	2328	-1.86		.28		.31	.23	8.15	89.93
2	0014	-1.86		.28		.34	.26	8.09	89.38
2	0200	-1.87		.30		.33	.27	8.05	90.56
2	0400	-1.87		.32		.37	.28	8.02	86.84
2	0600	-1.86		.34		.39	.32	8.01	86.12
2	0800	-1.86		.38		.43	.35	8.02	89.62
2	1000	-1.87		.40		.45	.38	8.02	90.15
2	1200	-1.88		.43		.48	.40	8.01	90.75
2	1256	-1.84		.48		.54	.46	8.08	87.30
2	1500	-1.87		.52		.55	.47	8.14	86.87
2	2000	-1.86		.55		.59	.50	8.17	90.61
3	0100	-1.84		.55		.59	.49	8.15	87.67
3	0600	-1.83		.54		.57	.48	8.17	90.96
3	1100	-1.86		.51		.54	.44	8.19	92.58
3	1600	-1.84		.50		.53	.46	8.13	93.08
3	2100	-1.85		.47		.51	.42	8.12	88.87
4	0200	-1.85		.50		.53	.44	8.20	91.03
4	0700	-1.96		.43		.47	.38	8.23	91.34
4	1200	-1.86		.49		.53	.42	8.23	92.33
4	1700	-1.87		.48		.50	.42	8.17	90.53
4	2200	-1.90		.45		.47	.39	8.14	85.84
5	0300	-1.84		.50		.52	.43	8.15	91.61
5	0800	-1.84		.49		.52	.43	8.17	92.03
5	1800	-1.85		.51		.52	.43	8.15	88.85
6	0400	-1.83		.52		.54	.44	8.14	89.73
6	0900	-1.83		.52		.53	.46	8.17	89.32
6	1400	-1.90		.50		.51	.42	8.19	89.00
6	1900	-1.86		.51		.52	.44	8.16	87.79
7	0000	-1.90		.48		.49	.40	8.15	89.28
7	1000	-1.92		.47		.48	.39	8.16	85.60

RAW DATA: RUN 109

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	2208	-1.86	0.00	2.16			1.85	7.95	60.97
1	2215	-1.86	0.00	2.11			1.89	7.93	60.92
1	2300	-1.85	0.00	2.18			1.93	7.93	60.75
2	0000	-1.85	0.00	2.28			2.06	7.84	61.08
2	0100	-1.85	0.00	2.38			2.18	7.87	61.15
2	0158	-1.85	0.00	2.52			2.30	7.85	61.08
2	0600	-1.86	0.00	2.95			2.77	7.92	61.32
2	1100	-1.87	0.00	3.65			3.42	8.00	61.45
2	1600	-1.88	0.00	4.29			4.12	7.96	60.57
2	2100	-1.85	0.00	4.71			4.69	8.08	60.37
3	0200	-1.85	0.00	5.78			5.54	8.06	60.93
3	0700	-1.85	0.00	6.91			6.62	8.08	60.10
3	1200	-1.84	0.00	7.90			7.52	8.05	60.63
3	1700	-1.87	0.00	8.76			8.26	8.00	59.97
3	2200	-1.87	0.00	9.44			8.93	8.00	60.65
4	0300	-1.85	0.00	9.89			9.39	7.97	61.10
4	0800	-1.88	0.00	10.31			9.93	8.04	60.25
4	1300	-1.87	0.00	10.67			10.34	8.04	60.88
4	1800	-1.86	0.00	10.99			10.65	8.01	61.51
4	2300	-1.87	0.00	11.52			11.15	8.02	61.12

RAW DATA: RUN 110

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	2328	-1.86	0.00	1.98				7.99	60.93
2	0014	-1.86	0.00	1.96				7.99	60.93
2	0200	-1.87	0.00	2.00				7.90	61.11
2	0400	-1.87	0.00	2.17				7.88	60.91
2	0600	-1.86	0.00	2.27				7.87	60.82
2	0800	-1.86	0.00	2.44				7.88	60.95
2	1000	-1.87	0.00	2.52				7.88	61.01
2	1200	-1.88	0.00	2.55				7.88	61.23
2	1256	-1.84	0.00	2.63				7.94	61.25
2	1500	-1.87	0.00	2.76				7.99	61.15
2	2000	-1.86	0.00	2.79				7.98	61.74
3	0100	-1.84	0.00	2.87				7.92	61.61
3	0600	-1.83	0.00	3.03				8.04	61.05
3	1100	-1.86	0.00	3.09				8.08	61.65
3	1600	-1.84	0.00	3.09				8.00	61.43
3	2100	-1.85	0.00	3.07				7.94	61.33
4	0200	-1.85	0.00	3.12				8.04	62.35
4	0700	-1.96	0.00	3.06				8.04	61.57
4	1200	-1.86	0.00	3.12				8.09	61.54
4	1700	-1.87	0.00	3.10				8.01	62.08
4	2200	-1.90	0.00	3.04				7.98	61.86
5	0300	-1.84	0.00	3.00				7.98	61.73
5	0800	-1.84	0.00	2.92				8.01	62.83
5	1800	-1.85	0.00	2.93				8.00	61.74
6	0400	-1.83	0.00	2.95				8.02	61.93
6	0900	-1.83	0.00	2.91				8.02	61.90
6	1400	-1.90	0.00	2.91				8.01	61.50
6	1900	-1.86	0.00	2.90				8.00	61.73
7	0000	-1.90	0.00	2.88				8.00	61.37
7	1000	-1.92	0.00	2.92				7.97	61.31

RAW DATA: RUN 111

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	0039	-1.92		1.49	1.50	1.71	1.44	14.27	105.88
1	0100	-1.88		1.52	1.52	1.76	1.48	14.20	108.94
1	0111	-1.87		1.57	1.57	1.79	1.51	14.28	110.65
1	0200	-1.85		1.61	1.61	1.86	1.57	14.14	110.13
1	0300	-1.83		1.66	1.70	1.92	1.61	14.07	113.17
1	0400	-1.83		1.71	1.75	2.00	1.68	14.03	110.37
1	0500	-1.83		1.81	1.83	2.08	1.76	14.02	108.79
1	0600	-1.82		1.88	1.91	2.15	1.82	14.02	110.09
1	0700	-1.83		1.91	1.97	2.19	1.89	14.02	109.36
1	0800	-1.82		2.00	2.05	2.31	1.98	14.04	108.72
1	0900	-1.84		2.07	2.11	2.34	2.02	14.04	109.36
1	1000	-1.86		2.12	2.17	2.40	2.06	14.05	113.08
1	1100	-1.85		2.17	2.23	2.44	2.12	14.01	110.07
1	1155	-1.87		2.27	2.33	2.54	2.22	14.26	110.32
1	1600	-2.07		2.36	2.43	2.63	2.30	14.26	110.91
1	2100	-1.84		2.64	2.71	2.83	2.56	14.26	110.71
2	0200	-1.86		2.72	2.79	2.87	2.61	14.20	108.54
2	0700	-1.83		2.86	2.94	2.96	2.75	14.28	107.91
2	1200	-1.85		2.91	3.00	2.99	2.79	14.28	109.86
2	1700	-1.88		2.89	2.98	2.95	2.78	14.24	111.40
2	2200	-1.85		2.92	2.99	2.97	2.80	14.23	111.05
3	0300	-1.88		2.93	3.02	2.96	2.82	14.18	108.68
3	0800	-1.89		2.99	3.07	3.04	2.87	14.23	110.74
3	1300	-1.91		3.03	3.12	3.06	2.90	14.27	110.46
3	1800	-1.92		3.08	3.18	3.14	2.94	14.17	108.19
3	2300	-1.88		3.13	3.21	3.17	2.98	14.18	107.24
4	0400	-1.87		3.17	3.27	3.20	3.03	14.16	107.52
4	0900	-1.89		3.21	3.31	3.27	3.07	14.22	107.38
4	1024	-1.90		3.24	3.33	3.27	3.11	14.29	110.65
4	1500	-1.91		3.23	3.32	3.26	3.08	14.22	110.15
4	2000	-1.91		3.24	3.33	3.27	3.09	14.18	110.84
5	0100	-1.88		3.29	3.37	3.32	3.15	14.18	106.84
5	0600	-1.87		3.37	3.47	3.42	3.22	14.28	107.64
5	1100	-1.93		3.38	3.48	3.43	3.22	14.32	107.99
5	1600	-1.90		3.35	3.45	3.40	3.21	14.28	109.49
5	2100	-1.91		3.39	3.49	3.43	3.24	14.29	115.01
6	0200	-1.89		3.43	3.53	3.47	3.28	14.25	110.41
6	0700	-1.89		3.54	3.64	3.58	3.40	14.32	106.70
6	1200	-1.90		3.59	3.69	3.62	3.44	14.28	106.33
6	1700	-1.91		3.61	3.71	3.64	3.46	14.25	107.57
7	0300	-1.89		3.63	3.73	3.66	3.49	14.26	112.07

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
7	0800	-1.87		3.67	3.77	3.71	3.54	14.27	108.16
7	1300	-1.91		3.66	3.76	3.70	3.52	14.27	107.57
7	1800	-1.90		3.66	3.77	3.71	3.53	14.24	111.12
7	2300	-1.90		3.68	3.78	3.72	3.55	14.23	109.20
8	0027	-1.91		3.70	3.80	3.74	3.56	14.26	110.26
8	0500	-1.87		3.74	3.85	3.78	3.61	14.24	111.71
8	1000	-1.89		3.76	3.86	3.79	3.62	14.26	110.66
8	1500	-1.93		3.75	3.85	3.80	3.62	14.26	108.51
8	2000	-1.90		3.79	3.89	3.82	3.66	14.24	109.48
9	0100	-1.90		3.82	3.93	3.86	3.69	14.22	110.94
9	0600	-1.88		3.96	4.06	4.00	3.83	14.26	108.79
9	1100	-1.91		4.01	4.11	4.04	3.88	14.29	107.31
9	1600	-1.90		4.05	4.15	4.07	3.92	14.27	109.53
9	2100	-1.91		4.06	4.17	4.09	3.94	14.24	108.83
10	0200	-1.87		4.15	4.26	4.18	4.04	14.22	103.05
10	0700	-1.89		4.16	4.26	4.19	4.05	14.30	107.08
10	1200	-2.02		4.15	4.25	4.17	4.04	14.27	107.57
10	1700	-1.91		4.26	4.37	4.28	4.15	14.24	106.17
11	0200	-1.89		4.29	4.39	4.30	4.18	14.23	108.69
11	0700	-1.89		4.35	4.45	4.36	4.24	14.28	106.36
11	1200	-1.93		4.34	4.45	4.36	4.23	14.28	104.83
11	1700	-1.91		4.39	4.49	4.39	4.28	14.25	108.88
11	2200	-1.90		4.42	4.53	4.43	4.32	14.26	106.97
12	0300	-1.88		4.44	4.55	4.46	4.34	14.22	106.96
12	0800	-1.89		4.49	4.59	4.50	4.39	14.26	100.99
12	1300	-1.93		4.49	4.59	4.50	4.38	14.28	106.38
12	1800	-1.91		4.49	4.60	4.50	4.40	14.24	107.83
12	2300	-1.89		4.53	4.63	4.54	4.43	14.22	103.75
13	0400	-1.88		4.55	4.66	4.57	4.46	14.24	104.29
13	0900	-1.88		4.58	4.70	4.60	4.49	14.28	103.19
13	1400	-1.90		4.60	4.72	4.62	4.50	14.28	105.73
13	1900	-1.91		4.62	4.73	4.62	4.53	14.20	103.33
14	0000	-1.88		4.68	4.80	4.70	4.59	14.22	104.76
15	2027	-1.90		4.60	4.73	4.63	4.52	14.25	108.35
16	0100	-1.89		4.42	4.53	4.45	4.33	13.93	108.95
16	0129	-1.90		4.55	4.67	4.59	4.45	14.24	113.61
16	0600	-1.88		4.54	4.65	4.58	4.44	14.21	110.98
16	1100	-1.88		4.65	4.77	4.68	4.56	14.41	108.91
16	1600	-1.91		4.58	4.69	4.61	4.49	14.21	114.22
16	2100	-1.91		4.65	4.76	4.67	4.56	14.34	111.94
17	0200	-1.89		4.67	4.79	4.70	4.59	14.32	113.31
17	0700	-1.88		4.71	4.83	4.74	4.63	14.35	110.54
17	1200	-1.88		4.73	4.85	4.74	4.65	14.36	109.25
17	1700	-1.91		4.67	4.78	4.69	4.59	14.17	109.13
17	2200	-1.90		4.69	4.79	4.69	4.61	14.18	110.93
18	0938	-1.87		4.81	4.92	4.92	4.73	14.27	108.37

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
18	1400	-1.91		4.76	4.87	4.76	4.68	14.19	105.96
18	1900	-1.90		4.83	4.94	4.83	4.75	14.32	108.74
19	0000	-1.88		4.87	4.97	4.86	4.79	14.30	108.54
19	0500	-1.86		4.92	5.02	4.91	4.83	14.31	107.54
19	1000	-1.91		4.95	5.04	4.93	4.87	14.34	107.53
19	1500	-1.90		4.98	5.08	4.97	4.90	14.36	109.96
19	2000	-1.92		4.95	5.05	4.92	4.86	14.24	108.15
20	0100	-1.88		4.99	5.08	4.96	4.91	14.23	107.81
20	0600	-1.86		5.07	5.18	5.04	4.99	14.27	106.18
20	1100	-1.86		5.11	5.20	5.07	5.03	14.28	108.25
20	1600	-1.91		5.10	5.19	5.05	5.01	14.26	104.58
21	0039	-1.88		5.15	5.23	5.11	5.07	14.23	106.94
21	0500	-1.88		5.20	5.29	5.15	5.13	14.20	100.19
21	1000	-1.90		5.43	5.51	5.36	5.35	14.26	96.74
21	1500	-1.91		5.55	5.62	5.47	5.48	14.28	96.09
21	2000	-1.91		5.59	5.66	5.50	5.52	14.22	95.05
22	0100	-1.89		5.69	5.76	5.60	5.63	14.31	94.68
22	0600	-1.88		5.78	5.85	5.68	5.72	14.29	95.56
22	1100	-1.91		5.84	5.91	5.74	5.78	14.34	96.84
22	1600	-1.92		5.91	5.97	5.79	5.85	14.35	93.71
22	2100	-1.90		5.96	6.03	5.83	5.91	14.33	95.69
23	0200	-1.87		6.00	6.06	5.86	5.95	14.28	95.43
23	0700	-1.88		6.15	6.21	6.01	6.10	14.34	90.30
23	1200	-1.91		6.15	6.19	6.00	6.09	14.34	93.07
23	1654	-1.93		5.94	5.97	5.78	5.87	14.25	103.23
23	2100	-1.89		5.99	6.02	5.84	5.94	14.23	100.47
24	0200	-1.87		6.01	6.03	5.86	5.96	14.20	100.91
24	0700	-1.87		6.07	6.09	5.91	6.02	14.23	96.37
24	2226	-1.89		5.79	5.84	5.68	5.74	14.31	106.13
25	0300	-1.87		5.62	5.65	5.50	5.56	13.93	107.88
25	0800	-1.89		5.66	5.69	5.54	5.60	13.93	107.27
25	1300	-1.91		5.66	5.69	5.54	5.61	13.93	109.72
25	2134	-1.91		5.87	5.88	5.74	5.81	14.20	109.79
26	0200	-1.89		5.94	5.94	5.79	5.88	14.24	108.01
26	0700	-1.88		6.02	6.01	5.87	5.96	14.30	104.67
26	1200	-1.91		6.04	6.04	5.89	5.99	14.29	107.86
26	1700	-1.91		6.06	6.05	5.88	6.00	14.27	108.09
26	2200	-1.89		6.10	6.07	5.91	6.04	14.22	106.23
27	0300	-1.88		6.10	6.07	5.92	6.05	14.21	109.94
27	0800	-1.89		6.15	6.11	5.96	6.09	14.24	108.82
27	1300	-1.91		6.18	6.13	5.99	6.12	14.26	107.45
27	1800	-1.90		6.19	6.13	5.99	6.13	14.24	107.48
27	2300	-1.88		6.19	6.13	5.98	6.13	14.19	106.16
28	0400	-1.87		6.28	6.22	6.06	6.22	14.27	105.29
28	0900	-1.87		6.33	6.27	6.12	6.27	14.28	103.91
28	1400	-1.91		6.26	6.18	6.04	6.19	14.29	111.22

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
28	1900	-1.90		6.33	6.21	6.08	6.23	14.26	139.60
29	0000	-1.88		6.31	6.23	6.10	6.25	14.24	107.53
29	0500	-1.87		6.34	6.27	6.15	6.30	14.24	104.55
29	1000	-1.89		6.38	6.30	6.19	6.33	14.28	110.64
29	1500	-1.91		6.36	6.28	6.16	6.31	14.25	106.64
29	2000	-1.92		6.38	6.29	6.19	6.33	14.27	110.51
30	0100	-1.91		6.39	6.28	6.19	6.33	14.25	111.97
30	0600	-1.88		6.44	6.34	6.24	6.39	14.26	109.90
30	1100	-1.88		6.50	6.39	6.31	6.45	14.29	105.64
30	1600	-1.91		6.50	6.39	6.30	6.45	14.31	109.83
30	2100	-1.90		6.46	6.34	6.27	6.41	14.25	110.04
31	0200	-1.89		6.48	6.36	6.28	6.43	14.23	110.89
31	0700	-1.89		6.53	6.40	6.33	6.47	14.27	108.98
31	1200	-1.90		6.57	6.43	6.38	6.51	14.29	108.42
31	1700	-1.88		6.58	6.44	6.39	6.52	14.24	112.28
31	2200	-1.88		6.70	6.54	6.51	6.64	14.24	103.09
32	0300	-1.86		6.70	6.56	6.50	6.64	14.21	106.66
32	0800	-1.90		6.72	6.56	6.53	6.67	14.30	104.97
33	0110	-1.88		6.71	6.54	6.55	6.64	14.28	109.36
33	0600	-1.87		6.75	6.56	6.57	6.67	14.22	104.97
33	1100	-1.90		6.77	6.56	6.58	6.68	14.21	105.02
33	1600	-1.90		6.76	6.56	6.57	6.68	14.19	110.14
33	2111	-1.89		6.85	6.65	6.67	6.77	14.28	106.14
34	0100	-1.87		6.87	6.66	6.68	6.79	14.24	106.76
34	0600	-1.85		6.96	6.75	6.77	6.87	14.28	106.80
34	1100	-1.89		6.98	6.75	6.78	6.87	14.30	104.62
34	1600	-1.91		6.97	6.74	6.78	6.87	14.29	103.60
34	2100	-1.90		6.99	6.75	6.80	6.87	14.26	107.18
35	0200	-1.88		7.00	6.76	6.81	6.89	14.22	108.04
35	0700	-1.88		7.06	6.80	6.86	6.93	14.26	104.44
35	1200	-1.91		7.06	6.78	6.86	6.93	14.27	106.20
35	1700	-1.91		7.08	6.79	6.88	6.94	14.26	106.56
35	2200	-1.91		7.10	6.80	6.89	6.94	14.24	105.20
36	0300	-1.88		7.13	6.80	6.92	6.96	14.22	106.71
36	0800	-1.88		7.14	6.80	6.94	6.95	14.24	106.99
36	1300	-1.91		7.14	6.80	6.94	6.94	14.26	106.89
36	1800	-1.92		7.15	6.79	6.95	6.95	14.26	106.58
36	2300	-1.92		7.15	6.78	6.95	6.95	14.23	105.48
37	0400	-1.88		7.19	6.84	6.99	6.99	14.23	105.57
37	0900	-1.89		7.24	6.87	7.04	7.03	14.28	103.97
37	1400	-1.89		7.23	6.86	7.03	7.01	14.23	106.68
37	1900	-1.89		7.26	6.87	7.05	7.02	14.24	105.94
38	0000	-1.88		7.26	6.87	7.06	7.02	14.20	107.40
38	0500	-1.87		7.28	6.93	7.09	7.06	14.22	105.61
38	1000	-1.87		7.35	6.96	7.15	7.11	14.26	103.18
38	1500	-1.90		7.36	6.97	7.15	7.11	14.25	107.56

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
38	2000	-1.90		7.34	6.92	7.13	7.08	14.19	106.41
39	0100	-1.88		7.35	6.92	7.14	7.07	14.16	105.19
39	0600	-1.86		7.41	7.03	7.20	7.14	14.19	105.61
39	1100	-1.90		7.41	6.99	7.19	7.13	14.20	102.31

RAW DATA: RUN 112

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	0039	-1.92		1.19		1.12	1.18	10.77	83.17
1	0100	-1.88		1.21		1.16	1.20	10.80	83.30
1	0111	-1.87		1.18		1.17	1.19	10.77	82.31
1	0200	-1.85		1.22		1.18	1.22	10.70	82.93
1	0300	-1.83		1.32		1.22	1.29	10.24	84.33
1	0400	-1.83		1.27		1.26	1.32	10.03	85.57
1	0500	-1.83		1.32		1.31	1.36	9.94	85.28
1	0600	-1.82		1.40		1.40	1.41	9.91	83.83
1	0700	-1.83		1.47		1.38	1.42	9.89	83.66
1	0800	-1.82		1.52		1.46	1.49	9.88	85.19
1	0900	-1.84		1.58		1.47	1.56	9.88	84.55
1	1000	-1.86		1.62		1.52	1.60	9.88	83.10
1	1100	-1.85		1.67		1.61	1.64	9.85	85.14
1	1155	-1.87		2.13		2.03	2.05	10.85	85.98
1	1600	-2.07		2.36		2.29	2.29	10.80	86.24
1	2100	-1.84		2.95		2.89	2.89	10.84	85.94
2	0200	-1.86		2.98		3.00	2.95	10.75	83.13
2	0700	-1.83		3.10		3.04	3.01	10.81	84.03
2	1200	-1.85		3.11		3.05	3.03	10.81	83.62
2	1700	-1.88		3.11		3.05	3.01	10.79	84.77
2	2200	-1.85		3.23		3.21	3.13	10.79	83.20
3	0300	-1.88		3.25		3.20	3.14	10.76	83.81
3	0800	-1.89		3.30		3.29	3.19	10.80	81.21
3	1300	-1.91		3.32		3.32	3.21	10.79	82.68
3	1800	-1.92		3.32		3.32	3.22	10.78	83.25
3	2300	-1.88		3.38		3.36	3.26	10.78	84.05
4	0400	-1.87		3.39		3.40	3.27	10.76	82.24
4	0900	-1.89		3.39		3.41	3.30	10.78	81.13
4	1024	-1.90		3.42		3.45	3.31	10.80	82.07
4	1500	-1.91		3.42		3.43	3.31	10.79	82.07
4	2000	-1.91		3.43		3.44	3.31	10.77	82.60
5	0100	-1.88		3.49		3.51	3.38	10.76	82.04
5	0600	-1.87		3.55		3.59	3.43	10.81	80.20
5	1100	-1.93		3.56		3.59	3.44	10.85	81.48
5	1600	-1.90		3.60		3.62	3.48	10.86	83.05
5	2100	-1.91		3.62		3.64	3.50	10.85	82.84
6	0200	-1.89		3.64		3.67	3.54	10.80	82.91
6	0700	-1.89		3.73		3.73	3.60	10.85	81.81
6	1200	-1.90		3.75		3.77	3.63	10.83	83.79
6	1700	-1.91		3.78		3.78	3.63	10.81	81.98
7	0300	-1.89		3.82		3.84	3.70	10.82	82.29

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
7	0800	-1.87		3.85		3.86	3.74	10.80	81.84
7	1300	-1.91		3.87		3.88	3.76	12.29	83.21
7	1800	-1.90		3.91		3.89	3.78	12.27	82.94
7	2300	-1.90		3.92		3.92	3.78	12.27	82.22
8	0027	-1.91		3.29		3.30	3.18	10.96	84.48
8	0500	-1.87		3.33		3.34	3.24	10.95	82.48
8	1000	-1.89		3.34		3.34	3.22	10.97	81.81
8	1500	-1.93		3.31		3.33	3.21	10.97	82.95
8	2000	-1.90		3.34		3.34	3.25	10.95	81.59
9	0100	-1.90		3.35		3.35	3.26	10.94	82.57
9	0600	-1.88		3.40		3.42	3.31	10.96	82.75
9	1100	-1.91		3.43		3.44	3.32	10.98	81.35
9	1600	-1.90		3.47		3.47	3.37	10.98	80.69
9	2100	-1.91		3.46		3.48	3.37	10.95	81.07
10	0200	-1.87		3.49		3.51	3.40	10.93	79.38
10	0700	-1.89		3.55		3.55	3.44	10.99	78.90
10	1700	-2.02		3.42		3.40	3.31	10.87	79.95
10	2126	-1.91		3.52		3.49	3.40	10.85	81.37
11	0200	-1.89		3.53		3.52	3.42	10.84	80.16
11	0700	-1.89		3.57		3.58	3.48	10.89	81.13
11	1200	-1.93		3.51		3.49	3.41	10.81	81.80
11	1700	-1.91		3.52		3.51	3.42	10.80	81.90
11	2200	-1.90		3.54		3.54	3.44	10.81	83.35
12	0300	-1.88		3.57		3.55	3.47	10.78	83.30
12	0800	-1.89		3.59		3.59	3.49	10.81	80.64
12	1300	-1.93		3.56		3.56	3.47	10.82	80.91
12	1800	-1.91		3.56		3.55	3.46	10.79	82.30
12	2300	-1.89		3.58		3.58	3.49	10.79	81.88
13	0400	-1.88		3.62		3.61	3.52	10.79	80.85
13	0900	-1.88		3.64		3.63	3.54	10.81	80.90
13	1400	-1.90		3.64		3.62	3.52	10.81	81.95
13	1900	-1.91		3.63		3.62	3.53	10.77	80.92
14	0000	-1.88		3.68		3.66	3.57	10.78	80.15
15	2027	-1.90		3.68		3.67	3.54	10.78	82.13
16	0100	-1.89		3.60		3.58	3.46	10.52	81.67
16	0129	-1.90		3.77		3.75	3.63	10.84	82.75
16	0600	-1.88		3.79		3.78	3.64	10.68	83.00
16	1100	-1.88		3.85		3.82	3.69	10.72	81.87
16	1600	-1.91		3.84		3.83	3.69	10.68	83.14
16	2100	-1.91		3.85		3.85	3.71	10.72	83.67
17	0200	-1.89		3.88		3.87	3.74	10.69	84.19
17	0700	-1.88		3.91		3.89	3.75	10.69	82.08
17	1200	-1.88		3.92		3.90	3.76	10.70	83.74
17	1700	-1.91		3.88		3.86	3.73	10.66	84.94
17	2200	-1.90		3.90		3.89	3.74	10.65	83.09
18	0938	-1.87		4.04		4.03	3.88	10.80	81.81

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
18	1400	-1.91		4.03		4.02	3.87	10.81	81.49
18	1900	-1.90		4.00		3.99	3.84	10.77	83.83
19	0000	-1.88		4.03		4.02	3.88	10.76	84.32
19	0500	-1.86		4.06		4.05	3.90	10.75	84.16
19	1000	-1.91		4.10		4.09	3.93	10.80	83.40
19	1500	-1.90		4.11		4.10	3.94	10.81	84.56
19	2000	-1.92		4.08		4.07	3.91	10.76	84.78
20	0100	-1.88		4.12		4.12	3.95	10.76	85.89
20	0600	-1.86		4.17		4.16	3.99	10.78	82.94
20	1100	-1.86		4.19		4.18	4.02	10.78	83.10
20	1600	-1.91		4.16		4.15	3.99	10.79	83.50
21	0039	-1.88		4.21		4.20	4.04	10.77	82.08
21	0500	-1.88		4.25		4.24	4.08	10.76	81.14
21	1000	-1.90		4.41		4.39	4.23	10.80	78.71
21	1500	-1.91		4.46		4.45	4.28	10.79	79.48
21	2000	-1.91		4.48		4.47	4.30	10.77	77.65
22	0100	-1.89		4.51		4.50	4.33	10.76	78.43
22	0600	-1.88		4.58		4.57	4.40	10.76	78.17
22	1100	-1.91		4.65		4.62	4.46	10.79	75.94
22	1600	-1.92		4.63		4.61	4.45	10.81	78.55
22	2100	-1.90		4.66		4.64	4.48	10.80	78.08
23	0200	-1.87		4.68		4.66	4.51	10.77	76.47
23	0700	-1.88		4.74		4.72	4.57	10.82	76.45
23	1200	-1.91		4.72		4.70	4.54	10.81	77.52
23	1654	-1.93		4.52		4.51	4.34	10.80	84.21
23	2100	-1.89		4.60		4.59	4.42	10.80	80.58
24	0200	-1.87		4.63		4.62	4.45	10.79	81.09
24	0700	-1.87		4.66		4.66	4.48	10.80	81.65
24	2226	-1.89		4.72		4.72	4.58	10.82	82.12
25	0300	-1.87		4.68		4.67	4.54	10.38	79.78
25	0800	-1.89		4.73		4.73	4.59	10.32	78.28
25	1300	-1.91		4.75		4.74	4.60	10.25	79.47
25	2134	-1.91		5.22		5.20	5.06	10.78	79.47
26	0200	-1.89		5.19		5.19	5.03	10.73	80.80
26	0700	-1.88		5.27		5.26	5.12	10.78	79.45
26	1200	-1.91		5.29		5.30	5.14	10.78	79.79
26	1700	-1.91		5.31		5.30	5.15	10.77	81.01
26	2200	-1.89		5.33		5.32	5.16	10.73	81.18
27	0300	-1.88		5.36		5.35	5.20	10.73	81.24
27	0800	-1.89		5.39		5.39	5.24	10.74	80.81
27	1300	-1.91		5.41		5.40	5.25	10.77	82.51
27	1800	-1.90		5.41		5.41	5.26	10.76	82.31
27	2300	-1.88		5.43		5.42	5.27	10.71	82.82
28	0400	-1.87		5.53		5.52	5.37	10.80	79.96
28	0900	-1.87		5.57		5.56	5.41	10.82	79.61
28	1400	-1.91		5.35		5.35	5.19	10.82	86.47

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
28	1900	-1.90		5.40		5.39	5.24	10.81	87.10
29	0000	-1.88		5.45		5.47	5.29	10.80	83.05
29	0500	-1.87		5.47		5.49	5.33	10.79	83.34
29	1000	-1.89		5.45		5.46	5.29	10.81	85.70
29	1500	-1.91		5.47		5.47	5.31	10.82	84.28
29	2000	-1.92		5.48		5.49	5.32	10.80	85.27
30	0100	-1.91		5.55		5.56	5.39	10.80	81.91
30	0600	-1.88		5.62		5.62	5.46	10.81	83.93
30	1100	-1.88		5.66		5.65	5.50	10.83	81.63
30	1600	-1.91		5.65		5.65	5.50	10.86	84.77
30	2100	-1.90		5.60		5.61	5.45	10.75	82.81
31	0200	-1.89		5.62		5.61	5.46	10.70	84.82
31	0700	-1.89		5.66		5.65	5.51	10.73	82.86
31	1200	-1.90		5.63		5.69	5.54	10.73	83.58
31	1700	-1.88		5.70		5.72	5.55	10.71	82.13
31	2200	-1.88		5.78		5.78	5.62	10.80	81.97
32	0300	-1.86		5.80		5.80	5.65	10.78	81.07
32	2202	-1.90		5.64		5.64	5.48	10.79	80.15
33	0110	-1.88		5.78		5.78	5.63	10.81	84.61
33	0600	-1.87		5.93		5.93	5.76	10.34	78.95
33	1100	-1.90		6.07		6.06	5.88	10.41	79.66
33	1600	-1.90		6.11		6.10	5.92	10.39	81.50
33	2111	-1.89		6.50		6.49	6.31	10.73	79.51
34	0100	-1.87		6.51		6.52	6.32	10.73	79.86
34	0600	-1.85		6.57		6.58	6.38	10.76	80.27
34	1100	-1.89		6.58		6.58	6.39	10.74	80.40
34	1600	-1.91		6.58		6.58	6.38	10.70	81.08
34	2100	-1.90		6.58		6.59	6.39	10.69	81.91
35	0200	-1.88		6.64		6.65	6.44	10.70	82.38
35	0700	-1.88		6.70		6.70	6.50	10.73	80.11
35	1200	-1.91		6.58		6.59	6.38	10.73	85.12
35	1700	-1.91		6.62		6.62	6.41	10.73	83.98
35	2200	-1.91		6.63		6.63	6.42	10.71	84.59
36	0300	-1.88		6.65		6.66	6.45	10.70	84.47
36	0800	-1.88		6.68		6.69	6.48	10.71	82.59
36	1300	-1.91		6.68		6.70	6.48	10.72	83.55
36	1800	-1.92		6.74		6.75	6.53	10.73	82.87
36	2300	-1.92		6.75		6.76	6.54	10.70	85.13
37	0400	-1.88		6.80		6.82	6.59	10.72	84.35
37	0900	-1.89		6.87		6.89	6.66	10.76	82.10
37	1400	-1.89		6.87		6.88	6.66	10.73	82.13
37	1900	-1.89		6.90		6.91	6.69	10.74	81.99
38	0000	-1.88		6.90		6.92	6.69	10.71	81.22
38	0500	-1.87		6.96		6.97	6.74	10.73	81.03
38	1000	-1.87		7.02		7.03	6.80	10.75	82.24
38	1500	-1.90		7.03		7.04	6.81	10.75	80.83

DAY	TIME	TIN	TOUT	THA	THB	TWC	TWD	HEAT	FLOW
38	2000	-1.90		7.01		7.02	6.80	10.72	80.85
39	0100	-1.88		7.05		7.06	6.84	10.70	79.98
39	0600	-1.86		7.11		7.12	6.89	10.73	79.88
39	1100	-1.90		7.12		7.13	6.90	10.75	81.69

RAW DATA: RUN 113

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	0039	-1.92	0.00	1.28				6.89	56.43
1	0100	-1.88	0.00	1.30				6.88	56.62
1	0111	-1.87	0.00	1.32				6.90	56.42
1	0200	-1.85	0.00	1.33				6.85	56.27
1	0300	-1.83	0.00	1.36				6.81	56.49
1	0400	-1.83	0.00	1.36				6.81	56.31
1	0500	-1.83	0.00	1.36				6.81	56.23
1	0600	-1.82	0.00	1.38				6.81	56.60
1	0700	-1.83	0.00	1.40				6.81	56.39
1	0800	-1.82	0.00	1.42				6.81	56.43
1	0900	-1.84	0.00	1.39				6.82	56.26
1	1000	-1.86	0.00	1.39				6.82	56.15
1	1100	-1.85	0.00	1.44				6.81	56.48
1	1155	-1.87	0.00	1.47				6.85	56.59
1	1600	-2.07	0.00	1.49				6.92	56.89
1	2100	-1.84	0.00	1.71				6.93	56.55
2	0200	-1.86	0.00	1.79				6.90	56.36
2	0700	-1.83	0.00	1.91				6.92	55.94
2	1200	-1.85	0.00	2.07				6.93	57.03
2	1700	-1.88	0.00	2.14				6.91	55.94
2	2200	-1.85	0.00	2.19				6.90	56.19
3	0300	-1.88	0.00	2.22				6.89	56.07
3	0800	-1.89	0.00	2.32				6.92	56.57
3	1300	-1.91	0.00	2.39				6.96	56.59
3	1800	-1.92	0.00	2.39				6.84	57.03
3	2300	-1.88	0.00	2.27				6.85	57.22
4	0400	-1.87	0.00	2.23				6.85	57.98

RAW DATA: RUN 114

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1600	-1.92		.26	.29	.42	.15	10.64	136.47
1	1700	-1.93		.24	.26	.37	.12	10.54	134.37
1	1800	-1.93		.24	.26	.36	.12	10.50	135.96
1	1900	-1.93		.22	.25	.36	.11	10.47	136.16
1	2000	-1.93		.22	.25	.36	.11	10.45	132.16
1	2100	-1.92		.24	.27	.39	.13	10.44	129.33
1	2200	-1.92		.24	.26	.40	.12	10.51	133.99
1	2300	-1.91		.26	.32	.45	.16	10.58	130.73
2	0000	-1.91		.27	.33	.46	.18	10.56	132.65
2	0100	-1.90		.30	.35	.49	.19	10.58	133.66
2	0600	-1.88		.34	.39	.53	.22	10.56	134.33
2	1100	-1.90		.37	.42	.56	.22	10.57	135.26
2	1600	-1.92		.38		.60	.26	10.56	131.64
2	2100	-1.91		.46		.65	.32	10.62	131.51
3	0200	-1.90		.50		.71	.37	10.62	133.12
3	0700	-1.90		.55		.75	.41	10.61	131.49
3	1200	-1.92		.57		.76	.43	10.61	134.89
3	1700	-1.93		.62		.78	.47	10.62	132.54
3	2200	-1.91		.66		.82	.50	10.57	130.52
4	0300	-1.90		.69		.86	.54	10.55	130.87
4	0800	-1.89		.74		.91	.58	10.56	131.44
4	1300	-1.92		.75		.92	.59	10.58	132.35
4	1600	-1.94		.77		.94	.61	10.57	135.09
4	2300	-1.91		.82		.99	.66	10.55	132.88
5	0400	-1.90		.83		1.02	.68	10.55	129.83
5	0900	-1.89		.87		1.03	.71	10.56	134.80
5	1400	-1.91		.68		1.03	.72	10.57	131.81
5	1900	-1.94		.85		1.01	.70	10.55	134.98
6	0000	-1.91		.92		1.07	.75	10.60	130.46
6	0500	-1.89		.95		1.10	.76	10.59	131.48
6	1000	-1.89		.97		1.12	.77	10.63	131.39
6	1500	-1.94		.95		1.10	.73	10.63	130.28
6	1851	-1.90		.59		.83	.47	10.62	129.74
6	2300	-1.89		.65		.87	.51	10.48	127.73
7	0400	-1.90		.69		.90	.57	10.67	133.47
7	0900	-1.87		.77		.98	.65	10.68	134.57
7	1400	-1.93		.75		.93	.61	10.61	130.63
7	1900	-1.93		.77		.96	.63	10.58	136.39
8	0000	-1.89		.84		1.00	.67	10.57	134.50
8	0500	-1.89		.66		1.03	.70	10.57	130.67
8	1000	-1.91		.87		1.03	.71	10.56	138.62

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
8	1500	-1.93		.88		1.05	.71	10.57	132.32
8	2000	-1.93		.90		1.06	.73	10.56	134.62
9	0100	-1.90		.95		1.10	.77	10.63	134.59
9	0600	-1.89		.96		1.13	.79	10.61	132.13
9	1100	-1.91		.97		1.12	.79	10.62	133.94
9	1600	-1.93		.97		1.13	.79	10.63	139.10
9	2100	-1.91		.98		1.14	.79	10.60	133.96
10	0200	-1.90		1.00		1.15	.81	10.59	138.53
10	0700	-1.90		1.03		1.16	.83	10.63	136.50
10	1200	-1.92		1.02		1.16	.82	10.63	133.85
10	1700	-1.93		1.01		1.15	.81	10.62	134.67
10	2200	-1.91		1.03		1.17	.83	10.59	133.72
11	0300	-1.90		1.05		1.19	.84	10.60	140.30
11	0800	-1.91		1.05		1.19	.85	10.63	130.69
11	1300	-1.97		.81		1.03	.72	10.60	130.79
12	0100	-1.91		.86		1.05	.70	10.33	127.52
12	0600	-1.90		.88		1.08	.73	10.30	128.44
12	1030	-1.88		.97		1.18	.81	10.63	133.31
12	1500	-1.92		.97		1.16	.79	10.66	135.71
12	2000	-1.92		.95		1.14	.76	10.51	129.61
12	2319	-1.89		1.00		1.19	.81	10.58	135.85
13	0400	-1.90		1.01		1.20	.83	10.58	133.26
13	0900	-1.88		1.05		1.24	.86	10.61	131.68
13	1400	-1.92		1.04		1.22	.83	10.60	127.29
13	1900	-1.93		1.02		1.20	.82	10.58	132.91
14	0000	-1.91		1.04		1.22	.83	10.56	133.19
14	0500	-1.90		1.06		1.23	.85	10.57	133.71
14	1000	-1.90		1.07		1.24	.86	10.60	131.05
14	1500	-1.92		1.07		1.25	.85	10.60	133.67
14	2000	-1.92		1.08		1.25	.85	10.57	135.61
15	0100	-1.91		1.10		1.26	.87	10.57	132.56
15	0600	-1.90		1.11		1.28	.89	10.57	133.57
15	1100	-1.92		1.11		1.28	.88	10.59	137.82
15	1600	-1.91		1.13		1.29	.89	10.58	137.86
15	2100	-1.92		1.12		1.28	.88	10.57	134.62
16	0200	-1.90		1.14		1.30	.91	10.56	135.48
16	0700	-1.90		1.16		1.31	.92	10.57	131.86
16	1200	-1.92		1.14		1.30	.90	10.58	132.33
16	1700	-1.93		1.13		1.29	.89	10.57	132.95
16	2200	-1.91		1.15		1.30	.90	10.57	134.76
17	0300	-1.89		1.18		1.33	.93	10.56	138.17
17	0800	-1.90		1.18		1.32	.93	10.58	133.37
17	1300	-1.91		1.17		1.33	.92	10.60	136.20
17	1800	-1.92		1.17		1.31	.91	10.56	135.23
17	2300	-1.90		1.20		1.34	.94	10.61	134.19
18	0400	-1.90		1.20		1.34	.94	10.58	138.87

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
18	0900	-1.88		1.23		1.38	.96	10.62	132.21
18	1400	-1.92		1.21		1.35	.94	10.62	130.51
18	1900	-1.93		1.19		1.34	.92	10.60	132.90
19	0000	-1.91		1.21		1.36	.94	10.59	127.64
19	0500	-1.89		1.23		1.38	.97	10.60	129.91
19	1000	-1.90		1.24		1.38	.97	10.62	132.53
19	1500	-1.92		1.23		1.38	.96	10.62	132.26
19	2000	-1.93		1.22		1.35	.94	10.60	134.69
20	0100	-1.91		1.23		1.37	.96	10.60	132.99
20	0600	-1.89		1.25		1.39	.98	10.59	134.64
20	1100	-1.93		1.25		1.37	.96	10.60	134.25
20	1600	-1.92		1.16		1.32	.91	10.60	131.41
20	2100	-1.91		1.20		1.40	.95	10.50	131.66
21	0200	-1.89		1.26		1.45	1.00	10.57	129.14
21	0700	-1.89		1.29		1.48	1.03	10.58	132.21
21	1200	-1.92		1.28		1.46	1.01	10.59	128.14
21	1700	-1.92		1.24		1.42	.97	10.57	133.81
21	2200	-1.90		1.26		1.45	.99	10.56	138.11
22	0300	-1.89		1.28		1.47	1.00	10.54	133.58
22	0800	-1.89		1.31		1.49	1.03	10.57	133.75
22	1300	-1.89		1.30		1.49	1.03	10.57	131.59
22	1800	-1.85		1.34		1.53	1.06	10.56	134.25
22	2300	-1.89		1.32		1.50	1.03	10.55	133.67
23	0400	-1.89		1.32		1.50	1.03	10.53	137.86
23	0900	-1.88		1.34		1.52	1.05	10.55	129.39
23	1400	-1.88		1.33		1.53	1.05	10.57	135.14
23	1900	-1.84		1.36		1.55	1.08	10.55	133.40
24	0000	-1.89		1.34		1.54	1.05	10.59	130.69
24	0500	-1.87		1.38		1.57	1.08	10.59	133.27
24	1000	-1.95		1.31		1.50	1.01	10.61	126.92
24	1500	-1.89		1.38		1.56	1.07	10.63	134.96
24	2000	-1.86		1.39		1.57	1.08	10.58	135.29
25	0100	-1.87		1.36		1.55	1.06	10.57	138.18
25	0600	-1.89		1.38		1.56	1.07	10.60	132.66
25	1100	-1.87		1.39		1.58	1.09	10.61	133.91
25	1600	-1.88		1.40		1.57	1.08	10.63	131.65
25	2100	-1.88		1.37		1.56	1.06	10.57	136.24
26	0200	-1.87		1.39		1.58	1.08	10.58	135.20
26	0700	-1.88		1.40		1.58	1.09	10.60	132.41
26	1200	-1.88		1.40		1.60	1.09	10.61	131.97
26	1700	-1.89		1.40		1.59	1.08	10.61	134.87
26	2200	-1.92		1.38		1.55	1.06	10.60	128.28
27	0300	-1.93		1.34		1.53	1.02	10.57	136.59
27	0800	-1.94		1.36		1.54	1.04	10.59	132.08
27	1300	-1.97		1.35		1.54	1.02	10.61	130.65
27	1800	-1.92		1.38		1.57	1.07	10.60	132.38

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
27	2300	-1.95		1.38		1.55	1.05	10.59	131.78

RAW DATA: RUN 115

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1600	-1.92		.92		.88	.89	12.86	120.97
1	1700	-1.93		.82		.81	.81	12.75	124.17
1	1800	-1.93		.80		.77	.78	12.73	123.90
1	1900	-1.93		.80		.70	.75	12.74	125.53
1	2000	-1.93		.74		.68	.76	12.70	125.90
1	2100	-1.92		.80		.69	.76	12.69	123.53
1	2200	-1.94		.81		.78	.82	12.76	125.22
1	2300	-1.91		.82		.80	.85	12.75	128.04
2	0000	-1.91		.91		.88	.90	12.72	126.22
2	0100	-1.90		.94		.89	.99	12.81	125.49
2	0600	-1.88		1.09		1.02	1.10	12.78	129.98
2	1100	-1.90		1.26		1.16	1.26	12.79	126.66
2	1600	-1.92		1.45		1.35	1.44	12.79	129.42
2	2100	-1.91		1.60		1.57	1.62	12.78	127.07
3	0200	-1.90		1.80		1.78	1.82	12.79	124.77
3	0700	-1.90		1.96		1.93	1.96	12.77	125.52
3	1200	-1.92		2.07		2.08	2.06	12.80	128.89
3	1700	-1.93		2.23		2.14	2.16	12.82	127.32
3	2200	-1.91		2.33		2.26	2.24	12.81	127.60
4	0300	-1.90		2.46		2.37	2.36	12.78	124.54
4	0800	-1.89		2.56		2.49	2.46	12.79	125.81
4	1300	-1.92		2.61		2.56	2.49	12.82	126.57
4	1800	-1.94		2.65		2.57	2.54	12.81	127.28
4	2300	-1.91		2.71		2.65	2.59	12.79	128.73
5	0400	-1.90		2.75		2.70	2.67	12.78	127.63
5	0900	-1.89		2.80		2.76	2.69	12.80	126.59
5	1400	-1.91		2.82		2.78	2.71	12.82	124.98
5	1900	-1.94		2.82		2.77	2.70	12.79	126.90
6	0000	-1.91		2.84		2.82	2.75	12.79	128.32
6	0500	-1.89		2.90		2.85	2.79	12.78	124.34
6	1000	-1.89		2.96		2.90	2.81	12.83	123.68
6	1500	-1.94		2.91		2.87	2.80	12.76	127.52
6	1851	-1.90		2.31		2.32	2.26	12.81	129.31
6	2300	-1.89		2.37		2.40	2.33	12.68	124.87
7	0400	-1.90		2.42		2.46	2.40	12.78	123.93
7	0900	-1.87		2.50		2.53	2.46	12.79	123.90
7	1400	-1.93		2.48		2.52	2.44	12.82	126.75
7	1900	-1.93		2.48		2.53	2.45	12.78	126.57
8	0000	-1.89		2.52		2.57	2.50	12.76	129.43
8	0500	-1.89		2.55		2.60	2.52	12.77	124.84
8	1000	-1.91		2.54		2.60	2.52	12.78	123.74

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
8	1500	-1.93		2.53		2.61	2.52	12.78	127.59
8	2000	-1.93		2.54		2.62	2.54	12.78	126.98
9	0100	-1.90		2.57		2.61	2.54	12.74	131.45
9	0600	-1.89		2.61		2.63	2.57	12.75	129.02
9	1100	-1.91		2.61		2.64	2.57	12.77	129.33
9	1600	-1.93		2.62		2.65	2.59	12.80	123.83
9	2100	-1.91		2.63		2.65	2.59	12.79	126.73
10	0200	-1.90		2.65		2.67	2.60	12.76	125.96
10	0700	-1.90		2.66		2.70	2.64	12.80	126.82
10	1200	-1.92		2.67		2.70	2.61	12.83	125.94
10	1700	-1.93		2.66		2.69	2.60	12.82	132.00
10	2200	-1.91		2.67		2.70	2.63	12.79	126.97
11	0300	-1.90		2.66		2.72	2.64	12.79	126.48
11	0800	-1.91		2.68		2.73	2.65	12.81	126.93
11	1300	-1.97		2.78		2.83	2.75	12.82	117.81
12	0100	-1.91		2.66		2.71	2.62	12.56	125.67
12	0600	-1.90		2.67		2.71	2.65	12.57	126.99
12	1030	-1.88		2.79		2.80	2.74	12.82	125.14
12	1500	-1.92		2.77		2.80	2.73	12.84	124.67
12	2000	-1.92		2.70		2.74	2.68	12.67	127.90
12	2319	-1.89		2.79		2.81	2.73	12.79	127.22
13	0400	-1.90		2.79		2.83	2.74	12.79	126.14
13	0900	-1.88		2.81		2.87	2.79	12.82	125.24
13	1400	-1.92		2.79		2.84	2.76	12.80	124.08
13	1900	-1.93		2.77		2.82	2.74	12.77	128.00
14	0000	-1.91		2.77		2.81	2.74	12.75	126.00
14	0500	-1.90		2.79		2.83	2.77	12.76	132.72
14	1000	-1.90		2.81		2.87	2.79	12.81	126.46
14	1500	-1.92		2.79		2.85	2.78	12.81	126.85
14	2000	-1.92		2.79		2.85	2.76	12.79	126.96
15	0100	-1.91		2.80		2.85	2.77	12.79	127.32
15	0600	-1.90		2.82		2.86	2.78	12.77	127.39
15	1100	-1.92		2.80		2.88	2.77	12.81	127.30
15	1600	-1.91		2.82		2.87	2.80	12.79	129.90
15	2100	-1.92		2.79		2.86	2.79	12.77	126.07
16	0200	-1.90		2.82		2.89	2.81	12.79	125.86
16	0700	-1.90		2.84		2.87	2.81	12.79	128.85
16	1200	-1.92		2.83		2.86	2.80	12.78	127.53
16	1700	-1.93		2.80		2.86	2.78	12.79	126.28
16	2200	-1.91		2.81		2.87	2.80	12.78	130.44
17	0300	-1.89		2.85		2.92	2.80	12.78	127.78
17	0800	-1.90		2.86		2.91	2.84	12.80	125.07
17	1300	-1.91		2.86		2.90	2.84	12.82	125.92
17	1800	-1.92		2.84		2.86	2.82	12.79	127.93
17	2300	-1.90		2.86		2.90	2.82	12.79	134.41
18	0400	-1.90		2.85		2.90	2.83	12.76	127.81

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
18	0900	-1.88		2.89		2.92	2.87	12.80	125.42
18	1400	-1.92		2.88		2.90	2.84	12.81	127.37
18	1900	-1.93		2.83		2.91	2.82	12.79	128.28
19	0600	-1.91		2.87		2.93	2.85	12.78	126.25
19	0500	-1.89		2.89		2.96	2.88	12.81	127.03
19	1000	-1.90		2.90		2.95	2.89	12.81	126.47
19	1500	-1.92		2.88		2.98	2.89	12.84	125.13
19	2000	-1.93		2.83		2.90	2.82	12.71	126.51
20	0100	-1.91		2.92		2.99	2.89	12.87	127.39
20	0600	-1.89		2.92		2.99	2.91	12.85	127.37
20	1100	-1.93		2.90		2.99	2.89	12.85	125.81
20	1600	-1.92		2.93		2.99	2.93	12.81	122.54
20	2100	-1.91		2.96		3.01	2.93	12.69	125.80
21	0200	-1.89		3.00		3.08	2.99	12.79	124.82
21	0700	-1.89		3.02		3.10	3.01	12.78	123.52
21	1200	-1.92		3.02		3.10	3.00	12.80	127.95
21	1700	-1.92		3.01		3.09	3.01	12.78	124.06
21	2200	-1.90		3.02		3.10	3.02	12.76	128.42
22	0300	-1.89		3.05		3.09	3.04	12.73	125.55
22	0800	-1.89		3.07		3.14	3.06	12.75	122.05
22	1300	-1.89		3.06		3.13	3.05	12.77	124.16
22	1800	-1.85		3.08		3.17	3.09	12.77	124.14
22	2300	-1.89		3.05		3.12	3.05	12.75	123.32
23	0400	-1.89		3.05		3.12	3.05	12.73	124.73
23	0900	-1.88		3.09		3.17	3.08	12.74	122.79
23	1400	-1.88		3.09		3.17	3.09	12.77	128.25
23	1900	-1.84		3.14		3.22	3.13	12.76	120.85
24	0000	-1.89		3.09		3.15	3.06	12.75	123.78
24	0500	-1.87		3.13		3.18	3.11	12.76	124.53
24	1000	-1.95		3.08		3.16	3.06	12.80	121.30
24	1500	-1.89		3.13		3.23	3.14	12.81	122.41
24	2000	-1.86		3.14		3.22	3.12	12.75	130.42
25	0100	-1.87		3.14		3.21	3.12	12.75	124.32
25	0600	-1.89		3.14		3.22	3.11	12.77	122.47
25	1100	-1.87		3.16		3.24	3.14	12.78	124.38
25	1600	-1.88		3.15		3.25	3.14	12.80	123.28
25	2100	-1.88		3.11		3.19	3.11	12.74	122.71
26	0200	-1.87		3.12		3.20	3.12	12.75	124.28
26	0700	-1.88		3.13		3.23	3.12	12.78	128.36
26	1200	-1.88		3.12		3.24	3.12	12.78	123.34
26	1700	-1.89		3.14		3.22	3.11	12.79	122.03
26	2200	-1.92		3.09		3.20	3.07	12.78	125.84
27	0300	-1.93		3.06		3.17	3.06	12.74	123.78
27	0800	-1.94		3.08		3.18	3.07	12.77	124.26
27	1300	-1.97		3.08		3.17	3.07	12.77	121.89
27	1800	-1.92		3.12		3.21	3.11	12.77	124.04

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
27	2300	-1.95		3.09		3.18	3.06	12.75	123.20

RAW DATA: RUN 116

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
1	1600	-1.92	0.00	.28				3.03	53.86
1	1700	-1.93	0.00	.28				3.00	53.76
1	1800	-1.93	0.00	.30				3.01	53.81
1	1900	-1.93	0.00	.33				3.01	53.83
1	2000	-1.93	0.00	.38				3.01	53.99
1	2100	-1.92	0.00	.41				3.01	53.37
1	2200	-1.94	0.00	.39				3.01	53.65
1	2300	-1.91	0.00	.45				3.01	52.92
2	0000	-1.91	0.00	.46				3.01	53.41
2	0100	-1.90	0.00	.46				3.01	53.30
2	0600	-1.88	0.00	.53				3.01	53.74
2	1100	-1.90	0.00	.59				3.01	53.56
2	1600	-1.92	0.00	.57				3.01	53.60
2	2100	-1.91	0.00	.64				3.01	53.05
3	0200	-1.90	0.00	.60				3.01	53.65
3	0700	-1.90	0.00	.66				3.01	53.78
3	1200	-1.92	0.00	.66				3.02	53.44
3	1700	-1.93	0.00	.67				3.02	53.84
3	2200	-1.91	0.00	.70				3.02	53.68
4	0300	-1.90	0.00	.69				3.01	53.57
4	0800	-1.89	0.00	.74				3.01	53.25
4	1300	-1.92	0.00	.73				3.02	52.93
4	1800	-1.94	0.00	.73				3.02	53.55
4	2300	-1.91	0.00	.78				3.01	53.32
5	0400	-1.90	0.00	.75				3.01	54.29
5	0900	-1.89	0.00	.82				3.01	53.23
5	1400	-1.91	0.00	.83				3.01	52.83
5	1900	-1.94	0.00	.84				3.01	53.20
6	0000	-1.91	0.00	.88				3.01	53.33
6	0500	-1.89	0.00	.90				3.00	53.47
6	1000	-1.89	0.00	.92				3.01	53.11
6	1500	-1.94	0.00	.89				3.01	53.36
6	1851	-1.90	0.00	.90				3.03	52.33
6	2300	-1.89	0.00	1.05				3.01	52.62
7	0400	-1.90	0.00	1.02				3.00	51.52
7	0900	-1.87	0.00	1.02				3.01	51.77
7	1400	-1.93	0.00	1.10				3.01	52.02
7	1900	-1.93	0.00	1.12				3.01	52.10
8	0000	-1.89	0.00	1.16				3.00	51.72
8	0500	-1.89	0.00	1.25				3.00	51.69
8	1000	-1.91	0.00	1.26				3.01	51.88

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
8	1500	-1.93	0.00	1.30				3.02	51.68
8	2000	-1.93	0.00	1.34				3.01	51.65
9	0100	-1.90	0.00	1.40				3.01	52.05
9	0600	-1.89	0.00	1.40				3.01	51.89
9	1100	-1.91	0.00	1.42				3.01	51.85
9	1600	-1.93	0.00	1.42				3.01	51.54
9	2100	-1.91	0.30	1.41				3.01	51.61
10	0200	-1.90	0.00	1.44				3.00	51.55
10	0700	-1.90	0.00	1.50				3.01	51.35
10	1200	-1.92	0.00	1.46				3.02	51.84
10	1700	-1.93	0.00	1.46				3.01	51.83
10	2200	-1.91	0.00	1.52				3.00	52.02
11	0300	-1.90	0.00	1.48				3.01	52.16
11	0800	-1.91	0.00	1.58				3.02	51.83
11	2011	-1.97	0.00	1.47				3.02	52.60
12	0100	-1.91	0.00	.85				2.94	51.82
12	0600	-1.90	0.00	.84				2.95	52.05
12	1030	-1.88	0.00	.96				3.03	51.76
12	1500	-1.92	0.30	1.00				3.08	52.11
12	2000	-1.92	0.00	.97				3.03	51.85
12	2319	-1.89	0.00	.99				3.03	52.01
13	0400	-1.90	0.00	.99				3.02	51.80
13	0900	-1.88	0.00	1.03				3.03	51.68
13	1400	-1.92	0.00	1.08				3.00	51.42
13	1900	-1.93	0.00	1.09				3.00	51.72
14	0000	-1.91	0.00	1.11				2.99	51.81
14	0500	-1.90	0.00	1.09				2.99	51.99
14	1000	-1.90	0.00	1.12				3.00	51.47
14	1500	-1.92	0.00	1.16				3.00	52.16
14	2000	-1.92	0.00	1.13				3.00	51.88
15	0100	-1.91	0.00	1.11				3.02	51.87
15	0600	-1.90	0.00	1.11				2.99	51.61
15	1100	-1.92	0.00	1.15				3.00	51.93
15	1600	-1.91	0.00	1.18				3.04	51.95
15	2100	-1.92	0.00	1.22				3.04	52.06
16	0200	-1.90	0.00	1.24				3.01	51.97
16	0700	-1.90	0.00	1.25				3.01	51.53
16	1200	-1.92	0.00	1.22				3.04	52.08
16	1700	-1.93	0.30	1.24				3.01	52.34
16	2200	-1.91	0.30	1.25				3.01	51.96
17	0300	-1.89	0.00	1.27				3.00	51.59
17	0800	-1.90	0.00	1.28				3.00	51.81
17	1300	-1.91	0.00	1.25				3.01	51.76
17	1800	-1.92	0.00	1.27				3.00	51.97
17	2300	-1.90	0.00	1.31				3.00	52.36
18	0400	-1.90	0.00	1.31				3.02	51.92

DAY	TIME	TIN	TOUT	TWA	TWB	TWC	TWD	HEAT	FLOW
18	0900	-1.88	0.00	1.32				3.00	51.91
18	1400	-1.92	0.00	1.31				3.03	52.34
18	1900	-1.93	0.00	1.31				2.99	52.29
19	0000	-1.91	0.00	1.27				2.99	51.79
19	0500	-1.89	0.00	1.34				2.99	51.69
19	1000	-1.90	0.00	1.36				2.99	51.51
19	1500	-1.92	0.00	1.36				2.99	51.80
19	2000	-1.93	0.00	1.35				2.99	52.04
20	0100	-1.91	0.00	1.40				3.02	51.36
20	0600	-1.89	0.00	1.42				2.99	51.83
20	1100	-1.93	0.00	1.47				3.02	51.65
20	1600	-1.91	0.00	1.36				3.01	51.40
21	0200	-1.89	0.00	1.47				3.02	51.51
21	0700	-1.89	0.00	1.44				3.01	51.74
21	1200	-1.92	0.00	1.47				3.02	51.51
21	1700	-1.92	0.00	1.52				3.02	51.78
21	2200	-1.90	0.00	1.52				3.02	51.46
22	0300	-1.89	0.00	1.54				3.01	51.50
22	0800	-1.89	0.00	1.55				3.01	51.51
22	1300	-1.89	0.00	1.58				3.02	51.49
22	1800	-1.85	0.00	1.61				3.01	51.72
22	2300	-1.89	0.00	1.61				3.01	51.64
23	0400	-1.89	0.00	1.60				3.00	51.51
23	0900	-1.88	0.00	1.64				3.00	51.57
23	1400	-1.88	0.00	1.65				3.01	51.65
23	1900	-1.84	0.00	1.67				3.01	51.90
24	0000	-1.89	0.00	1.65				3.00	51.55
24	0500	-1.87	0.00	1.68				2.99	51.63
24	1000	-1.95	0.00	1.64				3.01	51.36
24	1500	-1.89	0.00	1.71				3.01	51.69
24	2000	-1.86	0.00	1.73				3.00	51.44
25	0100	-1.87	0.00	1.74				3.00	51.80
25	0600	-1.89	0.00	1.72				3.00	51.55
25	1100	-1.87	0.00	1.75				3.00	51.17
25	1600	-1.88	0.00	1.79				3.01	51.69
25	2100	-1.88	0.00	1.80				2.99	51.46
26	0200	-1.87	0.00	1.79				2.99	51.51
26	0700	-1.88	0.00	1.78				3.00	51.62
26	1200	-1.88	0.00	1.83				3.00	51.08
26	1700	-1.89	0.00	1.79				3.00	51.40
26	2200	-1.92	0.00	1.79				3.00	51.64
27	0300	-1.93	0.00	1.81				2.99	51.26
27	0800	-1.94	0.00	1.63				3.00	51.45
27	1300	-1.97	0.00	1.85				3.00	51.25
27	1800	-1.92	0.00	1.88				3.00	51.45
27	2300	-1.95	0.00	1.88				2.99	51.27

APPENDIX D

CHEMICAL ANALYSIS PROCEDURES

Samples of cooling tower water and city water were drawn daily and analyzed for total hardness (TH), calcium hardness (CaH), methyl-orange alkalinity (m-alk), chloride (cl), silica (Si), total solids (TS) and conductivity (cond). In addition to the chemical analysis, biological growth in the cooling tower water was monitored.

The determination of TH, CaH, m-alk and cl were carried out using the analysis kits prepared by Chemax, Inc., Industrial Chemistry. Silica was estimated using test kit made by Hach Chemical Company. The above tests are simplified procedures that utilize pre-mixed chemical reagents and they give less accurate results, compared to the Standard Methods¹ (\pm 10 ppm as CaCO_3 for m-alkalinity and \pm 5 ppm for others), but are satisfactory for daily monitoring of water quality.

CHEMAX DROP TEST PROCEDURES

The various tests under this category have an identical procedure. Initially the titration bottle is filled to the mark (10 ml) and an appropriate amount of reagents are added. Then the titrant solution is added dropwise until the endpoint, marked by specific color change.

Total Hardness Test

The three reagents used are:

Reagent 1: ammonium chloride-ammonium hydroxide buffer

Reagent 2: calmagite solution (0.2%)

Reagent 3: EDTA solution (0.5%)

Five drops of Reagent 1 and three drops of Reagent 2 are added to the 10 ml sample, which turns lavender to red if hardness is present. The solution is then titrated with Reagent 3, until the last traces of violet have disappeared and the solution turns blue. One drop of Reagent 3 is equivalent to 5 ppm TH expressed as CaCO_3 .

Calcium Hardness Test

The three reagents used are:

Reagent 1: potassium hydroxide solution (8N)

Reagent 2: calver 2 indicator

Reagent 3: EDTA solution

Two drops of Reagent 1 and one capsule of Reagent 2 are added to the 10 ml sample which turns red if calcium is present. The solution is then titrated with Reagent 3 until the last traces of violet have disappeared and the solution turns blue. One drop of Reagent 3 is equivalent to 5 ppm CaH expressed as CaCO_3 .

Magnesium hardness is computed by taking the difference between total and calcium hardness.

M-Alkalinity Test

The two reagents used are:

Reagent 1: mixed bromo-cresol green and methyl red
solution (0.1%)

Reagent 2: sulfuric acid (0.0503N)

A drop of Reagent 1 is added to the 10 ml sample, which turns bluish-green if alkalinity is present. The solution is then titrated with Reagent 2 until the solution turns red. One drop of Reagent 2 is equivalent to 10 ppm alkalinity expressed as CaCO_3 .

Chloride Test

The two reagents used are:

Reagent 1: potassium chromate solution (5%)

Reagent 2: silver nitrate solution

Two drops of Reagent 1 are added to the 10 ml sample, which turns yellow in color. The solution is then titrated with Reagent 2 until the solution turns orange-red. One drop of Reagent 2 is equivalent to 5 ppm as NaCl.

HACH PROCEDURE

Silica Test

The reagents used for this test are supplied by Hach Chemical Company and the procedure is based on the silicomolybdate method, referred to in Standard Methods.¹ The following dry powdered reagents are provided in individual, premeasured, polyethylene "powder pillows" ready to use.

Reagent 1: molybdate powder pillow

Reagent 2: acid powder pillow

Reagent 3: citric acid powder pillow

The first two reagents are mixed to the 25 ml water sample taken in the colorimeter bottle. The sample is then allowed to stand for 10 minutes during which a yellow color develops if silica is present. Finally, the third reagent is added and the prepared sample is placed in the cell holder of the Hach DR colorimeter, after the apparatus has been calibrated by a blank sample. The reading then indicates directly ppm of SiO₂.

MISCELLANEOUS TESTS

Conductivity Test

An Industrial Instrument, Inc., conductivity meter is used for the procedure and the conductivity is read off in microohms/cm.

Total Solids Test

A 200 ml sample is taken in a glass beaker and evaporated in an oven at 150°F for 24 hours. The weight of the residue obtained is suitably converted to give ppm of total dissolved solids present in the sample.

Microorganism Test

The Millipore Sampler manufactured by the Millipore Corporation is used to test water samples for microorganisms. First the case is filled with water up to the mark and the filter tab is inserted into the case. The sampler is shaken well and left undisturbed for 30 seconds. The filter tab is then removed, excess water emptied

from the case, and the filter tab is tightly inserted into the case. Then the sampler is placed in an incubator for 24 hours at 35°C. If microorganisms are present, colonies will show on the surface of the sampler. The colonies are counted and reported as colonies/ml.

APPENDIX E

LISTING OF RESULTS FOR ALL RUNS

NOMENCLATURE

DAY: days elapsed (days)

TIME: total hours elapsed (24-hr clock)

VEL: flow velocity (ft/sec)

Q/A: heat flux ($\text{Btu}/\text{ft}^2 \cdot \text{hr}$)

TSA: local surface temperature at location A($^{\circ}\text{F}$)

TSB: local surface temperature at location B($^{\circ}\text{F}$)

TSC: local surface temperature at location C($^{\circ}\text{F}$)

TSD: local surface temperature at location D($^{\circ}\text{F}$)

RFA*E4: local fouling resistance at location A($\text{ft}^2 \cdot \text{hr} \cdot ^{\circ}\text{F}/\text{Btu}$) $\times 10^4$

RFB*E4: local fouling resistance at location B($\text{ft}^2 \cdot \text{hr} \cdot ^{\circ}\text{F}/\text{Btu}$) $\times 10^4$

RFC*E4: local fouling resistance at location C($\text{ft}^2 \cdot \text{hr} \cdot ^{\circ}\text{F}/\text{Btu}$) $\times 10^4$

RFD*E4: local fouling resistance at location D($\text{ft}^2 \cdot \text{hr} \cdot ^{\circ}\text{F}/\text{Btu}$) $\times 10^4$

***** RESULTS -- RUN 98 *****

DAY	TIME	VEL	Q/A	TSA	PFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	2.1	6.03	117539.	156.2	.76			151.1	.80		
1	4.1	5.97	115057.	156.1	.80			151.1	.71		
1	5.4	5.95	115152.	156.3	.78			151.3	.64		
1	6.1	6.06	115057.	155.2	.88			150.3	.71		
2	8.1	6.08	115057.	154.2	.99			149.3	.77		
2	10.1	6.00	114466.	155.3	.97			150.3	.68		
2	12.1	5.96	114961.	155.9	1.04			150.9	.68		
2	14.1	5.96	115343.	156.1	1.02			151.1	.66		
2	16.1	5.98	115248.	156.2	1.11			151.2	.68		
2	18.1	6.17	115439.	155.5	1.18			150.6	.72		
2	20.1	5.93	115343.	156.6	1.14			151.6	.66		
2	22.1	5.96	115534.	156.5	1.22			151.5	.70		
2	23.1	6.05	115439.	156.4	1.25			151.4	.72		
2	27.1	5.88	115057.	156.2	1.48			151.2	.82		
3	32.1	5.91	114675.	155.5	1.70			150.5	1.01		
3	37.1	6.03	114261.	154.8	2.06			149.9	1.20		
3	42.1	5.93	117158.	156.9	2.21			151.8	1.35		
3	47.1	6.11	116497.	155.9	2.58			150.9	1.57		
3	52.1	5.92	116499.	156.1	2.73			151.0	1.66		
4	57.1	6.06	1164971.	155.6	2.98			150.6	1.78		
4	62.1	6.06	116967.	156.0	3.22			150.9	1.96		
4	67.1	6.18	116967.	156.0	3.54			151.0	2.21		
4	72.1	5.97	116267.	156.3	3.61			151.2	2.19		
4	77.1	6.16	116585.	155.3	3.79			150.4	2.34		
5	92.1	6.01	116394.	156.8	3.80			151.8	2.36		
5	97.1	6.11	116776.	156.4	3.99			151.4	2.53		
5	92.1	6.03	116267.	155.9	4.07			150.8	2.55		
5	97.1	5.98	116967.	157.4	4.15			152.3	2.61		
5	102.1	6.01	116971.	156.2	4.27			151.2	2.73		
6	107.1	6.02	116776.	156.1	4.36			151.1	2.72		
6	112.1	6.04	116680.	156.5	4.42			151.5	2.76		
6	117.1	5.97	117062.	157.2	4.50			152.1	2.73		
6	122.1	6.09	117062.	155.4	4.65			150.4	2.88		
6	127.1	6.07	116967.	155.9	4.71			150.9	2.87		
7	132.1	6.10	116690.	156.1	4.77			151.1	2.86		
7	137.1	5.98	116471.	157.1	4.75			152.0	2.77		
7	142.1	5.96	116690.	156.8	4.82			151.8	2.76		
7	147.1	6.00	116367.	155.8	4.90			150.7	2.81		
8	152.1	6.01	116871.	155.9	4.94			150.9	2.78		
9	157.1	5.98	116776.	156.1	4.95			151.1	2.72		
9	162.1	6.05	117158.	156.1	5.00			151.0	2.71		
9	167.1	6.01	117253.	156.1	4.99			151.1	2.68		

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
8	172.1	6.00	116471.	156.3	5.02			151.2	2.68		
9	177.1	6.24	116585.	154.8	5.16			149.9	2.78		
9	182.1	6.04	116871.	156.3	5.06			151.3	2.58		
9	187.1	5.97	117253.	157.3	5.03			152.2	2.54		
9	192.1	6.04	117158.	156.5	5.10			151.5	2.63		
10	197.1	6.05	116680.	156.1	5.18			151.1	2.63		
10	202.1	6.08	116680.	156.5	5.17			151.5	2.60		
10	207.1	6.10	116776.	156.4	5.19			151.4	2.56		
10	212.1	6.06	117062.	156.6	5.19			151.5	2.56		
10	217.1	6.03	117062.	156.5	5.15			151.5	2.56		
10	222.1	6.04	117158.	156.5	5.20			151.4	2.68		
11	227.1	6.08	116680.	156.2	5.24			151.2	2.68		
11	232.1	6.00	117062.	157.6	5.19			152.5	2.63		
11	237.1	5.94	117253.	157.5	5.21			152.4	2.70		
11	242.1	6.15	116967.	155.0	5.40			150.8	2.98		
11	247.1	6.00	116776.	156.6	5.30			151.5	2.80		
12	252.1	6.05	116471.	156.8	5.33			151.8	2.81		
12	257.1	5.95	117253.	157.2	5.29			152.1	2.82		
12	262.1	6.02	117253.	156.3	5.36			151.3	2.92		
12	267.1	6.16	117253.	156.3	5.52			151.3	3.01		
13	272.1	6.01	117062.	157.3	5.49			152.2	3.03		
13	277.1	6.19	117062.	155.9	5.63			151.0	3.18		
13	282.1	6.17	117158.	155.2	5.71			150.3	3.51		
13	287.1	6.24	117062.	154.7	5.71			149.8	3.71		
13	292.1	6.05	116967.	156.6	5.57			151.6	3.66		
14	297.1	6.15	116967.	155.9	5.64			150.9	3.83		
14	302.1	6.09	117158.	156.7	5.58			151.7	3.83		
14	307.1	6.08	116471.	155.4	5.66			150.4	3.87		
14	312.1	6.16	117062.	155.6	5.64			150.6	3.97		
14	317.1	6.03	117062.	156.2	5.56			151.2	3.96		
15	322.1	6.04	116776.	156.8	5.56			151.8	4.01		
15	327.1	6.14	117158.	156.4	5.61			151.4	4.19		
15	332.1	6.05	117158.	156.7	5.56			151.6	4.24		
15	337.1	6.18	117062.	154.9	5.65			149.9	4.37		
15	342.1	6.06	117062.	156.6	5.55			151.5	4.27		
16	347.1	6.05	116776.	156.5	5.60			151.4	4.32		
16	352.1	6.02	117253.	156.9	5.60			151.9	4.33		
16	357.1	6.04	117253.	156.3	5.64			151.2	4.41		
16	362.1	6.05	117062.	157.0	5.70			151.9	4.56		
16	367.1	6.24	116471.	154.3	5.85			149.4	4.83		
17	372.1	6.08	116776.	155.4	5.75			150.4	4.83		
17	376.1	5.77	118494.	158.6	5.89			153.3	5.00		
17	391.1	5.89	117158.	157.0	6.05			151.9	5.12		
18	396.1	6.11	117062.	155.9	6.06			150.9	5.12		
18	401.1	6.03	117158.	157.1	6.02			152.1	5.08		
18	406.1	6.28	117253.	153.7	6.26			148.8	5.25		
18	411.1	6.11	116776.	154.9	6.07			149.9	5.08		

DAY	TIME	VEL	O/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFQ*E4
19	416.1	6.10	116571.	155.6	6.07			150.6	5.04		
19	421.1	6.10	115585.	155.8	6.05			150.8	4.97		
19	426.1	6.03	117062.	156.2	6.03			151.2	4.89		
19	431.1	6.25	117349.	155.4	6.11			150.5	4.90		
19	436.1	6.13	136445.	166.4	4.44			160.6	3.34		
20	441.1	6.15	136350.	155.5	4.46			159.8	3.32		
20	446.1	6.22	136827.	155.6	4.46			159.9	3.28		
20	451.1	6.08	136536.	156.9	4.36			161.1	3.14		
20	456.1	6.14	136732.	156.2	4.40			160.4	3.13		
20	461.1	6.23	136541.	155.1	4.47			159.3	3.15		
21	466.1	6.37	136541.	154.6	4.55			158.9	3.21		
21	471.1	6.17	136636.	155.3	4.47			159.6	3.12		
21	476.1	6.08	136636.	156.6	4.41			160.3	3.03		
21	481.1	6.26	136732.	154.3	4.50			158.6	3.13		
21	486.1	6.19	136923.	155.3	4.48			159.5	3.09		
22	491.1	6.17	136923.	155.7	4.49			159.9	3.06		
22	496.1	6.24	137113.	155.6	4.53			159.8	3.06		
22	501.1	6.11	137209.	155.5	4.48			159.7	3.00		
22	506.1	6.19	136923.	154.4	4.53			158.6	3.04		
22	511.1	6.09	136427.	155.8	4.45			159.9	2.93		
23	516.1	6.15	136827.	156.2	4.46			160.4	2.94		
23	521.1	6.18	137113.	155.5	4.46			159.7	2.92		
23	526.1	6.09	136923.	155.8	4.43			159.9	2.85		
23	531.1	6.06	136427.	156.0	4.40			160.1	2.86		
24	536.1	6.14	136732.	155.1	4.45			159.2	2.88		
24	541.1	6.30	136636.	163.7	4.55			158.0	2.96		
24	546.1	6.36	137304.	164.1	4.57			158.5	2.98		
24	551.1	6.12	137018.	155.1	4.44			159.2	2.86		
24	556.1	6.16	136427.	154.3	4.48			158.5	2.90		
25	561.1	6.17	136827.	156.0	4.46			160.2	2.87		
25	566.1	6.20	136923.	155.2	4.51			159.4	2.90		
25	571.1	6.03	137400.	155.5	4.43			160.6	2.84		
25	576.1	6.13	137209.	155.1	4.47			159.2	2.89		
25	581.1	6.15	136923.	155.7	4.46			159.8	2.85		
25	586.1	6.20	136527.	155.5	4.47			159.7	2.87		
26	591.1	6.25	137113.	154.9	4.52			159.2	2.90		
26	596.1	6.12	137400.	156.7	4.38			160.9	2.79		
26	601.1	6.21	137018.	165.5	4.44			159.7	2.82		
26	606.1	6.30	137113.	155.1	4.51			159.4	2.90		
27	611.1	6.33	137113.	154.6	4.53			158.9	2.90		
27	616.1	6.23	137018.	155.6	4.46			159.8	2.83		
27	621.1	6.27	137113.	155.0	4.50			159.3	2.85		
27	626.1	6.19	136923.	155.3	4.44			159.5	2.80		
27	631.1	6.37	137018.	153.6	4.58			157.9	2.91		
28	636.1	6.13	137018.	156.1	4.42			160.3	2.78		
28	641.1	6.23	137400.	155.4	4.47			160.6	2.79		
28	646.1	6.40	137113.	154.1	4.59			158.4	2.90		

DAY	TIME	VEL	O/A	TSA	RF4*E4	TSB	RF8*E4	TSC	RFC*E4	TSD	RFD*E4
28	651.1	6.27	137400.	165.5	4.49			159.7	2.81		
29	656.1	6.21	136923.	165.7	4.45			159.9	2.79		
29	661.1	6.17	137018.	165.1	4.44			150.3	2.78		
29	666.1	6.34	137304.	165.2	4.53			159.5	2.85		
29	671.1	6.29	137400.	164.8	4.54			159.0	2.84		
29	676.1	6.20	137018.	165.6	4.48			159.8	2.78		
30	681.1	6.37	137018.	164.5	4.59			158.9	2.88		
30	686.1	6.18	137304.	166.4	4.48			160.6	2.79		
30	691.1	6.24	137113.	164.7	4.56			158.9	2.84		
30	696.1	6.17	137209.	165.4	4.49			159.5	2.77		
30	701.1	6.47	136827.	162.8	4.69			157.2	2.94		
31	714.1	6.21	137304.	165.3	4.55			159.5	2.81		
31	719.1	6.39	137400.	163.7	4.64			158.0	2.89		
31	724.1	6.27	137018.	164.7	4.62			159.0	2.86		
32	729.1	6.30	137018.	164.8	4.63			159.0	2.89		
32	734.1	6.17	137209.	165.9	4.58			160.1	2.83		
32	739.1	6.21	137304.	165.6	4.60			159.8	2.86		
32	744.1	6.17	137400.	166.3	4.56			160.5	2.81		
32	749.1	6.19	136827.	165.5	4.62			159.8	2.84		
33	754.1	6.32	136827.	164.8	4.68			159.1	2.91		
33	759.1	6.16	137209.	166.8	4.57			161.0	2.82		
33	764.1	6.28	137018.	164.9	4.70			159.2	2.92		
33	769.1	6.34	135777.	163.8	4.82			158.2	3.05		
33	774.1	6.34	135195.	163.9	4.85			158.3	3.05		
34	779.1	6.21	134460.	164.5	4.86			158.8	3.06		
34	784.1	6.20	133963.	164.0	4.88			158.3	3.09		
34	789.1	6.19	133772.	163.7	4.91			158.0	3.09		
34	794.1	6.35	133581.	161.8	5.00			156.3	3.17		
34	799.1	6.23	133581.	163.9	4.90			158.2	3.08		
35	804.1	6.18	133495.	164.2	4.88			158.6	3.06		
35	809.1	6.38	132721.	162.3	5.05			156.8	3.22		
35	814.1	6.21	133008.	163.4	4.96			157.8	3.13		
35	819.1	6.32	133008.	162.3	5.00			156.7	3.17		
36	824.1	6.34	133103.	162.2	5.00			156.7	3.19		
36	829.1	6.43	133103.	161.8	5.05			156.3	3.22		
36	834.1	6.23	133103.	163.0	4.92			157.4	3.13		
36	839.1	6.17	133103.	163.9	4.88			158.2	3.09		
36	844.1	6.17	132721.	163.0	4.90			157.4	3.09		
37	849.1	6.29	133008.	163.1	4.94			157.6	3.15		
37	854.1	6.15	132912.	164.1	4.87			158.5	3.08		
37	859.1	6.31	131098.	161.7	5.08			156.2	3.27		
37	864.1	6.19	130907.	162.5	5.09			157.0	3.23		
37	869.1	6.39	130621.	160.9	5.26			155.5	3.42		
38	874.1	6.26	130907.	161.7	5.23			156.2	3.36		
38	879.1	6.32	130912.	161.2	5.25			155.7	3.39		
38	884.1	6.32	131098.	161.3	5.27			155.8	3.42		
38	889.1	6.44	131098.	160.4	5.36			155.0	3.48		

***** RESULTS -- RUN 99 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.3	3.95	55667.	168.9	-3.48			167.0	-3.48		
1	.5	3.96	55571.	168.8	-3.39			167.0	-3.29		
1	1.0	3.93	55380.	170.8	-3.60			169.0	-3.60		
1	1.5	4.00	56430.	172.4	-3.82			170.6	-3.58		
1	2.0	3.93	57003.	175.2	-4.23			173.4	-3.90		
1	2.5	3.95	56430.	175.1	-4.00			173.2	-3.86		
1	3.0	4.00	55953.	174.1	-3.90			172.3	-3.71		
1	3.5	4.01	55667.	174.2	-3.79			172.4	-3.65		
1	4.0	4.07	55571.	173.6	-3.64			171.8	-3.55		
1	4.5	4.11	55571.	173.7	-3.70			171.9	-3.51		
1	5.0	3.97	55571.	175.2	-3.98			173.4	-3.83		
1	5.5	3.98	55380.	175.0	-3.81			173.2	-3.77		
1	6.0	4.10	55380.	173.8	-3.54			172.0	-3.50		
1	6.5	4.03	55285.	174.6	-3.74			172.8	-3.69		
1	7.0	4.07	55285.	174.4	-3.75			172.6	-3.51		
2	7.5	4.15	55285.	173.7	-3.59			172.0	-3.45		
2	8.5	3.99	55285.	175.7	-3.84			173.9	-3.79		
2	9.5	4.14	55189.	174.0	-3.64			172.3	-3.40		
2	11.5	4.00	55285.	175.6	-3.81			173.8	-3.72		
2	14.5	3.73	55476.	179.5	-3.61			177.6	-3.55		
2	18.5	3.77	55571.	179.0	-3.42			177.1	-3.51		
2	20.5	3.76	55667.	180.2	-3.53			178.3	-3.62		
2	23.5	3.75	55571.	181.6	-3.34			179.7	-3.68		
2	26.5	3.80	55476.	181.6	-3.25			179.8	-3.59		
2	29.5	3.78	55571.	181.0	-3.22			179.1	-3.56		
2	30.5	3.78	55476.	180.5	-3.15			178.6	-3.34		
3	31.5	3.79	55476.	180.3	-3.07			178.5	-3.41		
3	32.5	3.82	55380.	179.4	-2.86			177.6	-3.25		
3	33.5	3.79	55380.	179.6	-3.04			177.7	-3.28		
3	33.5	3.79	55380.	179.6	-2.94			177.8	-3.19		
3	34.5	3.85	55380.	179.1	-2.85			177.3	-3.29		
3	39.5	3.87	55476.	178.1	-2.41			176.2	-3.06		
3	44.5	3.92	55667.	178.2	-2.18			176.4	-2.82		
3	49.5	3.93	55571.	180.0	-2.11			178.1	-2.85		
3	54.5	3.89	55476.	180.5	-2.15			178.6	-3.09		
4	59.5	3.82	55380.	180.4	-2.04			178.5	-2.97		
4	64.5	3.87	55667.	179.5	-1.76			177.6	-2.80		
4	69.5	3.84	55667.	180.2	-1.55			178.3	-2.83		
4	71.3	3.97	55571.	179.2	-1.28			177.4	-2.61		
4	75.5	3.94	55380.	178.8	-0.96			177.0	-2.50		
5	80.5	3.94	55380.	177.6	-0.56			175.8	-2.24		
5	85.5	3.80	55189.	178.4	-0.50			176.6	-2.33		

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
5	90.5	3.73	55476.	177.5	-.28			175.6	-2.14		
5	95.5	3.74	55476.	177.3	.10			175.4	-2.06		
5	100.5	3.75	55380.	177.9	.38			176.0	-1.88		
6	105.5	3.77	55285.	177.4	.67			175.5	-.90		
6	110.5	3.74	55380.	177.7	.90			175.9	-.57		
6	115.5	3.72	55380.	178.3	.84			176.4	-.52		
6	120.5	3.85	55380.	176.8	1.17			174.9	-.15		
6	125.5	3.74	55189.	177.4	1.02			175.5	-.16		
7	130.5	3.74	55189.	177.2	1.05			175.3	-.28		
7	135.5	3.71	55285.	177.4	1.11			175.5	-.30		
7	140.5	3.86	55285.	175.7	1.52			173.8	.10		
7	145.5	3.66	55285.	178.4	1.03			176.5	-.29		
7	150.5	3.73	55285.	177.1	1.30			175.3	-.21		
8	155.5	3.72	55189.	176.3	1.36			174.4	-.06		
8	160.5	3.66	55380.	176.2	1.42			174.3	.01		
8	165.5	3.65	55380.	175.3	1.49			173.4	.08		
8	170.5	3.65	55189.	175.8	1.40			173.9	-.01		
9	175.5	3.75	55189.	175.0	1.75			173.1	.23		
9	180.5	3.65	55189.	176.4	1.48			174.5	-.08		
9	185.5	3.72	55476.	176.0	1.70			174.1	.19		
9	190.5	3.78	55380.	175.1	1.96			173.3	.35		
9	195.5	3.78	55189.	175.4	1.91			173.6	.34		
10	200.5	3.71	55189.	176.5	1.72			174.6	.11		
10	205.5	3.67	55189.	176.1	1.74			174.2	.08		
10	210.5	3.73	55476.	175.0	1.97			173.1	.27		
10	215.5	3.60	55380.	176.6	1.78			174.7	.04		
10	220.5	3.62	55189.	177.8	1.68			175.9	-.07		
11	225.5	3.66	55189.	177.7	1.94			175.8	-.01		
11	230.5	3.73	55285.	176.5	2.10			174.7	.29		
11	235.5	3.67	55380.	176.7	2.02			174.8	.22		
11	240.5	3.76	55285.	175.6	2.23			173.7	.57		
11	245.5	3.77	55285.	175.7	2.30			173.8	.50		
12	250.5	3.69	55094.	177.2	2.13			175.3	.22		
12	255.5	3.67	55380.	177.9	1.94			176.0	.19		
12	260.5	3.71	55380.	177.9	2.10			176.0	.25		
12	265.5	3.75	55285.	177.5	2.22			175.6	.32		
12	270.5	3.72	55285.	178.4	2.15			176.5	.15		
13	275.5	3.69	55189.	178.1	2.01			176.2	.16		
13	280.5	3.69	55380.	177.9	2.05			176.0	.10		
13	285.5	3.71	55285.	177.7	2.17			175.9	.12		
13	290.5	3.73	55189.	177.5	2.21			175.7	.21		
14	295.5	3.78	55285.	177.1	2.25			175.2	.29		
14	300.5	3.78	55285.	176.2	2.31			174.3	.31		
14	305.5	3.72	55189.	176.6	2.09			174.7	.13		
14	310.5	3.76	56526.	178.9	2.10			177.0	.09		
14	315.5	3.82	56526.	178.5	2.23			176.6	.27		
15	320.5	3.71	56526.	179.7	1.92			177.7	-.04		

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
15	325.5	3.72	56621.	180.0	1.92			178.0	-.04		
15	330.5	3.70	56621.	179.1	1.98			177.1	.02		
15	335.5	3.73	56812.	178.6	1.91			176.7	.00		
15	340.5	3.85	56430.	177.9	2.24			176.0	.22		
15	341.5	3.77	56621.	179.0	1.99			177.1	.03		
16	346.5	3.78	56430.	178.5	1.94			176.6	.07		
16	351.5	3.71	56621.	178.9	1.91			177.0	-.05		
16	356.5	3.73	56621.	178.7	1.90			176.8	-.01		
16	361.5	3.79	56526.	176.0	2.24			174.1	.23		
16	366.5	3.79	56526.	176.2	2.16			174.3	.24		
17	371.5	3.76	56430.	176.5	2.16			174.6	.19		
17	376.5	3.80	56621.	175.9	2.21			174.0	.24		
17	381.5	3.87	56621.	175.0	2.42			173.1	.45		
17	386.5	3.86	56526.	176.1	2.37			174.2	.40		
18	391.5	3.80	56430.	177.2	2.27			175.3	.21		
18	396.5	3.89	56430.	175.8	2.42			174.0	.49		
18	401.5	3.88	56621.	175.1	2.49			173.2	.52		
18	406.5	3.79	56526.	176.9	2.28			174.9	.31		
18	411.5	3.77	56430.	176.1	2.28			174.1	.36		
19	416.5	3.80	56335.	175.2	2.44			173.3	.47		
19	421.5	3.76	56335.	175.5	2.28			173.6	.36		
19	426.5	3.71	56526.	176.2	2.30			174.3	.29		
19	431.5	3.60	56335.	175.6	2.18			173.6	.17		
19	436.5	3.70	56239.	174.9	2.41			172.9	.39		
20	441.5	3.63	56239.	175.5	2.20			173.6	.23		
20	446.5	3.65	56239.	174.7	2.33			172.8	.27		
20	451.5	3.68	56335.	175.4	2.35			173.5	.33		
21	466.5	3.71	56239.	176.4	2.33			174.4	.36		
21	471.5	3.71	56239.	175.9	2.32			174.0	.30		
21	476.5	3.71	56239.	176.7	2.27			174.8	.30		
21	481.5	3.83	56239.	175.6	2.46			173.7	.53		
21	486.5	3.85	56239.	175.6	2.51			173.8	.58		
22	491.5	3.82	56239.	175.7	2.45			173.8	.47		
22	496.5	3.73	56430.	176.7	2.26			174.8	.25		
22	501.5	3.85	56335.	173.3	2.62			171.5	.65		
22	506.5	3.79	56144.	173.9	3.06			172.0	.94		
23	511.5	3.84	56144.	173.2	3.28			171.4	1.20		
23	516.5	3.79	56144.	173.3	3.35			171.5	1.19		
23	521.5	3.75	56430.	173.2	3.32			171.3	1.16		
23	526.5	3.77	56335.	173.7	3.43			171.8	1.22		
23	531.5	3.80	56144.	173.8	3.45			172.0	1.19		
24	536.5	3.83	56239.	173.3	3.55			171.4	1.29		
24	541.5	3.78	56239.	173.1	3.43			171.2	1.17		
24	546.5	3.93	56335.	172.3	3.72			170.4	1.50		
24	557.4	3.72	57385.	164.6	2.49			162.7	.73		
24	557.5	3.71	57290.	165.1	2.46			163.1	.71		
24	557.5	3.75	57290.	164.6	2.54			162.7	.82		

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
24	558.5	3.78	56621.	168.0	2.50			166.1	.77		
25	563.5	3.97	56239.	171.1	3.12			169.3	.99		
25	568.5	3.90	56526.	172.9	3.17			171.0	1.01		
25	573.5	3.88	56430.	173.1	3.29			171.2	1.13		
25	578.5	3.92	56335.	172.8	3.54			170.9	1.37		
26	583.5	3.89	56239.	173.0	3.64			171.2	1.43		
26	588.5	3.88	56239.	172.5	3.73			170.7	1.47		
26	593.5	3.86	56430.	172.5	3.81			170.7	1.51		
26	598.5	3.97	56335.	172.7	3.99			170.8	1.72		
26	603.5	3.95	56335.	174.7	3.87			172.8	1.61		
27	608.5	3.94	56239.	174.4	3.97			172.6	1.66		
27	613.5	3.96	56239.	173.5	4.13			171.7	1.77		
27	618.5	4.03	56335.	173.7	4.24			171.9	1.88		
27	623.5	4.08	56335.	174.1	4.25			172.3	1.99		
27	628.5	3.97	56144.	175.6	4.05			173.8	1.79		
28	633.5	3.99	56239.	175.7	4.12			173.9	1.81		
28	638.5	3.98	56144.	175.2	4.12			173.4	1.85		
28	643.5	3.98	56239.	175.6	4.13			173.8	1.82		
28	648.5	4.00	56239.	175.6	4.18			173.8	1.87		
28	653.5	4.08	56144.	173.6	4.45			171.8	2.13		
29	658.5	4.01	56144.	173.9	4.30			172.1	1.99		
29	663.5	3.96	56239.	173.9	4.25			172.0	1.94		
29	668.5	4.08	56239.	173.2	4.47			171.4	2.20		

***** RESULTS -- RUN 100 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
1	.3	4.07	56193.	165.7	-.33			305.9	-.12	233.2	-.29
1	.5	4.08	56150.	166.0	-.53			306.1	-.20	233.4	-.22
1	1.0	4.08	56206.	167.7	-.67			307.9	-.19	235.2	.08
1	1.5	4.10	56206.	168.6	-.53			308.1	.01	235.7	.46
1	2.0	4.10	56206.	169.9	-.47			309.6	.03	237.1	.04
1	2.5	4.10	56178.	170.6	-.44			310.0	.11	237.7	.39
1	3.0	4.10	56150.	171.0	-.47			310.6	-.01	238.2	.32
1	3.5	4.10	56193.	171.4	-.31			310.7	.13	238.5	.42
1	4.0	4.10	56065.	171.7	-.25			311.0	.14	238.8	.81
1	4.5	4.10	56178.	172.3	-.46			311.7	.00	239.4	.98
1	5.0	4.09	56037.	172.1	-.25			311.8	.11	239.4	1.20
1	5.5	4.08	56178.	173.0	-.53			313.1	-.15	240.4	.86
1	6.0	4.09	56206.	172.8	-.54			312.7	-.06	240.1	1.10
1	6.5	4.09	56122.	172.7	-.50			312.4	.01	240.0	1.30
1	7.0	4.11	56178.	172.8	-.55			312.1	.10	239.9	1.81
2	7.5	4.08	56178.	173.5	-.68			313.7	-.10	241.0	1.65
2	8.5	4.07	56122.	173.6	-.66			313.9	-.04	241.1	1.79
2	9.5	4.10	56150.	173.5	-.72			313.1	.20	240.7	2.37
2	11.5	4.09	56122.	173.4	-.74			313.2	.32	240.7	2.43
2	14.5	4.11	55953.	172.9	-.56			311.7	.75	239.7	1.62
2	18.5	4.13	55381.	172.3	-.41			310.4	1.23	238.8	2.46
2	20.5	4.06	55897.	174.1	-.45			314.1	.94	241.5	1.89
2	23.5	4.06	55840.	175.8	-.32			315.9	1.08	243.2	2.00
2	26.5	4.07	55340.	176.5	.01			316.2	1.55	243.8	2.94
2	29.5	4.08	55784.	175.1	.35			314.1	2.03	242.0	3.21
2	30.5	4.07	55784.	175.0	.35			314.6	1.97	242.2	3.51
3	31.5	4.06	55784.	175.2	.41			315.0	1.98	242.5	3.76
3	32.5	4.09	55784.	174.4	.59			313.3	2.33	241.3	3.77
3	33.5	4.08	55728.	174.1	.63			313.1	2.38	241.0	4.06
3	33.8	4.05	55728.	174.7	.56			314.9	2.06	242.2	3.81
3	34.5	3.86	55728.	178.0	.05			324.5	.46	248.5	2.84
3	39.5	3.87	55531.	176.8	.49			322.4	1.01	246.9	2.47
3	44.5	4.06	55419.	174.4	1.12			313.2	2.06	241.2	3.08
3	49.5	3.92	55447.	178.1	.74			321.7	1.71	247.2	3.15
3	54.5	3.85	55503.	179.7	.38			325.9	.98	250.1	3.04
4	59.5	4.07	55278.	175.0	1.19			313.4	3.16	241.6	4.96
4	64.5	3.90	55194.	177.0	.73			320.8	1.69	246.2	2.96
4	69.5	3.89	55166.	177.3	.71			321.2	1.65	246.6	2.64
4	71.3	4.09	55139.	174.8	1.26			312.0	3.38	240.8	4.01
4	75.5	4.07	55181.	174.7	1.22			312.4	3.29	241.0	4.85
5	80.5	3.88	55109.	176.6	.74			320.8	1.69	246.0	3.95
5	85.5	4.06	55181.	172.6	1.34			310.8	3.31	239.1	5.31

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
5	96.5	4.06	54397.	170.4	1.61			308.1	3.63	236.7	4.45
5	95.5	4.07	54969.	169.6	1.50			307.0	3.62	235.7	4.77
5	100.5	3.88	54884.	174.0	.86			317.4	1.80	243.0	4.20
6	105.5	4.06	54828.	171.1	1.45			308.7	3.32	237.3	5.40
6	110.5	4.06	54772.	170.7	1.61			308.0	3.50	236.8	5.01
6	115.5	3.84	54744.	174.5	.86			319.1	1.46	244.1	4.04
6	120.5	4.05	54660.	171.6	1.43			308.9	3.35	237.7	5.30
6	125.5	4.04	54547.	170.7	1.49			308.0	3.33	236.8	5.67
7	130.5	4.04	54575.	170.4	1.54			307.8	3.35	236.5	5.97
7	135.5	4.05	54519.	170.0	1.61			307.1	3.45	236.0	5.44
7	140.5	4.05	54435.	170.1	1.66			306.8	3.53	235.9	5.68
7	145.5	4.06	54406.	170.0	1.60			306.4	3.55	235.7	5.70
7	150.5	3.84	54406.	173.3	1.04			317.0	1.60	242.5	4.68
8	155.5	4.05	54378.	169.3	1.65			315.8	3.52	234.9	6.09
8	160.5	3.97	54322.	169.0	1.61			308.0	3.00	235.9	4.73
8	165.5	4.04	54238.	166.6	1.95			303.1	3.82	232.3	5.18
8	170.5	3.82	54238.	171.1	1.08			315.0	1.57	240.4	4.59
9	175.5	3.81	54238.	171.7	1.09			315.8	1.60	241.1	5.08
9	180.5	3.83	54182.	171.1	1.24			314.5	1.86	240.1	5.11
9	185.5	3.82	54125.	171.7	1.16			315.3	1.71	240.8	3.81
9	190.5	3.91	54491.	170.7	1.48			312.2	2.57	238.8	4.23
9	195.5	4.03	54519.	169.4	1.69			306.8	3.54	235.5	6.06
10	200.5	3.88	54491.	171.8	1.29			314.3	2.20	240.4	5.10
10	205.5	4.02	54519.	168.5	1.77			306.6	3.46	235.0	6.07
10	210.5	3.88	54435.	170.2	1.53			312.3	2.44	238.6	4.08
10	215.5	3.86	54435.	170.4	1.41			313.6	2.13	239.3	4.09
10	220.5	3.98	54463.	169.9	1.63			319.1	3.08	236.9	5.61
11	225.5	3.82	54435.	173.3	1.07			317.9	1.59	242.9	4.62
11	230.5	3.95	54378.	170.7	1.59			310.5	2.96	238.0	4.49
11	235.5	3.99	54378.	168.9	1.75			307.4	3.36	235.6	4.94
11	240.5	3.99	55700.	170.9	1.70			312.8	3.16	239.2	4.45
11	245.5	3.80	55644.	174.7	1.09			323.2	1.35	246.2	3.66
12	250.5	3.80	55531.	175.1	1.17			323.2	1.45	246.4	4.47
12	255.5	3.80	55503.	175.0	1.22			323.0	1.46	246.3	3.25
12	260.5	3.84	55475.	174.9	1.36			321.5	1.84	245.5	3.44
12	265.5	4.01	55503.	172.5	1.85			313.3	3.37	240.3	5.11
12	270.5	3.78	55503.	170.8	1.06			325.6	1.16	248.4	3.76
13	275.5	4.01	55503.	172.4	1.70			313.1	3.30	240.1	5.40
13	280.5	4.01	55475.	171.7	1.81			312.3	3.39	239.4	5.03
13	285.5	3.82	55475.	175.2	1.22			322.4	1.60	246.1	4.21
13	290.5	3.79	55750.	176.0	.99			324.3	1.17	247.4	3.88
14	295.5	3.84	55475.	175.1	1.29			321.3	1.78	245.5	4.07
14	300.5	4.00	55419.	171.6	1.79			312.5	3.24	239.4	5.10
14	305.5	3.96	55362.	171.9	1.72			314.0	2.93	240.3	5.45
14	310.5	4.00	56150.	173.3	1.78			316.3	3.19	242.0	4.93
14	315.5	3.96	56337.	174.1	1.74			317.9	2.93	243.3	4.51
15	320.5	3.99	56393.	173.4	1.83			316.3	3.19	242.2	5.1+

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TS8	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
15	325.5	3.79	55953.	176.8	1.41			326.2	1.55	248.7	3.67
15	330.5	3.99	55953.	172.4	1.99			315.0	3.31	241.1	4.10
15	335.5	3.80	55381.	175.0	1.54			324.1	1.70	246.7	3.28
15	340.5	4.00	55869.	173.3	1.91			315.3	3.38	241.6	5.16
15	341.5	4.00	55953.	173.1	2.08			315.2	3.43	241.5	4.79
16	346.5	4.00	55953.	173.1	2.08			315.2	3.43	241.5	5.43
16	351.5	3.78	56109.	176.1	1.55			326.3	1.45	248.4	3.14
16	356.5	3.76	55925.	176.2	1.55			326.8	1.39	248.7	2.91
16	361.5	4.00	55840.	170.4	2.39			312.3	3.64	238.7	5.18
16	366.5	3.80	55953.	174.0	1.83			323.0	1.83	245.8	3.73
17	371.5	3.95	55397.	171.5	2.32			315.1	3.26	240.6	5.37
17	376.5	3.92	55897.	171.7	2.24			316.4	2.99	241.3	4.12
17	381.5	3.92	55784.	171.5	2.34			315.9	3.19	241.0	4.07
17	386.5	3.77	55700.	175.1	1.80			324.6	1.62	247.1	3.47
18	391.5	3.81	55728.	174.6	1.90			323.0	1.97	246.0	4.16
18	396.5	3.99	55728.	171.5	2.49			313.6	3.65	239.9	5.47
18	401.5	4.00	55756.	170.3	2.64			312.1	3.85	238.6	4.53
18	406.5	4.02	55700.	170.4	2.66			311.2	4.07	238.1	4.77
18	411.5	3.81	55644.	173.3	2.09			321.3	2.14	244.5	4.30
19	416.5	4.01	55812.	169.9	2.76			311.5	4.02	238.1	5.66
19	421.5	4.00	55784.	169.7	2.80			311.3	4.00	237.9	5.46
19	426.5	3.96	55700.	169.9	2.70			312.7	3.63	238.6	4.50
19	431.5	3.98	55616.	167.4	3.01			309.4	4.10	235.8	4.94
19	436.5	4.01	55644.	168.2	2.87			309.4	4.11	236.2	5.76
20	441.5	4.00	55869.	168.0	3.10			309.9	4.30	236.3	5.99
21	446.5	3.99	55784.	167.5	3.26			319.6	4.43	235.9	5.72
20	451.5	3.77	55728.	172.3	2.57			321.9	2.34	244.2	4.22
21	466.5	4.00	55700.	169.8	3.13			311.3	4.37	237.9	5.88
21	471.5	3.99	55672.	169.4	3.16			311.2	4.34	237.6	5.83
21	476.5	4.03	55644.	170.1	3.16			311.5	4.39	238.2	5.83
21	481.5	3.77	55587.	174.8	2.38			324.2	2.20	246.7	4.24
21	486.5	3.77	55953.	175.3	2.47			325.6	2.23	247.6	3.95
22	491.5	3.98	55953.	171.3	3.17			314.1	4.28	240.1	5.52
22	496.5	3.99	55840.	170.4	3.24			312.6	4.42	238.9	4.77
22	501.5	4.06	55840.	163.0	3.52			308.0	5.08	235.4	5.22
22	506.5	4.07	55840.	167.5	3.64			307.2	5.27	234.7	6.11
23	511.5	3.86	55397.	171.0	3.09			318.1	3.47	241.8	5.28
23	516.5	4.07	55897.	167.2	3.73			317.0	5.37	234.5	6.42
23	521.5	4.07	55700.	165.9	3.99			305.4	5.60	233.1	5.42
23	526.5	4.07	55700.	166.8	3.88			306.2	5.50	233.9	5.48
23	531.5	4.08	55756.	167.5	3.79			306.6	5.53	234.5	6.34
24	536.5	3.89	56150.	171.3	3.29			317.9	3.74	241.7	5.32
24	541.5	4.03	56137.	167.4	3.96			318.9	5.36	235.5	6.08
24	546.5	3.89	55981.	170.6	3.51			316.7	4.67	241.0	4.83
24	551.4	4.02	56769.	162.7	6.16			326.1	7.06	251.7	4.75
24	557.5	4.01	56712.	174.1	6.03			317.9	6.94	243.3	5.17
24	557.5	3.99	56684.	164.3	6.22			308.9	7.02	233.9	5.66

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
24	558.5	3.94	56234.	163.4	5.71			308.5	6.44	233.2	5.71
25	563.5	3.99	55700.	169.3	4.47			310.2	5.47	236.6	5.56
25	568.5	3.92	55559.	169.8	4.07			313.6	4.71	239.0	4.04
25	573.5	3.89	55784.	170.6	3.95			316.0	4.32	240.6	3.94
25	578.5	3.95	55812.	163.9	4.04			313.2	4.82	238.9	4.70
26	583.5	3.97	55840.	169.6	4.08			312.5	4.92	238.4	5.15
26	588.5	3.92	55756.	169.5	4.10			313.9	4.64	239.0	4.67
26	593.5	4.01	55644.	167.4	4.06			308.6	5.16	235.4	4.34
26	598.5	3.97	55587.	169.6	3.99			311.7	4.90	238.0	4.21
26	603.5	4.01	55644.	171.7	3.99			311.7	5.14	238.6	5.11
27	608.5	3.94	55587.	171.9	3.66			315.1	4.41	240.8	4.57
27	613.5	3.96	55616.	170.8	3.78			313.6	4.58	239.5	4.79
27	618.5	4.06	55587.	170.0	3.96			309.3	5.42	237.0	5.03
27	623.5	3.90	55587.	174.0	3.35			318.8	3.87	243.7	4.09
27	628.5	3.89	55940.	174.8	3.41			320.5	3.87	244.9	4.29
28	633.5	3.92	55369.	174.3	3.50			318.9	4.16	243.9	4.58
28	638.5	3.83	55812.	175.4	3.24			323.1	3.38	246.5	4.15
28	643.5	3.97	55812.	173.5	3.56			316.4	4.53	242.3	4.65
28	648.5	3.85	55784.	175.4	3.21			322.3	3.47	246.1	3.85
28	653.5	3.87	55840.	174.2	3.26			320.6	3.67	244.7	4.28
29	658.5	4.03	55840.	171.1	3.75			312.0	5.13	238.9	5.32
29	663.5	3.88	55756.	172.7	3.44			318.3	3.96	242.8	3.94
29	668.5	4.05	55728.	173.5	3.87			310.5	5.40	237.9	5.14

***** RESULTS -- RUN 101 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.9	6.36	86985.	146.0	.12	146.2	.09			148.6	.10
1	1.4	6.23	86794.	146.6	.02	146.8	-.01			149.3	.13
1	2.4	6.36	86603.	145.7	.15	146.0	.19			148.4	.23
1	3.4	6.19	86412.	146.6	.15	146.9	.15			149.3	.19
1	4.4	6.32	86317.	146.1	.20	146.4	.21			148.8	.35
1	5.4	6.33	86126.	145.9	.33	146.2	.23			148.6	.34
1	6.4	6.30	86030.	146.0	.31	146.3	.38			148.7	.36
1	7.4	6.41	86030.	145.4	.45	145.7	.38			148.1	.56
1	8.4	6.33	87271.	147.7	.27	148.0	.37			150.4	.44
1	9.4	6.34	87176.	148.2	.34	148.5	.35			150.9	.48
2	10.4	6.24	86985.	147.5	.32	147.8	.36			150.3	.55
2	11.4	6.39	87080.	146.7	.55	147.0	.52			149.4	.62
2	12.4	6.30	87080.	146.9	.52	147.2	.46			149.6	.56
2	13.4	6.26	86985.	147.4	.44	147.7	.47			150.1	.67
2	14.4	6.21	87080.	148.0	.43	148.3	.50			150.7	.63
2	15.4	6.24	87080.	147.3	.51	147.5	.52			150.0	.62
2	16.4	6.24	87176.	147.9	.57	148.2	.54			150.6	.57
2	17.4	6.16	87176.	148.1	.52	148.4	.49			150.8	.65
2	18.4	6.28	87367.	147.5	.55	147.8	.62			150.2	.81
2	19.4	6.42	87462.	146.1	.73	146.4	.80			148.8	1.00
2	22.4	6.22	87367.	147.3	.64	147.6	.67			150.0	.83
2	27.4	6.30	87367.	146.5	.82	146.8	.82			149.2	1.08
2	32.4	6.16	87271.	148.1	.73	148.4	.86			150.9	.99
3	37.4	6.11	86985.	147.7	.88	148.0	.92			150.4	1.04
3	41.4	6.26	87176.	147.2	.94	147.5	1.07			149.9	1.20
3	50.4	6.29	87271.	146.5	1.08	146.8	1.14			149.2	1.40
3	55.4	6.18	87176.	147.4	1.01	147.7	1.14			150.1	1.39
4	60.4	6.18	86985.	147.8	1.12	148.1	1.25			150.6	1.31
4	65.4	6.23	87080.	146.4	1.22	146.7	1.31			149.2	1.47
4	70.4	6.17	87462.	146.7	1.21	147.0	1.27			149.5	1.55
4	75.4	6.40	87367.	146.2	1.36	146.5	1.46			148.9	1.75
4	80.4	6.23	87271.	147.4	1.35	147.7	1.42			150.2	1.73
5	85.4	6.19	86985.	147.2	1.48	147.5	1.64			150.0	1.86
5	90.4	6.16	86985.	147.7	1.48	148.0	1.68			150.4	1.86
5	95.4	6.31	87367.	146.2	1.62	146.5	1.78			148.9	2.03
5	97.3	6.35	87462.	146.3	1.67	146.6	1.80			149.0	2.08
5	101.4	6.36	87176.	146.3	1.64	146.6	1.83			149.0	2.12
6	106.4	6.18	86985.	147.8	1.60	148.1	1.76			150.6	2.01
6	111.4	6.14	86985.	148.1	1.57	148.4	1.82			150.9	2.04
6	116.4	6.16	87176.	147.5	1.63	147.8	1.82			150.3	2.07
6	121.4	6.11	87367.	147.6	1.74	147.9	2.00			150.4	2.24
6	126.4	6.23	87080.	147.3	1.84	147.6	2.10			150.1	2.38

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
7	131.4	6.12	86985.	148.5	1.71	148.8	2.00			151.3	2.24
7	136.4	6.25	87090.	147.5	1.82	147.8	2.14			150.3	2.32
7	141.4	6.14	86989.	148.0	1.73	148.3	2.08			150.8	2.39
7	146.4	6.32	86985.	146.4	1.88	146.7	2.17			149.1	2.45
7	151.4	6.15	87080.	147.8	1.73	148.1	2.08			150.5	2.38
8	156.4	6.05	86985.	148.7	1.66	149.0	2.07			151.4	2.25
8	161.4	6.10	87080.	148.4	1.69	148.7	2.07			151.2	2.25
8	166.4	6.12	87367.	148.1	1.65	148.4	2.06			150.9	2.33
8	171.4	6.20	87271.	147.6	1.81	147.9	2.16			150.3	2.40
8	176.4	6.21	87080.	147.1	1.74	147.4	2.18			149.9	2.43
9	181.4	6.12	86985.	147.9	1.68	148.2	2.03			150.6	2.34
9	186.4	6.10	87367.	148.2	1.67	148.5	2.05			151.0	2.29
9	191.4	6.14	87558.	147.6	1.71	147.9	2.06			150.3	2.36
9	196.4	6.18	87176.	146.8	1.71	147.1	2.12			149.6	2.40
9	201.4	6.30	87176.	146.7	1.75	147.0	2.17			149.4	2.45
10	206.4	6.25	87080.	147.5	1.73	147.8	2.05			150.2	2.36
10	211.4	6.26	87367.	147.3	1.74	147.6	2.09			150.1	2.40
10	216.4	6.23	87558.	147.0	1.74	147.3	2.12			149.7	2.37
10	221.4	6.17	87367.	147.8	1.65	148.1	2.03			150.6	2.25
11	226.4	6.22	87176.	147.7	1.70	148.0	2.02			150.4	2.27
11	231.4	6.28	87176.	147.6	1.74	147.9	2.06			150.4	2.37
11	236.4	6.10	87462.	148.9	1.59	149.2	1.91			151.7	2.21
11	241.4	6.31	87558.	146.6	1.76	146.8	2.11			149.3	2.39
11	246.4	6.23	87176.	147.1	1.71	147.4	2.03			149.8	2.34
12	251.4	6.20	87176.	147.9	1.65	148.2	2.00			150.6	2.18
12	256.4	6.27	87080.	148.0	1.67	148.2	2.06			150.7	2.24
12	261.4	6.27	87080.	146.8	1.81	147.1	2.13			149.5	2.44
12	266.4	6.35	87462.	146.3	1.76	146.6	2.11			149.0	2.39
12	271.4	6.38	87367.	146.4	1.76	146.7	2.14			149.1	2.39
13	276.4	6.41	87176.	146.9	1.76	147.2	2.11			149.6	2.30
13	281.4	6.32	87080.	147.4	1.67	147.7	2.06			150.1	2.28
13	286.4	6.28	87367.	146.9	1.69	147.2	2.04			149.6	2.29
13	291.4	6.36	87367.	146.5	1.75	146.7	2.06			149.2	2.25
13	296.4	6.44	87271.	145.9	1.71	146.2	2.06			148.6	2.32
14	301.4	6.33	86503.	146.5	1.67	146.7	1.99			149.1	2.24
14	306.4	6.23	86794.	147.7	1.61	148.0	1.93			150.5	2.15
14	311.4	6.32	87080.	146.5	1.68	146.8	2.03			149.2	2.29
14	316.4	6.47	87080.	145.7	1.81	145.9	2.13			148.3	2.33
14	321.4	6.26	86985.	146.8	1.65	147.1	2.00			149.5	2.29
15	326.4	6.38	86794.	146.3	1.75	146.6	2.07			149.0	2.32
15	331.4	6.39	87176.	147.1	1.74	147.4	2.06			149.8	2.31
15	335.0	6.29	111047.	160.5	1.63	160.8	1.89			163.9	2.15
15	339.4	6.47	111047.	159.4	1.77	159.8	2.01			162.8	2.30
15	344.4	6.36	110956.	160.7	1.73	161.1	1.99			164.1	2.21
16	349.4	6.42	110474.	160.3	1.79	160.7	2.06			163.7	2.31
16	354.4	6.42	110951.	160.3	1.79	160.7	2.12			163.7	2.37
16	359.4	6.30	111047.	160.7	1.75	161.1	2.02			164.2	2.30

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
16	364.4	6.40	110856.	160.1	1.81	160.5	2.12			163.5	2.36
16	369.4	6.31	110569.	161.5	1.71	161.0	2.00			164.9	2.27
17	374.4	6.30	110665.	160.7	1.76	161.1	2.02			164.2	2.34
17	379.4	6.18	110951.	162.1	1.73	162.5	1.99			165.6	2.23
17	384.4	6.23	111238.	161.3	1.72	161.7	2.00			164.8	2.29
17	389.4	6.29	110760.	160.6	1.77	160.9	2.11			164.0	2.37
18	394.4	6.23	110760.	161.6	1.75	162.0	2.06			165.1	2.30
18	399.4	6.25	110665.	161.4	1.80	161.7	2.09			164.8	2.32
18	404.4	6.20	110760.	162.1	1.78	162.4	2.07			165.6	2.38
18	409.4	6.18	110760.	161.4	1.79	161.8	2.08			164.9	2.34
18	414.4	6.45	110665.	159.4	1.95	159.8	2.24			162.8	2.48
19	419.4	6.23	110569.	161.8	1.83	162.1	2.15			165.2	2.39
19	424.4	6.14	110760.	162.8	1.76	163.2	2.07			166.3	2.31
19	429.4	6.29	110951.	161.5	1.92	161.9	2.21			165.0	2.50
19	434.4	6.20	110856.	161.3	1.85	161.6	2.19			164.7	2.45
19	439.4	6.26	110474.	161.2	1.88	161.6	2.20			164.7	2.44
20	444.4	6.17	110569.	161.9	1.82	162.3	2.16			165.4	2.42
20	449.4	6.24	110569.	161.7	1.86	162.1	2.18			165.2	2.44
20	454.4	6.18	110474.	161.8	1.83	162.2	2.20			165.3	2.43
20	459.4	6.22	110569.	161.2	1.88	161.6	2.20			164.7	2.43
20	464.4	6.20	110474.	161.7	1.89	162.0	2.21			165.1	2.45
21	469.4	6.06	110187.	162.5	1.80	162.9	2.11			166.0	2.30
21	474.4	6.27	110187.	160.9	1.94	161.3	2.26			164.4	2.55
21	479.4	6.33	110378.	160.1	2.02	160.4	2.31			163.5	2.57
21	484.4	6.34	110760.	159.9	1.97	160.3	2.28			163.4	2.55
21	489.4	6.39	110569.	159.7	2.00	160.1	2.31			163.1	2.58
22	494.4	6.15	110474.	162.0	1.81	162.4	2.13			165.5	2.39
22	499.4	6.26	110951.	161.4	1.88	161.8	2.19			164.9	2.48
22	504.4	6.25	111047.	160.8	1.89	161.1	2.20			164.2	2.47
22	509.4	6.43	110951.	159.7	1.99	160.1	2.28			163.1	2.55
23	514.4	6.34	110760.	160.5	1.94	160.9	2.23			164.0	2.50
23	519.4	6.40	110569.	160.6	1.99	160.9	2.28			164.0	2.57
23	524.4	6.16	110951.	162.2	1.81	162.6	2.15			165.7	2.41
23	529.4	6.33	111142.	160.8	1.94	161.1	2.28			164.2	2.49
23	534.4	6.35	110569.	160.9	1.94	161.3	2.25			164.3	2.52
24	539.4	6.26	110569.	161.6	1.88	161.9	2.21			165.0	2.48
24	544.4	6.23	110474.	161.4	1.89	161.8	2.21			164.9	2.49
24	549.4	6.24	110856.	161.6	1.89	162.0	2.21			165.1	2.49
24	554.4	6.23	110760.	161.6	1.94	162.0	2.26			165.1	2.54
24	559.4	6.26	110474.	160.9	2.04	161.3	2.33			164.3	2.64
25	564.4	6.25	110569.	161.6	2.00	162.0	2.33			165.1	2.57
25	569.4	6.30	110569.	160.7	2.03	161.1	2.37			164.1	2.61
25	574.4	6.18	110760.	161.7	1.96	162.0	2.30			165.2	2.56
25	579.4	6.22	110665.	161.0	2.00	161.4	2.36			164.5	2.62
25	582.4	5.71	110378.	164.9	1.92	165.3	2.28			168.6	2.50
26	587.4	5.64	110378.	166.4	1.86	166.8	2.22			170.1	2.41
26	592.4	5.64	110293.	166.0	1.89	166.4	2.28			169.7	2.50

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFO*E4
26	597.4	4.90	110665.	173.6	1.28	174.0	1.61			177.7	1.86
26	602.4	5.75	110665.	164.4	2.01	164.8	2.39			168.1	2.61
26	607.4	5.75	110474.	174.8	1.95	175.2	2.30			178.5	2.52
27	612.4	5.72	110378.	166.3	2.16	166.7	2.54			170.0	2.81
27	617.4	5.63	110283.	166.7	2.15	167.1	2.54			170.4	2.80
27	622.4	5.68	110474.	165.5	2.23	165.9	2.61			169.2	2.83
27	627.4	5.71	110569.	165.0	2.22	165.4	2.61			168.7	2.82
27	632.4	5.65	110474.	166.0	2.16	166.4	2.54			169.7	2.76
28	637.4	5.76	110283.	165.3	2.18	165.7	2.56			169.0	2.83
28	642.4	5.70	110283.	166.1	2.13	166.5	2.49			169.8	2.73
28	647.4	5.66	110569.	165.5	2.09	165.9	2.47			169.2	2.73

***** RESULTS -- RUN 102 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFU*E4
1	.3	3.96	9562.	171.8	-2.17	172.7	-2.21	177.7	-2.22	191.7	-2.62
1	.9	4.08	94381.	173.0	-2.13	173.9	-2.26	178.7	-2.16	192.3	-2.62
1	1.9	3.99	93894.	175.4	-2.19	176.2	-2.28	181.1	-2.20	194.3	-2.85
1	2.9	4.06	94186.	174.3	-1.98	175.2	-2.14	180.0	-1.99	193.7	-2.71
1	3.9	4.02	93894.	174.3	-1.92	175.2	-2.11	180.0	-1.90	193.7	-2.69
1	4.9	4.10	93796.	173.5	-1.72	174.3	-1.88	179.2	-1.60	192.7	-2.49
1	5.9	4.11	93601.	173.1	-1.60	174.0	-1.75	178.8	-1.54	192.2	-2.42
1	6.9	4.08	93504.	173.9	-1.62	174.7	-1.77	179.5	-1.53	193.0	-2.45
1	7.9	4.05	93504.	174.5	-1.69	175.4	-1.79	180.2	-1.49	193.8	-2.48
1	8.9	4.04	93699.	174.5	-1.60	175.4	-1.67	180.2	-1.40	193.9	-2.42
1	9.9	4.09	93504.	173.9	-1.42	174.7	-1.51	179.5	-1.27	193.0	-2.28
2	10.9	4.08	93407.	173.9	-1.39	174.8	-1.43	179.6	-1.22	193.1	-2.25
2	11.2	4.03	93309.	174.7	-1.47	175.5	-1.51	180.4	-1.30	194.0	-2.35
2	13.9	4.07	93407.	174.4	-1.23	175.2	-1.24	180.0	-1.09	193.5	-2.10
2	18.9	3.98	93504.	176.0	-1.17	176.8	-1.09	181.7	-0.95	195.5	-1.90
2	23.9	4.03	94283.	175.2	-0.78	176.0	-0.77	180.9	-0.60	194.7	-1.39
2	28.9	4.12	94575.	174.2	-0.42	175.0	-0.31	179.9	-0.11	193.4	-0.77
2	33.9	4.09	94478.	175.4	-0.29	176.2	-0.12	181.1	-0.22	194.7	-0.42
3	38.9	4.00	94478.	176.7	-0.16	177.5	-0.11	182.5	-0.50	196.3	-0.25
3	43.9	4.00	94283.	176.1	.19	177.0	.60	181.9	1.16	195.7	.16
3	48.9	4.06	94478.	174.9	1.09	175.8	1.47	180.6	1.95	194.3	.78
3	53.9	4.08	94381.	174.6	2.24	175.4	2.19	180.3	2.41	193.9	1.17
4	58.9	4.06	94186.	174.9	2.88	175.8	2.81	180.6	2.66	194.3	1.36
4	63.9	3.98	94381.	176.5	3.05	177.3	2.95	182.3	2.68	196.2	1.30
4	68.9	3.98	94381.	176.5	3.05	177.3	2.95	182.3	2.68	196.2	1.30
4	73.9	4.05	94478.	175.0	3.48	175.9	3.55	180.8	2.98	194.5	1.64
4	78.9	4.10	94381.	174.6	3.67	175.4	3.80	180.3	3.12	193.9	1.79
5	83.9	4.02	94283.	176.1	3.72	176.9	3.81	181.8	3.44	195.6	1.72
5	88.9	3.98	94575.	176.9	3.76	177.8	3.85	182.7	3.67	196.6	1.75
5	93.9	4.07	94673.	174.7	4.13	175.5	4.22	180.4	3.37	194.1	2.13
5	98.9	4.12	94673.	174.0	4.34	174.8	4.44	179.7	3.56	193.3	2.41
5	101.0	3.97	94283.	176.0	4.15	176.8	4.24	181.8	3.35	195.7	2.16
5	103.9	3.97	94478.	176.4	4.14	177.3	4.23	182.2	3.32	196.1	2.21
6	108.9	3.96	94575.	176.3	4.29	177.8	4.32	182.8	3.27	196.7	2.38
6	113.9	3.93	94770.	177.6	4.26	178.5	4.33	183.5	3.21	197.5	2.40
6	118.9	3.98	94073.	176.1	4.39	177.0	4.48	182.0	3.35	195.9	2.64
6	122.1	4.21	94478.	173.2	4.57	174.0	4.72	178.3	3.55	192.2	2.92
6	126.9	4.02	94478.	176.3	4.47	177.1	4.62	182.0	3.40	195.0	2.76
7	131.9	3.92	94186.	177.5	4.33	178.4	4.45	183.4	3.24	197.4	2.57
7	136.9	4.02	94283.	175.3	4.55	176.8	4.67	181.7	3.42	195.5	2.81
7	142.1	3.98	94381.	176.0	4.56	176.8	4.71	181.8	3.43	195.7	2.81
7	146.9	3.98	94381.	175.6	4.63	176.5	4.78	181.4	3.50	195.3	2.98

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
7	151.9	4.04	93391.	175.0	4.83	175.9	5.00	180.7	3.61	194.4	3.01
8	160.9	3.95	94186.	176.4	4.67	177.3	4.84	182.2	3.56	196.1	2.87
8	165.4	3.91	94575.	177.4	4.63	178.2	4.80	183.3	3.52	197.3	2.85
8	169.9	3.96	94478.	176.0	4.86	176.9	5.04	181.8	3.73	195.7	3.07
8	174.9	4.00	93391.	175.3	4.94	176.1	5.06	181.0	3.81	194.8	3.17
9	179.9	3.99	95062.	176.9	4.93	177.8	5.08	182.7	3.81	196.7	3.15
9	184.9	3.97	95160.	177.6	4.86	178.4	5.00	183.4	3.73	197.4	3.03
9	189.9	3.94	95162.	177.6	4.85	178.5	5.02	183.5	3.72	197.0	3.08
9	194.9	3.98	95162.	176.2	5.04	177.0	5.18	182.0	3.91	196.0	3.28
9	199.9	4.03	94575.	175.7	5.11	176.5	5.26	181.4	3.96	195.2	3.40
10	204.9	3.93	94673.	177.2	5.00	178.1	5.12	183.1	3.87	197.1	3.23
10	209.9	3.95	94770.	177.5	4.99	178.4	5.13	183.4	3.89	197.4	3.36
10	214.9	3.97	94965.	176.2	5.20	177.1	5.29	182.1	4.04	196.1	3.58
10	219.9	3.95	94770.	176.6	5.20	177.5	5.34	182.5	4.07	196.5	3.60
10	224.9	4.07	94770.	175.3	5.37	176.1	5.52	181.0	4.28	194.7	3.31
11	229.9	3.91	94868.	177.7	5.14	178.5	5.25	183.6	4.03	197.7	3.52
11	234.9	3.99	94868.	176.8	5.26	177.6	5.40	182.6	4.19	196.5	3.70
11	239.9	4.00	94868.	175.8	5.39	176.7	5.56	181.6	4.32	195.5	3.80
11	244.9	4.08	94673.	174.7	5.54	175.6	5.66	180.4	4.48	194.1	3.36
11	249.9	4.00	94673.	175.9	5.45	176.8	5.59	181.7	4.38	195.6	3.89
12	254.9	4.07	94575.	175.4	5.53	176.3	5.68	181.1	4.50	194.8	4.03
12	259.9	4.03	94965.	176.3	5.50	177.1	5.62	182.1	4.46	195.9	3.35
12	264.9	4.04	94868.	175.5	5.64	176.3	5.76	181.3	4.61	195.1	4.10
12	269.9	4.12	94575.	174.1	5.81	175.0	5.90	179.3	4.78	193.3	4.27
13	274.9	4.03	94575.	175.3	5.65	176.8	5.74	181.7	4.61	195.4	4.07
13	279.9	4.05	94575.	175.7	5.67	176.6	5.76	181.5	4.66	195.2	4.13
13	284.9	3.99	94770.	176.3	5.62	177.2	5.76	182.1	4.63	196.0	4.06
13	289.2	3.85	94673.	176.1	5.60	179.0	5.63	194.1	4.57	198.3	4.01
13	290.9	3.83	93796.	177.3	5.88	174.2	5.89	183.2	4.88	197.4	4.26
13	291.4	3.84	93601.	177.3	5.92	178.2	5.90	183.2	4.92	197.3	4.28
13	291.9	3.67	93564.	179.8	5.66	180.7	5.67	185.9	4.66	200.4	3.98
13	296.9	3.88	93017.	177.3	6.08	178.2	6.17	183.1	5.13	197.0	4.48
14	301.9	3.78	92322.	178.4	6.03	179.3	5.98	184.3	5.64	198.4	4.31
14	306.9	3.74	92326.	173.1	6.03	179.9	6.01	185.0	5.67	193.3	4.38
14	311.9	3.81	93017.	178.3	6.22	179.2	6.22	184.2	5.32	198.3	4.59
14	316.9	3.79	92326.	177.7	6.26	178.6	6.24	183.6	5.36	197.7	4.63
14	320.7	3.99	94673.	176.3	6.40	177.2	6.40	182.1	5.49	196.6	4.63
14	321.9	3.97	94478.	176.4	6.40	177.3	6.41	182.2	5.50	196.1	4.89
15	326.9	3.96	94473.	176.9	6.41	177.8	6.30	182.7	5.44	196.7	4.39
15	331.9	3.94	94575.	177.2	6.39	178.1	6.31	183.1	5.45	197.1	4.86
15	336.9	3.95	94673.	176.5	6.51	177.5	6.43	182.4	5.60	196.4	5.01
15	341.9	3.97	94186.	175.9	6.56	176.8	6.48	181.7	5.65	195.6	5.07
15	346.5	3.72	95160.	180.3	6.36	181.7	6.31	186.9	5.46	201.5	4.78
16	351.9	3.74	94965.	181.1	6.42	184.1	6.39	187.2	5.52	201.6	4.84
16	357.8	3.61	94575.	182.2	6.31	183.1	6.28	183.4	5.39	203.3	4.08
16	361.9	3.70	94365.	183.5	6.47	181.5	6.50	186.8	5.62	201.5	4.91
16	362.6	4.04	94770.	175.4	6.84	176.3	6.88	181.2	6.00	195.1	5.41

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFU*E4
16	366.9	3.91	94381.	177.2	6.63	178.0	6.69	183.0	5.80	197.1	5.12
17	371.9	4.02	94478.	176.3	6.69	177.2	6.81	182.1	5.96	195.9	5.30
17	376.9	3.93	94381.	177.5	6.62	178.4	6.68	183.4	5.80	197.4	5.10
17	381.9	3.92	94478.	176.9	6.62	177.8	6.74	182.8	5.85	196.8	5.14
17	383.8	3.84	95339.	180.5	6.39	181.4	6.50	186.5	5.64	201.0	4.91
17	386.5	3.90	94673.	176.5	6.93	177.3	7.07	182.4	6.16	196.5	5.42
17	387.9	3.95	94381.	176.3	6.91	177.2	7.11	182.2	6.23	196.1	5.48
17	392.9	3.91	94283.	177.4	6.83	178.3	7.03	183.3	6.14	197.3	5.38
18	397.9	3.94	94685.	177.2	6.90	178.0	7.08	183.0	6.16	196.9	5.41
18	402.9	3.78	94283.	179.7	6.48	180.6	6.67	185.8	5.72	200.1	4.92
18	407.9	3.85	95257.	178.3	6.80	179.2	6.99	184.3	6.00	198.6	5.29
18	412.9	3.99	95062.	176.1	7.76	177.0	7.84	182.0	6.83	195.9	6.33
19	417.9	3.90	94770.	178.3	8.15	179.2	8.21	184.3	7.13	198.4	6.74
19	422.9	3.76	94381.	180.1	9.90	181.0	9.85	186.2	8.79	200.6	8.38
19	427.9	3.72	94478.	180.3	10.44	181.2	10.39	186.4	9.35	200.9	8.30
19	432.9	3.83	94575.	177.8	10.99	178.7	10.96	183.7	9.97	198.0	9.55
19	437.9	3.90	94668.	176.6	11.42	177.4	11.42	182.4	10.41	196.5	10.09
20	442.9	3.73	93894.	179.6	11.29	180.5	11.34	185.6	10.31	203.1	9.89
20	447.9	3.85	94088.	178.5	11.86	179.4	11.84	184.4	10.90	198.6	10.48
20	452.9	3.87	94088.	177.8	12.37	178.7	12.34	183.7	11.43	197.8	11.08
20	457.9	3.86	94381.	177.1	12.65	178.0	12.62	183.0	11.71	197.2	11.32
20	464.9	3.92	93991.	177.1	12.89	177.9	12.92	182.9	11.93	196.9	11.62
21	469.9	3.70	93699.	180.1	12.93	181.0	12.98	186.2	12.05	200.7	11.54
21	474.9	3.65	94186.	181.2	13.02	182.1	12.99	187.3	12.11	202.0	11.58
21	479.9	3.86	94283.	177.3	13.60	178.2	13.54	183.2	12.69	197.4	12.19
21	484.9	3.83	94186.	177.7	13.66	178.6	13.63	183.6	12.77	197.8	12.29
21	489.9	3.72	94188.	180.1	13.46	181.1	13.43	186.2	12.57	200.7	12.03
22	494.9	3.88	94188.	177.7	13.77	178.6	13.75	183.6	12.90	197.7	12.40
22	499.9	3.88	94186.	177.7	13.81	178.6	13.78	183.6	12.94	197.7	12.36
22	514.9	3.82	94186.	177.6	13.86	178.4	13.83	183.5	12.97	197.8	12.46
22	519.9	3.82	94368.	179.4	13.72	180.3	13.69	185.4	12.84	199.7	12.32
23	514.9	3.69	94673.	161.2	13.58	182.1	13.55	187.4	12.71	202.0	12.13
23	519.9	3.70	94770.	181.3	13.58	182.2	13.55	187.4	12.69	202.1	12.11
23	524.9	3.66	94368.	181.0	13.63	181.9	13.60	187.1	12.73	201.9	12.10
23	529.9	3.64	94668.	181.7	13.59	182.6	13.55	187.3	12.68	202.7	11.98
23	534.9	3.70	94575.	180.6	13.71	181.5	13.68	186.7	12.82	201.4	12.16
24	539.9	3.69	94673.	181.4	13.64	182.3	13.64	187.5	12.75	202.2	12.06
24	544.9	3.71	94368.	181.3	13.69	181.9	13.71	187.1	12.85	201.7	12.25
24	549.9	3.86	94770.	178.3	13.98	179.2	14.03	184.3	13.18	198.5	12.62
24	554.9	3.99	94575.	176.0	14.23	176.9	14.28	181.8	13.44	195.7	12.87
24	559.9	3.76	94381.	179.3	13.91	180.2	13.94	185.3	13.03	193.7	12.44
25	564.9	3.93	94381.	176.3	14.16	177.8	14.21	182.3	13.40	196.3	12.75
25	569.9	3.85	94381.	178.4	14.03	179.2	14.06	184.3	13.24	198.5	12.57
25	574.9	3.73	94381.	179.1	13.95	180.0	14.03	185.2	13.17	193.5	12.46
25	579.9	3.73	94478.	179.3	13.87	180.7	13.94	185.9	13.65	200.4	12.35
25	584.9	3.91	94381.	179.8	13.99	179.7	14.07	184.3	13.18	199.1	12.51
26	589.9	3.74	94475.	179.2	13.98	180.1	14.06	185.3	13.17	193.6	12.46

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RF9*E4	TSC	RFC*E4	TSD	RFU*E4
26	594.9	3.88	94478.	177.7	14.14	178.6	14.24	133.6	13.37	197.8	12.66
26	599.9	3.72	94575.	173.3	13.95	180.8	14.05	136.0	13.16	200.6	12.46
26	604.9	3.71	94381.	180.6	13.93	181.6	14.00	186.7	13.14	201.3	12.48
26	609.9	3.87	94478.	177.6	14.23	178.5	14.33	183.6	13.49	197.7	12.88
27	613.9	3.98	94478.	176.3	14.53	177.2	14.55	182.2	13.71	196.1	13.19
27	618.9	3.84	94673.	178.6	14.32	179.4	14.36	184.5	13.49	198.8	12.32
27	623.9	3.84	94770.	177.7	14.36	178.6	14.46	183.7	13.56	198.0	13.00
27	628.9	4.00	94381.	175.4	14.75	176.2	14.80	181.1	14.00	195.0	13.42
27	633.9	4.06	94478.	174.8	14.77	175.7	14.82	180.6	14.02	194.2	13.46
28	638.9	3.89	94381.	177.5	14.50	178.4	14.58	133.4	13.76	197.5	13.16
28	643.9	3.84	94478.	178.1	14.45	178.9	14.55	184.0	13.78	198.2	13.09
28	648.9	4.00	94770.	175.4	14.73	176.3	14.89	181.3	14.08	195.1	13.40
28	653.9	3.91	94263.	177.4	14.66	178.2	14.79	133.2	14.00	197.3	13.35
29	658.9	4.02	94188.	175.4	14.37	176.3	15.01	181.2	14.25	194.9	13.63
29	663.9	3.88	94381.	177.7	14.64	178.6	14.77	183.6	14.05	197.7	13.34
29	668.9	3.83	94575.	178.5	14.54	179.4	14.70	184.5	14.01	198.8	13.23
29	673.9	4.05	94575.	174.6	14.99	175.4	15.18	180.3	14.48	194.0	13.76
29	678.9	3.97	94381.	175.5	14.89	176.4	15.08	181.4	14.40	195.3	13.63
30	683.9	3.80	94263.	178.4	14.63	179.3	14.84	184.4	14.14	198.7	13.30
30	688.9	4.03	94770.	175.0	14.93	175.9	15.20	180.8	14.52	194.5	13.77
30	693.9	3.99	94478.	175.8	14.38	176.7	15.27	181.6	14.51	195.5	13.72
30	698.9	3.84	94263.	177.3	14.82	178.2	15.14	183.3	14.37	197.5	13.51
31	703.9	4.09	94186.	174.0	15.25	174.8	15.52	179.6	14.82	193.2	14.01
31	708.9	3.88	94186.	177.0	14.90	177.9	15.22	182.3	14.43	197.6	13.61
31	713.9	4.04	94381.	175.3	15.10	176.2	15.45	181.0	14.75	194.8	13.87
31	718.9	3.90	94381.	177.1	14.94	178.0	15.28	183.0	14.59	197.1	13.65
31	723.9	4.00	94263.	175.6	15.17	176.4	15.51	181.3	14.81	195.2	13.92
31	728.9	4.08	94263.	174.1	15.33	174.9	15.73	179.3	15.01	193.4	14.11
32	733.9	3.97	94188.	175.5	15.24	176.4	15.63	181.3	14.90	195.2	13.98
32	738.9	3.93	94188.	175.7	15.24	176.6	15.66	181.6	14.93	195.5	13.96
32	743.9	3.85	94186.	177.3	15.14	178.2	15.58	183.2	14.82	197.4	13.83
32	748.9	4.06	94186.	173.8	15.53	174.7	16.01	179.5	15.24	193.2	14.33
32	753.9	3.87	94088.	177.2	15.21	178.1	15.72	183.1	14.95	197.2	13.97
33	758.9	4.08	94575.	174.3	15.57	175.2	16.02	180.0	15.30	193.7	14.37
33	763.9	3.93	94088.	177.1	15.29	178.0	15.76	183.0	15.02	197.0	14.06

***** RESULTS -- RUN 103 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSU	RFD*E4
1	.3	4.04	102206.	166.9	-.24	166.0	-.23	168.9	-.36	174.1	-.35
1	.9	4.17	101727.	168.4	.04	167.5	.27	170.3	-.05	175.4	.01
1	1.9	4.03	101344.	171.3	.14	170.4	.23	173.2	.12	178.5	.00
1	2.9	4.19	101823.	169.4	.54	168.5	.66	171.2	.55	176.4	.31
1	3.9	4.04	101531.	170.9	.53	169.9	.62	172.7	.54	178.0	.21
1	4.9	4.09	101535.	170.4	.67	169.5	.77	172.3	.69	177.6	.46
1	5.9	4.31	101631.	167.8	1.04	166.9	1.18	169.7	1.08	174.7	.72
1	6.9	4.16	101727.	170.0	.95	169.1	1.07	171.9	.99	177.1	.67
1	7.9	4.20	101727.	169.8	1.08	168.8	1.20	171.6	1.18	176.8	.81
1	8.9	4.28	101319.	168.6	1.27	167.7	1.39	170.5	1.40	175.5	1.01
1	9.9	4.10	101823.	171.1	1.08	170.2	1.20	173.0	1.17	178.3	.85
2	10.9	4.11	101631.	170.8	1.20	169.9	1.32	172.7	1.29	177.9	.91
2	11.2	4.16	101631.	170.2	1.26	169.2	1.38	172.0	1.35	177.2	.98
2	13.9	4.06	102206.	172.2	1.39	171.2	1.46	174.1	1.53	179.4	1.10
2	18.9	3.99	102302.	173.6	1.44	172.6	1.59	175.5	1.63	180.9	1.11
2	23.9	4.20	102589.	170.1	1.85	169.2	2.05	172.0	2.12	177.2	1.57
2	28.9	4.14	102302.	170.6	1.97	169.7	2.17	172.5	2.24	177.7	1.69
2	33.9	4.15	102110.	171.2	1.99	170.3	2.19	173.1	2.29	178.3	1.71
3	38.9	4.01	102206.	173.1	1.91	172.2	2.11	175.0	2.25	180.4	1.64
3	43.9	4.06	102110.	172.9	1.98	172.0	2.15	174.9	2.32	180.2	1.68
3	48.9	4.12	102206.	170.9	2.15	169.9	2.33	172.8	2.53	178.0	1.84
3	53.9	4.15	102206.	170.4	2.20	169.5	2.37	172.3	2.55	177.5	1.92
4	58.9	4.15	102302.	170.8	2.16	169.9	2.28	172.7	2.51	177.9	1.85
4	63.9	4.07	102014.	171.9	1.97	171.0	2.17	173.9	2.35	179.1	1.73
4	68.9	4.10	102014.	171.5	2.02	170.5	2.19	173.4	2.40	178.6	1.81
4	73.9	4.06	102206.	171.6	2.00	170.7	2.15	173.6	2.35	178.8	1.76
4	78.9	4.06	102014.	171.7	1.97	170.8	2.09	173.7	2.29	178.9	1.75
5	83.9	4.17	102114.	171.0	2.07	170.0	2.14	172.9	2.37	178.0	1.84
5	88.9	4.06	102398.	172.6	1.90	171.6	2.05	174.5	2.22	179.8	1.69
5	93.9	4.04	102685.	171.9	1.96	170.9	2.09	173.8	2.26	179.1	1.72
5	98.9	4.19	102589.	169.9	2.18	169.0	2.28	171.8	2.48	177.0	1.96
5	101.0	3.99	102206.	172.6	1.93	171.6	2.03	174.5	2.23	179.9	1.66
5	103.9	3.97	102302.	173.4	1.87	172.5	1.95	175.4	2.14	180.7	1.57
6	108.9	3.97	102685.	173.7	1.89	172.8	1.99	175.7	2.15	181.1	1.56
6	113.9	4.08	103068.	172.6	1.99	171.6	2.09	174.5	2.26	179.8	1.73
6	118.9	4.03	102972.	172.6	1.99	171.7	2.06	174.6	2.23	179.9	1.72
6	122.1	4.13	102972.	171.5	1.89	170.6	1.96	173.4	2.13	178.7	1.66
6	126.9	3.89	102972.	175.4	1.77	174.4	1.85	177.4	2.01	182.8	1.49
7	131.9	4.02	102645.	173.3	1.93	172.4	2.00	175.3	2.14	180.5	1.65
7	136.9	3.98	102781.	175.2	1.75	174.2	1.79	177.2	1.95	182.6	1.46
7	142.1	4.01	103068.	172.9	1.96	171.9	1.98	174.8	2.17	180.2	1.69
7	146.9	3.92	103164.	173.9	1.86	172.9	1.91	175.9	2.07	181.3	1.57

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
7	151.9	3.99	102685.	173.3	1.93	172.3	1.93	175.2	2.12	180.6	1.66
8	160.9	4.03	102685.	172.6	2.02	171.7	2.04	174.6	2.21	179.9	1.77
8	165.4	3.77	102972.	176.5	1.69	175.5	1.69	178.6	1.84	184.2	1.38
8	169.9	3.94	102685.	173.3	1.99	172.3	2.01	175.2	2.17	180.6	1.73
8	174.9	4.03	102110.	171.9	2.13	171.0	2.12	173.9	2.29	179.2	1.88
9	179.9	3.90	102014.	174.3	1.96	173.3	1.98	176.2	2.12	181.6	1.70
9	184.9	4.02	102398.	173.1	2.08	172.2	2.05	175.1	2.22	180.4	1.84
9	189.9	3.93	102398.	174.2	1.98	173.2	1.98	176.1	2.17	181.5	1.75
9	194.9	3.90	102398.	173.6	2.06	172.6	2.03	175.6	2.19	181.0	1.80
9	199.9	4.00	101919.	172.6	2.15	171.6	2.12	174.5	2.29	179.8	1.90
10	204.9	3.94	102110.	173.4	2.06	172.5	2.03	175.4	2.22	180.8	1.83
10	209.9	4.00	102110.	173.2	2.11	172.2	2.08	175.1	2.25	180.5	1.84
10	214.9	4.08	102206.	171.0	2.29	170.1	2.26	173.0	2.46	178.2	2.08
10	219.9	3.92	102110.	173.5	2.11	172.5	2.08	175.5	2.24	180.9	1.85
10	224.9	4.11	102206.	171.2	2.35	170.3	2.32	173.2	2.46	178.4	2.12
11	229.9	4.09	102206.	171.5	2.33	170.5	2.32	173.4	2.47	178.6	2.12
11	234.9	4.06	102206.	172.2	2.28	171.3	2.22	174.2	2.39	179.4	2.04
11	239.9	3.91	102302.	173.5	2.16	172.5	2.10	175.4	2.26	180.9	1.93
11	244.9	4.12	102206.	170.8	2.45	169.9	2.39	172.7	2.56	177.9	2.21
11	249.9	4.04	102206.	171.8	2.37	170.9	2.31	173.8	2.51	179.0	2.16
12	254.9	4.07	102014.	172.0	2.39	171.0	2.31	173.9	2.50	179.1	2.18
12	259.9	4.01	102302.	172.9	2.37	171.9	2.29	174.3	2.45	180.2	2.10
12	264.9	4.06	102398.	171.8	2.50	170.9	2.41	173.7	2.58	173.0	2.26
12	269.9	4.08	102110.	171.2	2.54	170.3	2.50	173.1	2.65	178.4	2.33
13	274.9	4.14	102014.	171.0	2.64	170.1	2.53	172.9	2.73	178.1	2.41
13	279.9	3.99	102014.	172.9	2.45	172.0	2.39	174.9	2.56	180.2	2.20
13	284.9	4.05	102206.	172.0	2.59	171.1	2.50	174.0	2.67	179.2	2.35
13	289.2	3.97	101923.	172.5	2.79	171.5	2.76	174.4	3.06	179.8	2.65
13	290.9	4.07	101057.	170.4	3.08	169.4	3.05	172.3	3.33	177.5	2.32
13	291.4	3.96	100865.	171.9	2.93	171.0	2.90	173.8	3.20	179.1	2.79
13	291.9	4.07	100865.	173.5	3.10	169.6	3.06	172.4	3.35	177.6	2.94
13	296.9	4.06	100482.	171.5	3.07	170.6	3.01	173.4	3.32	178.6	2.88
14	301.9	4.03	100386.	171.6	3.09	170.7	3.03	173.5	3.31	178.7	2.90
14	306.9	4.02	100+82.	171.7	3.10	170.7	3.04	173.6	3.35	178.8	2.94
14	311.9	3.89	387942.	394.2	-5.35	390.5	-5.23	401.7	-5.48	422.3	-5.65
14	316.9	3.99	10J+82.	171.6	3.27	170.7	3.23	173.5	3.49	178.8	3.07
14	320.7	4.01	102206.	172.5	3.32	171.6	3.26	174.5	3.56	179.8	3.13
14	321.9	3.98	102206.	173.0	3.28	172.0	3.22	174.3	3.51	180.3	3.08
15	326.9	3.88	102206.	174.6	3.17	173.6	3.11	176.6	3.40	182.0	2.36
15	331.9	3.99	102493.	173.4	3.33	172.4	3.25	175.3	3.54	180.7	3.13
15	336.9	3.91	102589.	173.9	3.30	173.0	3.22	175.9	3.50	181.4	3.09
15	341.9	4.04	102206.	171.3	3.49	170.9	3.43	173.9	3.70	179.1	3.30
15	346.5	3.77	102206.	175.9	3.38	175.0	3.30	178.0	3.58	183.5	3.15
16	350.9	3.80	102110.	176.3	3.42	175.3	3.32	178.3	3.60	183.8	3.18
16	357.8	3.69	102398.	177.3	3.34	176.3	3.26	179.4	3.54	185.0	3.10
16	361.9	3.67	102589.	177.6	3.36	176.6	3.28	179.6	3.53	185.3	3.12
16	362.6	3.97	102302.	174.3	3.50	173.4	3.40	176.3	3.66	181.8	3.26

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFO*E4
16	366.9	3.89	102014.	174.0	3.55	173.1	3.46	176.0	3.70	181.4	3.33
17	371.9	3.98	102110.	173.5	3.65	172.5	3.54	175.4	3.80	180.8	3.45
17	376.9	3.98	102110.	173.5	3.61	172.6	3.53	175.5	3.77	180.8	3.42
17	381.9	4.00	102110.	172.4	3.71	171.4	3.62	174.3	3.89	179.6	3.51
17	383.8	3.48	103+51.	182.5	3.20	181.5	3.11	184.7	3.36	190.6	2.93
17	386.5	3.96	102493.	172.2	3.91	171.3	3.80	174.2	4.09	179.6	3.70
17	387.9	3.83	102393.	175.0	3.70	174.0	3.62	177.0	3.90	182.5	3.48
17	392.9	3.66	102206.	178.0	3.57	177.0	3.49	180.0	3.74	185.7	3.30
18	397.9	3.69	102014.	177.7	3.70	176.7	3.60	179.8	3.90	185.4	3.41
18	402.9	3.86	102014.	175.1	4.11	174.2	4.03	177.1	4.31	182.6	3.90
18	407.9	3.82	102110.	174.6	4.31	173.6	4.21	176.6	4.46	182.1	4.09
18	412.9	3.86	102014.	173.9	5.21	172.9	5.05	175.9	5.28	181.4	5.02
18	417.9	3.80	101919.	175.9	5.48	174.9	5.28	177.9	5.55	183.4	5.26
19	422.9	3.74	101727.	176.7	7.79	175.7	7.48	178.7	7.75	184.3	7.53
19	427.9	3.73	102014.	176.5	8.49	175.5	8.22	178.5	8.43	184.1	8.23
19	432.9	3.76	102110.	175.2	8.56	174.2	8.21	177.2	8.40	182.7	8.25
19	437.9	3.95	101823.	172.5	8.79	171.6	8.47	174.5	8.66	179.8	3.56
20	442.9	3.89	101727.	173.9	8.54	172.9	8.24	175.9	8.46	181.3	8.38
20	447.9	3.92	101535.	173.8	9.15	172.9	8.85	175.8	9.04	181.1	8.39
20	452.9	3.89	101631.	174.0	10.50	173.1	10.33	176.0	10.59	181.4	10.39
20	457.9	3.78	101919.	174.8	10.50	173.8	10.35	176.8	10.53	182.3	10.27
20	464.9	3.91	101727.	173.8	10.56	172.9	10.46	175.8	10.60	181.2	10.30
21	469.9	3.81	101440.	175.1	11.16	174.2	11.04	177.2	11.08	182.6	10.81
21	474.9	3.86	101823.	174.4	10.97	173.4	10.92	176.4	10.86	181.8	10.43
21	479.9	3.85	101319.	174.0	10.90	173.0	10.83	175.9	10.76	181.4	10.36
21	484.9	3.84	101535.	173.9	10.83	172.9	10.73	175.9	10.69	181.3	10.08
21	489.9	3.89	101823.	174.2	10.74	173.2	10.64	176.2	10.58	181.6	9.98
22	494.9	3.95	101727.	174.7	10.75	173.7	10.63	176.7	10.53	182.1	10.03
22	499.9	3.84	101823.	175.0	10.71	174.0	10.59	177.0	10.55	182.5	9.39
22	504.9	3.92	101919.	172.7	10.73	171.7	10.63	174.6	10.57	180.0	10.04
22	509.9	3.93	101535.	173.4	11.02	172.5	10.87	175.4	10.86	180.9	10.31
23	514.9	3.74	101535.	176.1	10.73	175.1	10.54	178.2	10.41	183.7	9.92
23	519.9	3.78	101727.	176.1	10.61	175.1	10.47	178.1	10.40	183.6	9.88
23	524.9	3.80	101727.	174.8	10.66	173.8	10.52	176.8	10.50	182.3	9.99
23	529.9	3.93	101823.	173.1	10.77	172.2	10.57	175.1	10.58	180.5	11.13
23	534.9	3.88	101535.	173.8	10.63	172.8	10.44	175.8	10.47	181.2	10.02
24	539.9	3.74	102206.	177.0	10.37	176.0	10.16	179.0	10.21	184.6	9.74
24	544.9	3.75	102206.	176.6	10.41	175.6	10.20	178.6	10.25	184.2	9.81
24	549.9	3.77	102014.	175.8	10.48	174.8	10.26	177.9	10.32	183.4	9.83
24	554.9	4.02	101823.	171.8	10.67	170.9	10.42	173.3	10.49	179.0	10.07
24	559.9	3.99	101823.	172.2	10.38	171.3	10.28	174.2	10.43	179.5	9.98
25	564.9	3.89	102302.	174.3	10.15	173.4	9.93	176.3	10.06	181.7	9.61
25	569.9	3.97	101727.	173.0	10.37	172.1	10.14	175.0	10.31	180.3	3.96
25	574.9	3.85	101727.	174.5	10.17	173.5	9.98	176.5	10.14	181.9	3.68
25	579.9	3.89	101923.	173.7	10.21	172.7	10.02	175.7	10.18	181.1	3.75
25	584.9	3.92	101823.	175.0	10.01	174.0	9.76	177.0	9.95	182.5	3.53
26	589.9	3.86	101823.	174.3	10.15	173.4	9.90	176.3	10.07	181.8	9.68

DAY	TIME	VEL	O/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
26	594.9	3.91	101823.	173.6	10.24	172.7	10.00	175.6	10.18	181.0	9.76
26	599.9	3.80	101919.	175.0	10.28	174.0	10.06	177.0	10.19	182.5	9.78
26	604.9	3.81	101727.	175.3	10.32	174.3	10.15	177.3	10.23	182.7	9.87
26	609.9	3.76	101823.	175.5	10.29	174.5	10.07	177.5	10.20	183.0	9.81
27	613.9	3.90	101727.	173.7	10.42	172.7	10.23	175.7	10.37	181.0	9.96
27	618.9	3.88	101919.	174.2	10.43	173.2	10.26	176.2	10.42	181.6	10.04
27	623.9	4.04	101919.	171.1	10.78	170.2	10.63	173.0	10.75	178.3	10.41
27	628.9	3.90	101727.	173.1	10.58	172.2	10.43	175.1	10.57	180.5	10.24
27	633.9	3.91	101823.	173.3	10.62	172.4	10.48	175.3	10.59	180.7	10.26
28	638.9	3.94	101727.	173.1	10.70	172.2	10.55	175.1	10.67	180.5	10.32
28	643.9	3.89	101727.	173.6	10.68	172.6	10.54	175.6	10.65	181.0	10.29
28	648.9	3.84	101919.	173.8	10.69	172.8	10.52	175.8	10.66	181.3	10.32
28	653.9	4.07	101631.	171.6	10.94	170.7	10.79	173.6	10.93	178.8	10.62
29	658.9	3.96	101535.	172.8	10.81	171.8	10.64	174.7	10.78	180.1	10.43
29	663.9	3.82	101823.	174.9	10.60	173.9	10.43	176.9	10.56	182.4	10.22
29	668.9	3.86	101919.	174.4	10.71	173.4	10.51	176.4	10.67	181.8	10.34
29	673.9	3.98	101919.	171.9	10.91	170.9	10.76	173.8	10.92	179.1	10.60
29	678.9	3.94	101727.	172.3	10.86	171.3	10.71	174.3	10.85	179.6	10.55
30	683.9	3.97	101823.	172.6	10.85	171.6	10.67	174.6	10.84	179.9	10.52
30	688.9	4.02	101919.	171.6	10.98	170.7	10.81	173.5	10.95	178.8	10.66
31	693.9	4.02	101919.	171.9	11.00	171.0	10.83	173.9	10.99	179.2	10.70
31	698.9	3.89	101919.	173.1	10.88	172.2	10.71	175.1	10.87	180.5	10.54
30	703.9	4.05	101631.	171.3	11.13	170.0	10.95	172.9	11.10	178.1	10.81
31	708.9	4.04	101535.	171.1	11.12	170.2	10.92	173.1	11.09	178.3	10.77
31	713.9	4.08	101727.	171.3	11.19	170.3	10.96	173.2	11.16	178.4	10.87
31	718.9	4.10	101535.	170.6	11.17	169.7	11.00	172.5	11.17	177.7	10.88
31	723.9	4.00	101440.	171.9	11.06	170.9	10.89	173.8	11.03	179.1	10.76
31	728.9	3.96	101631.	172.2	11.00	171.3	10.81	174.2	10.97	179.5	10.67
32	733.9	4.03	101344.	171.0	11.21	170.1	11.01	172.9	11.20	178.2	10.89
32	738.9	3.88	101344.	172.9	11.10	171.9	10.90	174.8	11.06	180.2	10.73
32	743.9	3.97	101440.	171.9	11.23	171.0	11.03	173.9	11.20	179.2	10.93
32	748.9	4.06	101440.	170.2	11.40	169.2	11.15	172.1	11.37	177.3	11.08
32	753.9	4.12	101440.	170.2	11.45	169.3	11.22	172.1	11.42	177.3	11.14
33	758.9	3.99	102302.	172.3	11.31	171.4	11.07	174.3	11.28	179.6	11.01
33	763.9	3.96	102695.	173.4	11.29	172.4	11.05	175.4	11.26	180.7	10.96

***** RESULTS -- RUN 104 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.3	4.02	74493.	153.3	-.03			153.3	-.11	164.8	.01
1	.9	4.06	73846.	155.9	-.15			155.8	-.23	167.2	-.16
1	1.9	4.06	73477.	157.0	-.19			157.0	-.35	168.3	-.19
1	2.9	4.05	73569.	156.8	-.20			156.8	-.24	168.1	-.06
1	3.9	4.04	73199.	156.3	-.10			156.3	-.33	167.6	-.10
1	4.9	4.02	72737.	156.4	-.04			156.4	-.23	167.7	.05
1	5.9	4.05	73477.	156.8	-.01			156.7	-.27	168.1	.10
1	6.9	4.03	73477.	157.3	-.04			157.3	-.16	168.7	.17
1	7.9	4.03	73477.	157.6	.03			157.6	-.24	169.0	.24
1	8.9	4.02	73662.	157.5	.15			157.5	-.15	168.9	.32
1	9.9	3.99	73477.	158.0	.12			158.0	-.25	169.4	.29
2	10.9	4.00	73292.	157.8	.19			157.8	-.19	169.2	.54
2	11.2	3.99	73292.	157.8	.19			157.8	-.15	169.2	.47
2	13.9	3.98	73939.	158.9	.34			158.8	-.15	170.4	.67
2	18.9	3.95	73846.	159.4	.61			159.3	.05	170.9	1.03
2	23.9	3.87	74586.	160.0	.78			159.9	.18	171.8	1.30
2	28.9	3.96	74586.	159.0	1.16			159.0	.42	170.7	1.74
2	33.9	3.95	74493.	159.9	1.35			159.8	.49	171.6	1.92
3	38.9	3.96	74493.	159.8	1.54			159.8	.57	171.5	2.11
3	43.9	3.89	74493.	160.3	1.63			160.2	.70	172.1	2.21
3	48.9	3.90	74493.	159.6	1.79			159.6	.83	171.4	2.41
3	53.9	3.94	74678.	159.4	1.89			159.3	.89	171.1	2.44
4	58.9	3.91	74586.	159.9	1.89			159.9	.93	171.7	2.54
4	63.9	3.90	74401.	160.1	1.91			160.0	.84	171.8	2.46
4	68.9	3.92	74401.	159.8	1.91			159.8	.98	171.5	2.61
4	73.9	3.93	74493.	159.3	1.98			159.2	1.02	171.0	2.54
4	78.9	3.96	74493.	159.2	1.91			159.2	1.06	170.9	2.55
5	83.9	3.95	74309.	159.8	1.91			159.8	1.02	171.5	2.44
5	88.9	3.88	74956.	161.1	1.83			161.0	1.03	173.0	2.50
5	93.9	3.89	75048.	159.9	1.95			159.9	1.21	171.8	2.58
5	98.9	3.87	74401.	159.6	1.93			159.6	1.15	171.5	2.54
5	101.0	3.91	74124.	159.2	1.89			159.1	1.22	170.9	
5	103.9	3.90	74124.	159.9	1.91			159.8	1.17	171.6	
6	108.9	3.89	74771.	160.5	1.84			160.5	1.17	172.4	
6	113.9	3.86	74863.	161.0	1.78			160.9	1.23	172.9	
6	118.9	3.88	74863.	160.1	1.82			160.1	1.34	172.0	
6	122.1	4.15	74771.	157.3	1.76			157.3	1.27	168.6	
6	126.9	3.93	74771.	160.4	1.85			160.4	1.37	172.2	
7	131.9	3.91	74678.	160.5	1.80			160.5	1.36	172.3	
7	136.9	3.90	74678.	160.4	1.82			160.4	1.41	172.2	
7	142.1	3.87	74771.	160.2	1.80			160.2	1.58	172.1	
7	146.9	3.90	74956.	159.7	1.84			159.6	1.72	171.5	

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
7	151.9	3.94	74586.	159.5	1.87			159.5	2.12	171.2	
8	160.9	3.89	74586.	160.1	1.90			160.0	3.03	171.9	
8	165.4	3.84	74771.	160.9	1.79			160.9	2.84	172.9	
8	169.9	3.89	74863.	159.8	1.94			159.8	2.91	171.7	
8	174.9	3.88	74586.	159.9	1.89			159.8	2.94	171.7	
9	179.9	3.90	74493.	160.2	1.92			160.2	2.97	172.0	
9	184.9	3.87	74586.	160.9	1.87			160.8		172.7	
9	189.9	3.88	74586.	160.5	2.00			160.4		172.3	
9	194.9	3.91	74678.	159.4	2.03			159.3		171.2	
9	199.9	3.90	74309.	159.7	1.99			159.7		171.5	
10	204.9	3.90	74401.	159.8	1.98			159.8		171.6	
10	209.9	3.95	74401.	159.8	2.05			159.8		171.5	
10	214.9	3.94	74401.	158.8	2.09			158.7		170.4	
10	219.9	3.94	74493.	159.2	2.03			159.1		170.9	
10	224.9	3.93	74493.	159.5	2.02			159.5		171.2	
11	229.9	4.01	74493.	158.6	2.21			158.6		170.2	
11	234.9	3.97	74493.	159.4	2.14			159.4		171.1	
11	239.9	3.99	74493.	158.3	2.25			158.3		169.9	
11	244.9	3.99	74493.	158.6	2.25			158.5		170.2	
11	249.9	3.97	74401.	158.8	2.23			158.7		170.4	
12	254.9	4.00	74493.	159.0	2.31			159.0		170.6	
12	259.9	3.99	74678.	159.3	2.37			159.3		170.9	
12	264.9	4.00	74678.	158.7	2.42			158.6		170.3	
12	269.9	4.04	74586.	158.2	2.49			158.1		169.7	
13	274.9	4.03	74493.	158.7	2.53			158.7		170.2	
13	279.9	4.01	74493.	158.9	2.57			158.9		170.5	
13	284.9	4.00	74586.	158.9	2.65			158.8		170.5	
13	289.2	3.97	74493.	158.8	3.17			158.8		170.5	
13	290.9	4.01	74031.	157.7	3.53			157.6		169.2	
13	291.4	4.01	73846.	157.8	3.56			157.7		169.2	
13	291.9	3.98	73939.	158.3	3.49			158.2		169.8	
13	296.9	4.00	73569.	158.9	3.57			158.9		170.3	
14	301.9	3.96	73477.	158.9	3.64			158.9		170.4	
14	306.9	3.86	73384.	160.0	3.50			160.0		171.7	
14	311.9	3.99	73384.	158.8	3.78			158.8		170.2	
14	316.9	3.98	73384.	158.1	3.84			158.0		169.5	
14	320.7	4.00	74216.	158.5	3.91			158.5		170.1	
14	321.9	4.00	74216.	158.5	3.88			158.5		170.0	
15	326.9	3.98	74124.	159.0	3.89			159.0		170.6	
15	331.9	4.00	74309.	158.9	3.89			158.9		170.5	
15	336.9	4.00	74401.	158.4	3.96			158.3		169.9	
15	341.9	4.05	74216.	157.7	4.03			157.6		169.1	
15	346.5	3.70	74124.	162.0	4.00			161.9		174.1	
16	350.9	3.81	74216.	161.6	4.37			161.6		173.5	
16	357.8	3.69	74863.	162.7	4.04			162.7		175.0	
16	361.9	3.69	74771.	162.4	4.02			162.3		174.6	
16	362.6	4.01	74493.	158.3	4.07			158.3		169.9	

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFO*E4
16	366.9	4.01	74309.	158.5	4.10			158.4		170.0	
17	371.9	3.98	74124.	159.3	4.07			159.3		170.9	
17	376.9	4.01	74124.	158.9	4.08			158.9		170.4	
17	381.9	3.99	74216.	158.3	4.13			158.3		169.8	
17	383.8	3.88	75048.	161.5	3.87			161.5		173.4	
17	386.5	3.80	74401.	159.9	3.80			159.8		171.8	
17	387.9	3.71	74216.	161.7	3.67			161.7		173.9	
17	392.9	3.76	74031.	161.5	3.78			161.4		173.5	
18	397.9	3.68	73939.	162.7	3.77			162.6		174.9	
18	402.9	3.73	74124.	162.2	3.32			162.1		174.3	
18	407.9	3.71	74124.	161.3	3.29			161.3		173.5	
18	412.9	3.68	74216.	161.7	3.89			161.7		173.9	
18	417.9	3.70	74124.	162.5	4.40			162.5		174.7	
19	422.9	3.68	73939.	162.7	6.98			162.7		174.9	
19	427.9	3.69	74216.	162.2	8.06			162.2		174.4	
19	432.9	3.65	74309.	162.0	8.04			161.9		174.3	
19	437.9	3.67	74124.	161.8	8.08			161.8		174.1	
20	442.9	3.67	73939.	162.3	8.15			162.2		174.5	
20	447.9	3.67	74124.	163.0	8.60			163.0		175.3	
20	452.9	3.68	74216.	162.6	9.99			162.5		174.8	
20	457.9	3.70	74401.	161.3	10.23			161.3		173.5	
20	464.9	3.71	74309.	162.3	10.32			162.3		174.5	
21	469.9	3.67	74031.	162.6	11.21			162.6		174.8	
21	474.9	3.69	74309.	162.3	11.42			162.2		174.5	
21	479.9	3.71	74309.	161.4	11.50			161.4		173.6	
21	484.9	3.74	74216.	161.0	11.47			160.9		173.1	
21	489.9	3.69	74216.	162.5	11.36			162.5		174.7	
22	494.9	3.70	74124.	162.3	11.52			162.3		174.5	
22	499.9	3.67	74309.	162.9	11.44			162.8		175.2	
22	504.9	3.65	74309.	161.9	11.47			161.8		174.2	
22	509.9	3.65	74031.	162.8	11.81			162.8		175.1	
23	514.9	3.65	74031.	162.9	11.80			162.9		175.2	
23	519.9	3.64	74216.	163.5	11.69			163.4		175.8	
23	524.9	3.63	74124.	162.6	11.75			162.6		174.9	
23	529.9	3.67	74216.	162.1	11.73			162.1		174.4	
23	534.9	3.67	74031.	162.3	11.74			162.2		174.5	
24	539.9	3.63	74586.	164.0	11.57			163.9		176.4	
24	544.9	3.67	74493.	163.1	11.74			163.0		175.4	
24	549.9	3.68	74493.	162.5	11.77			162.5		174.8	
24	554.9	3.63	74309.	162.8	11.66			162.8		175.2	
24	559.9	3.60	74216.	163.1	11.64			163.0		175.5	
25	564.9	3.65	74216.	162.7	11.73			162.6		175.0	
25	569.9	3.66	74216.	162.9	11.73			162.9		175.2	
25	574.9	3.65	74216.	162.7	11.73			162.6		175.0	
25	579.9	3.65	74309.	162.5	11.70			162.5		174.8	
25	584.9	3.61	74216.	163.2	11.63			163.1		175.6	
26	589.9	3.62	74216.	163.1	11.63			163.1		175.5	

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
26	594.9	3.64	74216.	162.9	11.67			162.8		175.2	
26	599.9	3.57	74309.	163.5	11.64			163.5		176.0	
26	604.9	3.61	74124.	163.4	11.75			163.3		175.8	
26	609.9	3.62	74216.	162.9	11.77			162.8		175.2	
27	613.9	3.73	74216.	161.7	11.83			161.6		173.8	
27	618.9	3.77	74401.	161.4	11.94			161.4		173.5	
27	623.9	3.77	74216.	160.3	12.05			160.2		172.3	
27	628.9	3.78	74031.	160.4	12.04			160.3		172.3	
27	633.9	3.75	74124.	161.1	11.99			161.1		173.1	
28	638.9	3.69	74124.	162.2	11.88			162.1		174.4	
28	643.9	3.74	74124.	161.2	12.05			161.1		173.2	
28	648.9	3.76	74309.	160.5	12.04			160.5		172.6	
28	653.9	3.73	74031.	161.9	11.94			161.8		174.0	
29	658.9	3.84	73939.	160.2	12.11			160.1		172.0	
29	663.9	3.74	74124.	161.5	11.97			161.5		173.6	
29	668.9	3.76	74216.	161.4	12.01			161.3		173.4	
29	673.9	3.71	74124.	161.0	11.98			160.9		173.1	
29	678.9	3.75	74124.	160.5	12.00			160.5		172.6	
30	683.9	3.82	74031.	160.2	12.09			160.2		172.1	
30	688.9	3.72	74124.	161.1	11.99			161.1		173.2	
30	693.9	3.75	74216.	161.2	12.00			161.2		173.3	
30	698.9	3.78	74031.	160.0	12.04			160.0		172.0	
30	703.9	3.79	73939.	160.1	12.05			160.1		172.0	
31	708.9	3.77	73939.	160.3	11.98			160.3		172.3	
31	713.9	3.83	74031.	160.3	12.11			160.3		172.2	
31	718.9	3.77	74031.	160.8	12.01			160.8		172.8	
31	723.9	3.82	73939.	160.0	12.10			160.0		171.9	
31	728.9	3.74	74031.	160.9	11.90			160.8		172.9	
32	733.9	3.76	73846.	160.4	11.99			160.3		172.4	
32	738.9	3.75	73846.	160.2	12.02			160.2		172.2	
32	743.9	3.80	73846.	159.9	12.06			159.9		171.8	
32	748.9	3.81	73939.	159.4	12.04			159.3		171.3	
32	753.9	3.83	73846.	159.8	12.07			159.8		171.7	
33	758.9	3.82	74863.	160.6	12.04			160.6		172.6	
33	763.9	3.75	75048.	161.8	11.99			161.8		174.0	

***** RESULTS -- RUN 105 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.3	4.65	91592.	159.8	-.02	155.9	-.08			157.1	-.08
1	1.3	4.83	90945.	160.2	.02	156.4	-.08			157.6	-.04
1	2.3	4.84	90668.	161.1	.02	157.3	.04			158.5	-.02
1	2.5	4.81	91592.	162.4	.08	158.6	-.01			159.7	.05
1	4.3	4.98	91130.	160.9	.40	157.2	.32			158.4	.32
1	6.3	4.81	91592.	163.3	.59	159.5	.41			160.6	.46
1	8.3	4.94	91314.	162.7	1.14	158.9	.83			160.1	.94
1	10.0	4.99	91407.	162.8	1.54	159.0	1.18			160.2	1.44
2	14.3	4.86	91222.	163.6	2.22	159.9	1.66			161.0	2.36
2	19.3	4.87	91592.	163.6	2.55	159.8	1.84			160.9	2.88
2	24.3	4.93	91499.	161.1	2.73	157.3	1.99			158.5	3.07
2	29.3	4.87	91499.	163.5	2.53	159.7	1.82			160.9	2.92
2	34.3	4.98	91407.	163.4	2.54	159.7	1.82			160.9	2.90
2	35.2	4.81	91777.	165.8	2.48	162.0	1.75			163.1	2.87
3	48.2	4.94	91777.	160.6	2.77	156.9	2.00			158.0	3.17
4	82.0	4.50	91369.	166.1	2.73	162.1	2.06			163.3	3.05
5	86.3	4.50	90575.	165.7	3.18	161.7	2.49			162.9	3.42
5	91.3	4.62	90668.	163.8	3.61	159.9	2.95			161.1	3.82
5	96.3	4.49	90668.	163.5	3.50	159.5	2.91			160.7	3.74
5	101.3	4.51	91499.	166.3	3.40	162.3	2.78			163.5	3.60
5	106.3	4.55	91407.	165.8	3.28	161.8	2.75			163.1	3.54
6	111.3	4.79	91130.	163.2	2.92	159.4	2.40			160.6	3.18
6	116.3	4.79	91314.	163.4	2.81	159.5	2.29			160.7	3.04
6	121.3	4.96	91407.	161.6	2.85	157.9	2.32			159.1	3.10
6	126.3	4.94	91361.	161.4	2.83	157.6	2.25			158.8	3.08
6	130.5	4.86	92054.	162.5	2.73	158.7	2.15			159.9	3.01
7	135.3	4.80	91684.	162.9	2.62	159.1	2.03			161.2	2.87
7	140.3	4.76	91361.	162.6	2.58	158.8	1.97			160.0	2.86
7	145.3	4.86	92054.	162.6	2.58	158.8	1.97			160.0	2.85
7	150.3	4.78	91869.	162.6	2.52	158.8	1.91			161.0	2.83
7	155.3	4.72	91777.	163.8	2.40	159.9	1.79			161.1	2.71
8	160.3	4.90	91592.	161.8	2.56	158.1	1.94			159.2	2.87
8	165.3	4.84	91361.	162.5	2.45	158.7	1.84			159.8	2.76
8	170.3	4.80	91361.	163.1	2.41	159.3	1.77			160.5	2.72
8	175.3	5.03	91684.	162.0	2.56	158.3	1.91			159.5	2.84
9	180.3	5.12	91684.	161.1	2.63	157.5	2.00			158.6	2.93
9	185.3	5.00	91684.	162.6	2.44	158.9	1.81			160.1	2.71
9	190.3	4.94	91869.	161.9	2.36	158.2	1.74			159.3	2.67
9	195.3	5.00	91777.	161.0	2.44	157.2	1.82			158.4	2.75
9	200.3	5.06	91684.	162.0	2.45	158.3	1.82			159.4	2.75
10	205.3	4.88	91777.	164.2	2.24	160.4	1.62			161.5	2.55
10	210.3	4.96	91684.	163.6	2.28	159.8	1.65			161.0	2.58

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
10	215.3	5.10	91469.	162.3	2.44	158.7	1.78			159.8	2.71
10	220.3	4.97	91777.	163.6	2.21	159.9	1.59			161.0	2.52
10	225.3	5.08	91499.	161.7	2.31	158.0	1.68			159.1	2.64
11	230.3	4.81	91684.	164.3	2.05	160.5	1.44			161.6	2.39
11	235.3	4.96	91684.	162.4	2.26	158.7	1.63			159.8	2.59
11	240.3	4.84	91777.	163.7	2.17	159.9	1.52			161.1	2.48
11	245.3	4.85	91684.	164.2	2.15	160.4	1.54			161.5	2.49
11	250.3	4.88	91592.	164.0	2.23	160.2	1.55			161.4	2.54
12	255.3	4.90	91499.	163.8	2.23	160.0	1.58			161.1	2.57
12	260.3	4.83	91369.	163.6	2.21	159.8	1.56			161.0	2.57
12	265.3	4.93	91869.	161.4	2.42	157.7	1.74			158.8	2.75
12	270.3	4.94	91592.	161.7	2.49	157.9	1.80			159.1	2.82
12	275.3	4.78	91592.	163.7	2.33	159.9	1.65			161.0	2.67
13	280.3	4.75	91499.	163.9	2.31	160.0	1.64			161.2	2.65
13	285.3	4.81	91684.	162.9	2.42	159.0	1.74			160.2	2.79
13	290.3	4.80	91777.	162.7	2.46	158.9	1.79			160.0	2.80
13	295.3	4.82	91499.	162.3	2.48	158.5	1.81			159.6	2.82
14	300.3	4.74	91407.	170.1	2.25	166.2	1.56			167.4	2.60
14	305.3	4.81	91592.	169.5	2.43	165.7	1.73			166.8	2.77
14	310.3	4.78	91684.	170.1	2.45	166.3	1.78			167.5	2.81
14	315.3	4.82	91684.	164.2	2.68	160.4	1.98			161.5	3.02
14	320.3	4.67	91222.	163.7	2.61	159.8	1.91			161.0	2.96
15	325.3	4.76	91407.	163.2	2.68	159.3	1.98			160.5	3.03
15	330.3	4.88	91499.	161.0	2.86	157.2	2.15			158.4	3.23
15	335.3	4.79	91222.	162.4	2.72	158.6	2.04			159.7	3.12
15	340.3	4.93	91314.	161.9	2.89	158.2	2.14			159.3	3.22
15	345.3	4.82	91499.	161.3	2.85	157.5	2.12			158.7	3.19
16	350.3	4.74	91314.	161.5	2.78	157.6	2.08			158.8	3.16
16	355.3	4.85	91407.	159.3	2.96	155.5	2.26			156.6	3.33
16	360.3	4.81	91407.	160.8	2.88	157.0	2.17			158.2	3.28
16	365.3	4.73	91499.	162.9	2.80	159.1	2.07			160.2	3.20
16	370.3	4.81	91407.	160.9	2.94	157.0	2.20			158.2	3.34
17	375.3	4.64	91314.	161.4	2.79	157.5	2.07			158.7	3.23
17	380.3	4.79	91222.	158.8	3.05	155.0	2.28			156.2	3.45
17	385.3	4.77	91222.	160.5	2.98	156.7	2.22			157.9	3.35
17	390.3	4.81	91314.	160.5	3.04	156.7	2.27			157.9	3.44
17	395.3	4.84	91222.	159.2	3.13	155.4	2.36			156.6	3.50
18	400.3	4.89	91037.	158.0	3.21	154.2	2.46			155.4	3.61
18	405.3	4.71	91407.	160.4	3.02	156.5	2.26			157.7	3.42
18	410.3	4.87	91222.	160.7	3.14	156.9	2.37			158.1	3.54
18	415.3	4.85	91407.	160.7	3.16	156.9	2.39			158.1	3.58
19	420.3	4.81	91314.	160.7	3.13	156.9	2.37			158.1	3.53
19	425.3	4.84	91222.	159.4	3.25	155.7	2.48			156.8	3.64
19	430.3	4.80	91684.	160.6	3.20	156.7	2.41			157.9	3.59
19	435.3	4.85	91499.	161.3	3.21	157.6	2.44			158.7	3.63
19	440.3	4.73	91314.	162.5	3.11	158.7	2.32			159.8	3.51
20	445.3	5.03	91130.	166.3	3.26	162.6	2.46			163.8	3.65

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
20	450.3	4.87	91407.	162.2	3.23	158.4	2.47			159.6	3.66
20	455.3	5.13	91499.	159.4	3.53	155.8	2.75			156.9	3.91
20	460.3	5.00	91592.	161.9	3.34	158.2	2.54			159.4	3.73
20	465.3	5.11	91407.	160.7	3.51	157.1	2.70			158.2	3.90
21	470.3	4.99	91961.	163.6	3.36	159.8	2.54			161.0	3.74
21	475.3	5.00	92239.	163.6	3.40	159.9	2.58			161.0	3.81
21	480.3	4.96	92054.	163.3	3.41	159.5	2.60			160.7	3.83

***** RESULTS -- RUN 106 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
1	.3	4.82	93382.	167.1	-.03			153.8	-.01	156.7	.02
1	1.3	4.93	92905.	169.3	.11			155.3	.02	158.1	.20
1	2.3	4.93	92905.	169.6	.21			156.5	.12	159.3	.12
1	2.5	5.07	93478.	168.7	.30			155.9	.19	158.6	.19
1	4.3	5.03	94146.	170.3	.77			157.3	.61	160.1	.59
1	6.3	5.10	94624.	170.2	1.32			157.3	1.01	160.1	1.03
1	8.3	5.06	93478.	170.6	1.84			157.8	1.54	160.5	1.52
1	10.0	5.02	93669.	171.8	2.24			158.8	1.89	161.6	1.87
2	14.3	5.11	93669.	170.5	3.06			157.7	2.58	160.4	2.59
2	19.3	5.05	94051.	171.1	3.12			158.2	2.72	161.0	2.73
2	24.3	5.00	93955.	169.9	3.03			156.9	2.69	159.7	2.70
2	29.3	5.17	94051.	169.9	2.97			157.1	2.63	159.8	2.71
2	34.3	5.04	94146.	172.5	2.57			159.6	2.28	162.3	2.35
2	35.2	4.89	93360.	174.3	2.51			161.0	2.22	163.9	2.48
3	48.2	4.62	93764.	173.7	2.54			159.9	2.34	162.9	2.56
4	82.0	5.06	93669.	169.0	2.64			156.1	2.29	158.9	2.62
5	86.3	4.95	92905.	170.1	2.84			157.1	2.47	159.9	2.73
5	91.3	4.90	93191.	170.4	3.00			157.3	2.65	160.1	2.73
5	96.3	4.90	93096.	168.6	3.05			155.5	2.76	158.3	2.87
5	101.3	4.98	93382.	170.3	3.01			157.3	2.73	160.0	2.79
5	106.3	5.06	93382.	169.3	2.99			156.5	2.73	159.2	2.82
6	111.3	5.19	93191.	168.1	2.93			155.5	2.66	158.2	2.68
6	116.3	5.20	93478.	168.3	2.73			155.6	2.46	158.3	2.51
6	121.3	4.96	93573.	170.9	2.33			157.9	2.08	160.6	2.14
6	126.3	5.12	93382.	168.1	2.49			155.3	2.18	158.1	2.25
6	130.5	4.95	93382.	170.3	2.31			157.3	2.06	160.0	2.09
7	135.3	4.96	93096.	169.9	2.31			156.3	2.05	159.7	2.08
7	140.3	5.12	93382.	167.5	2.50			154.8	2.18	157.5	2.25
7	145.3	5.01	93478.	169.7	2.23			156.8	1.99	159.5	2.03
7	150.3	5.06	93287.	168.4	2.34			155.6	2.10	158.3	2.13
7	155.3	5.09	93191.	161.6	2.32			155.8	2.07	158.6	2.11
8	160.3	5.13	93096.	168.1	2.35			155.4	2.09	158.1	2.13
8	165.3	4.97	93382.	169.8	2.14			156.8	1.88	159.5	1.89
8	170.3	5.15	93382.	169.1	2.35			155.4	2.06	158.1	2.07
8	175.3	5.13	93096.	169.5	2.35			156.8	2.09	159.5	2.13
9	180.3	4.85	93287.	172.8	2.02			159.6	1.79	162.4	1.79
9	185.3	4.86	93287.	173.0	1.97			159.8	1.73	162.6	1.76
9	190.3	5.01	93573.	170.0	2.14			157.1	1.87	159.8	1.88
9	195.3	4.95	93382.	170.3	2.08			157.2	1.83	160.0	1.84
9	200.3	4.94	93287.	172.1	2.01			159.0	1.76	161.8	1.79
10	205.3	5.03	93382.	171.5	2.07			158.6	1.83	161.3	1.94
10	210.3	5.14	93287.	170.4	2.15			157.8	1.92	160.5	1.91

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
10	215.3	5.03	93478.	171.8	2.04			158.9	1.80	161.6	1.81
10	220.3	5.14	93382.	170.6	2.08			157.9	1.85	160.6	1.83
10	225.3	5.16	93191.	169.6	2.10			157.0	1.87	159.7	1.85
11	230.3	5.18	93191.	169.1	2.15			156.5	1.88	159.2	1.90
11	235.3	5.16	93382.	169.2	2.17			156.5	1.88	159.2	1.89
11	240.3	5.23	93382.	168.4	2.26			155.8	2.01	158.5	2.00
11	245.3	5.08	93287.	170.5	2.09			157.7	1.84	160.5	1.85
11	250.3	4.97	93382.	172.1	1.95			159.1	1.72	161.8	1.67
12	255.3	5.19	93191.	169.6	2.22			157.0	1.95	159.7	1.97
12	260.3	5.14	93573.	169.2	2.28			156.5	2.00	159.2	1.98
12	265.3	5.18	93573.	167.7	2.36			155.0	2.09	157.7	2.05
12	270.3	5.23	93382.	167.5	2.47			155.0	2.19	157.6	2.15
12	275.3	5.20	93287.	168.1	2.49			155.5	2.16	158.2	2.18
13	280.3	5.17	93287.	169.4	2.44			155.7	2.14	158.4	2.16
13	285.3	5.18	93478.	167.9	2.45			155.2	2.19	157.9	2.17
13	290.3	5.20	93478.	167.4	2.56			154.8	2.27	157.5	2.28
13	295.3	4.96	93287.	169.8	2.31			156.8	2.05	159.6	2.03
14	300.3	5.08	93191.	175.4	2.32			162.6	2.02	165.3	2.03
14	305.3	5.19	93287.	174.6	2.45			162.0	2.16	164.7	2.12
14	310.3	5.10	93382.	175.6	2.40			162.9	2.13	165.6	2.08
14	315.3	5.12	93478.	170.0	2.58			157.2	2.27	159.9	2.28
14	320.3	5.13	93000.	167.7	2.69			155.0	2.37	157.7	2.35
15	325.3	5.19	93287.	167.6	2.72			155.0	2.39	157.7	2.41
15	330.3	5.02	93382.	168.6	2.55			155.7	2.28	158.5	2.29
15	335.3	4.99	93096.	169.3	2.51			156.4	2.25	159.1	2.29
15	340.3	5.22	93191.	167.8	2.76			155.2	2.43	157.9	2.45
15	345.3	5.03	93382.	168.2	2.65			155.3	2.36	158.0	2.31
16	350.3	5.05	93191.	167.3	2.73			154.4	2.43	157.2	2.41
16	355.3	5.14	93287.	165.2	2.89			152.5	2.60	155.2	2.55
16	360.3	5.05	93191.	167.2	2.76			154.4	2.46	157.1	2.47
16	365.3	5.06	93382.	168.5	2.76			155.7	2.46	158.4	2.44
16	370.3	5.06	93287.	167.2	2.82			154.4	2.52	157.1	2.53
17	375.3	5.13	93191.	165.2	2.98			152.5	2.67	155.2	2.65
17	380.3	5.13	93096.	164.3	3.02			151.6	2.70	154.3	2.66
17	385.3	5.05	93000.	166.5	2.90			153.7	2.60	156.4	2.58
17	390.3	5.14	93191.	166.0	3.01			153.3	2.69	156.0	2.68
17	395.3	4.96	93096.	167.0	2.82			154.0	2.56	156.8	2.54
18	400.3	5.04	92905.	165.4	3.00			152.6	2.67	155.3	2.68
18	405.3	5.04	93191.	166.0	3.01			153.1	2.69	155.8	2.67
18	410.3	5.06	93096.	167.7	2.98			154.9	2.67	157.6	2.63
18	415.3	5.07	93382.	167.5	3.04			154.7	2.72	157.4	2.70
19	420.3	5.13	93096.	166.3	3.09			153.6	2.78	156.4	2.76
19	425.3	5.04	93096.	166.4	3.09			153.5	2.76	156.3	2.71
19	430.3	5.06	93382.	166.8	3.12			153.9	2.80	156.6	2.75
19	435.3	5.20	93287.	166.6	3.23			154.0	2.88	156.7	2.87
19	440.3	5.19	93191.	166.7	3.25			154.1	2.90	156.8	2.89
20	445.3	4.97	93096.	176.0	3.12			163.0	2.79	165.7	2.77

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
20	450.3	4.97	93287.	170.2	3.27			157.2	2.97	160.0	2.91
20	455.3	4.98	93478.	170.1	3.28			157.0	2.98	159.8	2.93
20	460.3	4.88	93478.	172.3	3.13			159.1	2.81	161.9	2.79
20	465.3	5.05	93287.	170.6	3.32			157.7	3.00	160.5	2.95
21	470.3	4.98	93191.	172.1	3.21			159.2	2.91	161.9	2.88
21	475.3	5.01	93478.	172.0	3.30			159.1	2.96	161.8	2.94
21	480.3	5.11	93382.	170.3	3.46			157.5	3.10	160.3	3.09

***** RESULTS -- RUN 107 *****

DAY	TIME	VFL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.3	3.97	75560.	156.5	.37	157.0	.35	160.5	.39	156.1	.38
1	.4	4.07	75939.	155.5	.57	156.0	.44	159.4	.53	155.1	.47
1	1.2	3.96	75465.	156.8	.32	157.4	.30	160.9	.31	156.4	.26
2	2.2	3.99	75181.	156.3	.43	156.8	.38	160.3	.50	155.9	.41
2	3.2	4.10	75086.	154.7	.68	155.2	.66	158.6	.83	154.3	.65
2	4.2	3.98	74802.	156.1	.57	156.6	.55	160.1	.71	155.7	.51
2	8.2	4.12	75560.	154.5	1.17	155.0	1.12	158.4	1.29	154.1	1.07
2	13.2	4.00	75560.	155.8	1.40	156.4	1.38	159.8	1.46	155.4	1.30
2	18.2	3.89	75560.	157.1	1.66	157.7	1.64	161.2	1.71	156.7	1.56
2	23.2	3.93	75371.	157.2	2.02	157.8	1.96	161.3	1.96	156.8	1.85
3	28.2	4.00	75655.	156.4	2.79	157.0	2.85	160.5	2.84	156.0	2.52
3	33.2	3.96	75939.	157.3	3.85	157.8	3.90	161.3	3.37	156.8	3.33
3	38.2	3.84	75845.	159.3	4.94	159.8	4.95	163.5	4.37	158.9	4.49
3	43.2	3.86	75750.	157.9	6.18	158.5	6.20	162.1	5.58	157.5	5.81
3	48.2	3.84	75845.	158.3	7.18	158.9	7.15	162.5	6.50	157.9	6.80
4	53.2	3.68	75655.	161.2	8.17	161.8	8.11	165.6	7.44	160.8	7.80
4	58.2	3.59	75845.	162.0	8.89	162.5	8.86	166.4	8.11	161.5	8.59
4	63.2	3.60	75939.	162.3	9.56	162.8	9.53	166.7	8.75	161.8	9.23
4	68.2	3.64	75655.	161.6	10.24	162.2	10.21	166.0	9.40	161.2	9.94
4	73.2	3.65	75845.	161.3	10.90	161.9	10.83	165.7	10.00	160.9	10.57
5	78.2	3.53	75845.	164.0	11.16	164.6	11.13	168.5	10.24	163.6	10.83
5	83.2	3.66	76034.	161.9	11.92	162.4	11.89	166.2	10.96	161.4	11.63
5	88.2	3.64	76034.	161.9	12.43	162.4	12.40	166.3	11.47	161.4	12.14
5	93.2	3.96	76034.	157.0	13.07	157.5	13.05	161.1	12.12	156.6	12.74
6	98.2	3.94	76034.	157.4	13.53	157.9	13.51	161.5	12.51	157.0	13.20
6	103.2	3.91	75845.	157.9	14.04	158.4	14.02	162.0	13.01	157.5	13.71
6	108.2	3.95	75845.	157.4	14.65	157.9	14.63	161.5	13.56	157.0	14.32
6	113.2	3.93	75750.	156.9	15.14	157.5	15.11	161.0	14.01	156.5	14.81
6	118.2	3.89	75750.	157.8	15.59	158.4	15.50	161.9	14.36	157.4	15.20
6	121.6	4.03	75655.	157.5	16.02	158.1	15.97	161.5	14.81	157.1	15.66
7	126.2	3.39	75655.	169.9	15.40	170.5	15.39	174.6	14.16	169.4	15.08
7	131.2	3.41	75750.	169.3	15.67	169.9	15.63	173.9	14.40	168.8	15.35
7	136.2	3.47	75845.	169.8	15.74	170.4	15.70	174.5	14.44	169.4	15.39
7	141.2	3.40	75750.	170.6	15.66	171.2	15.66	175.2	14.43	170.1	15.38
8	146.2	3.44	75560.	168.1	15.95	168.7	15.95	172.7	14.69	167.7	15.60
8	151.2	3.31	75560.	167.5	16.14	168.1	16.17	172.3	14.85	167.0	15.79
8	156.2	3.35	75845.	166.7	16.21	167.4	16.21	171.5	14.94	166.3	15.90
8	161.2	3.31	75750.	166.8	16.15	167.5	16.15	171.6	14.87	166.4	15.84
8	166.2	3.32	75655.	166.6	16.21	167.2	16.17	171.3	14.86	166.1	15.82
9	171.2	3.36	75465.	165.8	16.32	166.4	16.32	170.5	15.01	165.3	15.97
9	176.2	3.37	75655.	166.4	16.37	167.0	16.40	171.1	15.10	165.9	16.02
9	184.2	3.82	75845.	158.1	16.34	158.7	16.38	162.3	15.17	157.7	16.02

DAY	TIME	VEL	O/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
9	189.2	3.89	75655.	156.9	16.39	157.4	16.39	161.0	15.18	156.5	16.02
10	194.2	3.83	75560.	159.2	16.07	159.7	16.11	163.3	14.89	158.7	15.71
10	199.2	3.81	75560.	158.9	16.03	159.5	16.04	163.1	14.79	158.5	15.67
10	204.2	3.80	75939.	159.0	16.01	159.5	16.01	163.2	14.77	158.6	15.65
10	209.2	3.85	75750.	157.5	16.14	158.0	16.15	161.6	14.91	157.1	15.78
10	215.2	3.69	75276.	160.7	16.22	161.3	16.26	165.0	14.96	160.3	15.86
11	220.2	3.64	75276.	161.9	15.80	162.5	15.80	166.3	14.53	161.5	15.44
11	225.2	3.62	75465.	162.1	15.73	162.7	15.74	166.5	14.43	161.6	15.38
11	230.2	3.79	75560.	158.9	16.16	159.5	16.14	163.1	14.85	158.5	15.77
11	235.2	3.84	75371.	158.0	16.10	158.5	16.04	162.1	14.75	157.5	15.70
11	240.2	3.77	75371.	159.8	15.98	160.4	15.92	164.0	14.63	159.4	15.59
12	245.2	4.04	75181.	155.9	16.27	156.4	16.25	159.9	14.99	155.5	15.88
12	250.2	4.14	75465.	154.5	16.43	155.0	16.41	158.4	15.16	154.1	16.07
12	255.2	4.04	75371.	154.8	16.28	155.3	16.25	158.8	14.99	154.4	15.91
12	260.2	4.03	75371.	154.7	16.33	155.2	16.27	158.6	15.01	154.3	15.90
12	265.2	4.05	75371.	155.0	16.36	155.5	16.30	158.9	15.04	154.6	15.92
13	270.2	4.00	75465.	156.4	16.22	156.9	16.16	160.4	14.90	156.0	15.82
13	275.2	3.97	75371.	156.4	16.24	156.9	16.21	160.4	14.91	156.0	15.84
13	280.2	4.05	76129.	155.6	16.34	156.1	16.29	159.6	15.00	155.2	15.92
13	285.2	4.09	76224.	154.8	16.39	155.3	16.37	158.8	15.09	154.4	16.00
14	290.2	4.05	76224.	156.3	16.30	156.8	16.27	160.3	14.99	155.9	15.90
14	295.2	4.16	76413.	154.9	16.50	155.4	16.48	158.8	15.18	154.5	16.08
14	300.2	4.04	76508.	155.4	16.32	155.9	16.30	159.4	14.98	155.0	15.93
14	305.2	4.10	76319.	155.1	16.34	155.6	16.28	159.0	15.01	154.7	15.91
14	310.2	4.12	76129.	154.3	16.38	154.8	16.35	158.3	15.08	153.9	15.98

***** RESULTS -- RUN 108 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.4	4.05	77634.	153.7	.21			155.0	.19	151.0	.14
2	1.2	4.02	77062.	153.6	.22			155.0	.30	150.9	.26
2	3.0	4.08	76681.	152.3	.48			153.6	.45	149.6	.47
2	5.0	3.88	76395.	154.7	.23			156.1	.27	152.0	.20
2	7.0	3.84	76300.	155.5	.20			156.9	.24	152.7	.25
2	8.9	4.03	76395.	153.0	.68			154.3	.72	150.3	.67
2	11.0	4.06	76395.	152.3	.83			153.6	.88	149.7	.87
2	13.0	4.09	76300.	151.6	1.04			152.9	1.09	148.9	1.04
2	13.9	3.91	76967.	155.7	.68			157.1	.75	152.9	.72
2	16.0	3.88	77538.	155.6	.82			157.0	.79	152.8	.77
2	21.0	4.08	77024.	153.3	1.21			154.7	1.22	150.7	1.14
3	26.0	3.93	77634.	155.9	.89			157.3	.89	153.1	.79
3	31.0	4.10	77624.	154.0	1.10			155.3	1.07	151.3	.98
3	36.0	4.19	78015.	152.2	1.22			153.5	1.19	149.6	1.06
3	41.0	4.21	77443.	152.1	1.21			153.3	1.19	149.5	1.16
3	46.0	3.99	77348.	154.5	.79			155.9	.79	151.8	.72
4	51.0	4.11	78110.	153.6	1.00			154.9	.98	150.9	.89
4	56.0	4.12	78396.	150.3	1.16			151.7	1.17	147.7	1.09
4	61.0	4.18	78396.	152.6	1.08			153.9	1.09	150.0	.93
4	66.0	4.08	77824.	153.1	1.00			154.4	.93	150.4	.89
4	71.0	3.82	77538.	155.5	.58			156.9	.51	152.7	.49
5	76.0	4.14	77634.	153.1	1.07			154.4	1.01	150.5	.92
5	81.0	4.16	77824.	153.0	1.05			154.3	1.02	150.3	.93
5	91.0	3.99	77634.	154.7	.90			156.1	.79	152.0	.72
6	101.0	4.04	77538.	154.6	.95			156.0	.88	151.9	.77
6	106.0	4.02	77824.	155.1	.88			156.5	.78	152.4	.77
6	111.0	4.00	78015.	153.4	1.02			154.8	.92	150.7	.85
6	116.0	3.93	77729.	155.3	.82			156.7	.72	152.5	.69
7	121.0	4.01	77634.	153.0	1.02			154.3	.92	150.2	.84
7	131.0	3.81	77729.	155.3	.68			156.7	.57	152.4	.52

***** RESULTS -- RUN 109 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
1	.3	3.00	75969.	200.3	.27					195.7	.12
1	.4	2.99	75718.	200.3	.11					195.7	.27
1	1.2	2.97	75718.	201.3	.22					196.7	.28
2	2.2	3.01	74859.	199.7	.93					194.2	1.08
2	3.2	3.02	75145.	198.8	1.26					194.3	1.49
2	4.2	3.01	74354.	198.9	1.76					194.4	1.91
2	8.2	3.05	75622.	198.5	3.28					194.0	3.58
2	13.2	3.06	76386.	198.7	5.61					194.2	5.75
2	18.2	2.95	76004.	201.6	7.43					197.0	7.80
2	23.2	2.92	77150.	205.0	8.26					200.2	9.15
3	28.2	2.99	76359.	202.2	12.19					197.6	12.33
3	33.2	2.88	77150.	206.3	15.30					201.5	15.32
3	38.2	2.95	76864.	203.7	18.89					199.0	18.62
3	43.2	2.86	76386.	205.3	21.58					200.5	20.93
3	48.2	2.96	76386.	202.1	24.17					197.4	23.49
4	53.2	3.02	76100.	200.3	25.93					195.8	25.27
4	58.2	2.90	76768.	204.2	26.52					199.4	26.28
4	63.2	2.99	76768.	201.6	27.99					196.9	27.89
4	68.2	3.07	76482.	198.9	29.46					194.3	29.32
4	73.2	3.02	76577.	200.3	30.90					195.7	30.67

***** RESULTS -- RUN 110 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.4	2.99	76291.	198.2	-.08						
2	1.2	2.99	76291.	198.2	-.15						
2	3.0	3.02	75432.	195.9	.30						
2	5.0	2.99	75241.	196.5	.83						
2	7.0	2.98	75145.	197.0	1.12						
2	8.9	3.00	75241.	196.6	1.77						
2	11.0	3.01	75241.	196.1	2.12						
2	13.0	3.03	75241.	195.0	2.37						
2	13.9	3.04	75813.	196.7	2.40						
2	16.0	3.02	76291.	196.9	2.80						
2	21.0	3.10	76195.	194.7	3.19						
3	26.0	3.08	75622.	195.1	3.46						
3	31.0	3.01	76768.	199.1	3.42						
3	36.0	3.09	77150.	196.3	3.96						
3	41.0	3.06	76386.	196.7	3.95						
3	46.0	3.05	75813.	196.1	4.00						
4	51.0	3.18	76768.	193.5	4.45						
4	56.0	3.08	76768.	193.2	4.29						
4	61.0	3.07	77246.	196.8	3.99						
4	66.0	3.14	76482.	193.5	4.40						
4	71.0	3.12	76195.	193.1	4.27						
5	76.0	3.10	76195.	195.3	3.84						
5	81.0	3.24	76482.	191.8	4.01						
5	91.0	3.10	76386.	195.3	3.60						
6	101.0	3.13	76577.	195.4	3.64						
6	106.0	3.12	76577.	195.5	3.49						
6	111.0	3.07	76482.	194.8	3.58						
6	116.0	3.10	76386.	195.0	3.53						
7	121.0	3.05	76386.	195.2	3.43						
7	131.0	3.04	76100.	194.5	3.68						

***** RESULTS -- RUN 111 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.3	4.86	135288.	189.6	-.17	189.5	-.16	197.1	-.16	187.5	-.15
1	.7	4.99	134624.	188.5	-.02	188.3	-.03	195.8	.04	186.4	.01
1	.9	5.07	135383.	188.3	.09	188.2	.08	195.5	.12	186.3	.08
1	1.7	5.05	134055.	188.3	.17	188.2	.16	195.5	.26	186.3	.20
1	2.7	5.18	133392.	186.8	.39	186.6	.46	193.8	.51	184.8	.40
1	3.7	5.06	133012.	188.1	.40	187.9	.47	195.2	.57	186.0	.45
1	4.7	4.99	132918.	188.9	.54	188.7	.57	196.0	.67	186.8	.55
1	5.7	5.04	132918.	188.4	.71	188.3	.76	195.5	.84	186.4	.70
1	6.7	5.01	132918.	188.6	.76	188.4	.88	195.7	.91	186.5	.84
1	7.7	4.98	133107.	189.3	.88	189.2	.97	196.5	1.09	187.3	.96
1	8.7	5.01	133107.	188.4	1.10	188.2	1.17	195.5	1.22	186.3	1.11
1	9.7	5.18	133202.	185.8	1.39	185.7	1.48	192.8	1.54	183.8	1.37
1	10.7	5.04	132823.	187.5	1.37	187.4	1.48	194.6	1.49	185.5	1.38
1	11.6	5.06	135193.	188.4	1.47	188.2	1.58	195.6	1.59	186.3	1.48
1	15.7	5.08	135193.	182.2	2.10	182.1	2.23	189.4	2.22	180.2	2.09
1	20.7	5.07	135193.	189.0	2.15	188.9	2.27	196.2	2.11	187.0	2.10
2	25.7	4.98	134624.	189.3	2.29	189.2	2.42	196.6	2.17	187.2	2.19
2	30.7	4.95	135383.	191.1	2.42	190.9	2.56	198.4	2.19	189.0	2.32
2	35.7	5.03	135383.	189.4	2.64	189.2	2.81	196.6	2.39	187.3	2.52
2	40.7	5.10	135003.	187.4	2.76	187.2	2.93	194.5	2.47	185.3	2.66
2	45.7	5.09	134909.	188.4	2.75	188.2	2.87	195.5	2.44	186.3	2.62
3	50.7	4.98	134435.	188.5	2.77	188.4	2.93	195.8	2.41	186.4	2.66
3	55.7	5.07	134909.	187.4	2.96	187.2	3.10	194.6	2.64	185.3	2.83
3	60.7	5.06	135288.	187.2	3.04	187.0	3.20	194.4	2.69	185.1	2.90
3	65.7	4.96	134340.	187.6	3.13	187.4	3.32	194.9	2.83	185.5	2.97
3	70.7	4.92	134435.	189.4	3.09	189.2	3.24	196.7	2.75	187.3	2.91
4	75.7	4.93	134245.	189.4	3.18	189.2	3.36	196.7	2.81	187.3	3.01
4	80.7	4.92	134814.	189.3	3.25	189.1	3.43	196.6	2.94	187.2	3.09
4	82.1	5.07	135477.	187.5	3.42	187.4	3.58	194.7	3.06	185.4	3.27
4	86.7	5.05	134814.	187.1	3.45	186.9	3.61	194.3	3.10	185.0	3.27
4	91.7	5.08	134435.	186.4	3.53	186.3	3.69	193.6	3.18	184.4	3.34
5	96.7	4.90	134435.	189.6	3.38	189.5	3.53	197.0	3.02	187.5	3.23
5	101.7	4.94	135383.	190.1	3.48	189.9	3.66	197.4	3.16	189.0	3.30
5	106.7	4.95	135762.	188.4	3.61	188.2	3.80	195.7	3.29	186.3	3.42
5	111.7	5.02	135383.	188.1	3.59	188.0	3.77	195.4	3.27	186.0	3.43
5	116.7	5.26	135477.	184.9	3.90	184.7	4.08	191.9	3.58	182.9	3.72
6	121.7	5.06	135098.	187.7	3.78	187.5	3.96	194.9	3.45	185.6	3.60
6	126.7	4.89	135762.	190.3	3.78	190.2	3.96	197.8	3.43	188.2	3.62
6	131.7	4.88	135383.	190.0	3.91	189.9	4.09	197.4	3.54	187.9	3.73
6	136.7	4.93	135098.	188.8	4.05	188.6	4.23	196.1	3.69	186.7	3.87
7	146.7	5.13	135193.	186.8	4.23	186.7	4.41	194.0	3.88	184.8	4.06
7	151.7	4.96	135288.	189.7	4.09	189.5	4.27	197.0	3.75	187.6	3.95

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
7	156.7	4.93	135288.	188.9	4.13	188.7	4.31	196.2	3.78	186.8	3.97
7	161.7	5.09	135003.	186.9	4.28	186.8	4.48	194.1	3.97	184.9	4.14
7	166.7	5.01	134909.	188.0	4.25	187.8	4.43	195.2	3.91	185.9	4.11
8	168.2	5.05	135193.	187.3	4.33	187.1	4.51	194.5	4.00	185.2	4.17
8	172.7	5.12	135003.	187.5	4.40	187.3	4.60	194.6	4.07	185.4	4.25
8	177.7	5.07	135193.	187.6	4.42	187.5	4.60	194.8	4.07	185.5	4.26
8	182.7	4.97	135193.	187.7	4.39	187.5	4.58	195.0	4.07	185.6	4.26
8	187.7	5.02	135003.	187.9	4.46	187.7	4.65	195.1	4.11	185.8	4.32
9	192.7	5.08	134814.	186.9	4.60	186.8	4.80	194.1	4.27	184.9	4.46
9	197.7	4.99	135193.	189.0	4.70	188.8	4.88	196.3	4.36	186.9	4.56
9	202.7	4.92	135477.	189.2	4.77	189.0	4.95	196.6	4.41	187.1	4.63
9	207.7	5.02	135288.	188.0	4.94	187.9	5.12	195.3	4.56	185.9	4.80
9	212.7	4.99	135003.	188.0	4.97	187.8	5.17	195.2	4.62	185.9	4.86
10	217.7	4.72	134814.	192.6	4.81	192.4	5.01	200.2	4.43	190.4	4.72
10	222.7	4.91	135572.	190.0	4.99	189.8	5.17	197.4	4.63	187.9	4.90
10	232.7	4.93	135288.	185.7	5.30	185.5	5.48	193.0	4.92	183.6	5.21
10	237.1	4.87	135003.	189.6	5.24	189.4	5.44	197.0	4.85	187.4	5.14
11	241.7	4.98	134909.	188.6	5.37	188.4	5.55	195.8	4.98	186.5	5.27
11	246.7	4.88	135383.	190.3	5.34	190.1	5.52	197.7	4.93	188.2	5.24
11	251.7	4.81	135383.	190.1	5.34	189.9	5.53	197.6	4.94	187.9	5.24
11	256.7	4.99	135098.	188.0	5.60	187.8	5.78	195.3	5.18	185.9	5.50
11	261.7	4.91	135193.	189.5	5.54	189.3	5.74	196.9	5.14	187.4	5.46
12	266.7	4.90	134814.	189.8	5.57	189.7	5.77	197.2	5.19	187.7	5.49
12	271.7	4.63	135193.	193.7	5.36	193.6	5.54	201.4	4.93	191.5	5.29
12	276.7	4.88	135383.	189.1	5.69	188.9	5.87	196.5	5.29	187.0	5.60
12	281.7	4.94	135003.	188.5	5.75	188.4	5.95	195.9	5.35	186.4	5.69
12	286.7	4.76	134814.	191.6	5.61	191.4	5.79	199.1	5.20	189.4	5.54
13	291.7	4.78	135003.	191.6	5.64	191.5	5.84	199.1	5.24	189.5	5.58
13	296.7	4.73	135383.	192.6	5.60	192.5	5.82	200.2	5.20	190.5	5.55
13	301.7	4.85	135383.	190.4	5.81	190.2	6.02	197.8	5.42	188.3	5.73
13	306.7	4.74	134624.	191.1	5.82	191.0	6.02	198.6	5.39	189.0	5.77
14	311.7	4.80	134814.	191.2	5.92	191.0	6.14	198.7	5.53	189.1	5.87
15	356.2	4.97	135098.	188.6	5.95	188.4	6.19	195.9	5.59	186.5	5.91
16	360.7	4.99	132064.	186.5	5.91	186.3	6.11	193.6	5.55	184.4	5.84
16	361.2	5.20	135003.	185.6	6.08	185.4	6.30	192.7	5.76	183.6	6.00
16	365.7	5.08	134719.	187.4	5.94	187.3	6.14	194.6	5.61	185.4	5.86
16	370.7	4.99	136615.	189.9	5.88	189.7	6.10	197.2	5.52	187.8	5.82
16	375.7	5.22	134719.	184.8	6.21	184.6	6.41	191.8	5.87	182.8	6.15
16	380.7	5.13	135951.	186.8	6.14	186.7	6.33	194.0	5.77	184.8	6.08
17	385.7	5.19	135762.	186.6	6.20	186.4	6.42	193.7	5.86	184.5	6.16
17	390.7	5.06	136046.	188.6	6.12	188.4	6.33	195.8	5.77	186.5	6.08
17	395.7	5.01	136141.	189.4	6.09	189.2	6.31	196.7	5.70	187.3	6.05
17	400.7	5.00	134340.	187.3	6.21	187.2	6.41	194.6	5.84	185.2	6.17
17	405.7	5.08	134435.	186.7	6.30	186.5	6.48	193.8	5.89	184.6	6.25
18	417.3	4.97	135288.	189.6	6.27	189.4	6.47	196.9	5.87	187.5	6.23
18	421.7	4.86	134529.	189.4	6.23	189.2	6.43	196.7	5.80	187.2	6.19
18	426.7	4.98	135762.	188.8	6.34	188.7	6.54	196.1	5.92	186.7	6.30

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
19	431.7	4.98	135572.	189.4	6.38	189.2	6.56	196.7	5.95	187.3	6.34
19	436.7	4.93	135667.	190.6	6.38	190.5	6.56	198.0	5.94	189.5	6.32
19	441.7	4.93	135951.	189.4	6.51	189.2	6.67	196.8	6.06	187.3	6.48
19	446.7	5.04	136141.	188.4	6.63	188.2	6.81	195.7	6.20	186.3	6.60
19	451.7	4.96	135003.	188.1	6.66	187.9	6.84	195.4	6.18	186.0	6.60
20	456.7	4.94	134909.	189.4	6.64	189.2	6.80	196.7	6.17	187.3	6.60
20	461.7	4.87	135288.	191.2	6.64	191.0	6.83	198.6	6.16	189.1	6.60
20	466.7	4.96	135383.	190.0	6.80	189.9	6.96	197.3	6.30	187.9	6.76
20	471.7	4.80	135193.	190.7	6.74	190.5	6.90	198.2	6.21	188.6	6.68
21	480.4	4.90	134909.	189.9	6.91	189.7	7.05	197.3	6.41	187.8	6.87
21	484.7	4.59	134624.	194.2	6.70	194.0	6.86	201.9	6.15	192.0	6.68
21	489.7	4.42	135193.	196.7	6.92	196.5	7.06	204.6	6.32	194.4	6.89
21	494.7	4.39	135383.	197.0	7.10	196.9	7.23	205.0	6.49	194.7	7.10
21	499.7	4.33	134814.	197.5	7.18	197.3	7.30	205.5	6.54	195.2	7.17
22	504.7	4.31	135667.	199.0	7.20	198.8	7.32	207.1	6.56	196.7	7.22
22	509.7	4.36	135477.	198.4	7.43	198.2	7.55	206.4	6.77	196.1	7.44
22	514.7	4.42	135951.	196.8	7.63	196.7	7.75	204.8	6.98	194.6	7.64
22	519.7	4.27	136046.	199.3	7.57	199.1	7.67	207.5	6.87	196.9	7.59
22	524.7	4.37	135857.	198.0	7.77	197.8	7.89	206.0	7.06	195.7	7.80
23	529.7	4.35	135383.	198.7	7.82	198.6	7.92	206.8	7.09	196.4	7.85
23	534.7	4.09	135951.	203.6	7.71	203.4	7.81	212.0	6.95	201.1	7.75
23	539.7	4.23	135951.	200.1	7.96	199.9	8.03	208.3	7.20	197.7	7.98
23	544.6	4.73	135098.	190.9	8.30	190.8	8.35	198.5	7.56	188.8	8.29
23	548.7	4.60	134909.	193.9	8.19	193.7	8.23	201.6	7.46	191.7	8.21
24	553.7	4.62	134624.	194.0	8.24	193.8	8.26	201.6	7.51	191.8	8.26
24	558.7	4.40	134909.	197.6	8.06	197.4	8.09	205.6	7.30	195.3	8.09
24	574.1	4.87	135667.	190.6	8.01	190.5	8.09	198.1	7.38	188.5	8.03
25	578.7	4.95	132064.	187.7	8.13	187.5	8.18	194.8	7.48	185.6	8.13
25	583.7	4.92	132064.	187.4	8.23	187.3	8.27	194.6	7.57	185.4	8.22
25	588.7	5.03	132064.	185.4	8.38	185.3	8.42	192.5	7.73	183.4	8.39
25	597.3	5.03	134624.	187.1	8.48	187.0	8.49	194.4	7.82	185.1	8.48
26	601.7	4.95	135003.	189.0	8.45	188.9	8.44	196.3	7.75	186.9	8.45
26	606.7	4.80	135572.	191.8	8.36	191.6	8.33	199.3	7.65	189.6	8.36
26	611.7	4.95	135477.	188.9	8.62	188.7	8.61	196.2	7.92	186.7	8.63
26	616.7	4.96	135288.	188.6	8.68	188.4	8.66	195.9	7.93	186.5	8.69
26	621.7	4.87	134814.	190.0	8.69	189.8	8.62	197.4	7.91	187.9	8.69
27	626.7	5.04	134719.	188.0	8.84	187.8	8.78	195.2	8.09	185.9	8.86
27	631.7	4.99	135003.	188.5	8.87	188.4	8.79	195.8	8.10	186.5	8.87
27	636.7	4.93	135193.	188.9	8.89	188.7	8.79	196.3	8.12	186.8	8.89
27	641.7	4.93	135003.	189.0	8.91	188.9	8.79	196.4	8.12	186.9	8.91
27	646.7	4.87	134529.	190.1	8.87	189.9	8.74	197.5	8.05	188.0	8.87
28	651.7	4.83	135288.	191.5	8.88	191.3	8.76	198.9	8.04	189.3	8.88
28	656.7	4.76	135383.	192.4	8.90	192.3	8.77	200.0	8.07	190.3	8.90
28	661.7	5.09	135477.	186.9	9.17	186.8	9.01	194.1	8.35	184.8	9.15
28	666.7	5.02	135193.	187.9	9.24	187.8	9.01	195.2	8.36	185.8	9.17
29	671.7	4.93	135003.	189.6	9.09	189.4	8.94	196.9	8.28	187.5	9.10
29	676.7	4.79	135003.	191.8	8.99	191.6	8.85	199.2	8.21	189.6	9.03

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
29	681.7	5.07	135383.	187.8	9.33	187.6	9.18	195.0	8.57	185.7	9.35
29	686.7	4.89	135098.	189.3	9.20	189.2	9.04	196.7	8.40	187.2	9.22
29	691.7	5.06	135288.	186.9	9.40	186.7	9.23	194.1	8.64	184.8	9.42
30	696.7	5.13	135098.	186.2	9.48	186.1	9.27	193.4	8.71	184.2	9.48
30	701.7	5.04	135193.	188.3	9.42	188.2	9.22	195.6	8.63	186.3	9.43
30	706.7	4.84	135477.	191.1	9.30	190.9	9.09	198.6	8.52	189.0	9.32
30	711.7	5.03	135667.	187.8	9.53	187.7	9.32	195.1	8.75	185.7	9.55
30	716.7	5.04	135098.	187.6	9.51	187.5	9.28	194.8	8.75	185.5	9.53
31	721.7	5.08	134909.	187.3	9.59	187.1	9.35	194.5	8.81	185.2	9.60
31	726.7	5.00	135288.	188.6	9.55	188.5	9.30	195.9	8.77	186.6	9.55
31	731.7	4.97	135477.	188.8	9.60	188.6	9.33	196.1	8.83	186.7	9.60
31	736.7	5.14	135003.	186.9	9.80	186.7	9.53	194.0	9.04	184.8	9.79
31	741.7	4.73	135003.	192.4	9.61	192.3	9.30	200.0	8.82	190.3	9.61
32	746.7	4.89	134719.	190.5	9.77	190.4	9.50	197.9	8.98	188.4	9.77
32	765.7	4.81	135572.	191.0	9.71	190.8	9.40	198.5	8.93	188.9	9.73
33	768.9	5.01	135383.	188.8	9.87	188.6	9.54	196.1	9.16	186.7	9.85
33	773.7	4.81	134814.	191.4	9.79	191.2	9.43	198.8	9.03	189.2	9.76
33	778.7	4.82	134719.	190.4	9.91	190.2	9.51	197.8	9.13	188.2	9.86
33	783.7	5.05	134529.	187.2	10.15	187.0	9.76	194.4	9.38	185.1	10.11
33	787.9	4.87	135383.	190.4	10.01	190.3	9.63	197.8	9.25	188.3	9.97
34	792.7	4.90	135003.	190.4	10.08	190.2	9.68	197.7	9.30	188.2	10.04
34	797.7	4.90	135383.	191.2	10.15	191.0	9.76	198.6	9.38	189.1	10.10
34	802.7	4.80	135572.	191.5	10.15	191.4	9.72	199.0	9.35	189.4	10.06
34	807.7	4.75	135477.	191.6	10.14	191.4	9.70	199.1	9.35	189.4	10.07
34	812.7	4.91	135193.	189.4	10.36	189.2	9.90	196.7	9.58	187.2	10.25
35	817.7	4.95	134814.	189.2	10.42	189.0	9.97	196.5	9.65	187.1	10.33
35	822.7	4.79	135193.	191.7	10.32	191.5	9.83	199.2	9.51	189.5	10.19
35	827.7	4.87	135288.	189.7	10.45	189.6	9.92	197.2	9.66	187.6	10.32
35	832.7	4.89	135193.	189.5	10.52	189.3	9.97	196.8	9.72	187.3	10.37
35	837.7	4.82	135003.	190.2	10.51	190.0	9.95	197.6	9.70	188.0	10.33
36	842.7	4.89	134814.	190.8	10.60	189.8	9.98	197.3	9.79	187.9	10.40
36	847.7	4.91	135003.	189.9	10.61	189.8	9.97	197.3	9.82	187.8	10.37
36	852.7	4.90	135193.	189.2	10.64	189.1	10.00	196.6	9.85	187.1	10.39
36	857.7	4.89	135193.	189.1	10.67	189.0	9.99	196.5	9.88	187.0	10.41
36	862.7	4.84	134909.	189.6	10.65	189.5	9.96	197.1	9.86	187.5	10.40
37	867.7	4.84	134909.	190.7	10.65	190.6	9.99	198.2	9.85	188.6	10.39
37	872.7	4.77	135383.	191.8	10.62	191.7	9.93	199.4	9.82	189.7	10.35
37	877.7	4.89	134909.	189.9	10.79	189.6	10.10	197.1	10.00	187.6	10.50
37	882.7	4.86	135003.	190.3	10.80	190.1	10.07	197.7	9.99	188.2	10.47
38	887.7	4.92	134624.	189.4	10.90	189.3	10.17	196.7	10.11	187.3	10.57
38	892.7	4.84	134814.	190.9	10.80	190.8	10.15	198.4	10.03	188.8	10.51
38	897.7	4.73	135193.	192.8	10.77	192.6	10.04	200.4	9.96	190.6	10.44
38	902.7	4.93	135098.	189.1	11.07	188.9	10.34	196.4	10.26	187.0	10.72
38	907.7	4.88	134529.	189.4	11.06	189.2	10.27	196.7	10.24	187.3	10.69
39	912.7	4.82	134245.	190.5	11.01	190.4	10.21	197.9	10.19	188.4	10.61
39	917.7	4.84	134529.	191.0	11.06	190.9	10.35	198.4	10.25	188.9	10.68
39	922.7	4.69	134624.	192.1	10.97	191.9	10.19	199.7	10.13	189.9	10.57

***** RESULTS -- RUN 112 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.3	3.96	102591.	178.8	.07			179.1	-.11	176.7	-.00
1	.7	3.97	102877.	180.0	-.00			180.3	-.13	177.9	-.07
1	.9	3.91	102591.	181.2	-.20			181.6	-.22	179.1	-.21
1	1.7	3.95	101924.	180.5	-.03			180.9	-.13	178.5	-.07
1	2.7	4.03	97542.	176.0	.73			176.3	.46	174.1	.60
1	3.7	4.11	95542.	173.2	.91			173.5	.89	171.3	1.00
1	4.7	4.09	94685.	172.8	1.10			173.1	1.08	170.9	1.17
1	5.7	4.00	94399.	174.3	1.17			174.6	1.18	172.4	1.16
1	6.7	3.99	94208.	174.1	1.40			174.3	1.15	172.2	1.22
1	7.7	4.08	94113.	172.7	1.69			173.0	1.53	170.9	1.56
1	8.7	4.05	94113.	172.8	1.86			173.0	1.55	170.9	1.76
1	9.7	3.96	94113.	173.7	1.87			174.0	1.59	171.8	1.78
1	10.7	4.08	93827.	171.7	2.24			171.9	2.08	169.8	2.11
1	11.6	4.13	103353.	177.7	2.61			178.0	2.36	175.7	2.35
1	15.7	4.14	102877.	171.2	3.84			171.5	3.67	169.2	3.62
1	20.7	4.13	103258.	178.6	4.63			178.9	4.48	176.5	4.43
2	25.7	3.96	102400.	180.4	4.57			180.7	4.62	178.3	4.45
2	30.7	4.02	102972.	180.7	4.82			181.0	4.67	178.6	4.54
2	35.7	3.99	102972.	180.6	4.85			180.9	4.71	178.5	4.61
2	40.7	4.06	102781.	178.3	5.09			178.6	4.94	176.2	4.79
2	45.7	3.97	102781.	180.9	5.13			181.2	5.09	178.8	4.84
3	50.7	4.00	102496.	179.1	5.38			179.4	5.26	177.1	5.05
3	55.7	3.85	102877.	182.3	5.18			182.6	5.16	180.1	4.86
3	60.7	3.94	102781.	179.8	5.47			180.1	5.48	177.7	5.16
3	65.7	3.97	102686.	178.7	5.58			179.1	5.59	176.7	5.29
3	70.7	4.02	102686.	179.0	5.71			179.3	5.67	176.9	5.36
4	75.7	3.91	102496.	181.3	5.53			181.6	5.56	179.2	5.18
4	80.7	3.84	102686.	182.2	5.42			182.5	5.48	180.1	5.16
4	82.1	3.90	102877.	180.9	5.61			181.2	5.70	178.8	5.30
4	86.7	3.90	102781.	180.5	5.66			180.9	5.69	178.4	5.34
4	91.7	3.93	102591.	179.7	5.77			180.0	5.80	177.6	5.43
5	96.7	3.90	102496.	181.2	5.78			181.5	5.84	179.1	5.47
5	101.7	3.78	102972.	184.3	5.61			184.6	5.72	182.1	5.28
5	106.7	3.86	103353.	181.2	5.91			181.5	6.00	179.0	5.58
5	111.7	3.96	103448.	180.2	6.10			180.5	6.16	178.1	5.76
5	116.7	3.94	103353.	180.1	6.17			180.4	6.23	178.0	5.83
6	121.7	3.95	102877.	180.2	6.24			180.5	6.32	178.1	5.95
6	126.7	3.88	103353.	181.9	6.27			182.2	6.28	179.8	5.91
6	131.7	4.00	103162.	173.1	6.60			179.4	6.66	177.0	6.26
6	136.7	3.89	102972.	180.8	6.53			181.1	6.53	178.7	6.11
7	146.7	3.91	103067.	181.1	6.59			181.4	6.65	179.0	6.25
7	151.7	3.88	102877.	182.1	6.59			182.4	6.62	179.9	6.27

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
7	156.7	3.97	117070.	190.8	5.05			191.1	5.08	188.4	4.76
7	161.7	3.95	116879.	191.3	5.10			191.6	5.07	188.9	4.78
7	166.7	3.91	116879.	192.3	5.04			192.6	5.05	189.9	4.69
8	168.2	4.04	104401.	179.0	5.38			179.3	5.42	176.9	5.06
8	172.7	3.92	104305.	182.5	5.16			182.8	5.19	180.3	4.90
8	177.7	3.88	104496.	182.9	5.13			183.2	5.14	180.7	4.80
8	182.7	3.95	104496.	180.3	5.31			180.6	5.36	178.2	5.02
8	187.7	3.87	104305.	182.7	5.16			183.0	5.17	180.5	4.90
9	192.7	3.93	104210.	181.4	5.32			181.7	5.32	179.3	5.05
9	197.7	3.94	104401.	181.9	5.38			182.2	5.44	179.8	5.12
9	202.7	3.85	104591.	182.9	5.35			183.3	5.38	180.8	5.04
9	207.7	3.81	104591.	184.1	5.33			184.4	5.34	181.9	5.05
9	212.7	3.84	104305.	183.1	5.42			183.4	5.48	180.9	5.17
10	217.7	3.73	104115.	186.4	5.19			186.7	5.25	184.1	4.94
10	222.7	3.70	104686.	187.0	5.25			187.3	5.26	184.7	4.95
10	232.7	3.77	103543.	180.7	5.59			181.1	5.55	178.5	5.29
10	237.1	3.86	103353.	181.3	5.74			182.2	5.67	179.7	5.41
11	241.7	3.78	103258.	184.0	5.57			184.3	5.55	181.8	5.26
11	246.7	3.84	103734.	183.1	5.73			183.4	5.76	180.9	5.47
11	251.7	3.88	102972.	180.4	5.88			180.8	5.84	178.3	5.59
11	256.7	3.89	102877.	180.8	5.87			181.1	5.86	178.7	5.59
11	261.7	3.98	102972.	179.4	6.05			179.8	6.06	177.4	5.76
12	266.7	3.97	102686.	179.9	6.11			180.2	6.06	177.8	5.81
12	271.7	3.81	102972.	183.1	5.82			183.4	5.83	180.9	5.54
12	276.7	3.83	103067.	181.7	5.88			182.0	5.89	179.5	5.62
12	281.7	3.91	102781.	180.3	6.04			180.6	6.02	178.1	5.75
12	286.7	3.89	102781.	181.4	5.98			181.7	5.99	179.2	5.72
13	291.7	3.82	102781.	183.0	5.93			183.3	5.91	180.8	5.64
13	296.7	3.83	102972.	183.1	5.96			183.4	5.94	180.9	5.67
13	301.7	3.89	102972.	181.1	6.14			181.5	6.10	179.0	5.80
13	306.7	3.83	102591.	181.8	6.07			182.2	6.05	179.7	5.79
14	311.7	3.78	102686.	183.8	6.00			184.1	5.96	181.6	5.69
15	356.2	3.90	102686.	180.7	6.31			181.0	6.29	178.6	5.91
16	360.7	3.87	100209.	179.5	6.38			179.8	6.34	177.4	5.98
16	361.2	3.94	103258.	180.4	6.52			180.7	6.48	178.3	6.13
16	365.7	3.95	101734.	179.4	6.77			179.7	6.75	177.4	6.35
16	370.7	3.89	102115.	181.1	6.73			181.4	6.66	179.0	6.29
16	375.7	3.96	101734.	178.4	7.00			178.7	6.98	176.3	6.58
16	380.7	3.99	102115.	178.1	7.03			178.4	7.04	176.0	6.63
17	385.7	4.03	101829.	177.9	7.15			178.2	7.13	175.8	6.75
17	390.7	3.90	101829.	180.6	6.95			180.9	6.91	178.5	6.51
17	395.7	4.00	101924.	179.7	7.16			179.0	7.11	176.7	6.71
17	400.7	4.07	101543.	176.2	7.33			176.5	7.29	174.2	6.90
17	405.7	3.96	101448.	178.5	7.16			178.8	7.14	176.5	6.71
18	417.3	3.88	102977.	182.1	7.06			182.4	7.04	180.0	6.62
18	421.7	3.86	102972.	181.4	7.10			181.7	7.08	179.3	6.66
18	426.7	4.00	102591.	178.6	7.32			178.9	7.31	176.5	6.88

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
19	431.7	4.03	102496.	178.5	7.41			178.9	7.39	176.5	6.99
19	436.7	4.02	102400.	179.2	7.43			179.5	7.41	177.2	6.98
19	441.7	3.98	102877.	179.0	7.51			179.3	7.49	176.9	7.04
19	446.7	4.05	102972.	178.1	7.62			178.4	7.60	176.0	7.15
19	451.7	4.06	102496.	176.9	7.70			177.2	7.68	174.8	7.23
20	456.7	4.12	102496.	176.9	7.80			177.2	7.81	174.8	7.33
20	461.7	3.95	102686.	180.9	7.52			181.2	7.50	178.8	7.03
20	466.7	3.96	102686.	180.7	7.59			181.0	7.57	178.6	7.12
20	471.7	3.98	102781.	178.8	7.69			179.1	7.67	176.8	7.22
21	480.4	3.90	102591.	181.2	7.59			181.6	7.57	179.1	7.13
21	484.7	3.84	102496.	182.3	7.59			182.7	7.57	180.2	7.13
21	489.7	3.69	102877.	185.4	7.67			185.7	7.62	183.2	7.19
21	494.7	3.74	102781.	183.9	7.94			184.3	7.92	181.7	7.46
21	499.7	3.62	102591.	186.4	7.76			186.8	7.74	184.2	7.29
22	504.7	3.67	102496.	185.8	7.91			186.1	7.89	183.5	7.44
22	509.7	3.65	102496.	186.4	8.02			186.8	8.00	184.2	7.55
22	514.7	3.51	102781.	189.3	7.89			189.7	7.82	187.0	7.40
22	519.7	3.68	102972.	185.1	8.23			185.5	8.19	182.9	7.76
22	524.7	3.65	102877.	186.3	8.20			186.7	8.16	184.1	7.73
23	529.7	3.54	102591.	189.5	7.97			189.8	7.92	187.2	7.53
23	534.7	3.54	103067.	189.6	8.06			190.0	8.02	187.3	7.62
23	539.7	3.61	102972.	187.0	8.28			187.3	8.23	184.7	7.81
23	544.6	4.03	102877.	177.5	8.71			177.8	8.69	175.5	8.22
23	548.7	3.81	102877.	183.1	8.36			183.4	8.35	180.9	7.88
24	553.7	3.84	102781.	182.9	8.46			183.3	8.44	180.8	7.98
24	558.7	3.87	102877.	182.3	8.59			182.6	8.60	180.2	8.11
24	574.1	3.90	103067.	181.3	8.82			181.6	8.83	179.2	8.44
25	578.7	3.76	98876.	181.3	9.10			181.7	9.08	179.2	8.71
25	583.7	3.66	98304.	182.3	9.19			182.6	9.19	180.2	8.80
25	588.7	3.74	97638.	179.5.	9.59			179.8	9.57	177.4	9.17
25	597.3	3.74	102686.	183.9	9.85			184.2	9.80	181.7	9.42
26	601.7	3.82	102210.	182.2	9.98			182.6	9.99	180.1	9.55
26	606.7	3.74	102686.	184.8	9.88			185.1	9.86	182.6	9.48
26	611.7	3.76	102686.	183.4	10.06			183.7	10.10	181.2	9.66
26	616.7	3.83	102591.	181.7	10.29			182.0	10.27	179.6	9.86
26	621.7	3.84	102210.	181.8	10.37			192.1	10.36	179.6	9.92
27	626.7	3.85	102210.	182.0	10.43			182.3	10.41	179.8	10.00
27	631.7	3.82	102305.	182.3	10.46			182.6	10.47	180.2	10.05
27	636.7	3.92	102591.	179.8	10.72			180.2	10.70	177.7	10.29
27	641.7	3.91	102496.	180.3	10.69			190.6	10.69	178.2	10.28
27	646.7	3.94	102019.	179.9	10.83			180.2	10.81	177.8	10.39
28	651.7	3.77	102877.	184.5	10.53			184.3	10.51	182.3	10.11
28	656.7	3.75	103067.	185.2	10.55			185.5	10.53	183.0	10.12
28	661.7	4.16	103067.	175.8	10.91			176.1	10.92	173.8	10.47
28	666.7	4.19	102972.	175.4	11.09			175.7	11.07	173.4	10.64
29	671.7	3.96	102877.	180.3	10.74			180.6	10.80	178.2	10.31
29	676.7	3.97	102781.	180.2	10.81			180.5	10.87	178.1	10.43

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RF8*E4	TSG	RFC*E4	TSO	RF0*E4
29	681.7	4.11	102972.	177.1	11.04			177.4	11.07	175.1	10.60
29	686.7	4.03	103067.	178.2	10.98			178.5	10.99	176.1	10.54
29	691.7	4.09	102877.	176.6	11.17			176.9	11.21	174.6	10.73
30	696.7	3.89	102877.	180.8	10.94			181.1	10.97	178.7	10.51
30	701.7	4.01	102972.	179.4	11.24			179.7	11.25	177.3	10.81
30	706.7	3.87	103162.	182.3	11.04			182.6	11.02	180.1	10.61
30	711.7	4.06	103448.	177.9	11.40			178.2	11.41	175.9	10.99
30	716.7	3.94	102400.	179.6	11.23			179.9	11.26	177.5	10.82
31	721.7	4.06	101924.	177.2	11.57			177.6	11.55	175.2	11.13
31	726.7	3.95	102210.	179.7	11.40			180.0	11.38	177.6	10.98
31	731.7	3.99	102210.	178.6	11.58			178.9	11.59	176.5	11.17
31	736.7	3.90	102019.	180.7	11.42			181.0	11.47	178.6	11.01
31	741.7	3.89	102877.	181.6	11.43			181.9	11.43	179.5	11.00
32	746.7	3.84	102686.	183.2	11.35			183.5	11.35	181.0	10.94
32	765.7	3.78	102781.	183.3	10.93			183.6	10.94	181.1	10.50
33	768.9	4.05	102972.	179.6	11.71			178.9	11.72	176.6	11.30
33	773.7	3.70	98495.	182.1	12.28			182.5	12.29	180.0	11.82
33	778.7	3.75	99162.	180.9	12.68			181.2	12.66	178.8	12.17
33	783.7	3.86	98971.	178.4	13.06			178.7	13.04	176.3	12.54
33	787.9	3.74	102781.	184.5	12.92			184.8	12.90	182.3	12.43
34	792.7	3.76	102210.	184.1	13.06			184.4	13.09	181.9	12.56
34	797.7	3.79	102496.	184.4	13.14			184.7	13.17	182.2	12.65
34	802.7	3.80	102305.	182.9	13.34			183.2	13.34	180.7	12.84
34	807.7	3.84	101924.	181.1	13.56			181.4	13.57	178.9	13.04
34	812.7	3.89	101829.	180.2	13.66			180.6	13.69	178.1	13.16
35	817.7	3.92	101924.	180.3	13.78			180.6	13.82	178.2	13.26
35	822.7	3.78	102210.	183.5	13.59			183.8	13.59	181.3	13.07
35	827.7	4.08	102210.	176.6	13.97			176.9	14.00	174.5	13.43
35	832.7	4.01	102210.	177.8	13.94			178.1	13.95	175.8	13.38
35	837.7	4.05	102019.	177.0	14.07			177.3	14.08	175.0	13.51
36	842.7	4.04	101924.	177.9	14.05			178.2	14.08	175.9	13.51
36	847.7	3.93	102019.	180.2	13.89			180.5	13.92	178.1	13.36
36	852.7	3.99	102115.	178.2	14.06			178.5	14.12	176.2	13.53
36	857.7	3.95	102210.	178.8	14.14			179.1	14.17	176.7	13.59
36	862.7	4.08	101924.	176.0	14.48			176.3	14.51	174.0	13.91
37	867.7	4.03	102115.	178.2	14.36			178.5	14.41	176.2	13.80
37	872.7	3.90	102496.	180.8	14.22			181.2	14.27	178.7	13.67
37	877.7	3.90	102210.	180.6	14.28			180.9	14.31	178.5	13.73
37	882.7	3.89	102305.	180.8	14.32			181.1	14.35	178.7	13.77
38	887.7	3.85	102019.	181.8	14.26			182.2	14.31	179.7	13.71
38	892.7	3.83	102210.	182.5	14.31			182.9	14.34	180.4	13.74
38	897.7	3.91	102400.	181.2	14.56			181.5	14.59	179.1	13.99
38	902.7	3.82	102400.	182.1	14.50			182.4	14.53	179.9	13.93
38	907.7	3.82	102115.	181.8	14.52			182.1	14.55	179.7	13.97
39	912.7	3.77	101924.	183.4	14.49			183.7	14.52	181.2	13.94
39	917.7	3.76	102210.	184.3	14.50			184.7	14.53	182.2	13.93
39	922.7	3.88	102400.	181.0	14.82			181.3	14.86	178.9	14.25

***** RESULTS -- RUN 113 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.3	2.31	65788.	179.9	-.04						
1	.7	2.35	65692.	179.9	.05						
1	.9	2.31	65883.	181.6	-.13						
1	1.7	2.28	65406.	182.5	-.22						
1	2.7	2.32	65024.	181.2	.10						
1	3.7	2.29	65024.	182.3	-.06						
1	4.7	2.28	65024.	182.8	-.14						
1	5.7	2.34	65024.	180.9	.24						
1	6.7	2.31	65024.	181.8	.18						
1	7.7	2.31	65024.	181.9	.25						
1	8.7	2.28	65119.	182.4	.04						
1	9.7	2.26	65119.	182.5	.02						
1	10.7	2.32	65024.	180.7	.51						
1	11.6	2.34	65406.	180.0	.74						
1	15.7	2.39	66074.	173.3	1.82						
1	20.7	2.33	66170.	182.1	1.38						
2	25.7	2.30	65883.	182.2	1.69						
2	30.7	2.22	66074.	186.0	1.59						
2	35.7	2.42	66170.	179.1	3.29						
2	40.7	2.22	65979.	184.5	2.77						
2	45.7	2.27	65883.	183.6	3.11						
3	50.7	2.25	65788.	183.4	3.27						
3	55.7	2.34	66074.	180.4	4.11						
3	60.7	2.34	66456.	180.1	4.39						
3	65.7	2.42	65310.	176.0	5.12						
3	70.7	2.45	65406.	176.3	4.58						
4	75.7	2.57	65406.	173.1	4.91						

***** RESULTS -- RUN 114 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.4	6.11	100873.	154.0	.07	154.5	.08	159.0	.13	150.6	.06
1	1.4	6.03	99925.	153.6	.05	154.2	.03	158.7	.03	150.3	.01
1	2.4	6.09	99546.	153.0	.12	153.6	.09	158.0	.07	149.7	.07
1	3.4	6.10	99262.	152.8	.08	153.4	.09	157.8	.09	149.5	.06
1	4.4	5.95	99072.	153.7	-.01	154.3	-.00	158.8	-.01	150.4	-.02
1	5.4	5.84	98977.	154.7	-.05	155.3	-.05	159.9	-.03	151.4	-.07
1	6.4	6.02	99641.	153.9	.03	154.4	.01	158.9	.09	150.5	-.01
1	7.4	5.90	100304.	155.4	-.07	156.0	.01	160.6	.06	152.0	-.05
2	8.4	5.97	100115.	154.8	.02	155.4	.11	159.9	.16	151.4	.06
2	9.4	6.01	100304.	154.9	.09	155.5	.15	160.0	.23	151.6	.08
2	14.4	6.03	100115.	155.2	.17	155.8	.23	160.3	.31	151.9	.13
2	19.4	6.07	100210.	154.5	.33	155.0	.39	159.5	.47	151.1	.20
2	24.4	5.93	100115.	154.8	.33	155.4		159.9	.54	151.4	.29
2	29.4	5.93	100684.	155.4	.48	156.0		160.6	.60	152.0	.39
3	34.4	5.99	100684.	155.3	.60	155.9		160.4	.78	151.9	.53
3	39.4	5.92	100589.	155.7	.70	156.3		160.9	.85	152.3	.61
3	44.4	6.05	100589.	154.2	.90	154.8		159.3	1.04	150.9	.81
3	49.4	5.96	100684.	154.6	1.00	155.2		159.7	1.05	151.2	.88
3	54.4	5.89	100210.	155.4	1.03	156.0		160.6	1.07	152.0	.89
4	59.4	5.90	100020.	155.5	1.11	156.1		160.7	1.18	152.1	.99
4	64.4	5.92	100115.	155.7	1.22	156.3		160.9	1.29	152.3	1.08
4	69.4	5.96	100304.	154.7	1.35	155.3		159.8	1.42	151.3	1.20
4	74.4	6.06	100210.	153.3	1.54	153.9		158.4	1.62	150.0	1.39
4	79.4	5.98	100020.	154.7	1.55	155.3		159.8	1.62	151.3	1.40
5	84.4	5.86	100020.	155.8	1.46	156.4		161.0	1.58	152.4	1.35
5	89.4	6.05	100115.	154.8	1.67	155.4		159.9	1.72	151.5	1.52
5	94.4	5.94	100210.	155.1	1.67	155.7		160.2	1.68	151.7	1.52
5	99.4	6.06	100020.	153.3	1.77	153.8		158.3	1.82	149.9	1.65
6	104.4	5.88	100494.	155.6	1.72	156.2		160.8	1.73	152.2	1.55
6	109.4	5.92	100399.	155.9	1.77	156.4		161.0	1.79	152.5	1.55
6	114.4	5.92	100779.	156.1	1.80	156.7		161.3	1.81	152.7	1.55
6	119.4	5.88	100779.	155.0	1.86	155.5		160.2	1.87	151.5	1.55
6	123.3	5.86	100684.	156.2	.75	156.8		161.4	1.01	152.8	.72
6	127.4	5.78	99356.	156.3	.93	156.9		161.5	1.13	152.9	.84
7	132.4	6.00	101158.	155.5	1.09	156.1		160.6	1.27	152.1	1.06
7	137.4	6.04	101253.	156.1	1.25	156.7		161.3	1.43	152.8	1.21
7	142.4	5.89	100589.	155.0	1.31	155.6		160.2	1.40	151.6	1.22
7	147.4	6.11	100304.	153.4	1.54	153.9		158.4	1.67	150.0	1.44
8	152.4	6.04	100210.	154.9	1.57	155.5		160.0	1.62	151.6	1.39
8	157.4	5.89	100210.	156.0	1.52	156.6		161.2	1.59	152.6	1.38
8	162.4	6.19	100115.	153.3	1.82	153.8		158.3	1.88	150.0	1.67
8	167.4	5.96	100210.	154.4	1.74	154.9		159.5	1.81	151.0	1.57

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
8	172.4	6.04	100115.	153.7	1.86	154.3		158.8	1.91	150.4	1.68
9	177.4	6.04	100779.	155.0	1.86	155.5		160.1	1.88	151.6	1.66
9	182.4	5.95	100589.	155.8	1.80	156.4		161.0	1.87	152.4	1.63
9	187.4	6.02	100684.	154.8	1.93	155.4		159.9	1.95	151.4	1.73
9	192.4	6.21	100779.	153.0	2.11	153.5		158.0	2.16	149.7	1.90
9	197.4	6.02	100494.	154.7	1.97	155.2		159.8	2.02	151.3	1.75
10	202.4	6.19	100399.	153.8	2.12	154.3		158.8	2.15	150.5	1.89
10	207.4	6.11	100779.	154.5	2.12	155.0		159.6	2.09	151.2	1.86
10	212.4	6.01	100779.	154.6	2.08	155.2		159.7	2.07	151.2	1.83
10	217.4	6.05	100684.	154.0	2.11	154.6		159.1	2.11	150.7	1.86
10	222.4	6.01	100399.	154.7	2.11	155.3		159.8	2.10	151.3	1.86
11	227.4	6.25	100494.	153.4	2.29	153.9		158.4	2.29	150.1	2.00
11	232.4	5.89	100779.	155.7	2.05	156.3		160.9	2.03	152.3	1.80
11	244.6	5.90	100494.	153.8	1.60	154.4		159.0	1.80	150.4	1.65
12	249.4	5.77	97934.	154.9	1.67	155.5		160.0	1.80	151.5	1.52
12	254.4	5.81	97650.	154.8	1.75	155.3		159.9	1.91	151.4	1.63
12	258.9	5.99	100779.	155.9	1.82	156.5		161.0	2.00	152.5	1.68
12	263.4	6.08	101063.	154.3	1.97	154.8		159.4	2.10	150.9	1.77
12	268.4	5.85	99641.	155.0	1.87	155.6		160.2	1.99	151.7	1.65
12	271.7	6.09	100304.	154.7	2.03	155.2		159.7	2.16	151.3	1.80
13	276.4	5.99	100304.	155.0	2.02	155.6		160.2	2.15	151.7	1.82
13	281.4	5.93	100589.	156.2	2.01	156.8		161.4	2.13	152.8	1.78
13	286.4	5.76	100494.	156.2	1.98	156.8		161.5	2.06	152.8	1.71
13	291.4	5.98	100304.	154.3	2.13	154.8		159.4	2.22	150.9	1.87
14	296.4	5.99	100115.	154.6	2.15	155.2		159.8	2.25	151.3	1.86
14	301.4	6.01	100210.	154.9	2.18	155.4		160.0	2.25	151.5	1.90
14	306.4	5.91	100494.	155.7	2.11	156.3		160.9	2.17	152.3	1.83
14	311.4	6.01	100494.	154.5	2.24	155.0		159.6	2.34	151.1	1.93
14	316.4	6.08	100210.	153.8	2.34	154.4		158.9	2.42	150.5	2.00
15	321.4	5.97	100210.	154.9	2.28	155.5		160.0	2.33	151.5	1.95
15	326.4	6.00	100210.	154.9	2.31	155.5		160.0	2.38	151.5	2.00
15	331.4	6.16	100399.	153.3	2.46	153.9		158.4	2.54	150.1	2.12
15	336.4	6.16	100334.	153.6	2.49	154.1		158.6	2.55	150.3	2.13
15	341.4	6.04	100210.	154.0	2.42	154.6		159.1	2.47	150.7	2.06
16	346.4	6.08	100115.	154.3	2.45	154.9		159.4	2.50	151.0	2.11
16	351.4	5.94	100210.	155.4	2.40	155.9		160.5	2.41	152.0	2.04
16	356.4	5.96	100304.	154.7	2.41	155.3		159.8	2.45	151.3	2.05
16	361.4	5.98	100210.	154.2	2.43	154.8		159.3	2.48	150.8	2.07
16	366.4	6.05	100210.	154.3	2.48	154.9		159.4	2.50	151.0	2.09
17	371.4	6.18	100115.	154.0	2.59	154.5		159.0	2.62	150.7	2.20
17	376.4	6.06	100304.	155.0	2.48	155.6		160.1	2.47	151.7	2.10
17	381.4	6.10	100494.	154.1	2.54	154.7		159.2	2.59	150.8	2.15
17	386.4	6.07	100115.	153.8	2.58	154.4		158.9	2.58	150.5	2.16
17	391.4	6.03	100589.	155.0	2.54	155.5		160.1	2.53	151.6	2.12
18	396.4	6.20	100304.	153.6	2.68	154.2		158.6	2.68	150.3	2.26
18	401.4	5.95	100684.	156.1	2.50	156.7		161.3	2.51	152.7	2.06
18	406.4	5.89	100684.	155.4	2.51	156.0		160.6	2.50	152.0	2.08

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
18	411.4	5.98	100494.	154.4	2.57	154.9		159.5	2.59	151.0	2.13
19	416.4	5.78	100399.	156.4	2.43	157.0		161.6	2.43	152.9	2.00
19	421.4	5.86	100494.	156.4	2.48	156.9		161.6	2.49	152.9	2.07
19	426.4	5.96	100684.	155.5	2.59	156.0		160.6	2.58	152.1	2.15
19	431.4	5.95	100684.	154.9	2.62	155.5		160.1	2.63	151.6	2.18
19	436.4	6.05	100494.	153.9	2.70	154.5		159.0	2.66	150.6	2.23
20	441.4	5.98	100494.	154.9	2.62	155.5		160.1	2.61	151.6	2.18
20	446.4	6.04	100399.	155.0	2.67	155.6		160.1	2.66	151.7	2.23
20	451.4	6.03	100494.	154.0	2.77	154.6		159.1	2.70	150.7	2.27
20	456.4	5.92	100494.	155.1	2.42	155.6		160.2	2.46	151.7	2.04
20	461.4	5.93	99546.	154.7	2.59	155.3		159.8	2.74	151.4	2.20
21	466.4	5.83	100210.	156.4	2.56	157.0		161.6	2.68	153.0	2.16
21	471.4	5.95	100304.	155.6	2.72	156.2		160.8	2.84	152.2	2.31
21	476.4	5.79	100399.	155.9	2.66	156.5		161.2	2.74	152.5	2.23
21	481.4	6.01	100210.	154.2	2.72	154.8		159.4	2.82	150.9	2.28
21	486.4	6.17	100115.	153.7	2.84	154.3		158.7	2.97	150.4	2.39
22	491.4	6.00	99925.	155.0	2.76	155.6		160.1	2.89	151.7	2.29
22	496.4	6.01	100210.	155.1	2.82	155.7		160.3	2.92	151.8	2.36
22	501.4	5.93	100210.	155.7	2.74	156.3		160.9	2.86	152.3	2.30
22	506.4	6.03	100115.	156.1	2.81	156.7		161.2	2.94	152.8	2.34
22	511.4	6.01	100020.	155.1	2.87	155.6		160.2	2.97	151.7	2.37
23	516.4	6.16	99830.	153.9	2.99	154.4		158.9	3.10	150.6	2.49
23	521.4	5.84	100020.	156.5	2.78	157.1		161.7	2.86	153.1	2.29
23	526.4	6.06	100210.	155.1	2.89	155.6		160.2	3.04	151.7	2.42
23	531.4	6.00	100020.	156.6	2.82	157.2		161.7	2.95	153.2	2.35
24	536.4	5.89	100399.	156.1	2.81	156.7		161.3	2.95	152.7	2.32
24	541.4	5.99	100399.	156.0	2.93	156.5		161.1	3.05	152.6	2.41
24	546.4	5.75	100589.	155.5	2.78	156.1		160.8	2.88	152.1	2.27
24	551.4	6.06	100779.	155.2	2.99	155.7		160.3	3.09	151.8	2.45
24	556.4	6.07	100304.	155.7	2.98	156.2		160.8	3.08	152.3	2.44
25	561.4	6.18	100210.	154.6	3.01	155.2		159.6	3.15	151.3	2.49
25	566.4	5.97	100494.	155.6	2.96	156.2		160.7	3.05	152.2	2.41
25	571.4	6.02	100589.	155.9	2.95	156.5		161.0	3.07	152.6	2.43
25	576.4	5.93	100779.	156.3	2.93	156.9		161.5	2.99	152.9	2.36
25	581.4	6.10	100210.	154.8	3.02	155.4		159.8	3.15	151.5	2.47
26	586.4	6.07	100304.	155.4	3.01	156.0		160.5	3.14	152.1	2.46
26	591.4	5.96	100494.	156.0	2.98	156.5		161.1	3.07	152.6	2.43
26	596.4	5.94	100589.	156.1	2.96	156.7		161.3	3.10	152.7	2.41
26	601.4	6.05	100589.	155.1	3.06	155.6		160.2	3.19	151.7	2.49
26	606.4	5.80	100494.	155.9	2.93	156.5		161.2	2.98	152.5	2.36
27	611.4	6.12	100210.	153.2	3.10	153.8		158.3	3.23	149.9	2.51
27	616.4	5.95	100399.	154.2	3.04	154.8		159.4	3.14	150.9	2.47
27	621.4	5.89	100589.	153.9	3.05	154.5		159.1	3.16	150.5	2.45
27	626.4	5.96	100494.	154.8	3.04	155.4		160.0	3.16	151.4	2.49
27	631.4	5.94	100399.	154.0	3.12	154.6		159.2	3.18	150.6	2.52

***** RESULTS -- RUN 115 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.4	5.80	122499.	172.5	-.08			172.2	-.12	167.9	-.02
1	1.4	5.93	121452.	170.3	-.13			170.1	-.10	165.9	-.03
1	2.4	5.92	121261.	170.3	-.17			170.1	-.18	165.9	-.10
1	3.4	5.98	121356.	169.8	-.13			169.6	-.30	165.4	-.12
1	4.4	6.00	120975.	169.4	-.24			169.2	-.32	165.0	-.07
1	5.4	5.90	120880.	170.5	-.19			170.3	-.38	166.1	-.16
1	6.4	5.97	121547.	169.7	-.10			169.5	-.11	165.3	.04
1	7.4	6.08	121452.	169.6	-.07			169.3	-.06	165.2	.12
2	8.4	6.01	121166.	170.0	.10			169.8	.09	165.6	.20
2	9.4	5.98	122023.	171.1	.07			170.9	.02	166.7	.31
2	14.4	6.15	121737.	170.0	.50			169.8	.40	165.6	.64
2	19.4	6.03	121833.	170.6	.83			170.3	.67	166.2	.95
2	24.4	6.13	121833.	169.1	1.38			168.8	1.21	164.7	1.47
2	29.4	6.04	121737.	170.1	1.63			169.8	1.62	165.7	1.79
3	34.4	5.95	121833.	171.2	1.97			171.0	1.98	166.8	2.14
3	39.4	5.98	121642.	170.8	2.36			170.6	2.35	166.4	2.48
3	44.4	6.11	121928.	169.3	2.72			169.1	2.80	164.9	2.81
3	49.4	6.05	122118.	169.6	3.03			169.4	2.90	165.2	3.00
3	54.4	6.06	122023.	170.1	3.22			169.8	3.12	165.7	3.14
4	59.4	5.94	121737.	171.3	3.41			171.0	3.28	166.8	3.32
4	64.4	5.99	121833.	171.2	3.64			170.9	3.54	166.7	3.54
4	69.4	6.02	122118.	170.2	3.81			170.0	3.76	165.8	3.67
4	74.4	6.05	122023.	169.3	3.98			169.1	3.86	164.9	3.86
4	79.4	6.11	121833.	169.6	4.09			169.3	4.02	165.2	3.95
5	84.4	6.06	121737.	170.2	4.13			169.9	4.08	165.8	4.08
5	89.4	6.02	121928.	170.9	4.17			170.7	4.14	166.5	4.05
5	94.4	5.96	122118.	171.0	4.20			170.8	4.17	166.6	4.08
5	99.4	6.04	121833.	169.3	4.35			169.1	4.30	164.9	4.21
6	104.4	6.09	121833.	169.7	4.36			169.5	4.37	165.3	4.28
6	109.4	5.93	121737.	171.6	4.34			171.4	4.29	167.2	4.22
6	114.4	5.91	122214.	172.1	4.40			171.9	4.33	167.7	4.21
6	119.4	6.06	121547.	168.9	4.59			168.7	4.56	164.6	4.47
6	123.3	6.13	122023.	169.8	3.20			169.6	3.28	165.4	3.20
6	127.4	5.95	120785.	170.8	3.28			170.6	3.40	166.4	3.31
7	132.4	5.92	121737.	171.5	3.31			171.2	3.45	167.0	3.39
7	137.4	5.92	121833.	172.4	3.40			172.2	3.53	168.0	3.44
7	142.4	6.03	122118.	169.8	3.56			169.6	3.71	165.4	3.59
7	147.4	6.02	121737.	169.7	3.59			169.4	3.75	165.3	3.64
8	152.4	6.13	121547.	169.8	3.67			169.5	3.84	165.4	3.74
8	157.4	5.95	121642.	171.4	3.60			171.1	3.77	166.9	3.66
8	162.4	5.91	121737.	171.2	3.59			171.0	3.78	166.8	3.67
8	167.4	6.06	121737.	169.3	3.73			169.1	3.96	164.9	3.82

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
8	172.4	6.04	121737.	169.5	3.73			169.3	3.96	165.1	3.85
9	177.4	6.21	121356.	168.7	3.88			168.5	4.02	164.4	3.92
9	182.4	6.12	121452.	169.8	3.87			169.6	3.97	165.5	3.89
9	187.4	6.13	121642.	169.3	3.91			169.0	4.03	164.9	3.93
9	192.4	5.91	121928.	170.7	3.80			170.5	3.92	166.3	3.86
9	197.4	6.03	121833.	170.3	3.86			170.0	3.96	165.8	3.89
10	202.4	6.00	121547.	170.6	3.88			170.4	3.98	166.2	3.90
10	207.4	6.03	121928.	170.6	3.90			170.3	4.04	166.2	3.97
10	212.4	6.00	122214.	170.5	3.92			170.2	4.04	166.0	3.91
10	217.4	6.23	122118.	168.1	4.09			167.9	4.21	163.8	4.07
10	222.4	6.04	121833.	170.2	3.96			169.9	4.08	165.8	3.99
11	227.4	6.02	121833.	170.6	3.90			170.4	4.08	166.2	3.97
11	232.4	6.04	122023.	170.3	3.96			170.1	4.12	165.9	4.01
11	244.6	5.67	122118.	172.0	4.03			171.8	4.20	167.4	4.10
12	249.4	5.99	119642.	169.3	4.09			169.0	4.25	164.9	4.12
12	254.4	6.04	119737.	169.2	4.11			168.9	4.26	164.8	4.19
12	258.9	5.97	122118.	171.9	4.07			171.6	4.15	167.4	4.08
12	263.4	5.95	122309.	171.0	4.09			170.7	4.21	166.5	4.12
12	268.4	6.07	120690.	168.9	4.17			168.6	4.31	164.5	4.24
12	271.7	6.05	121833.	170.7	4.17			170.4	4.27	166.3	4.16
13	276.4	6.01	121833.	170.7	4.17			170.5	4.31	166.3	4.18
13	281.4	5.97	122118.	171.8	4.11			171.6	4.30	167.4	4.19
13	286.4	5.92	121928.	170.9	4.15			170.7	4.31	166.5	4.21
13	291.4	6.08	121642.	169.1	4.27			168.9	4.43	164.7	4.32
14	296.4	6.00	121452.	170.3	4.18			170.0	4.32	165.9	4.23
14	301.4	6.26	121547.	168.4	4.37			168.2	4.51	164.1	4.44
14	306.4	6.02	122023.	170.8	4.20			170.5	4.39	166.3	4.28
14	311.4	6.03	122023.	170.0	4.22			169.8	4.41	165.6	4.32
14	316.4	6.04	121833.	169.9	4.24			169.6	4.43	165.5	4.29
15	321.4	6.05	121833.	170.0	4.25			169.8	4.41	165.7	4.30
15	326.4	6.05	121642.	170.2	4.28			170.0	4.43	165.8	4.32
15	331.4	6.05	122023.	169.9	4.25			169.7	4.48	165.5	4.31
15	336.4	6.15	121833.	169.2	4.36			169.0	4.52	164.9	4.43
15	341.4	6.06	121642.	170.1	4.23			169.8	4.44	165.7	4.35
16	346.4	5.99	121833.	170.8	4.22			170.6	4.43	166.4	4.32
16	351.4	6.11	121833.	169.8	4.35			169.6	4.47	165.5	4.40
16	356.4	6.06	121737.	169.6	4.35			169.4	4.47	165.2	4.40
16	361.4	6.01	121833.	169.8	4.27			169.6	4.45	165.4	4.34
16	366.4	6.17	121737.	169.0	4.36			168.7	4.55	164.6	4.45
17	371.4	6.07	121737.	170.4	4.33			170.2	4.54	166.0	4.34
17	376.4	5.96	121928.	171.2	4.28			170.9	4.44	166.7	4.36
17	381.4	6.00	122118.	170.7	4.31			170.5	4.45	166.3	4.39
17	386.4	6.08	121833.	169.6	4.37			169.3	4.47	165.2	4.45
17	391.4	6.32	121833.	168.1	4.54			167.8	4.68	163.8	4.56
18	396.4	6.07	121547.	170.0	4.37			169.8	4.53	165.6	4.44
18	401.4	5.98	121928.	171.6	4.31			171.4	4.43	167.2	4.38
18	406.4	6.05	122023.	169.9	4.43			169.6	4.53	165.5	4.46

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
18	411.4	6.09	121833.	169.1	4.39			168.9	4.62	164.8	4.48
19	416.4	6.01	121737.	170.4	4.38			170.1	4.56	165.9	4.45
19	421.4	6.04	122023.	170.8	4.37			170.6	4.58	166.4	4.46
19	426.4	6.02	122023.	170.7	4.40			170.5	4.56	166.3	4.50
19	431.4	5.97	122309.	170.8	4.34			170.6	4.61	166.4	4.48
19	436.4	6.02	121071.	169.3	4.40			169.0	4.61	164.9	4.50
20	441.4	6.05	122595.	170.5	4.44			170.3	4.65	166.1	4.49
20	446.4	6.05	122404.	171.0	4.41			170.7	4.62	166.6	4.50
20	451.4	5.99	122404.	170.3	4.42			170.1	4.67	165.9	4.52
20	456.4	5.86	122023.	171.6	4.39			171.3	4.58	167.1	4.52
20	461.4	5.99	120880.	170.0	4.64			169.8	4.80	165.6	4.69
21	466.4	5.95	121833.	171.5	4.56			171.3	4.79	167.1	4.66
21	471.4	5.90	121737.	171.9	4.57			171.7	4.80	167.4	4.67
21	476.4	6.08	121928.	169.6	4.75			169.4	4.98	165.2	4.83
21	481.4	5.92	121737.	170.8	4.64			170.6	4.87	166.4	4.76
21	486.4	6.09	121547.	169.8	4.75			169.6	4.98	165.4	4.87
22	491.4	5.98	121261.	170.9	4.74			170.7	4.88	166.5	4.84
22	496.4	5.84	121452.	172.3	4.66			172.0	4.87	167.8	4.77
22	501.4	5.93	121642.	171.6	4.69			171.4	4.89	167.2	4.79
22	506.4	5.93	121642.	172.8	4.63			172.6	4.88	168.3	4.78
22	511.4	5.89	121452.	171.8	4.66			171.6	4.87	167.3	4.78
23	516.4	5.95	121261.	171.2	4.72			170.9	4.92	166.8	4.84
23	521.4	5.87	121356.	172.2	4.71			172.0	4.94	167.8	4.82
23	526.4	6.09	121642.	170.5	4.84			170.3	5.07	166.1	4.96
23	531.4	5.79	121547.	174.2	4.65			174.0	4.88	169.7	4.75
24	536.4	5.91	121452.	171.6	4.76			171.4	4.94	167.2	4.82
24	541.4	5.94	121547.	172.0	4.81			171.8	4.97	167.6	4.89
24	546.4	5.81	121928.	171.1	4.76			170.9	4.99	166.6	4.85
24	551.4	5.86	122023.	172.5	4.75			172.3	5.02	168.0	4.90
24	556.4	6.17	121452.	170.3	4.98			170.0	5.21	165.9	5.05
25	561.4	5.93	121452.	172.0	4.83			171.8	5.04	167.6	4.91
25	566.4	5.86	121642.	172.2	4.81			172.0	5.04	167.7	4.87
25	571.4	5.94	121737.	172.2	4.85			171.9	5.08	167.7	4.93
25	576.4	5.89	121928.	172.4	4.80			172.2	5.07	167.9	4.91
25	581.4	5.87	121356.	172.3	4.75			172.0	4.98	167.8	4.88
26	586.4	5.93	121452.	172.0	4.79			171.8	5.02	167.6	4.91
26	591.4	6.09	121737.	170.5	4.92			170.3	5.20	166.1	5.02
26	596.4	5.89	121737.	172.3	4.76			172.0	5.07	167.8	4.88
26	601.4	5.84	121933.	172.5	4.78			172.3	5.01	168.0	4.84
26	606.4	5.99	121737.	170.2	4.86			170.0	5.16	165.8	4.94
27	611.4	5.91	121356.	170.4	4.80			170.2	5.09	166.0	4.92
27	616.4	5.93	121642.	170.1	4.85			169.9	5.12	165.7	4.95
27	621.4	5.84	121642.	170.1	4.85			169.9	5.10	165.6	4.96
27	626.4	5.92	121642.	170.8	4.88			170.6	5.13	166.3	4.99
27	631.4	5.89	121452.	170.1	4.88			169.9	5.14	165.6	4.94

***** RESULTS -- RUN 116 *****

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RFD*E4
1	.4	1.81	28004.	156.1	.57						
1	1.4	1.79	27727.	155.9	.64						
1	2.4	1.80	27819.	155.7	.90						
1	3.4	1.80	27819.	155.6	1.25						
1	4.4	1.84	27819.	154.5	2.14						
1	5.4	1.70	27819.	159.5	.64						
1	6.4	1.76	27819.	156.6	1.47						
1	7.4	1.58	27819.	164.1	-.62						
2	8.4	1.70	27819.	159.4	1.15						
2	9.4	1.68	27819.	160.7	.70						
2	14.4	1.78	27819.	157.7	2.47						
2	19.4	1.74	27819.	158.5	2.77						
2	24.4	1.75	27819.	157.6	2.90						
2	29.4	1.61	27819.	162.8	1.74						
3	34.4	1.76	27819.	157.8	3.13						
3	39.4	1.79	27819.	156.8	4.07						
3	44.4	1.71	27912.	159.1	3.24						
3	49.4	1.81	27912.	155.7	4.55						
3	54.4	1.77	27912.	157.5	4.21						
4	59.4	1.74	27819.	158.4	3.79						
4	64.4	1.67	27819.	161.4	3.20						
4	69.4	1.58	27912.	163.9	2.20						
4	74.4	1.74	27912.	157.6	4.46						
4	79.4	1.68	27819.	160.2	4.03						
5	84.4	1.91	27819.	153.4	6.18						
5	89.4	1.66	27819.	161.6	3.92						
5	94.4	1.56	27819.	165.1	2.77						
5	99.4	1.65	27819.	160.4	4.54						
6	104.4	1.69	27819.	160.1	5.04						
6	109.4	1.72	27727.	159.3	5.55						
6	114.4	1.63	27819.	162.7	4.49						
6	119.4	1.69	27819.	159.0	5.55						
6	123.3	1.42	28004.	172.3	.87						
6	127.4	1.50	27819.	168.1	3.83						
7	132.4	1.15	27727.	187.7	-3.50						
7	137.4	1.24	27819.	182.7	-1.71						
7	142.4	1.32	27819.	176.0	1.50						
7	147.4	1.35	27819.	174.6	2.20						
8	152.4	1.22	27727.	183.0	-.43						
8	157.4	1.21	27727.	183.7	.20						
8	162.4	1.28	27819.	179.2	1.89						
8	167.4	1.21	27912.	183.3	.80						

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSD	RF0*E4
8	172.4	1.20	27819.	183.8	1.04						
9	177.4	1.33	27819.	176.3	4.30						
9	182.4	1.28	27819.	179.6	3.11						
9	187.4	1.27	27819.	179.9	3.22						
9	192.4	1.16	27819.	186.6	.80						
9	197.4	1.18	27819.	185.3	1.15						
10	202.4	1.16	27727.	186.9	.89						
10	207.4	1.09	27819.	193.1	-.76						
10	212.4	1.26	27912.	180.1	3.53						
10	217.4	1.26	27819.	179.7	3.67						
10	222.4	1.32	27727.	176.3	5.49						
11	227.4	1.36	27819.	174.4	5.75						
11	232.4	1.26	27912.	180.6	4.51						
11	244.6	1.49	27912.	166.3	8.55						
12	249.4	1.26	27173.	178.5	-1.90						
12	254.4	1.33	27265.	174.7	-.60						
12	258.9	1.24	28004.	183.2	-2.46						
12	263.4	1.35	28466.	176.5	.32						
12	268.4	1.27	28004.	180.1	-1.25						
12	271.7	1.32	28004.	177.9	-.25						
13	276.4	1.25	27912.	181.5	-1.55						
13	281.4	1.21	28004.	185.1	-2.44						
13	286.4	1.11	27727.	190.0	-3.74						
13	291.4	1.22	27727.	181.8	-.70						
14	296.4	1.25	27635.	180.1	.11						
14	301.4	1.31	27635.	176.9	1.09						
14	306.4	1.13	27727.	189.1	-3.03						
14	311.4	1.36	27727.	173.6	2.96						
14	316.4	1.28	27727.	178.7	.83						
15	321.4	1.27	27912.	179.7	.25						
15	326.4	1.18	27635.	185.0	-1.67						
15	331.4	1.29	27727.	177.7	1.38						
15	336.4	1.30	28097.	178.7	1.29						
15	341.4	1.33	28097.	176.4	2.51						
16	346.4	1.30	27819.	177.8	2.22						
16	351.4	1.15	27819.	187.7	-1.26						
16	356.4	1.34	28097.	176.0	2.64						
16	361.4	1.42	27819.	170.8	4.74						
16	366.4	1.30	27819.	177.7	2.35						
17	371.4	1.18	27727.	186.1	-.49						
17	376.4	1.25	27727.	180.7	1.56						
17	381.4	1.24	27819.	181.8	.88						
17	386.4	1.30	27727.	176.9	2.83						
17	391.4	1.43	27727.	171.1	5.32						
18	396.4	1.29	27912.	179.0	2.45						
18	401.4	1.29	27727.	179.2	2.40						
18	406.4	1.42	28004.	171.5	5.11						

DAY	TIME	VEL	Q/A	TSA	RFA*E4	TSB	RFB*E4	TSC	RFC*E4	TSO	RFD*E4
18	411.4	1.40	27635.	171.0	5.38						
19	416.4	1.25	27635.	180.6	1.52						
19	421.4	1.21	27635.	183.4	1.18						
19	426.4	1.15	27635.	187.7	- .17						
19	431.4	1.25	27635.	188.0	2.59						
19	436.4	1.33	27635.	175.1	4.29						
20	441.4	1.09	27912.	192.8	-1.62						
20	446.4	1.26	27635.	180.3	3.09						
20	451.4	1.20	27912.	184.1	2.19						
20	461.4	1.10	27819.	191.2	-1.44						
21	466.4	1.15	27912.	188.9	.46						
21	471.4	1.23	27819.	182.8	2.35						
21	476.4	1.15	27912.	188.0	.78						
21	481.4	1.24	27912.	181.3	3.65						
21	486.4	1.13	27912.	190.0	.54						
22	491.4	1.14	27819.	188.8	1.15						
22	496.4	1.15	27819.	188.6	1.35						
22	501.4	1.14	27912.	189.4	1.32						
22	506.4	1.22	27819.	184.4	3.41						
22	511.4	1.19	27819.	185.2	3.15						
23	516.4	1.15	27727.	188.3	1.95						
23	521.4	1.17	27727.	186.9	2.81						
23	526.4	1.20	27819.	185.2	3.52						
23	531.4	1.28	27819.	180.9	5.27						
24	536.4	1.16	27727.	187.2	2.83						
24	541.4	1.19	27635.	185.4	3.77						
24	546.4	1.09	27819.	191.3	1.23						
24	551.4	1.21	27819.	184.0	4.55						
24	556.4	1.12	27727.	191.1	2.17						
25	561.4	1.25	27727.	181.8	5.64						
25	566.4	1.16	27727.	187.2	3.50						
25	571.4	1.01	27727.	200.1	- .88						
25	576.4	1.21	27819.	184.3	5.21						
25	581.4	1.13	27635.	189.7	3.39						
26	586.4	1.15	27635.	188.5	3.70						
26	591.4	1.19	27727.	185.7	4.63						
26	596.4	.97	27727.	203.7	-1.38						
26	601.4	1.10	27727.	191.5	2.63						
26	606.4	1.19	27727.	184.0	5.33						
27	611.4	1.05	27635.	194.6	1.69						
27	616.4	1.12	27727.	188.5	4.08						
27	621.4	1.05	27727.	194.2	2.24						
27	626.4	1.12	27727.	189.1	4.36						
27	631.4	1.05	27635.	193.7	2.71						

APPENDIX F

MODEL CALCULATIONS

The following procedure illustrates the calculation of fouling resistance for a particular location of a thermocouple (location A), in heater rod number 152, during the run 105. Specifications of the heater rod, calibration equations and raw data can be found in Table I, Appendix B and Appendix C, respectively.

Clean Condition--Determination of h_i/v_i^r Raw Data

T_{IN} = -2.18 mV	D_1 = 0.75 in
T_W = 0.41 mV	D_2 = 0.422 in
Q_{mv} = 9.90 mV	L = 4.01 in
W_{mv} = 104.60 mV	

Conversion of data to appropriate units using equations from Appendix B for T_{in} , T_W and W_F

$$T_{in} = 32.583 (5.02 - 2.18)^{0.949} = 87.74^\circ\text{F}$$

$$T_W = 38.529 (4.72 + 0.41)^{0.8765} = 161.51^\circ\text{F}$$

$$\begin{aligned} W_F &= FLOCAL(1) \times (W_{mv} - 50)^{FLOCAL(2)} \\ &= 0.5460 \times (104.6 - 50)^{0.5275} \\ &= 4.50 \text{ gpm} \end{aligned}$$

$$\begin{aligned}
 AA &= \frac{\pi}{4} \times \frac{1}{144} ((D_1)^2 - (D_2)^2) \\
 &= \frac{\pi}{4} \times \frac{1}{144} ((0.75)^2 - (0.422)^2) \\
 &= 0.002097 \text{ ft}^2
 \end{aligned}$$

$$\begin{aligned}
 V &= W_F / 7.4805 \times 60 \times AA \\
 &= 4.50 / (7.4805 \times 60 \times 0.002097) \\
 &= 4.79 \text{ ft/sec}
 \end{aligned}$$

where 7.4805 is the dividing factor to convert gallons to ft^3

Local Bulk Temperature

$$\begin{aligned}
 AH &= \pi (D_2/12)(L/12) \\
 &= \pi \times 0.422 \times 4.01/144 \\
 &= 0.036918 \text{ ft}^2 \\
 TBF &= AH / (62.37 \times 3600 \times AA) \\
 &= 0.036918 / (62.37 \times 3600 \times 0.002097) \\
 &= 0.00007841
 \end{aligned}$$

where 62.37 lbm/ft^3 is density of water

$$\begin{aligned}
 PF &= (100 \times 3600) / (1055.056 \times AH) \\
 &= (100 \times 3600) / (1055.056 \times 0.036918) \\
 &= 9242.49 \text{ (Btu/hr)}/(\text{ft}^2 \cdot \text{mv})
 \end{aligned}$$

where 1055.056 is the dividing factor to convert Joules to Btu

$$\begin{aligned}
 T_b &= ((PF \times Q_{mv} \times TBF) / V) + T_{in} \\
 &= ((9242.49 \times 9.9 \times 0.00007841) / 4.79) + 87.74 \\
 &= 89.24^\circ\text{F}
 \end{aligned}$$

Local Surface Temperature

$$\begin{aligned}
 h_{\text{flux}} &= PF \times Q_{\text{mv}} \\
 &= 9242.49 \times 9.9 \\
 &= 91500.61 \text{ Btu}/(\text{hr} \cdot \text{ft}^2) \\
 T_s &= T_w - (h_{\text{flux}}/(k/x)) \\
 &= 161.51 - (91500.61/110974) \\
 &= 160.68^\circ\text{F}
 \end{aligned}$$

Local Film Coefficient

$$\begin{aligned}
 h &= h_{\text{flux}}/(T_s - T_b) \\
 &= 91500.61/(160.68 - 89.24) \\
 &= 1280.80 \text{ Btu}/(\text{hr} \cdot {}^\circ\text{F} \cdot \text{ft}^2) \\
 K &= h/V^n \\
 &= 1280.80/(4.79)^{0.7} \\
 &= 427.81 \text{ Btu}/(\text{ft}^2 \cdot \text{hr} \cdot {}^\circ\text{F} (\text{sec}/\text{ft})^{0.7})
 \end{aligned}$$

Taking the average of the ten scans in the beginning of the run

$$\begin{aligned}
 K_{\text{avg}} &= \frac{1}{10} \sum_{j=1}^{10} h_{aj} / V_j^n \\
 &= 432.22 \text{ Btu}/(\text{ft}^2 \cdot \text{hr} \cdot {}^\circ\text{F} (\text{sec}/\text{ft})^{0.7})
 \end{aligned}$$

Fouled Condition - Determination of R_f
 (Data collected on 17 November, 8.00 hrs)

Raw Data

$$T_{IN} = -2.06 \text{ mV}$$

$$T_w = 1.45 \text{ mV}$$

$$Q_{\text{mv}} = 9.88 \text{ mV}$$

$$W_{\text{mv}} = 104.61 \text{ mV}$$

Conversion of data to appropriate units using equations from Appendix B for T_{in} , T_W and w_F

$$T_{in} = 32.583 (5.02 - 2.06)^{0.949}$$

$$= 91.25^{\circ}\text{F}$$

$$T_W = 38.529 (4.72 + 1.45)^{0.8765}$$

$$= 189.88^{\circ}\text{F}$$

$$w_F = FLOCAL(1) \times (w_{mv} - 50)^{FLOCAL(2)}$$

$$= 0.5460 (104.61 - 50)^{0.5275}$$

$$= 4.50 \text{ gpm}$$

$$V = w_F / (7.4805 \times 60 \times AX)$$

$$= 4.50 / (7.4805 \times 60 \times 0.002097)$$

$$= 4.78 \text{ ft/sec}$$

Local Bulk Temperature

$$T_b = ((PF \times Q_{mv} \times TBF)/V) + T_{in}$$

$$= ((9242.49 \times 9.88 \times 0.00007841)/4.78) + 91.25$$

$$= 92.75^{\circ}\text{F}$$

Local Film Coefficient

$$h = K_{avg} V^n$$

$$= 432.22 (4.78)^{0.7}$$

$$= 1292.12 \text{ Btu}/(\text{ft}^2 \cdot \text{hr} \cdot ^{\circ}\text{F})$$

Local Surface Temperature

$$\begin{aligned}
 h_{\text{flux}} &= \text{PF} \times Q_{\text{mv}} \\
 &= 9242.49 \times 9.88 \\
 &= 91315.80 \text{ Btu}/(\text{hr} - \text{ft}^2) \\
 T_s &= (h_{\text{flux}}/h) + T_b \\
 &= (91315.80/1292.12) + 92.75 \\
 &= 163.42^\circ\text{F}
 \end{aligned}$$

Local Fouling Resistance

$$\begin{aligned}
 R_f &= (T_w - T_s)/h_{\text{flux}} - (x/k) \\
 &= (189.88 - 163.42)/91315.80 - 1/110974 \\
 &= 2.81 \times 10^{-4} (\text{ft}^2 - \text{hr} - {}^\circ\text{F})/\text{Btu}
 \end{aligned}$$

Error Estimation

from equation (5-23)

$$\frac{dT_{\text{in}}}{T_{\text{in}}} = \frac{(0.949 \times 0.005)}{(-2.18 + 5.02)} = 1.671 \times 10^{-3}$$

from equation (5-17)

$$\frac{dw_F}{w_F} = \frac{(0.5275 \times 0.005)}{(104.60 - 50)} = 4.830 \times 10^{-5}$$

from equation (5-16)

$$z_2 = \frac{100 \times 60 \times 7.4805}{1055.056 \times 62.37} = 0.6821$$

from equation (5-15)

$$z_1 = \frac{0.6821 \times 9.9}{(0.6821 \times 9.9 + 91.25)} = 0.0689$$

from equation (5-14)

$$\begin{aligned}\frac{dT_{bc}}{T_{bc}} &= 0.0689 \frac{(1.7)}{3378.02} \pm 0.0689 (4.83 \times 10^{-5}) \\ &\pm \frac{0.0689 \times 4.5 \times 37.74}{0.6821 \times 9.9} (1.671 \times 10^{-3}) \\ &= \pm 6.77 \times 10^{-3}\end{aligned}$$

from equation (5-24)

$$\frac{dT_{wc}}{T_{wc}} = \frac{0.8765 \times 0.005}{0.41 + 4.72} = 8.543 \times 10^{-4}$$

from equation (5-19)

$$Z_3 = 161.51 (110974) - 91500.61 = 17.832 \times 10^6$$

from equation (5-21)

$$\begin{aligned}\frac{d(Q/AH)_c}{(Q/AH)_c} &= \frac{1.7}{3378.02} \pm \frac{0.0005}{0.422} \pm \frac{0.005}{4.01} \\ &= 2.935 \times 10^{-3}\end{aligned}$$

from equation (5-18)

$$\begin{aligned}\frac{dT_{sc}}{T_{sc}} &= \frac{110974 \times 161.51}{17.8319 \times 10^6} (8.543 \times 10^{-4}) \\ &\pm \frac{91500.61}{17.8319 \times 10^6} (2.935 \times 10^{-3}) \\ &\pm \frac{91500.61}{17.8319 \times 10^6} \frac{(50)}{(110974)} \\ &= 8.76 \times 10^{-4}\end{aligned}$$

from equation (5-20)

$$\begin{aligned}\frac{dh_c}{h_c} &= 2.935 \times 10^{-3} \pm \frac{160.68}{(160.68 - 89.24)} (8.76 \times 10^{-4}) \\ &\pm \frac{89.24}{(160.68 - 89.24)} (6.77 \times 10^{-3}) \\ &= 1.336 \times 10^{-2}\end{aligned}$$

from equation (5-26)

$$z_4 = 91500.61 + 1292.12 \times 92.75 = 211344.74$$

from equation (5-30)

$$\begin{aligned} \frac{dT_s}{T_s} &= \frac{91500.61}{211344.74} (2.935 \times 10^{-3}) \pm \frac{91500.61}{211344.74} (1.336 \times 10^{-2}) \\ &\quad \pm \frac{1292.12 \times 92.75}{211344.74} (6.77 \times 10^{-3}) \\ &= \pm 1.089 \times 10^{-2} \end{aligned}$$

from equation (5-24)

$$\frac{dT_w}{T_w} = \frac{0.8765 \times 0.005}{1.45 + 4.72} = 7.102 \times 10^{-4}$$

from equation (5-32)

$$z_5 = 110974 (189.88 - 163.42) - 91315.8 = 2.8451 \times 10^6$$

from equation (5-31)

$$\begin{aligned} \frac{dR_f}{R_f} &= \frac{110974 \times 189.88}{2.8451 \times 10^6} (7.102 \times 10^{-4}) \\ &\quad \pm \frac{110974 \times 163.42}{2.8451 \times 10^6} (1.089 \times 10^{-2}) \\ &\quad \pm \frac{110974 (189.88 - 163.42)}{2.8451 \times 10^6} (2.937 \times 10^{-3}) \\ &\quad \pm \frac{91315.8}{2.8451 \times 10^6} \frac{(50)}{(110974)} \\ &= \pm 0.0777 \end{aligned}$$

The maximum relative error of fouling resistance

$$= \pm 7.77\%$$

APPENDIX G

COOLING TOWER WATER QUALITY
NOMENCLATURE

TH = total hardness (ppm CaCO_3)
CaH = calcium hardness (ppm CaCO_3)
MgH = magnesium hardness (ppm CaCO_3)
m-alk = methyl orange alkalinity (ppm CaCO_3)
p-alk = phenolphthalein alkalinity (ppm CaCO_3)
cl = chloride (ppm NaCl)
Si = silica (ppm SiO_2)
pH = acidity
TS = total solids (ppm)
cond = conductivity (micromhos/cm)

COOLING TOWER WATER
RUN 98

HOURS	TH	CA-H	4G-H	M-ALK	P-ALK	CL	SI	PH	TS
0	205.	145.	50.	130.		130.	100.	8.20	427.
24	225.	150.	65.	130.		140.	110.	8.30	442.
48	215.	155.	60.	130.		150.	105.	8.30	464.
72	220.	155.	65.	130.		150.	95.	8.20	453.
96	225.	160.	65.	130.		160.	100.	8.20	473.
120	205.	145.	60.	130.		170.	80.	8.30	447.
144	205.	145.	60.	130.		170.	80.	8.30	473.
168	220.	155.	65.	140.		180.	90.	8.30	479.
192	200.	145.	55.	130.		160.	100.	8.40	456.
216	210.	150.	60.	130.		160.	100.	8.40	524.
240	220.	155.	65.	130.		170.	95.	8.30	533.
264	210.	145.	55.	130.		170.	100.	8.30	514.
288	195.	145.	50.	110.		130.	100.	8.30	461.
312	200.	145.	55.	110.		140.	100.	8.30	474.
336	205.	150.	55.	120.		160.	105.	8.30	503.
360	210.	145.	55.	130.		170.	100.	8.30	527.
384	190.	140.	50.	140.		130.	100.	8.30	492.
408	205.	145.	60.	140.		170.	100.	8.30	525.
432	215.	150.	65.	150.		180.	100.	8.30	539.
456	185.	140.	45.	120.		170.	100.	8.30	505.
480	180.	140.	40.	120.		170.	100.	8.30	537.
504	185.	140.	45.	130.		190.	95.	8.30	537.
528	190.	140.	50.	130.		190.	110.	8.30	565.
552	195.	140.	55.	130.		200.	100.	8.30	572.
576	200.	145.	55.	150.		200.	105.	8.30	563.
600	210.	150.	60.	150.		210.	115.	8.30	594.
624	215.	150.	65.	160.		210.	105.	8.30	614.
648	215.	150.	65.	160.		200.	110.	8.30	604.
672	220.	155.	65.	170.		210.	120.	8.40	612.
696	210.	150.	60.	160.		220.	135.	8.40	621.
720	230.	160.	70.	180.		230.	135.	8.40	663.
744	215.	145.	70.	160.		220.	100.	8.40	654.
768	215.	145.	70.	160.		230.	105.	8.40	682.
792	215.	145.	70.	170.		230.	110.	8.40	694.
816	200.	135.	65.	180.		240.	110.	8.40	705.
840	230.	160.	70.	170.		280.	120.	8.40	719.
864	235.	160.	75.	170.		280.	120.	8.40	836.
888	240.	160.	80.	190.		290.	135.	8.40	313.

	TH	CA-H	4G-H	M-ALK	P-ALK	CL	SI	PH	TS
Avg	209.	149.	61.	143.	0.	190.	104.	8.3	559.
Sigma	14.2	7.0	8.5	23.7	0.0	40.0	12.6	0.06	102.5

COOLING TOWER WATER
RUN 100

HOURS	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
6	195.	148.	55.	218.		370.	135.	8.60	938.
24	200.	145.	55.	210.		410.	115.	8.60	933.
48	190.	135.	55.	210.		420.	130.	8.60	943.
72	190.	135.	55.	190.		460.	115.	8.70	963.
96	210.	155.	55.	240.		460.	125.	8.70	990.
120	185.	130.	55.	230.		470.	115.	8.70	997.
144	200.	145.	55.	230.		450.	110.	8.70	931.
168	210.	155.	55.	230.		480.	135.	8.60	1015.
192	195.	140.	55.	220.		470.	140.	8.60	993.
216	200.	145.	55.	220.		490.	140.	8.60	1026.
240	200.	145.	55.	230.		490.	150.	8.70	1026.
264	215.	150.	55.	240.		480.	160.	8.70	1047.
288	200.	145.	55.	250.		470.	155.	8.70	1030.
312	200.	145.	55.	230.		480.	170.	8.70	1070.
336	180.	125.	55.	250.		480.	160.	8.70	1024.
360	190.	135.	55.	240.		470.	170.	8.70	993.
384	165.	110.	55.	230.		420.	160.	8.60	963.
408	160.	105.	55.	240.		370.	160.	8.60	1132.
432	160.	105.	55.	230.		370.	150.	8.60	983.
456	170.	115.	55.	220.		410.	175.	8.60	970.
480	170.	115.	55.	230.		410.	175.	8.60	926.
504	175.	120.	55.	260.		450.	175.	8.60	779.
528	185.	130.	55.	280.		470.	165.	8.60	956.
552	180.	125.	55.	260.		460.	170.	8.60	930.
576	185.	125.	60.	270.		470.	170.	8.60	1010.
600	185.	125.	60.	280.		490.	165.	8.60	965.
624	185.	120.	65.	290.		510.	170.	8.60	976.
648	190.	135.	55.	290.		490.	175.	8.60	1021.
672	190.	135.	55.	290.		490.	175.	8.60	975.

	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
AVG	188.	132.	56.	241.	3.	454.	152.	8.6	935.
SIGMA	13.3	14.1	2.2	26.6	1.0	39.3	21.4	.05	60.1

COOLING TOWER WATER
RUN 101

HOURS	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
0	540.	375.	165.	160.		840.	120.	8.38	1037.
24	560.	335.	175.	160.		840.	120.	8.46	1055.
48	560.	385.	175.	160.		820.	125.	8.44	1257.
72	560.	385.	175.	130.		820.	125.	8.44	1384.
96	570.	390.	180.	140.		830.	130.	8.45	1517.
120	610.	410.	200.	40.		910.	125.	8.38	1552.
144	615.	410.	205.	50.		920.	135.	7.86	1562.
168	615.	410.	205.	50.		930.	135.	8.03	1573.
192	590.	400.	190.	50.		950.	140.	8.00	1681.
216	565.	385.	180.	50.		900.	145.	8.00	1642.
240	550.	380.	170.	50.		1060.	145.	7.97	
264	595.	400.	195.	60.		1150.	140.	7.98	
288	640.	425.	215.	60.		1130.	140.	7.98	1525.
312	615.	410.	205.	70.		1060.	145.	7.96	1599.
336	635.	420.	215.	60.		1040.	145.	7.95	1937.
360	670.	445.	225.	60.		1120.	140.	7.98	1936.
384	670.	445.	225.	60.		1130.	145.	7.97	1317.
408	660.	450.	230.	60.		1180.	145.	7.97	1319.
432	680.	450.	230.	60.		1210.	150.	7.97	1749.
456	575.	450.	225.	50.		1240.	155.	7.98	1460.
480	630.	420.	210.	50.		1180.	150.	7.99	1235.
504	590.	400.	190.	50.		1000.	145.	7.99	1624.
528	630.	420.	210.	50.		1050.	140.	7.98	1427.
552	555.	380.	175.	50.		930.	140.	7.97	1623.
576	525.	360.	165.	50.		870.	135.	7.99	1841.
600	555.	380.	175.	40.		960.	145.	7.97	1765.
624	565.	380.	185.	50.		960.	150.	7.94	1465.
648	580.	395.	185.	60.		970.	140.	8.00	1404.

	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
AVG	601.	435.	196.	71.	0.	993.	139.	8.1	1517.
SIGMA	46.4	25.7	25.9	38.4	1.0	122.3	9.3	.17	229.0

COOLING TOWER WATER
RUN 104

HOURS	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
0	615.	510.	105.	50.		970.	145.	7.97	1520.
24	625.	515.	110.	50.		960.	150.	7.98	1547.
48	620.	510.	110.	50.		1020.	155.	7.99	1833.
72	610.	505.	105.	50.		1040.	145.	8.00	1520.
96	625.	515.	110.	50.		1130.	145.	7.99	1684.
120	630.	520.	110.	50.		1110.	140.	8.01	1668.
144	635.	520.	115.	50.		1070.	135.	8.01	1794.
168	610.	505.	105.	50.		1010.	135.	7.98	1445.
192	585.	495.	90.	50.		1080.	140.	8.01	1216.
215	630.	520.	110.	50.		1070.	145.	7.98	1413.
240	610.	510.	100.	50.		1020.	145.	8.00	1263.
264	590.	495.	95.	40.		930.	140.	8.00	1215.
288	535.	490.	95.	40.		940.	140.	7.98	1793.
312	565.	475.	96.	40.		940.	130.	7.97	1354.
336	550.	460.	90.	40.		990.	135.	7.98	1383.
360	600.	500.	100.	40.		960.	130.	7.98	1655.
384	600.	500.	100.	40.		1040.	135.	8.01	1424.
408				10.		1120.	135.	5.14	1482.
432	725.	595.	130.	10.		1160.	130.	6.76	1610.
456	700.	580.	120.	20.		1170.	135.	7.26	1590.
480	620.	515.	105.	20.		1060.	130.	7.78	1342.
504				40.		1000.	125.	8.00	1468.
528	625.	515.	110.	40.		910.	120.	8.07	1512.
552	625.	515.	110.	30.		930.	125.	8.11	1672.
576	630.	520.	110.	30.		850.	120.	8.21	1615.
600	590.	495.	95.	20.		880.	120.	8.11	1729.
624	590.	495.	95.	30.		840.	120.	8.02	1547.
648	610.	510.	100.	30.		1000.	125.	8.09	1734.
672	630.	520.	110.	30.		960.	125.	8.17	1530.
696	615.	510.	105.	20.		920.	120.	8.15	1465.
720	630.	520.	110.	20.		950.	120.	8.16	1639.
744	610.	510.	100.	20.		930.	120.	8.00	1722.
768	615.	510.	105.	20.		920.	120.	8.11	1603.

	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
Avg	616.	511.	165.	36.	0.	897.	133.	7.9	1547.
Sigma	32.8	24.5	8.8	13.2	0.0	85.2	10.2	.56	162.2

COOLING TOWER WATER
RUN 106

HOURS	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
3	225.	150.	75.	220.		620.	130.	9.30	1210.
24	210.	140.	70.	240.		590.	135.	9.30	1209.
48	205.	140.	65.	230.		600.	125.	9.30	1221.
72	205.	140.	65.	230.		600.	125.	9.20	1221.
96	220.	150.	70.	250.		630.	130.	9.20	1231.
120	210.	145.	65.	250.		660.	135.	8.91	1239.
144	225.	150.	75.	250.		640.	140.	8.04	1279.
168	220.	150.	70.	250.		640.	135.	8.10	1284.
192	230.	155.	75.	240.		640.	135.	8.01	1251.
216	225.	150.	75.	250.		620.	140.	8.20	1287.
240	215.	145.	70.	250.		620.	140.	8.30	1265.
264	215.	145.	70.	250.		620.	140.	8.30	1199.
288	230.	155.	75.	250.		620.	140.	8.20	1211.
312	220.	145.	75.	240.		560.	135.	8.30	1171.
336	230.	150.	80.	240.		590.	140.	8.30	1200.
360	240.	165.	75.	250.		630.	140.	8.30	1159.
384	240.	160.	80.	240.		600.	135.	8.33	1230.
408	235.	155.	80.	230.		540.	135.	8.34	1179.
432	215.	150.	65.	210.		520.	135.	8.34	1076.
456	225.	150.	75.	230.		550.	140.	8.30	1132.
480	230.	155.	75.	220.		540.	140.	8.30	1133.

	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
AVG	222.	150.	73.	239.	0.	601.	136.	8.5	1207.
SIGMA	10.3	6.4	4.9	12.2	3.0	38.8	4.8	.46	53.6

COOLING TOWER WATER
RUN 107

HOURS	TH	OA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
0	210.	150.	60.	240.		350.	145.	8.63	852.
24	200.	140.	60.	230.		340.	145.	8.49	780.
48	220.	150.	70.	230.		350.	150.	8.52	922.
72	210.	140.	70.	220.		330.	150.	8.47	980.
96	215.	140.	75.	220.		340.	155.	8.49	818.
120	200.	135.	65.	230.		370.	155.	8.53	889.
144	205.	135.	70.	200.		400.	155.	8.35	938.
168	215.	140.	75.	210.		380.	160.	8.40	917.
192	225.	150.	75.	210.		390.	163.	8.38	1021.
216	225.	150.	75.	200.		360.	165.	8.45	1033.
240	220.	145.	75.	210.		390.	165.	8.48	888.
264	220.	145.	75.	200.		390.	165.	8.57	899.
288	225.	150.	75.	200.		388.	165.	8.58	925.
312	230.	156.	80.	170.		490.	160.	8.48	880.

	TH	CA-H	MG-H	M-A_K	P-ALK	CL	SI	PH	TS
Avg	215.	144.	71.	212.	0.	376.	157.	8.5	919.
Sigma	9.6	5.8	6.6	18.1	8.0	39.8	7.5	.88	67.2

COOLING TOWER WATER
RUN 110

HOURS	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
0	230.	155.	75.	170.		420.	140.	7.43	337.
24	230.	155.	75.	90.		520.	145.	7.54	923.
48	225.	150.	75.	30.		580.	145.	7.51	930.
72	230.	155.	75.	20.		580.	150.	7.48	1002.
96	255.	175.	30.	20.		480.	140.	7.48	1203.
120	280.	180.	30.	20.		520.	135.	7.52	1292.
144	240.	160.	30.	20.		440.	125.	7.52	1215.

	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
AVG	239.	161.	77.	53.	0.	507.	140.	7.5	1087.
SIGMA	13.8	11.4	2.7	57.7	0.0	62.4	8.2	.04	185.8

COOLING TOWER WATER
RUN 111

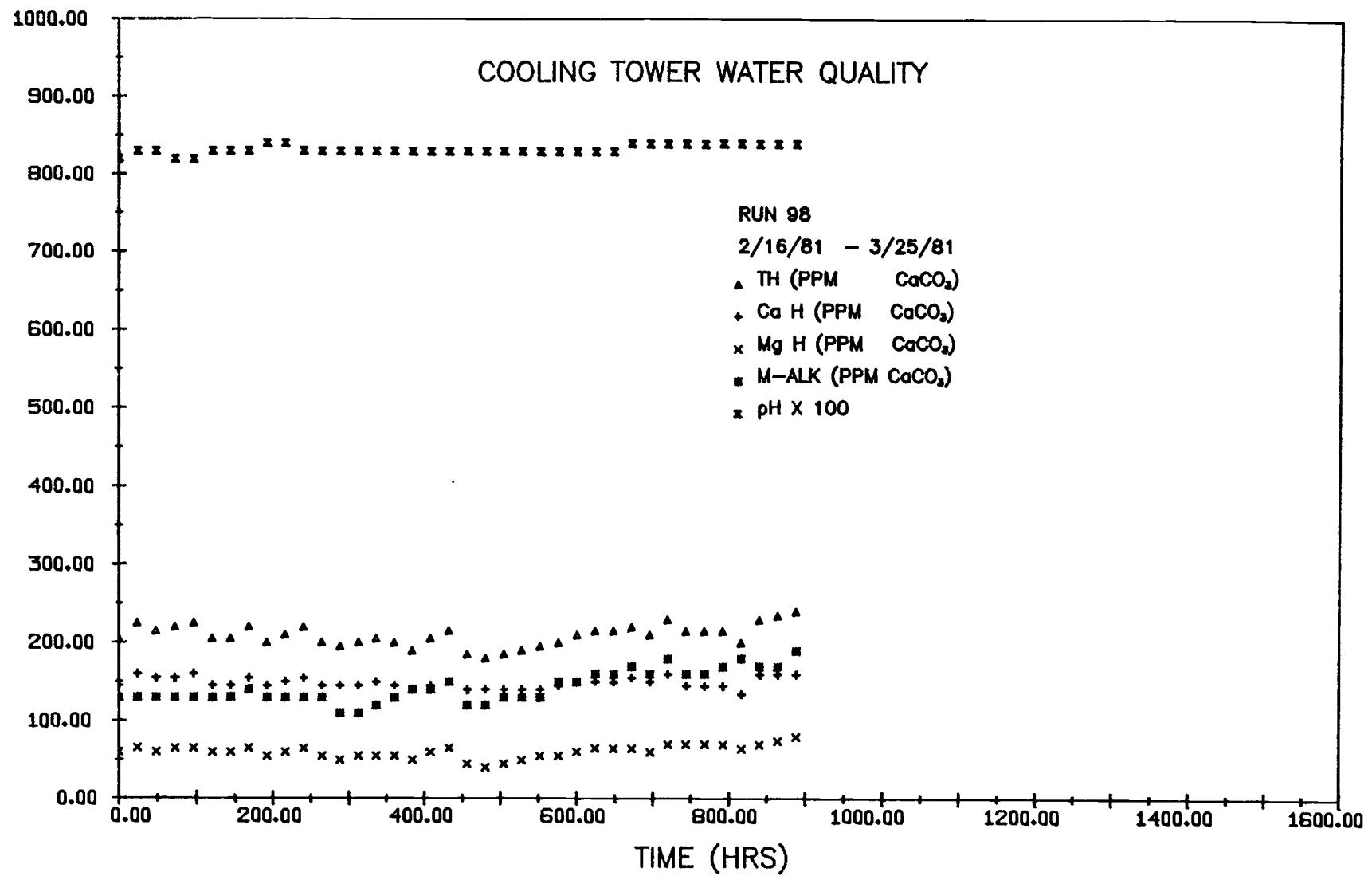
HOURS	TH	CA-H	MG-H	H-ALK	P-ALK	CL	SI	PH	TS
0	250.	180.	70.	20.		480.	125.	7.51	654.
24	255.	180.	75.	20.		470.	125.	7.55	583.
48	250.	180.	70.	10.		470.	125.	7.59	747.
72	250.	180.	70.	10.		460.	120.	7.46	757.
96	235.	170.	65.	10.		410.	115.	7.48	650.
120	240.	170.	70.	10.		400.	110.	7.51	530.
144	240.	170.	70.	10.		380.	110.	7.53	848.
168	245.	175.	70.	10.		400.	105.	7.59	865.
192	240.	170.	70.	10.		400.	110.	7.60	665.
216	245.	175.	70.	10.		410.	110.	7.65	720.
240	250.	180.	70.	10.		400.	110.	7.45	562.
264	240.	175.	65.	10.		390.	110.	7.50	481.
288	245.	175.	70.	10.		410.	110.	7.50	717.
312	245.	175.	70.	10.		410.	110.	7.53	717.
336	240.	175.	65.	10.		400.	105.	7.70	901.
360	260.	185.	75.	10.		400.	100.	7.50	676.
384	260.	185.	75.	10.		410.	105.	7.42	574.
408	260.	185.	75.	10.		400.	105.	7.49	759.
432	255.	180.	75.	10.		390.	110.	7.51	831.
456	225.	160.	65.	10.		380.	105.	7.52	643.
480	230.	165.	65.	10.		360.	100.	7.53	531.
504	240.	170.	70.	10.		400.	105.	7.43	589.
528	245.	175.	70.	10.		410.	105.	7.48	540.
552	250.	180.	70.	10.		460.	110.	7.49	722.
576	260.	185.	75.	10.		450.	105.	7.53	713.
600	240.	170.	70.	10.		430.	105.	7.53	607.
624	230.	165.	65.	10.		370.	100.	7.52	521.
648	225.	160.	65.	10.		350.	90.	7.48	411.
672	230.	165.	65.	10.		370.	95.	7.48	477.
696	220.	155.	65.	10.		370.	95.	7.50	734.
720	225.	160.	65.	10.		360.	95.	7.50	456.
744	230.	165.	65.	10.		360.	95.	7.56	439.
768	220.	155.	65.	10.		360.	95.	7.45	551.
792	230.	165.	65.	10.		380.	95.	7.39	558.
816	230.	165.	65.	10.		370.	95.	7.46	633.
840	225.	160.	65.	10.		360.	90.	7.51	719.
864	220.	155.	65.	10.		330.	85.	7.48	642.
888	235.	165.	70.	10.		360.	95.	7.51	581.
912	240.	170.	70.	10.		360.	95.	7.54	696.

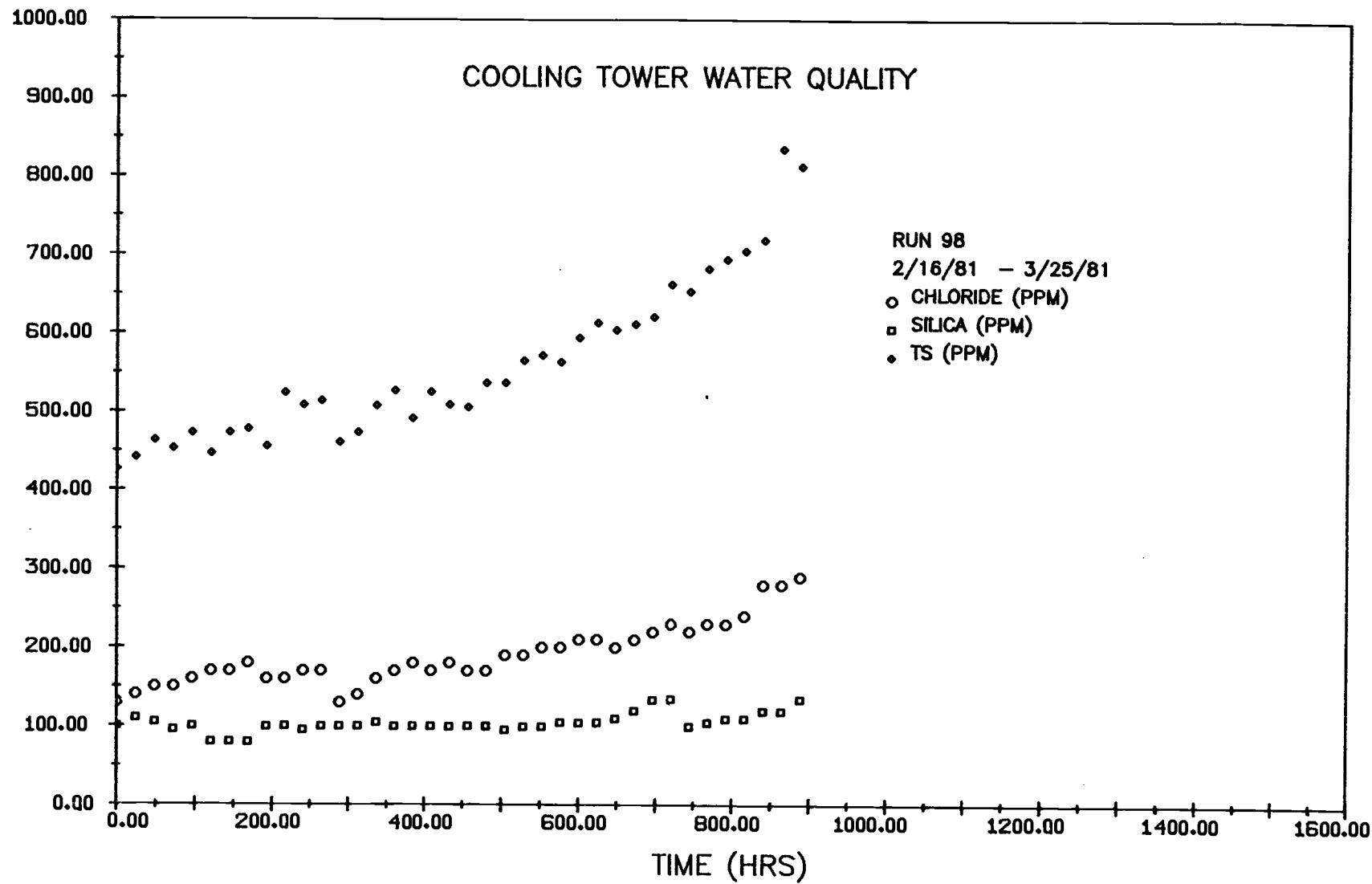
	TH	CA-H	MG-H	H-ALK	P-ALK	CL	SI	PH	TS
AVG	240.	171.	69.	11.	0.	397.	104.	7.5	642.
SIGMA	11.9	8.8	3.6	2.2	1.0	36.5	9.7	.35	122.4

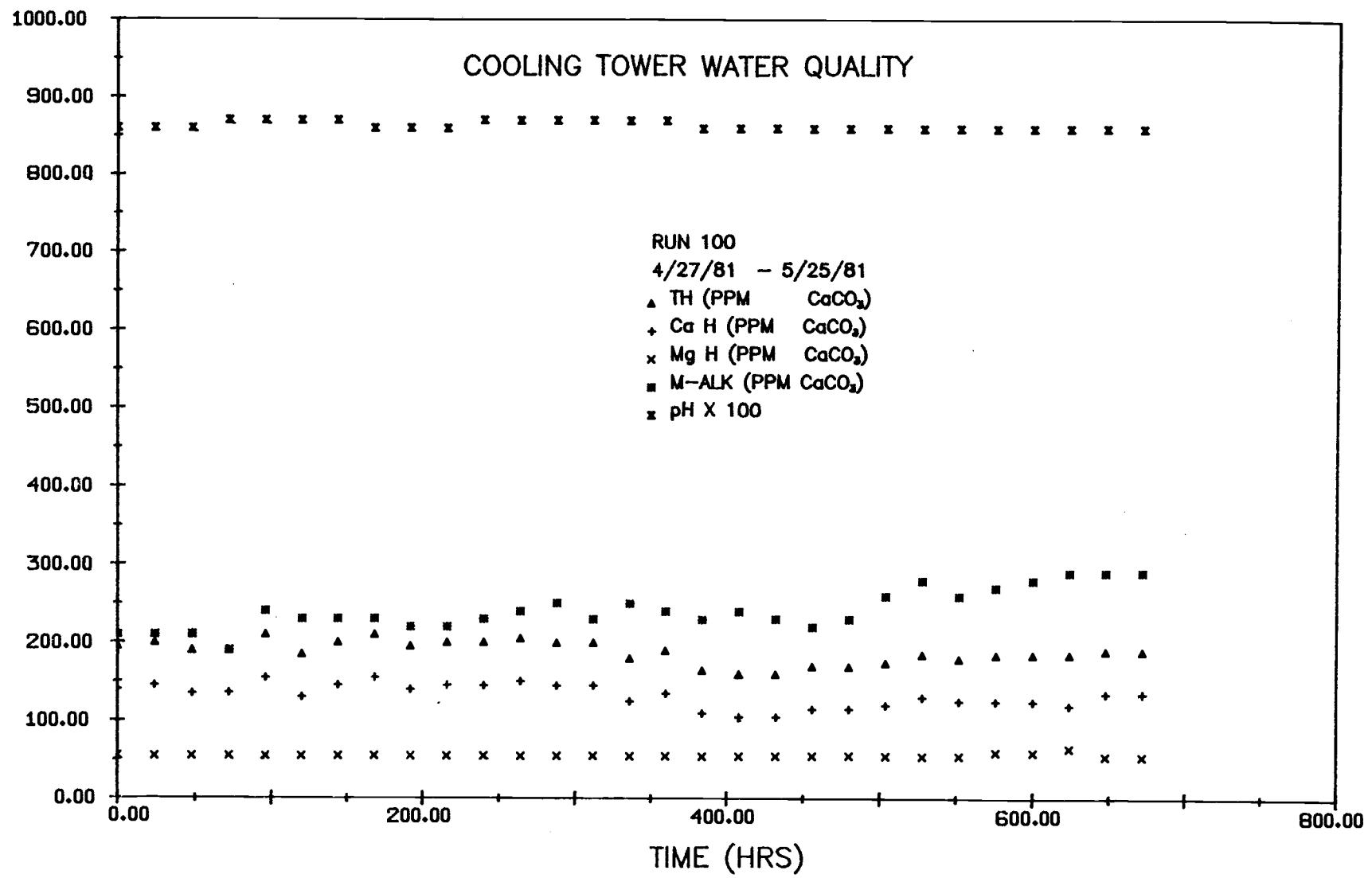
COOLING TOWER WATER
RUN 114

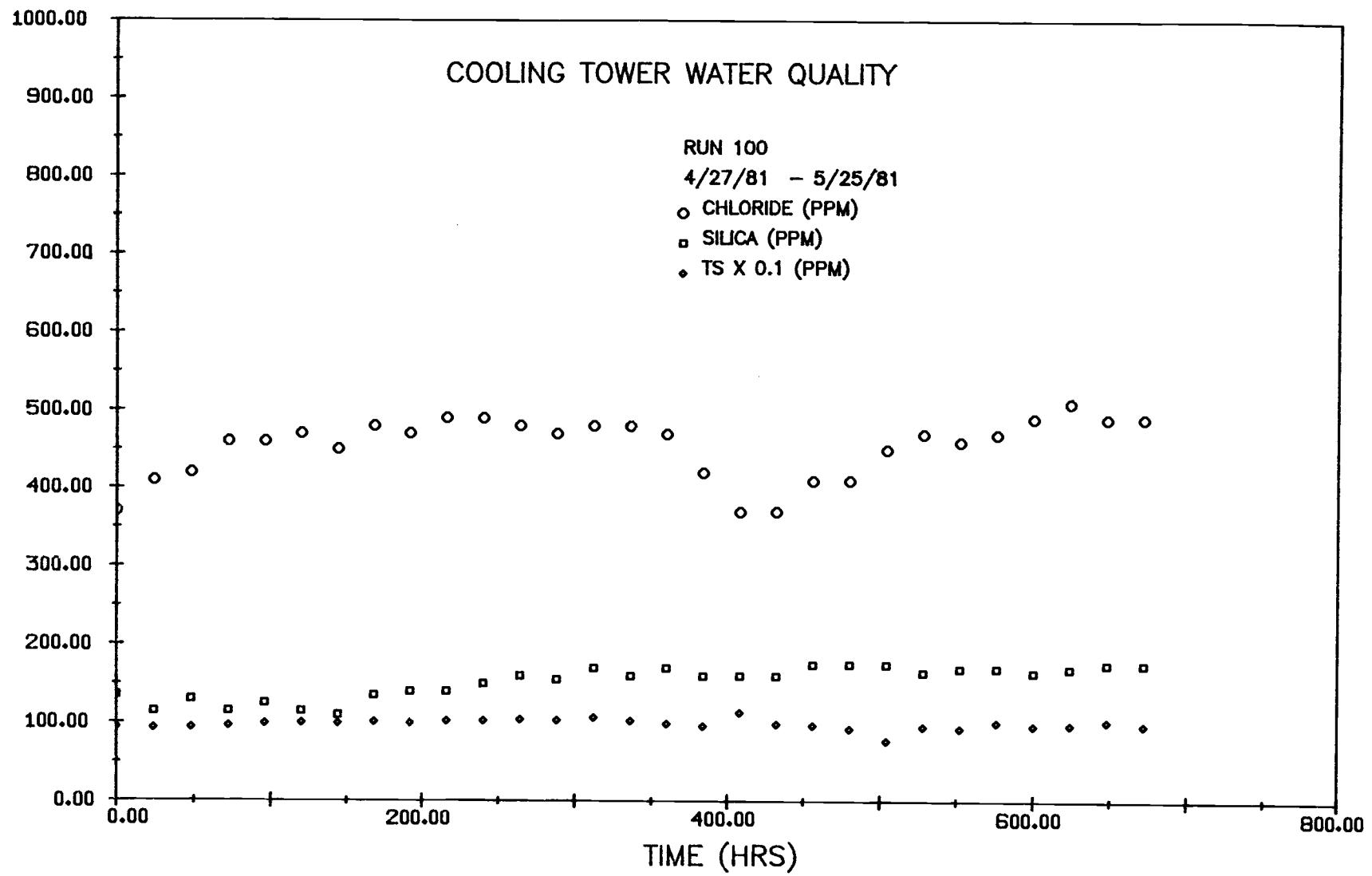
HOURS	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
0	455.	390.	65.	10.		630.	135.	7.54	1110.
24	435.	415.	70.	10.		710.	125.	7.51	1128.
48	475.	410.	65.	10.		670.	135.	7.53	1311.
72	460.	395.	65.	10.		670.	130.	7.52	1256.
96	465.	395.	70.	10.		720.	130.	7.54	1224.
120	460.	395.	65.	20.		690.	135.	7.52	987.
144	470.	400.	70.	20.		680.	135.	7.53	920.
168	440.	380.	60.	20.		590.	120.	7.55	892.
192	470.	400.	70.	20.		700.	125.	7.50	1069.
216	495.	430.	65.	20.		680.	125.	7.51	1235.
240	465.	395.	70.	20.		740.	115.	7.49	1044.
264	485.	430.	55.	20.		730.	105.	7.51	1007.
288	435.	430.	65.	10.		720.	105.	7.52	955.
312	490.	425.	65.	10.		730.	115.	7.47	1272.
336	500.	440.	60.	20.		740.	120.	7.43	1376.
360	485.	425.	60.	20.		750.	120.	7.51	1315.
384	480.	415.	65.	20.		730.	115.	7.49	908.
408	470.	400.	70.	20.		670.	110.	7.50	1168.
432	425.	365.	60.	20.		640.	110.	7.52	980.
456	440.	375.	65.	30.		630.	115.	7.52	1314.
480	460.	390.	70.	30.		690.	105.	7.47	1043.
504	475.	400.	75.	20.		780.	120.	7.50	1213.
528	475.	400.	75.	20.		740.	115.	7.51	1265.
552	455.	385.	70.	20.		720.	115.	7.51	1092.
576	460.	390.	70.	20.		660.	115.	7.50	1126.
600	460.	390.	70.	20.		710.	120.	7.52	953.
624	490.	425.	65.	30.		760.	120.	7.51	1017.

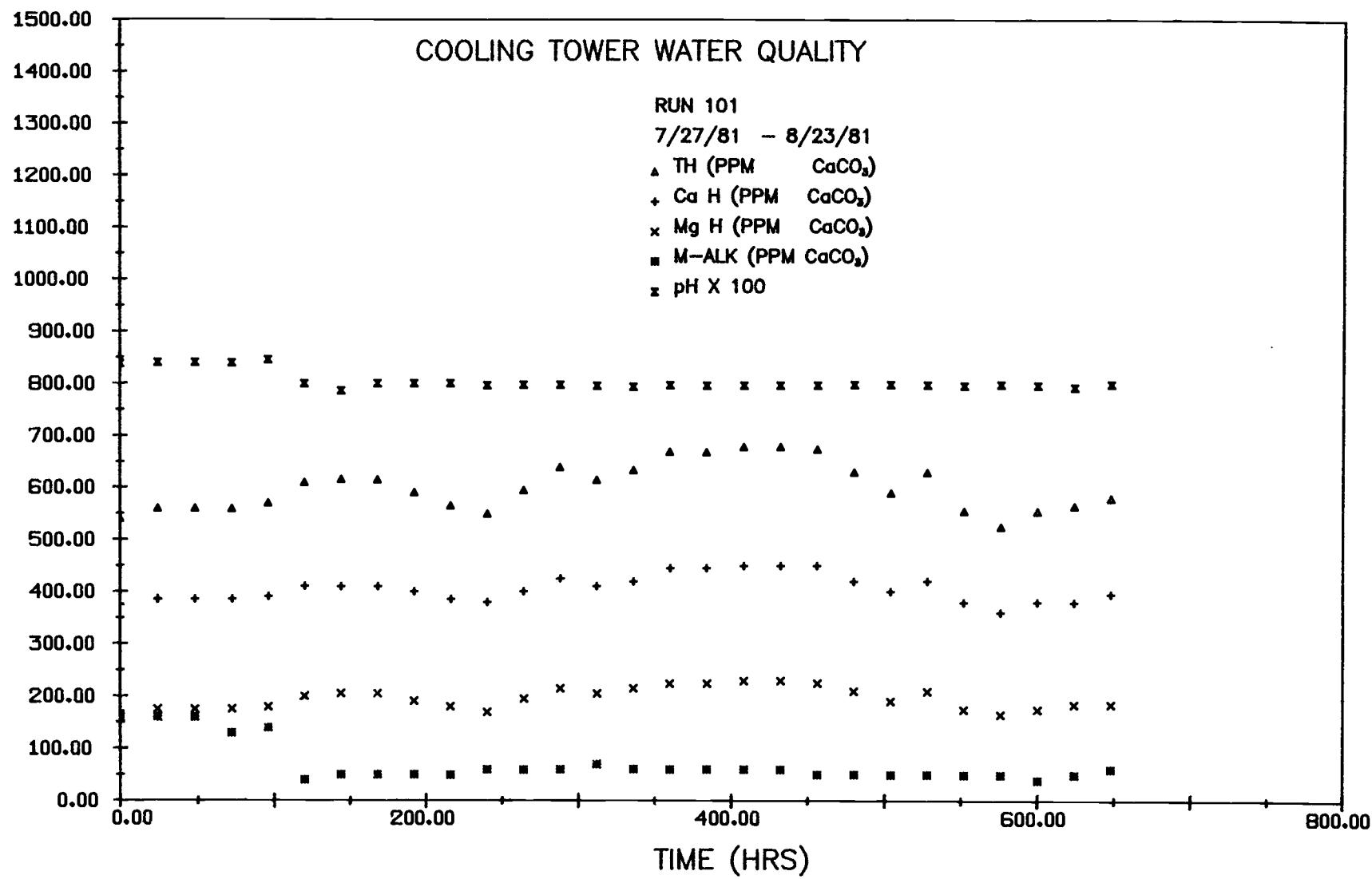
	TH	CA-H	MG-H	M-ALK	P-ALK	CL	SI	PH	TS
AVG	470.	403.	66.	19.	0.	705.	120.	7.5	1121.
SIGMA	18.2	19.0	4.8	6.0	0.0	36.7	9.2	.02	146.1

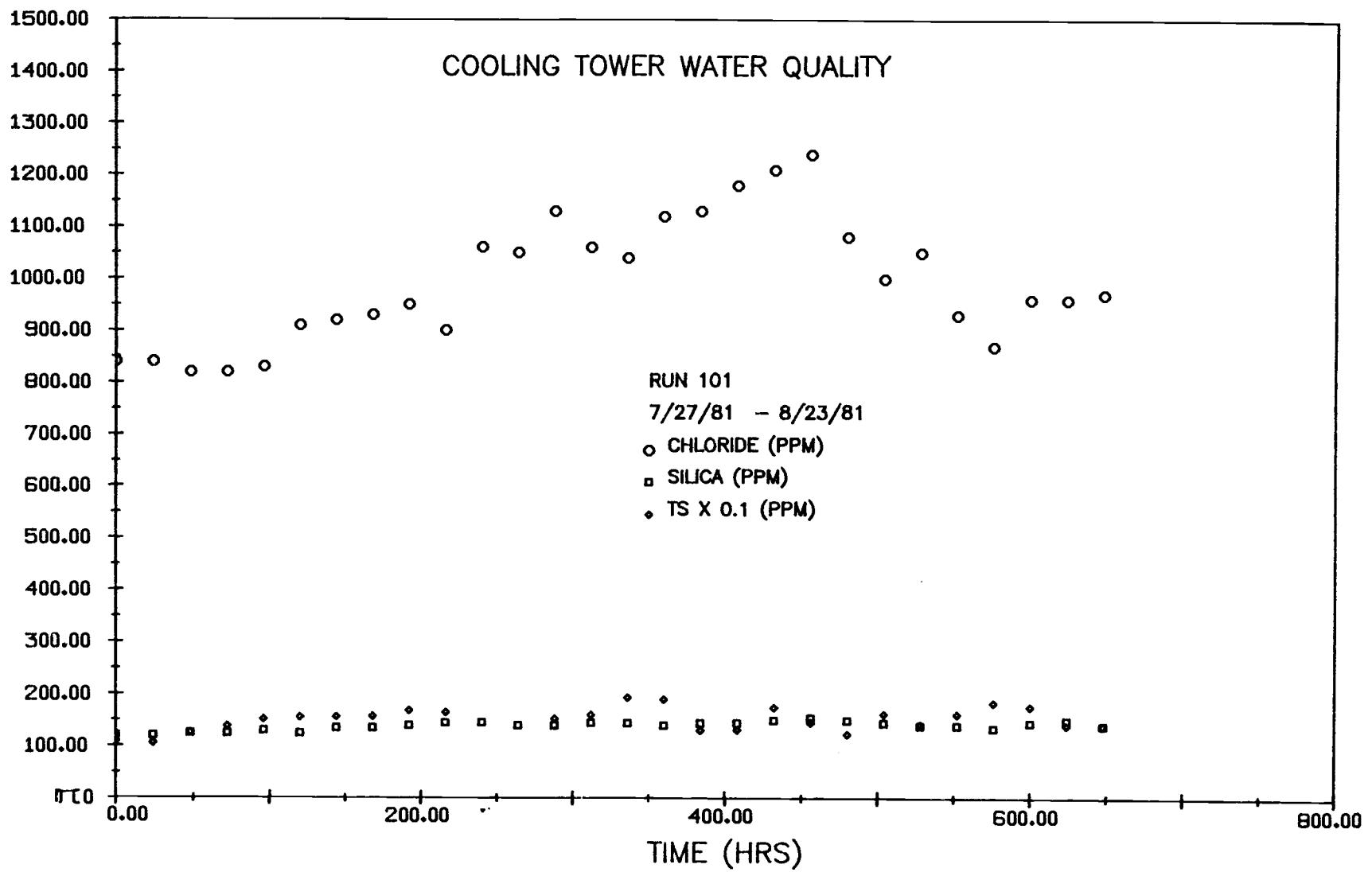


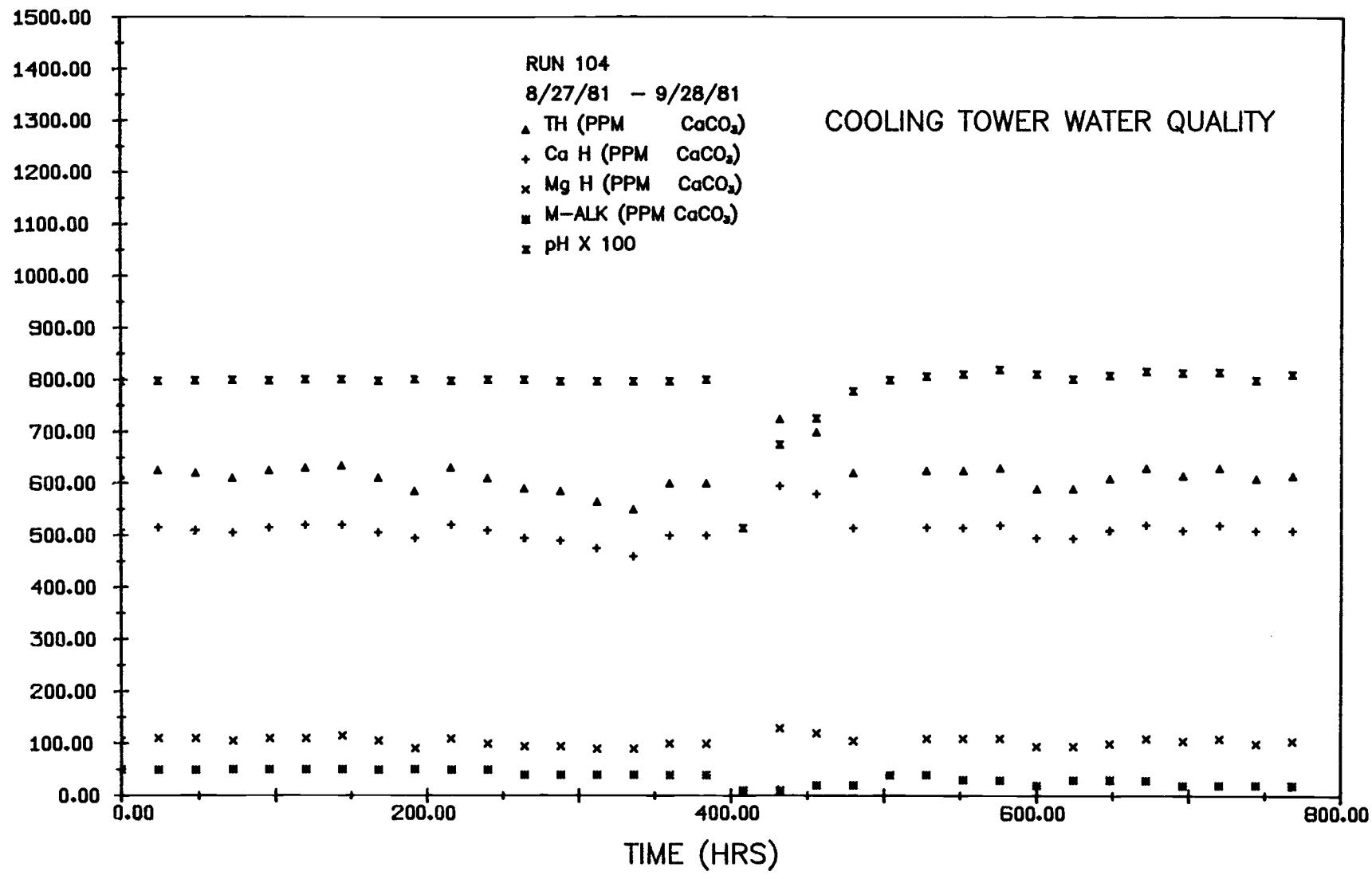


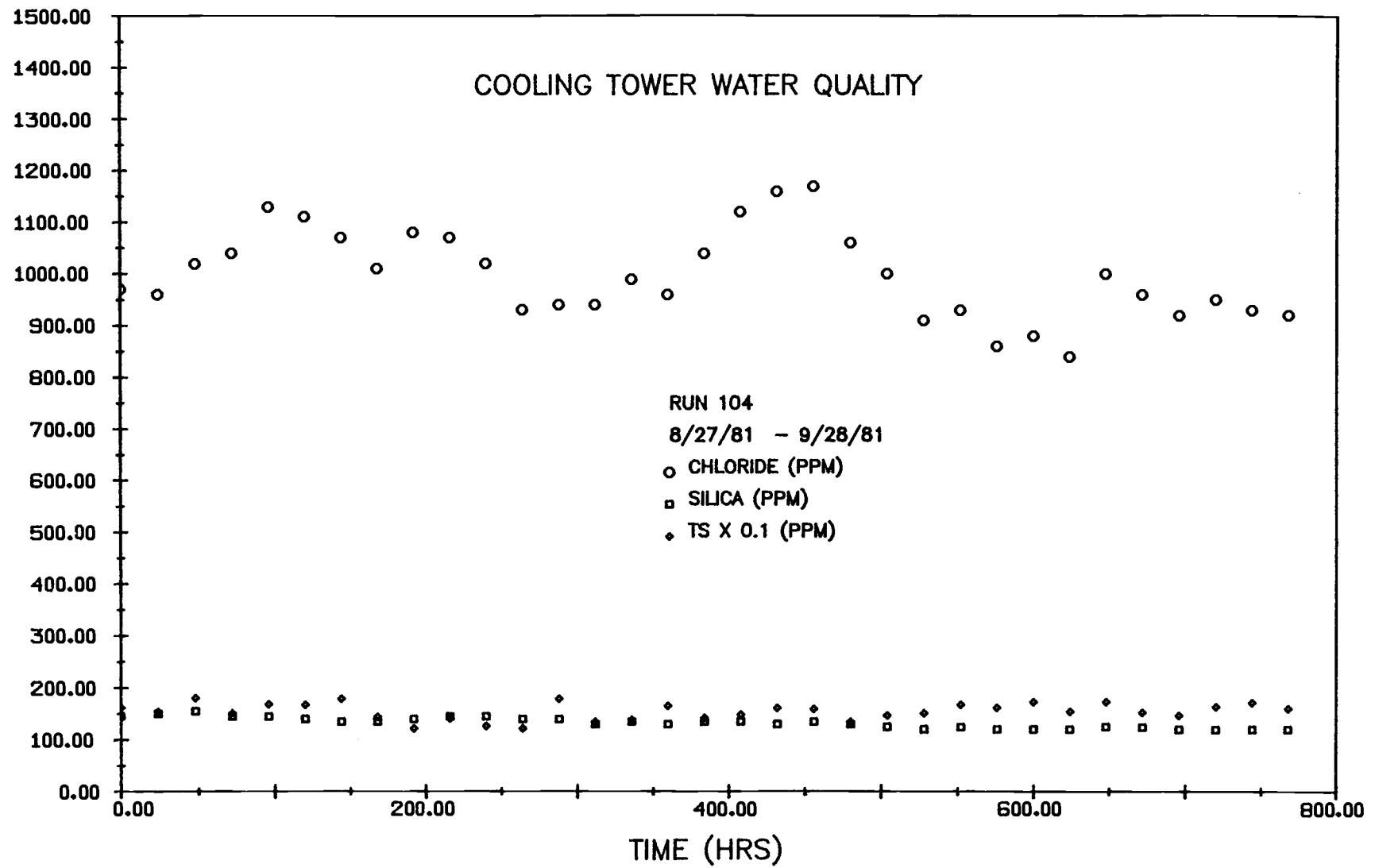


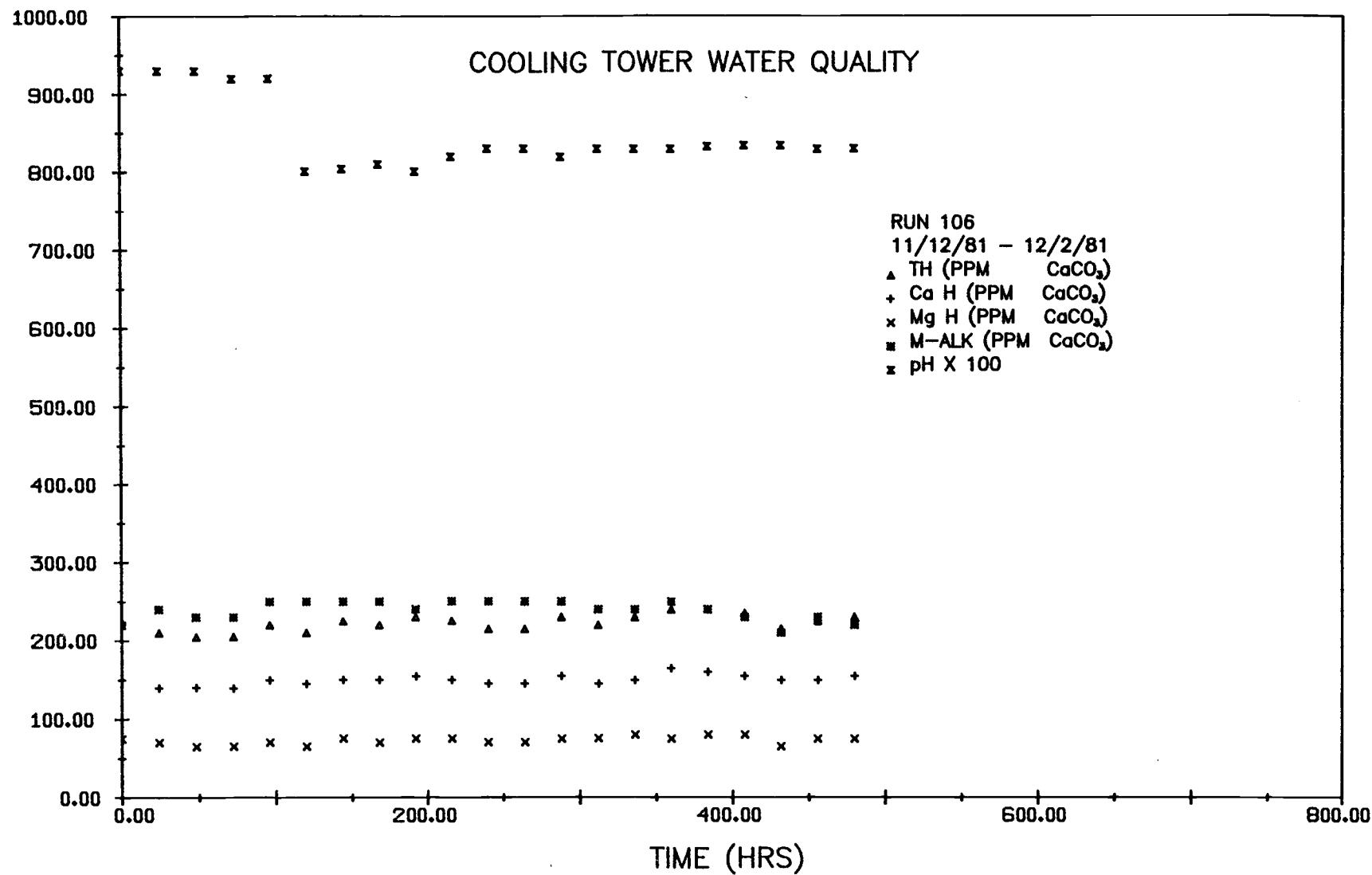


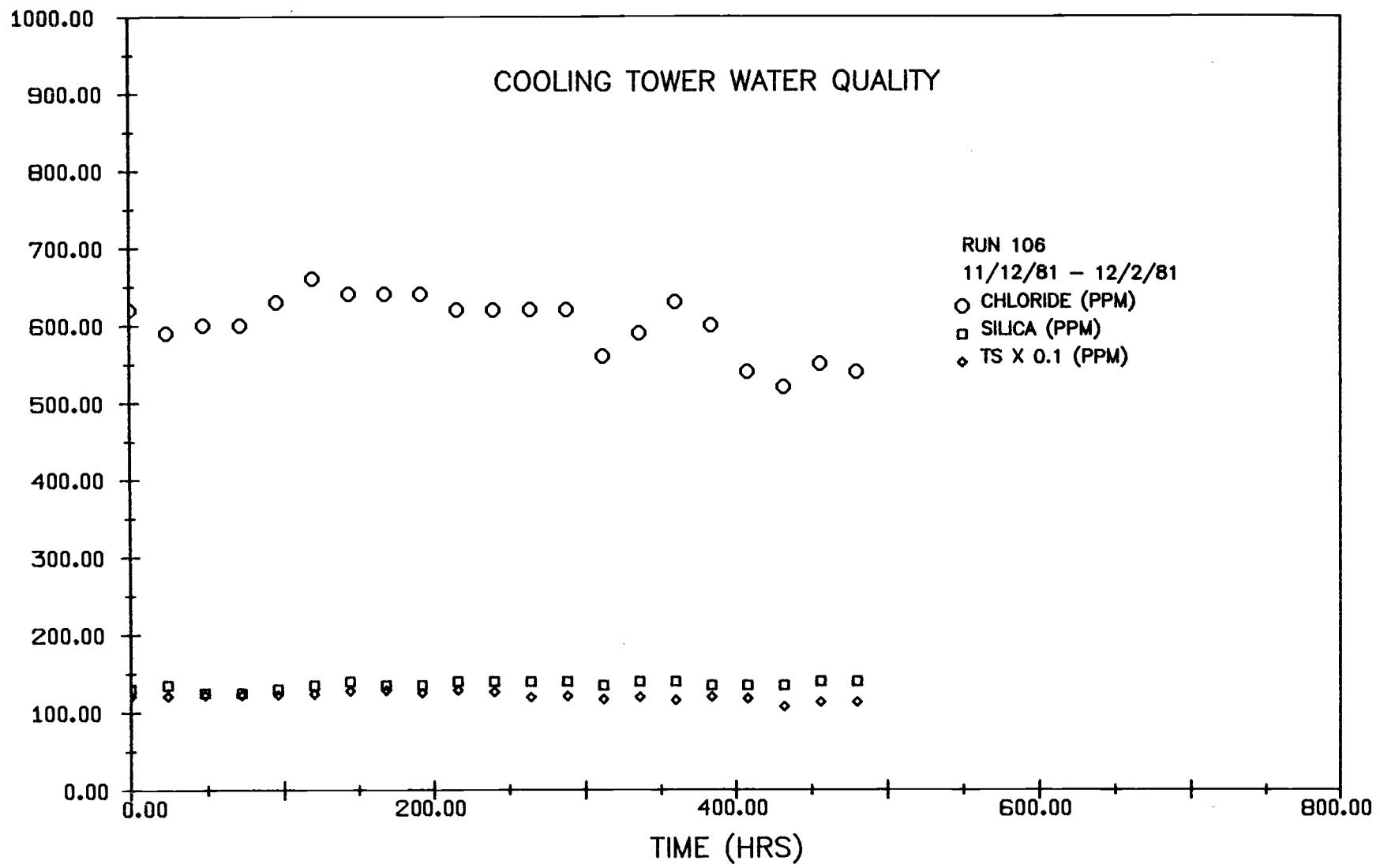


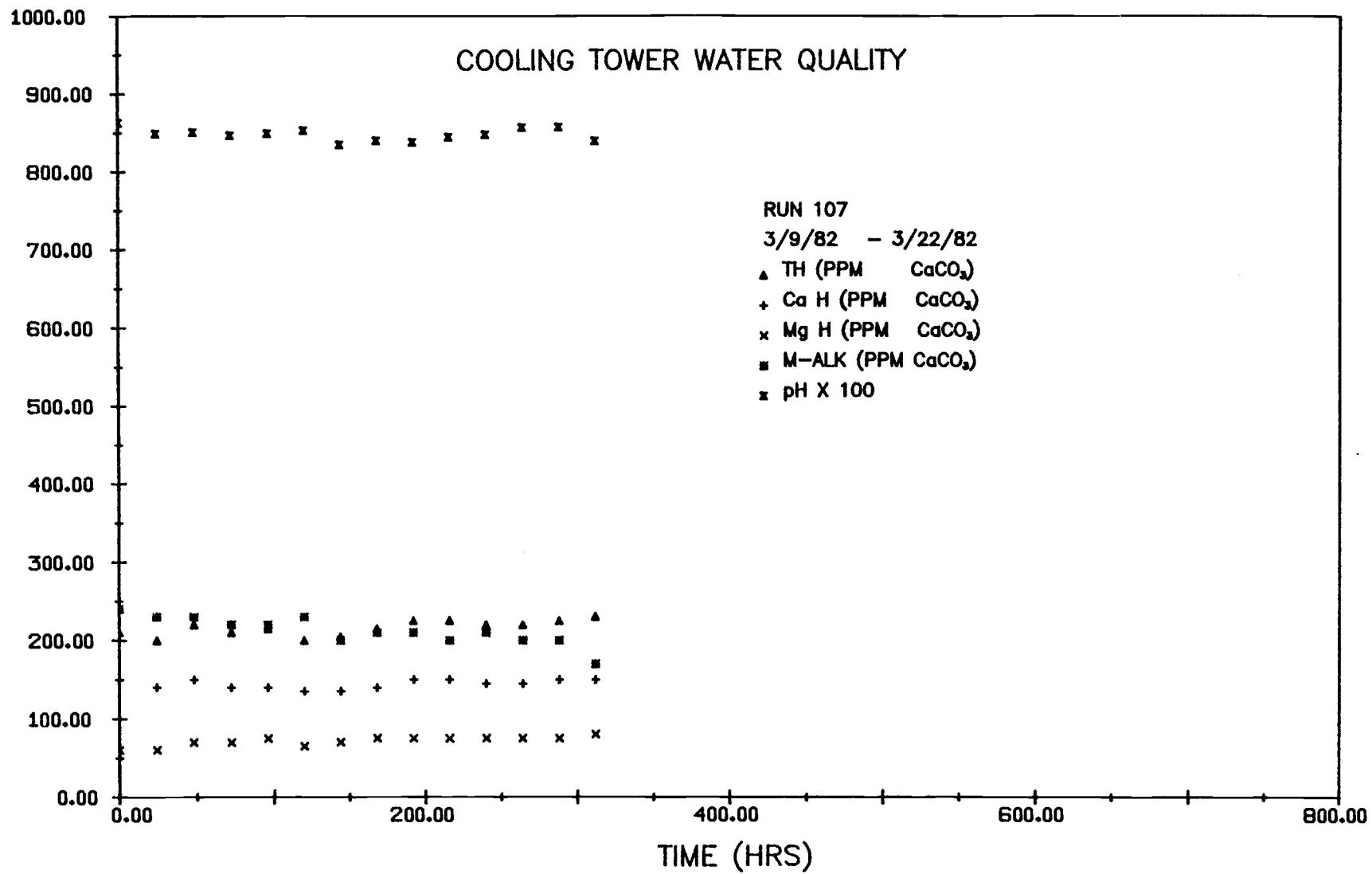


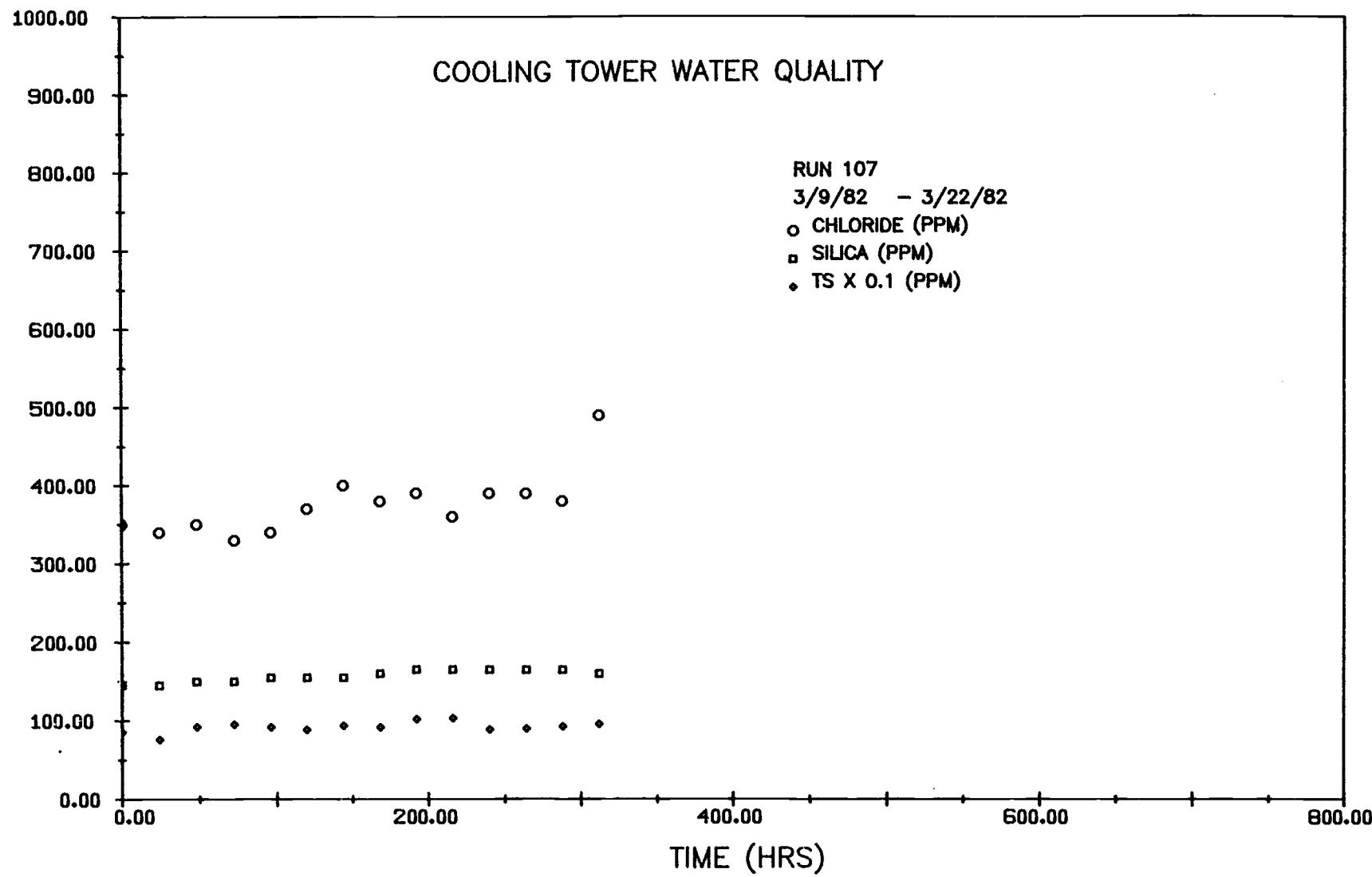


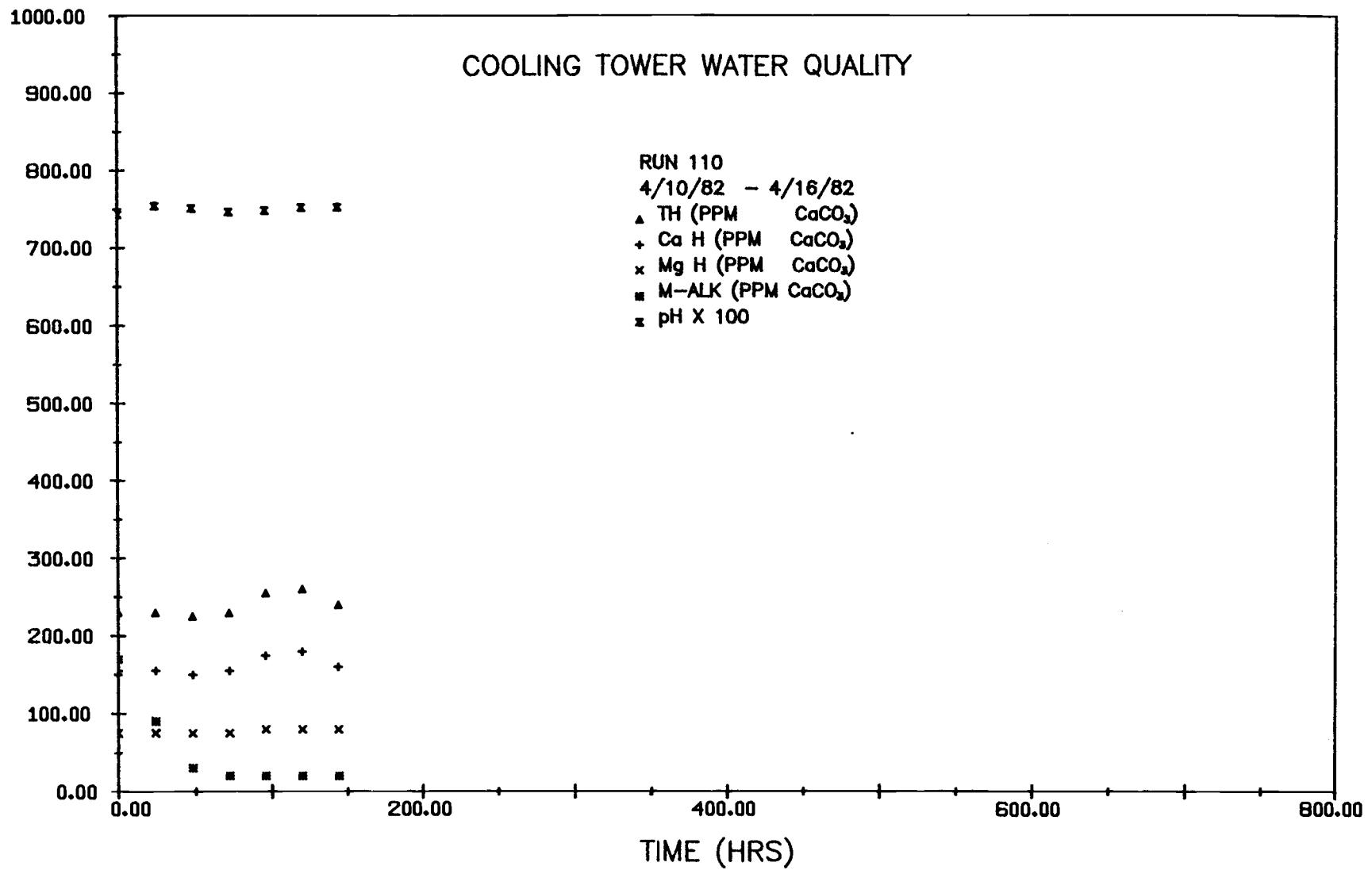


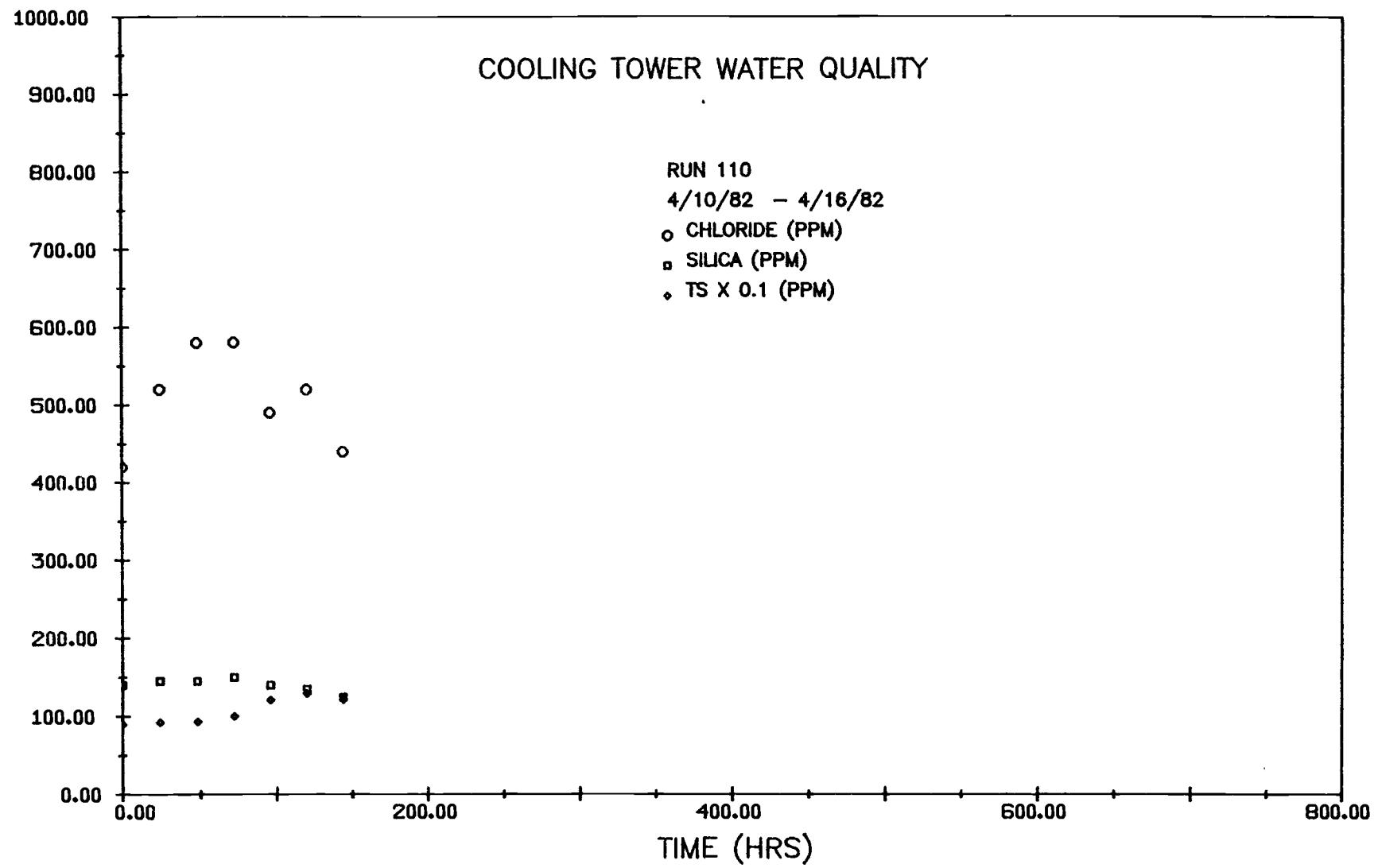


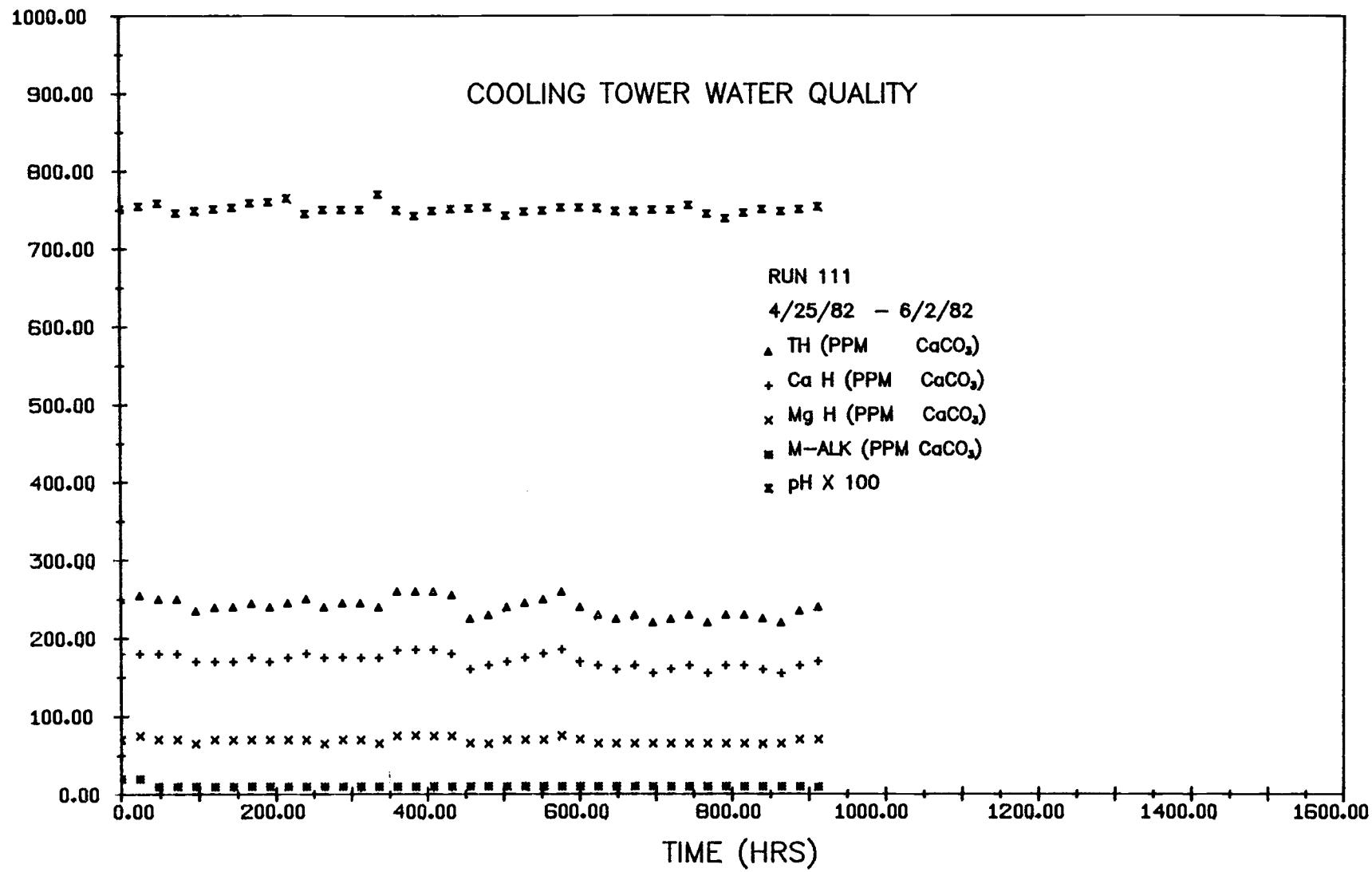


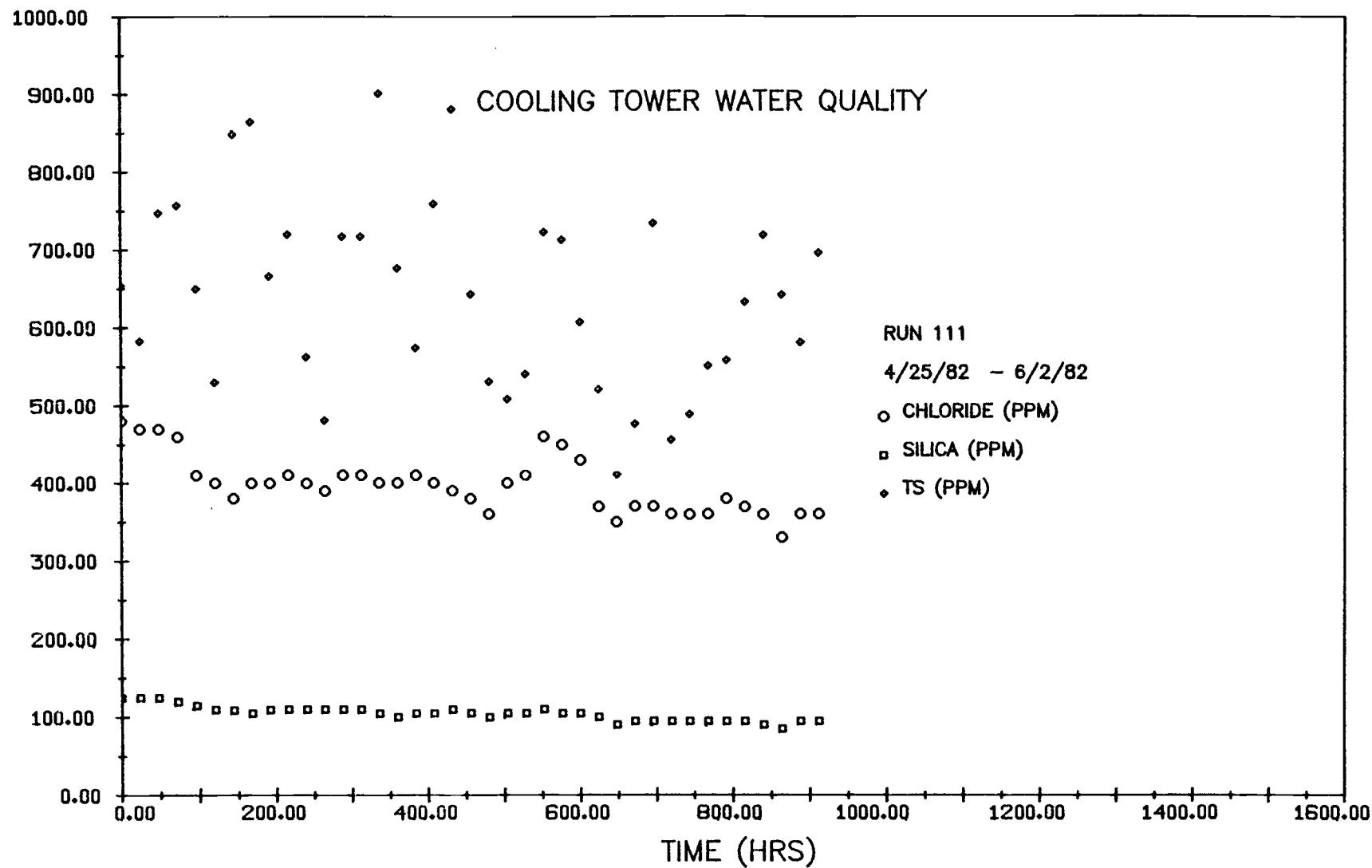


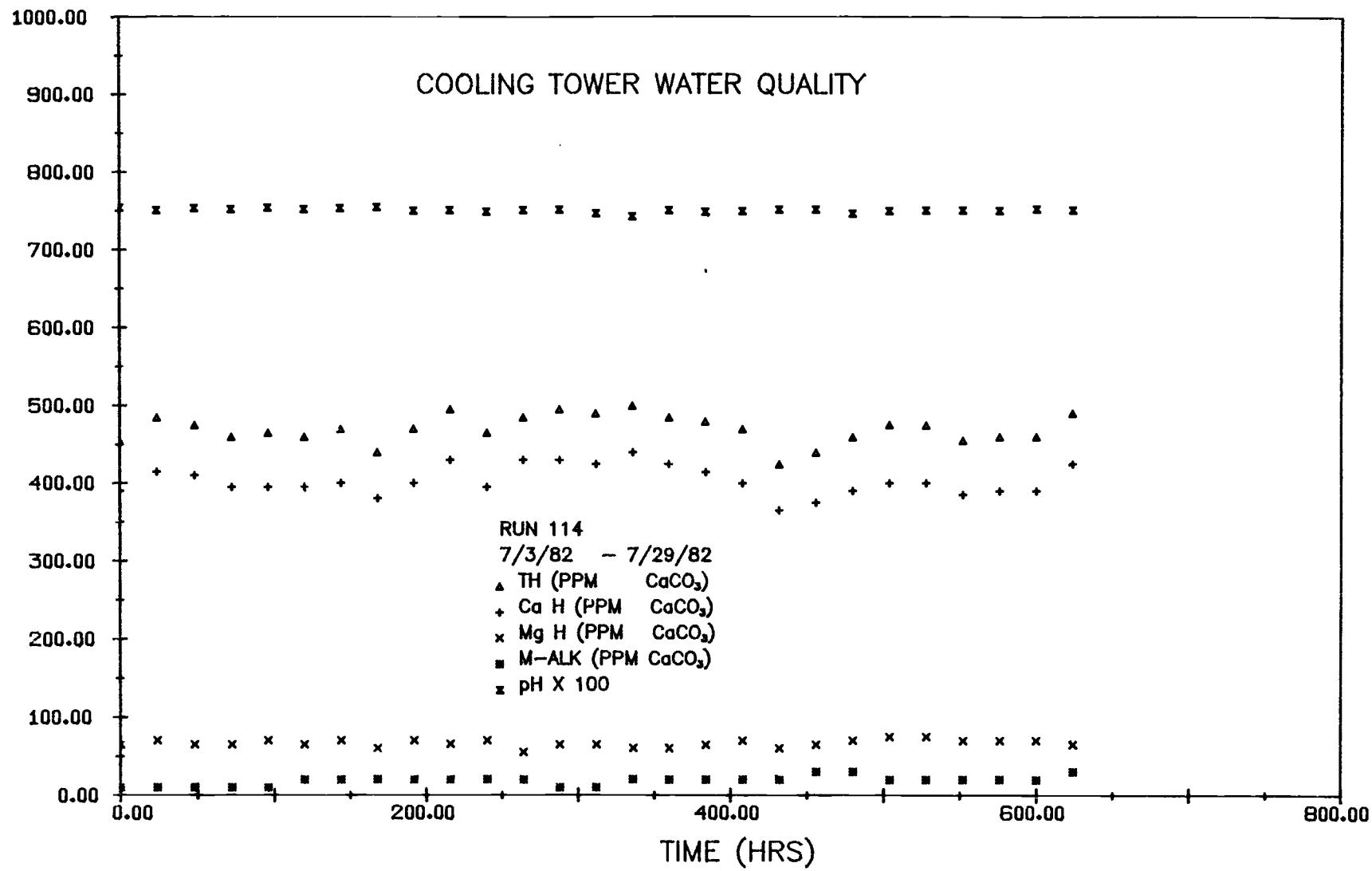


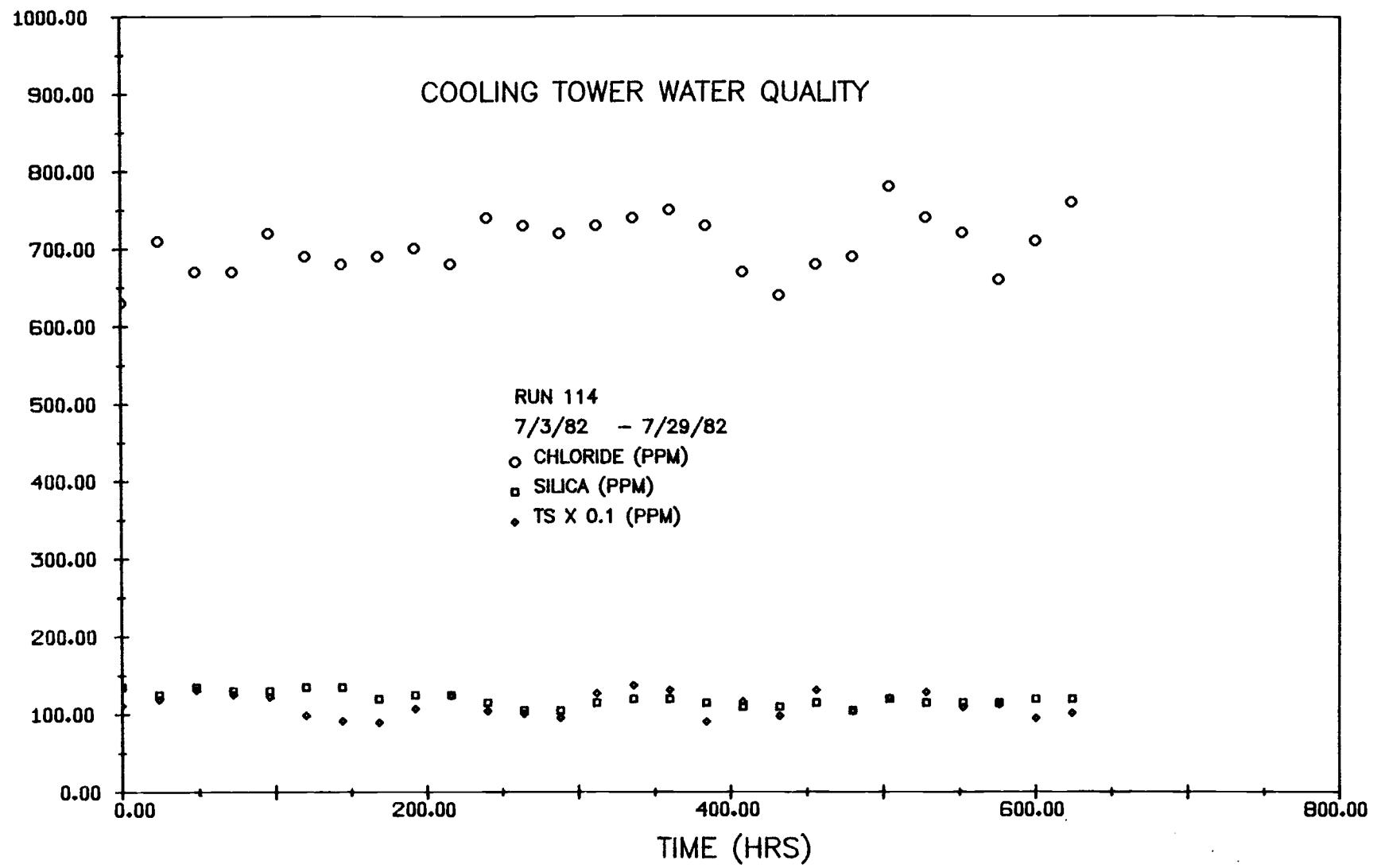












APPENDIX H

R_f vs Time Plots

