ENCLOSURE 2

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SUBCOOLED COUNTER-CURRENT FLOW LIMITING CHARACTERISTICS OF THE UPPER REGION OF A BWR FUEL BUNDLE

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ABSTRACT

Results of an adiabatic, single bundle test program to determine the subcooled counter-current flow limiting (CCFL) characteristics of the upper region of a BWR fuel bundle are presented. Data are reported for three methods of inlet water injection and three methods of steam injection. The results show that the CCFL characteristics are affected by the methods of both steam and water injection. It is also shown that CCFL with subcooled liquid injection is characterized by the steam condensing capability of the inlet water.

1.0 INTRODUCTION

During a hypothetical loss-of-coolant accident (LOCA) in the Boiling Water Reactor (BWR), the core will be reflooded with coolant water to maintain the fuel cladding temperatures below the accepted limits. Once reflooding is achieved, the heatup is terminated.

In the BWR, two separate emergency core cooling systems (ECCS) are provided which reflood the core: 1) the core spray, and 2) the low pressure coolant injection (LPCI). Each of these systems provide large quantities of water above and/or below the core region, depending on specific reactor design. The water supplied above the core must pass through the core and into the lower plenum volume to achieve core reflooding. Even though the reactor is shutdown during the LOCA, the core continues to generate power in the form of decay heat from the fuel and the stored heat in the core region. Thus, steam will be generated from the ECCS water as it contacts the core region. This steam will flow upward through the core and into the upper plenum region. The action of steam flowing upward while coolant water flows downward can lead to a condition defined as counter-current flow limiting (CCFL), which tends to restrict the water downflow.

Earlier CCFL studies have obtained data for various flow geometries and gas/liquid combinations, the most common of which are air/water and steam/water (1, 2, 3). The present investigation is a steam/water study of the CCFL phenomena in the BWR when the water flow is subcooled. This case is more applicable to the BWR because the source of water for the ECC systems, the condensate storage tank or the suppression pool, is significantly subcooled during the reflood portion of the LOCA.

2.0 OBJECTIVES

The objective of this test program was to determine the subcooled CCFL characteristics of the upper region of a BWR fuel bundle. To accomplish this, the test program was carried out in two phases. Phase 1 consisted of tests with saturated inlet water. The purpose of Phase 1 was to obtain a saturated water data base on which to evaluate the effects of subcooling. Phase 2 was the subcooled portion of the test program. The five objectives of Phase 2 may be listed as:

1. Obtain CCFL data for a wide range of inlet water flow rates and subcoolings. Using this data, provide an analytical model to evaluate the CCFL behavior of the BWR fuel assembly with subcooled water injection.
2. Determine the effect of the liquid injection method.
3. Determine the effect of the steam injection method.
4. Obtain temperature data from the pool of water which accumulates above the tie plate during CCFL, to help determine the mixing characteristics of the "tie plate pool".
5. Evaluate the applicability of the subcooled CCFL models proposed by Tien (4) and Wallis, et. al. (1).

3.0 TEST EQUIPMENT

The upper region of the BWR fuel bundle consists of the tie plate and the upper plenum region directly above the fuel bundle. The tie plate is simply a cast steel part which serves as the anchor point for the top of the fuel rods in each fuel bundle. The upper plenum is the open volume above the fuel bundles. For this test, the upper region was modeled with a shortened bundle test section with full scale cross section dimensions, simulated fuel rods (approximately 7 feet long), a production 8x8 tie plate and a simulated upper plenum volume.

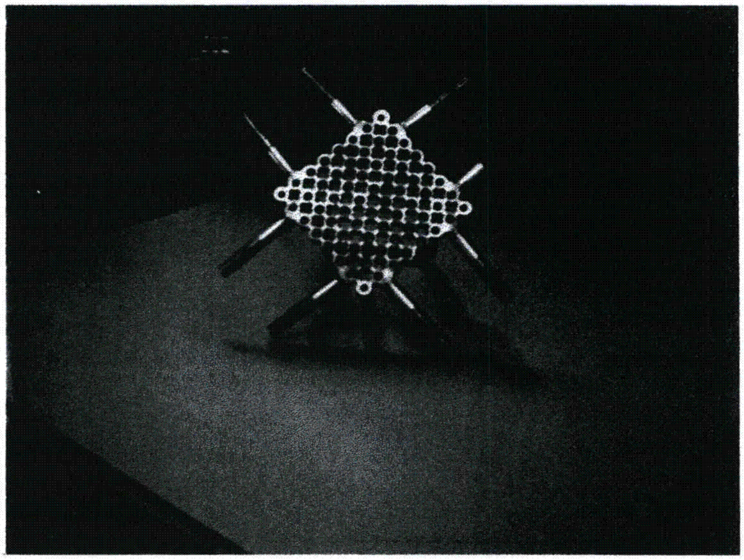
3.1 Test Section and Instrumentation

The test section consists of a full scale 8x8 fuel channel, shortened to seven feet in length. The bundle is made up of 64 simulated fuel rods. Each rod is a stainless steel tube with a nominal O.D. of 0.493 inches. The rods are open at the bottom but have a plug with a threaded extension silver soldered into the top. This threaded extension provides the means of anchoring the rods to the upper tie plate. The rods are held in the 8x8 square configuration by two production fuel spacers and a production 8x8 upper tie plate, shown in Fig. 1. It rests at the top of the fuel channel in a specially built flange which allows the complete simulated fuel assembly to be easily removed from the test section. The mating half of this tie plate flange is welded to a section of channel approximately three inches long, which simulates the channel extension above the tie plate in the reactor.

The upper tie plate region was enclosed in a large upper plenum cover which bolts to the upper plenum base plate and is vented to the atmosphere by the orificed steam stack. The inlet spray water was piped in through the base plate to the desired spray distribution system. Figure 2 shows the basic dimensions of the test section.

The test section was installed in the Zero Power Loop. The loop is supplied with steam from a gas-fired boiler which provides up to 1,500 lb/hr (0.189 kg/sec) of steam at 80 psig (55.16×10^4 n/m^2) and a spray water system which provides up to 8000 lb/hr (1 kg/sec) of water at temperatures ranging from 100°F to 205°F (38° - 96.1°C). A general flow schematic of the loop is shown in Figure 3.

The test section was instrumented with absolute and differential pressure transducers and thermocouples, as shown schematically in Fig. 3. Inlet steam flow was measured with a sharp edged orifice and inlet water flow was measured



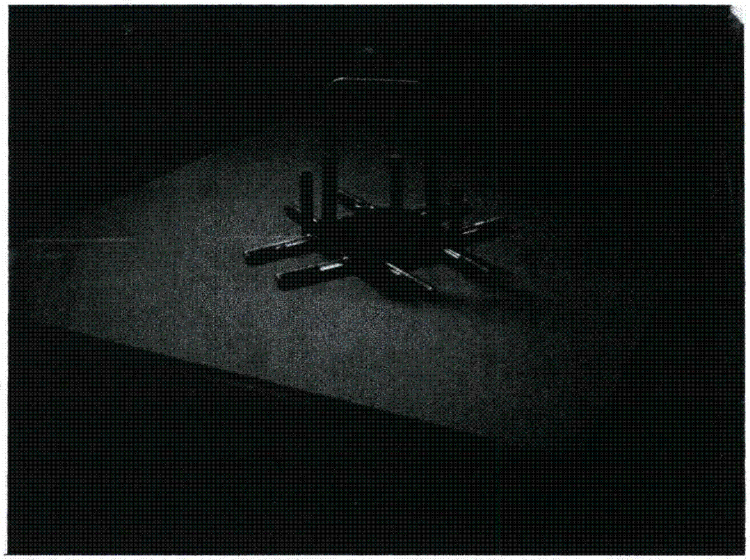


FIGURE 1 - ZERO POWER LOOP 8x8 TIE PLATE

Figure 2

TEST SECTION DIMENSIONS

Dimensions in inches (centimeters)

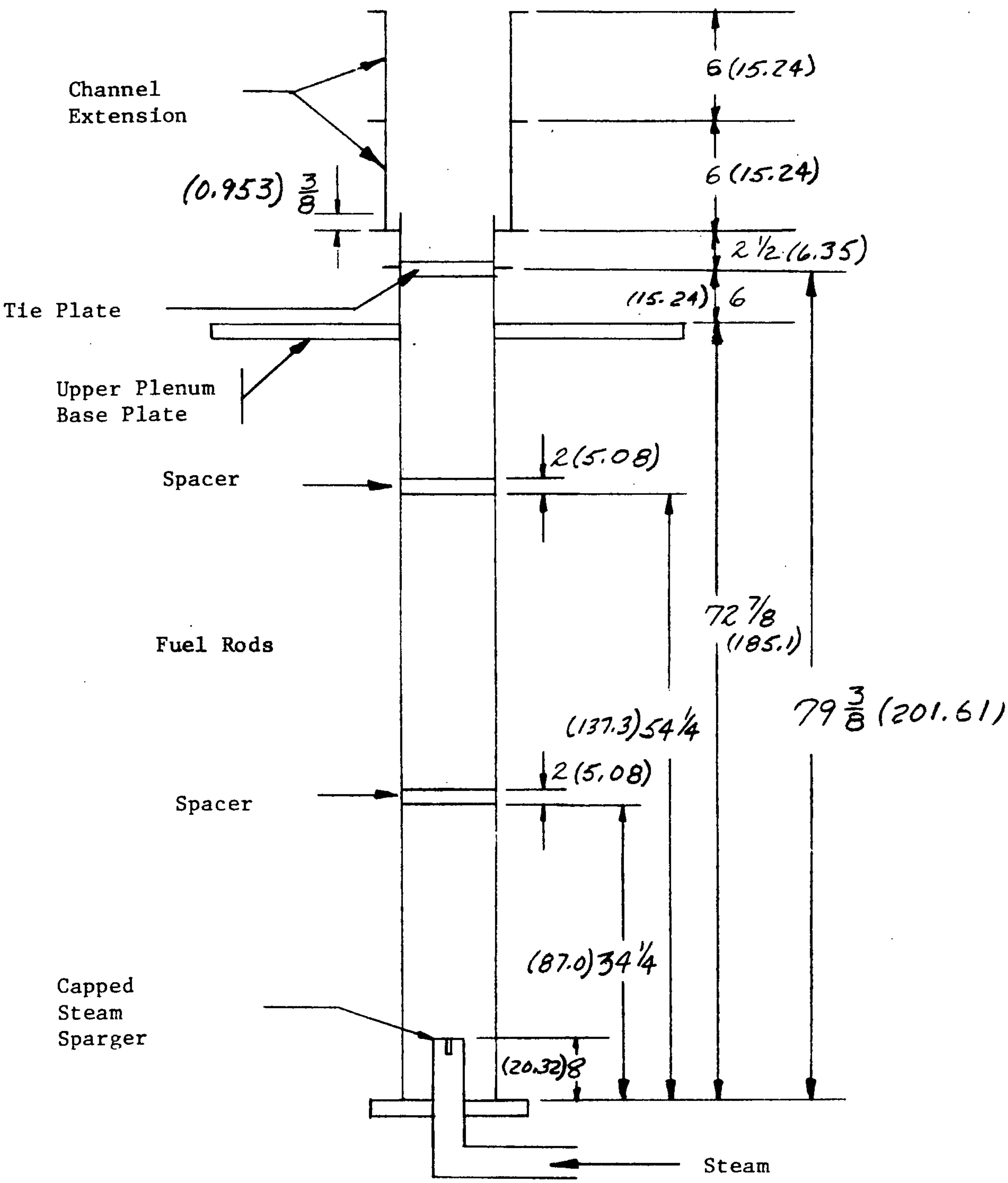
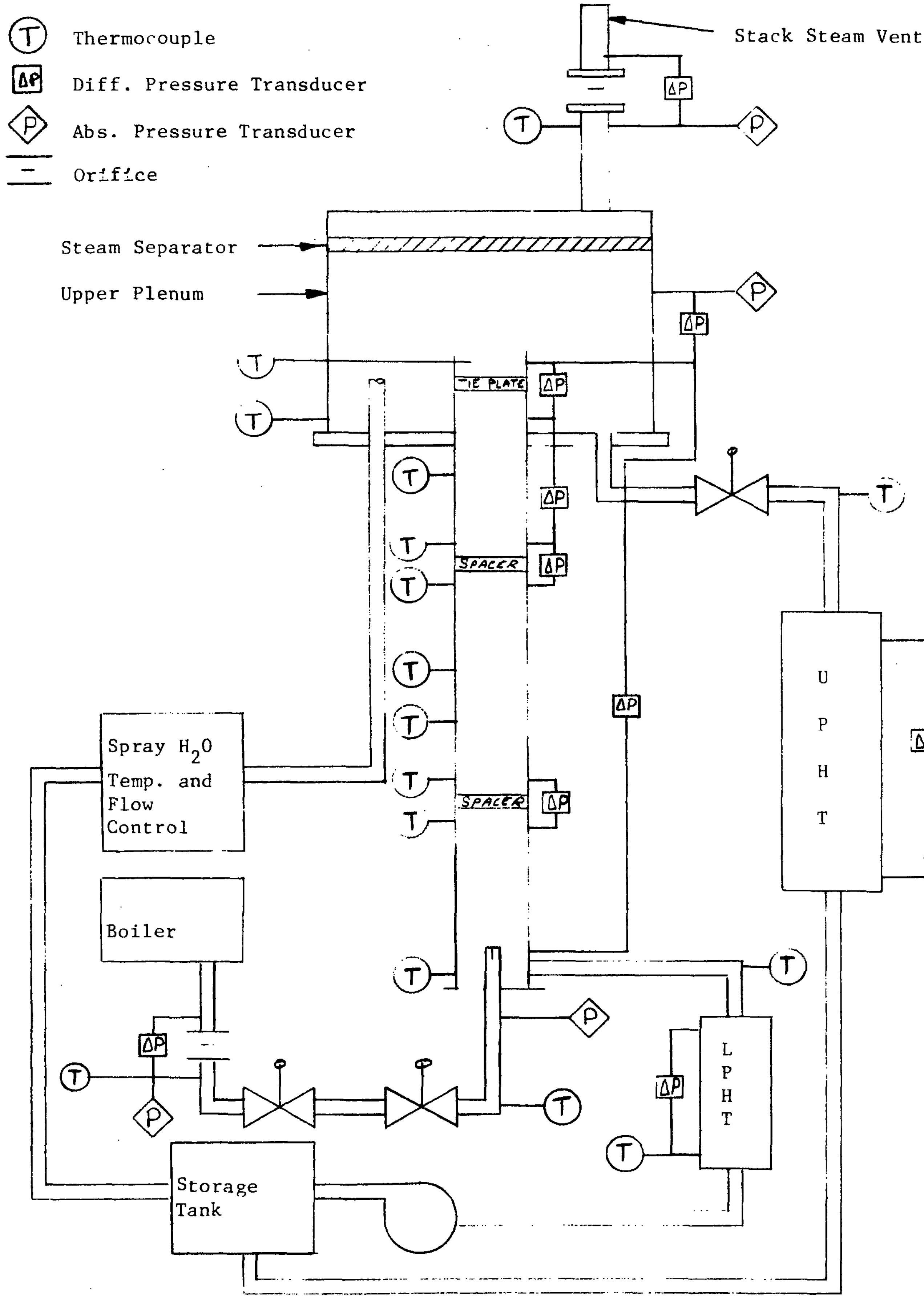


Figure 3

INSTRUMENTATION AND FLOW SCHEMATIC



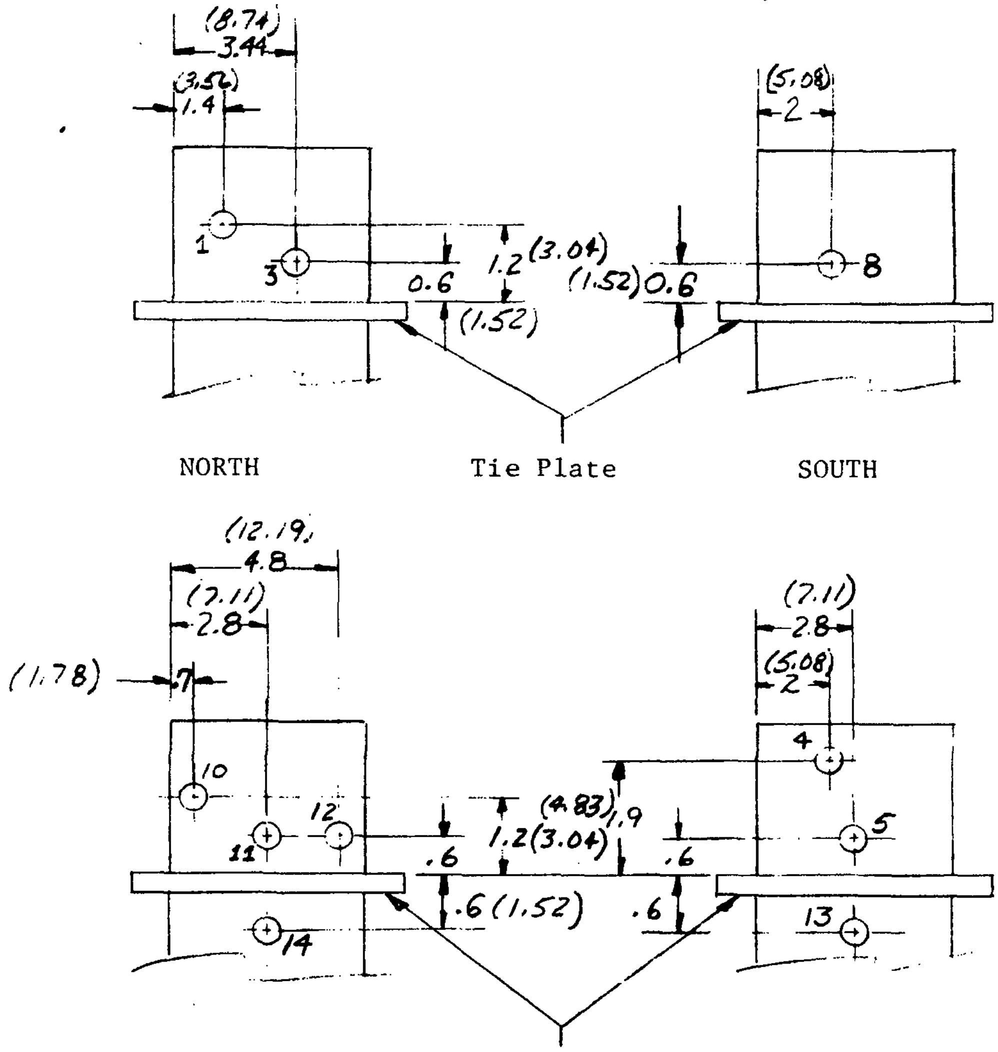
with a turbine meter. In addition, the region directly above the tie plate pool was instrumented with 10 thermocouples which were arranged as shown in Fig. 4. These thermocouples were intended to determine if there was any measurable temperature distribution in the tie plate pool. Seven thermocouples were also spaced axially along the fuel channel, as shown in Fig. 5. The upper and lower drain flows were measured with holding tanks (the upper plenum holding tank (UPHT) and lower plenum holding tank (LPHT) respectively). The actual drain flow measurement technique is described in Appendix A.

3.2 Data Acquisition

Data were recorded on magnetic tape with a Hewlett Packard 21 Mx mini-computer data acquisition system. The frequency for recording data (e.g., once every five seconds) was variable and could be adjusted by the test engineer. Once the data were recorded, they were converted from millivolts into engineering units by a data reduction code on the central computer. This code converted the data into engineering units and, for steady state runs, calculated averages of designated parameters for each data set.

Figure 4

TIE PLATE POOL THERMOCOUPLE LOCATIONS/SIDE VIEWS OF CHANNEL
ABOVE THE TIE PLATE
Dimensions in inches (centimeters)

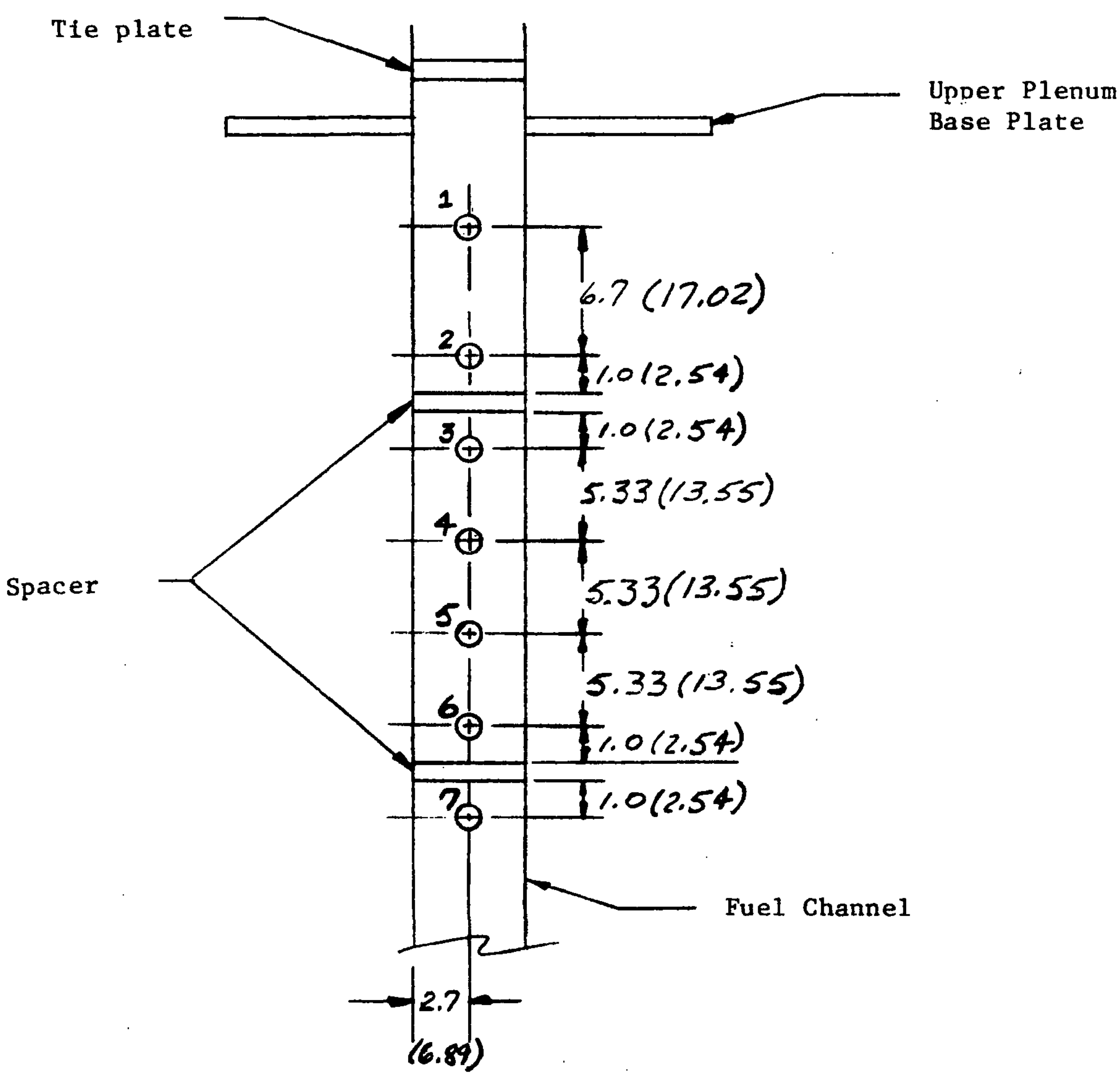


TC #	Extension into pool, inches (cm)	
1	1 3/8 (3.49)	
3	1 3/8 (3.49)	
4	5/8 (1.59)	
5	5/8, (1.59)	Bent to just above tie plate
8	2 (5.08)	
10	1 1/4 (3.18)	
11	1 3/4 (4.45)	Bent to just above tie plate
12	1 1/4 (3.18)	
13	5/8 (1.59)	Bent to just below tie plate
14	1 3/4 (4.45)	Bent to just below tie plate

Figure 5

CHANNEL THERMOCOUPLE LOCATIONS

Dimensions in inches (centimeters)



4.0 TEST PROCEDURES AND PARAMETERS

Two basic types of tests were performed. The largest number of tests were steady state runs, while a few were transient tests. Each technique is briefly outlined below.

4.1 Steady State Tests

Steady state tests were initiated by injecting the inlet water into the test section at the desired flow rate and temperature. After the loop was heated up and loop temperatures stabilized, data were recorded for about 3 minutes. The data acquisition system is designed so that each time data is recorded, each computer channel is scanned and its millivolt output is recorded. Thus, for example, a complete set of data points (a scan) is recorded every five seconds. Some data were recorded at 1/2, 1, and 2 second intervals to determine if there was any variation in the results as a function of recording cycle, but it was found to be insensitive so most of the data were recorded at 5 second intervals.

After the initial set of data were recorded, the inlet water flow was left unchanged and 200 lb/hr (0.025 kg/sec) of steam was added to the test section. After the steam flow had stabilized, data were recorded for approximately three minutes. When this was complete, the steam flow was increased in a step-wise manner up to 1,000 lb/hr (0.126 kg/sec), or until the test engineer observed complete limiting in the test section, in increments ranging from 25 to 200 lb/hr (0.003 to 0.025 kg/sec). After the maximum steam flow was reached, the steam flow rate was decreased in similar increments down to 200 lb/hr (0.025 kg/sec). Typically, the steady state data sets consist of about forty scans at each steam flow. Thus, each reported datum point represents the average value of those forty scans.

4.2 Transient Tests

The transient tests were executed in a 'steam first' mode. That is, steam was first injected into the test section at the specified rate. After the steam flow was stabilized, the inlet spray flow was initiated. With the steam flow held constant, the spray water temperature was decreased from 205°F (96.1°C) to a minimum of 80°F (76.7°C). The water temperature was decreased in two distinct ways. First, the temperature was decreased in a continuous transient. Alternately, the temperature was decreased in steps of 10-20°F (5.6-11.2°C), with the system allowed to reach steady state for several minutes before the temperature was again decreased. In either case, data were recorded continuously during the transient until CCFL breakdown occurred (i.e., the test section was no longer limited) or the minimum obtainable temperature was reached.

4.3 Test Parameters

The basic parameters which were varied include the following: 1) inlet water temperature, 2) inlet water flow rate, 3) inlet steam flow rate, 4) method of liquid injection, and 5) method of steam injection. The inlet water was varied from 2500 to 8000 lbm/hr (0.315 - 1.0 kg/sec) at 80° to 205°F (26.7 - 96.1°C), while the steam flow was varied from 0-1,000 lb/hr (0 - 0.126 kg/sec).

Three basic methods of inlet water injection were used. These, referred to as 1) bypass slots, 2) cross flow, and 3) spillover, are shown schematically in Figure 6. The bypass slots method is intended to simulate the path of inlet water when the bypass region is flooded. This was accomplished by cutting 4, 1/8" x 5" (0.318 x 12.7 cm) slots in a square pattern in a flange (see Fig. 7) which was then welded to the upper channel piece above the tie plate. A length of 1/2" (1.27 cm) tubing was connected from the water supply to each slot to provide the flow pattern illustrated in Figure 6-1. The cross flow method was intended to simulate the flow pattern near the peripheral bundles in a BWR when the core spray sparger is submerged. This flow pattern was accomplished by piping the water in through the side of the extended channel. Again, there were four separate lines which were designed such that there was a removable 1" (2.54 cm) diameter plate at each connection to the channel. One set of tests used plates with a single 1/2" (1.27 cm) diameter hole (referred to "cross flow, 4, 1/2" holes"). The other set of cross flow tests used plates with 8, 1/8" (0.318 cm) holes (referred to as cross flow, 8, 1/8" holes). In this way, the flow pattern could be changed by simply changing plates. To complete the cross flow technique, four 0.72" (1.83 cm) diameter holes were drilled in the side of the channel opposite from the inlet lines. In this way, the flow pattern described in Figure 6-2 was obtained. Two photographs of the actual test section are shown in Figure 8. These show the cross flow set-up and resulting flow pattern, with no steam, for the 8, 1/8" holes configuration. Finally the spillover flow was done by simply plugging the four bypass slots and injecting the water into the upper plenum. The water then accumulates until it "spills over" the channel extension into the simulated fuel bundle, as indicated in Figure 6-3.

Figure 6

INLET WATER INJECTION METHODS

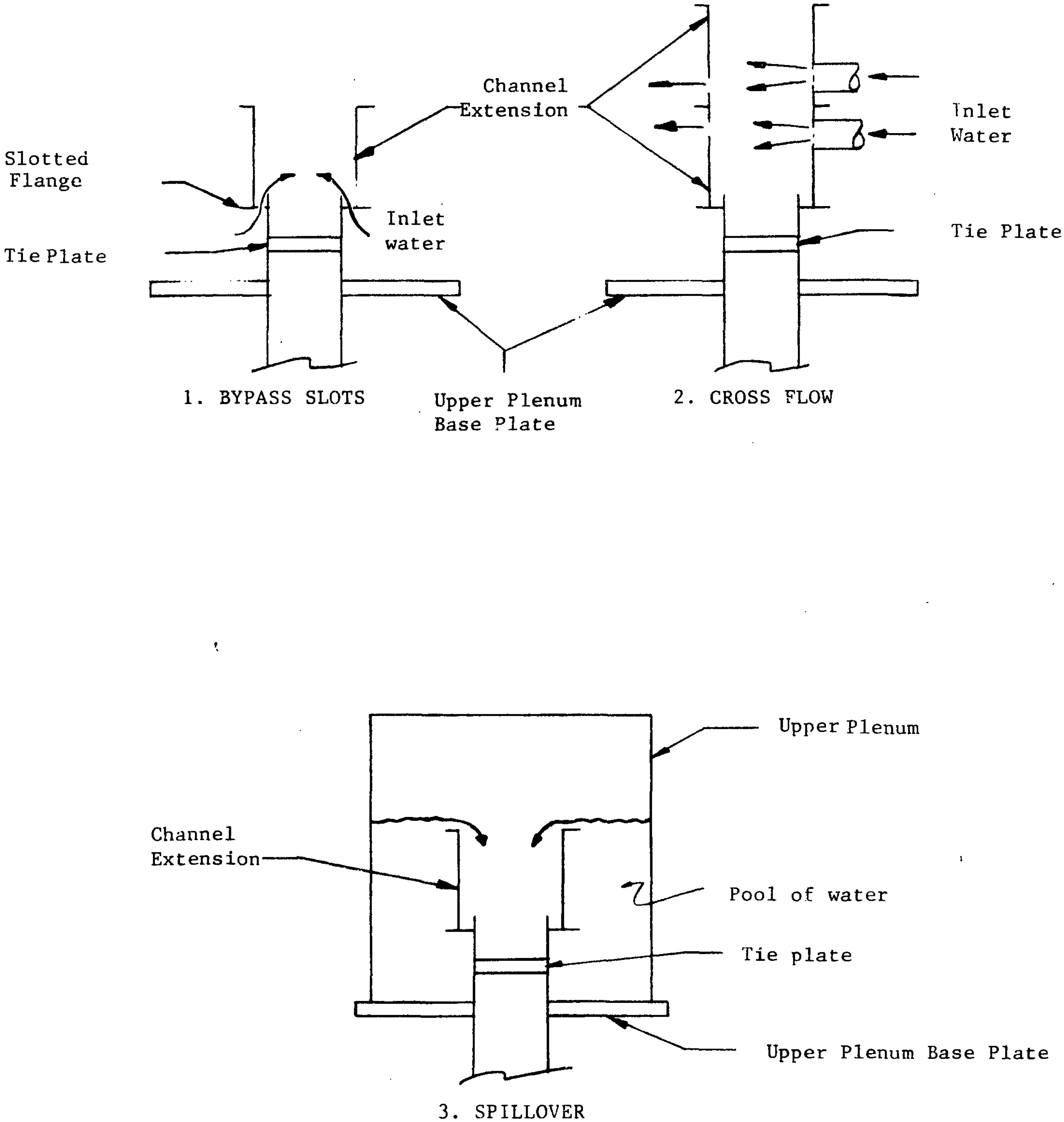
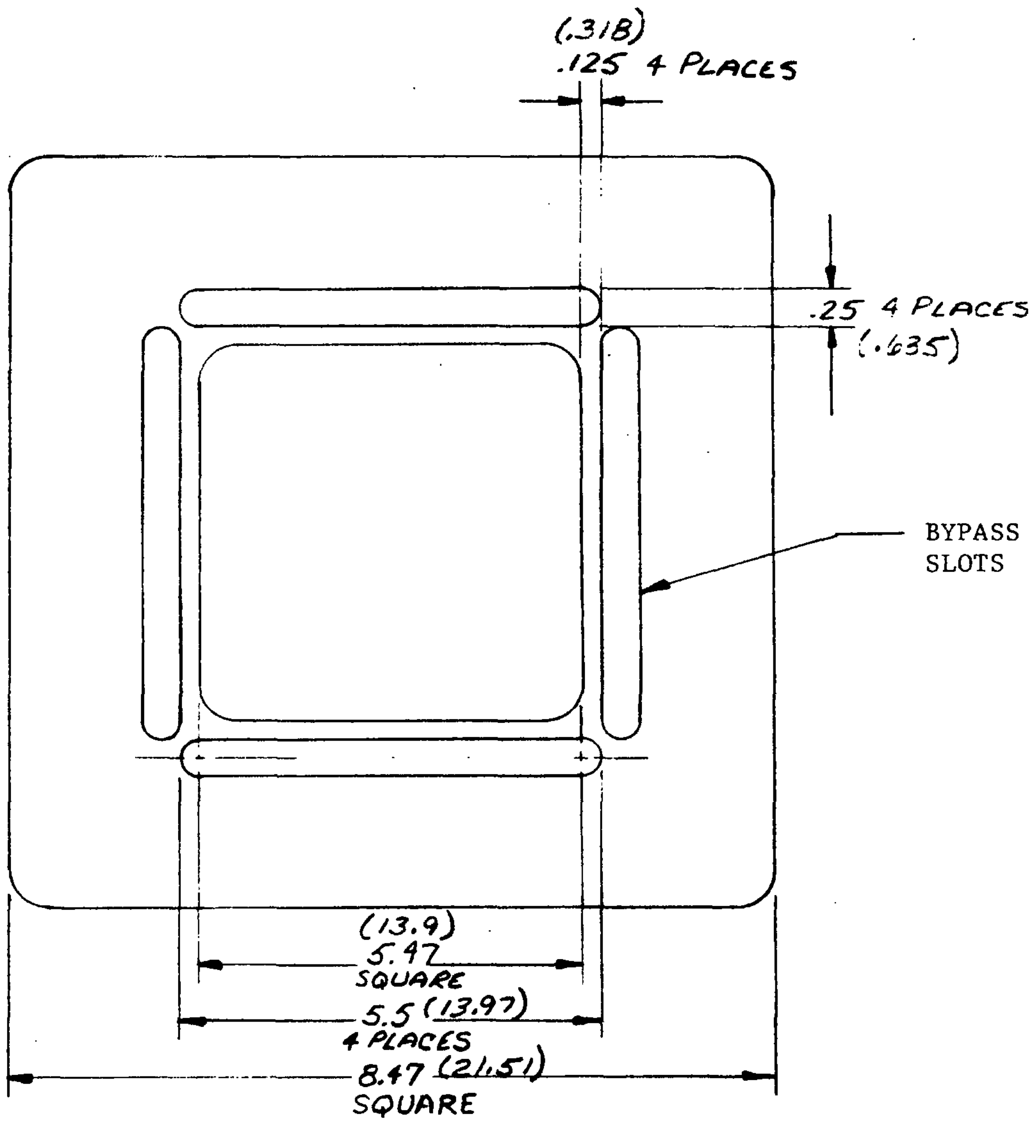


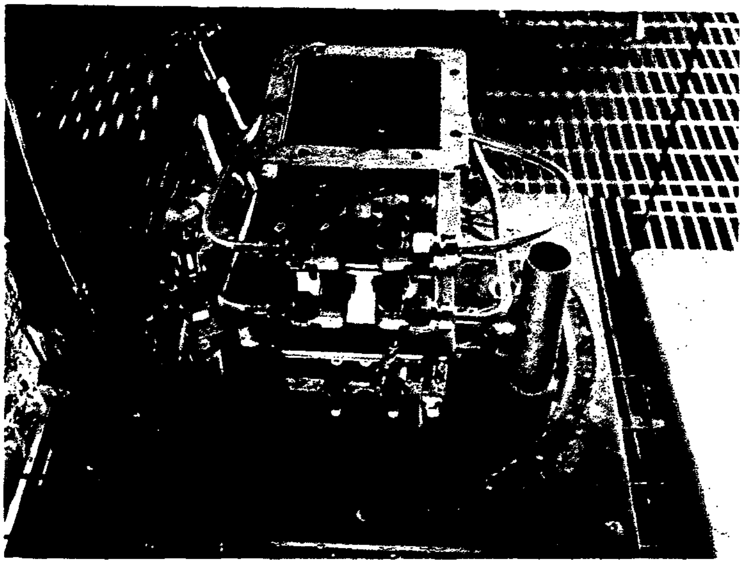
Figure 7

SLOTTED FLANGE

Dimensions in inches (centimeters)



1. UPPER PLENUM HARDWARE



2. TYPICAL FLOW PATTERN — NO STEAM

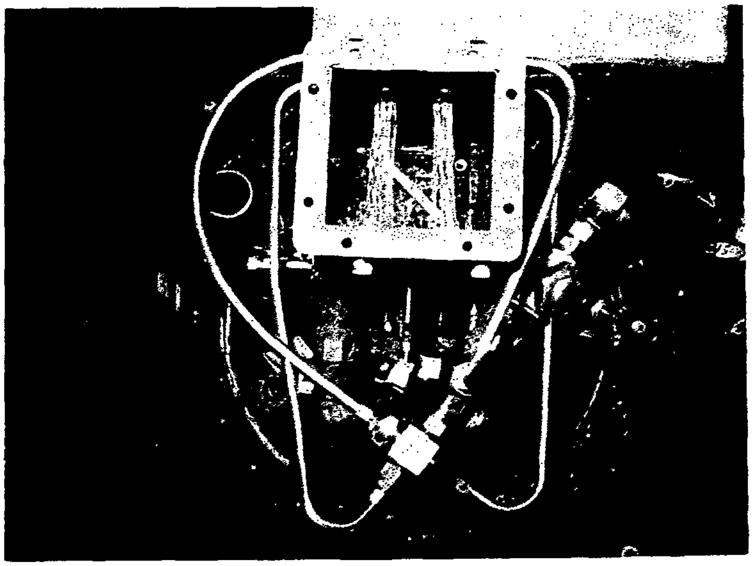


FIGURE 8 - ZERO POWER LOOP
CROSS FLOW, 8, 1/8" HOLES LIQUID INJECTION

In addition to the three types of inlet water injection, the basic geometry of the test section was changed by adding extensions to the channel. Two extensions, one 6" (15.24 cm) high and one 12" (30.48 cm) high, were used in these tests. The bypass tests were performed without an extension and with the 6" (15.24 cm) and the 12" (30.48 cm) extensions. Spillover tests were performed with the 6" (15.24 cm) and 12" (30.48 cm) extensions and cross flow tests were done only with the 12" (30.48 cm) extension.

Three methods of injecting steam into the test section were also tested. These are referred to as the capped sparger, the clarinet sparger, and the lower tie plate sparger and are shown schematically in Figures 9-1, 9-2 and 9-3 respectively. The capped sparger was a 2" (5.08 cm) pipe, 8" (20.32 cm) long which had four slots cut around its circumference and then was capped with a welded plate. To accomodate this sparger, the center 4x4 array of simulated rods was approximately 8.5" (21.6 cm) shorter than the rest of the rods. The clarinet sparger was a 1-1/2" (3.81 cm) pipe with its end flared out, similar to the bell of a clarinet. Again, the center 4x4 array of rods was 8-1/2" (21.6 cm) shorter to accomodate the clarinet sparger. Finally, the lower tie plate sparger was fabricated using a standard production lower tie plate nose piece which has approximately the same flow area as the upper tie plate. A pipe was welded to the bottom of this nose piece and the center sixteen fuel rods were lengthened to the same dimension as the other rods so that the steam entering the nose piece would be distributed to the fuel bundle through the lower tie plate.

The other major geometric variable changed was the configuration of the simulated fuel bundle. The following configurations were tested:

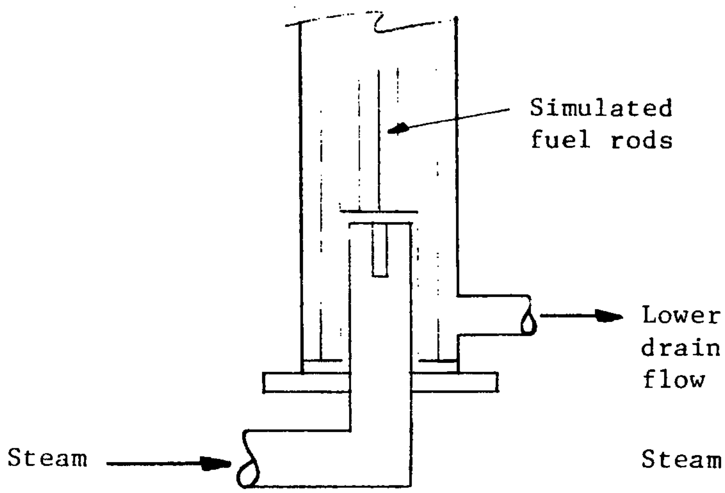
1. Full 8x8 bundle of rods with tie plate and two spacers.
2. Full 8x8 bundle with two spacers but no tie plate.
3. Tie plate only, no bundle.
4. Full 8x8 bundle with tie plate but no spacers.

These tests were performed to determine how each piece of hardware affected the CCFL results.

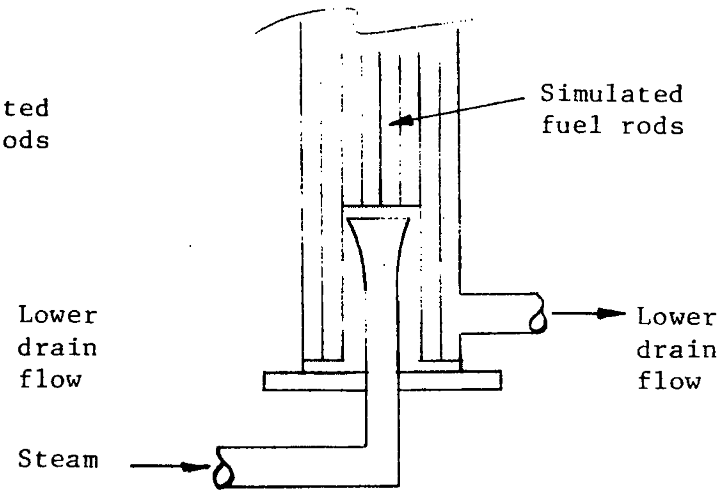
Table 1 is a complete tabulation of the tests which were run, showing how the different parameters were varied to achieve the specified objectives. A detailed list of each test run is included in Appendix B.

Figure 9

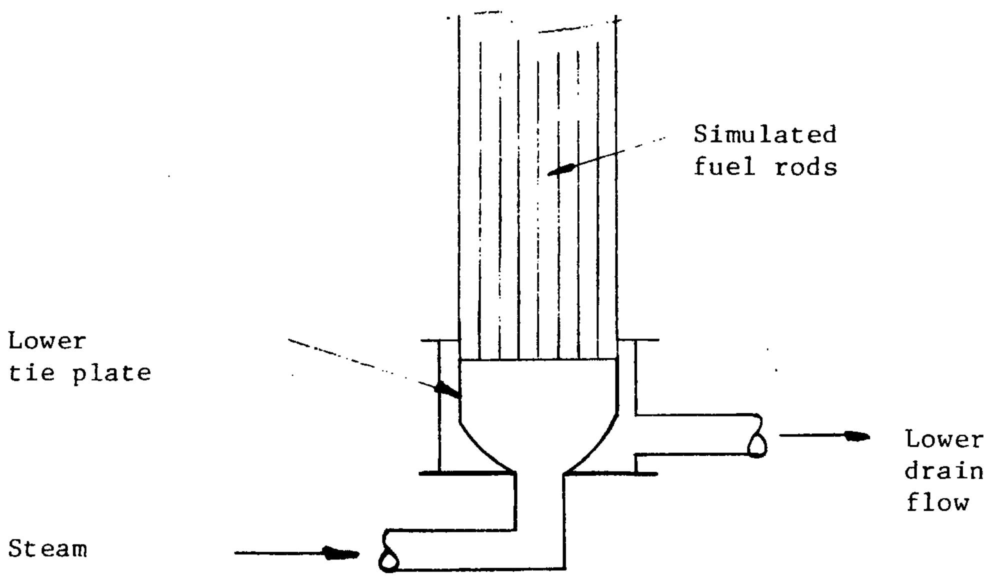
STEAM INJECTION METHODS



1. Capped Sparger



2. Clarinet Sparger



3. Lower Tie Plate Sparger

TABLE 1A

OBJECTIVE	TEST PERFORMED TO ACCOMPLISH THIS PURPOSE/OBJECTIVE Basic Geometry	Type of Test*
1. Establishment of a saturated CCFL data base.	No Extension	1
2. Obtain data for wide range of subcoolings and liquid flow rates.	6", 12" Extension	2
3. Determine effect of liquid injection method.	6", 12" Extension Cross Flow	1, 2, 3, 4
4. Determine effect of steam injection method.	6", 12" Extension Cross Flow	5, 6, 7, 8, 9, 10, 11, 12, 13
5. Determine temperature distribution in tie plate pool.	6", 12" Extension Cross Flow	1, 2, 3, 4
6. Evaluate subcooled CCFL models proposed by Tien (4) and Wallis, et. al. (1).	6", 12" Extension Cross Flow	1, 2, 3, 4
7. Develop a subcooled CCFL model.	6", 12" Extension Cross Flow	1 - 13
8. Evaluate CCFL characteristics of bundle components.	6", 12" Extension Cross Flow	5, 9, 12, 13

*See Table 1B

1 Spray Temperature, °F

2 Spray Flow, GPM

TABLE 1B

TEST MATRIX

Basic Geometry	No Extension	6" Extension							12" Extension			Cross Flow		
°F[1] / GPM[2]	200.	100.	120.	140.	160.	180.	200.	Tran-sient	100.	200.	Tran-sient	100.	120.	200.
5.		2	2	2	2	2	2	2	1,2			3,4		3
8.		2	2	2	2	2	2	2	2	2				
9.	1 *	2	2		2	2	2,1,9	2						
10.		2	2	2	2	2	2	2	1,2,6 7,8	2,8		1,3,4,5,6,7,8 10,11,12,13	5	3,4,5,13
12.									2	2		5		
15.								1	2,6,8		2,1	3,4,5,6,8,10, 11,12,13	5	3,5,8,11, 12,13
16.	1					2	2,1,9							

* <u>TYPE OF TEST</u>

1 - Spillover with Capped Steam Sparger
2 - Bypass Slots with Capped Steam Sparger
3 - 4 Open ½" Lines with Capped Steam Sparger
4 - 4 Plates with 8, 1/8" Holes with Capped Steam Sparger
5 - 4 Plates with 8, 1/8" Holes with Clarinet Steam Sparger
6 - Bypass Slots with Clarinet Steam Sparger
7 - Spillover with Clarinet Steam Sparger
8 - Bypass Slots with Lower Tie Plate Steam Sparger
9 - 8X8 Bundle, No Tie Plate with Capped Steam Sparger, Spillover.
10 - 8X8 Bundle with Tie Plate But No Spacers. 4 Plates with 8, 1/8" Holes with Capped Steam Sparger.
11 - Tie Plate Only, 4 Plates with 8, 1/8" Holes, with Capped Steam Sparger
12 - Tie Plate Only, 4 Plates with 8, 1/8" Holes, with Clarinet Sparger
13 - 8X8 Bundle with No Spacers, 4 Plates with 8, 1/8" Holes, with Clarinet Sparger

5.0 ANALYTICAL MODELS AND CORRELATIONS

5.1 Saturated CCFL

CCFL studies in recent years have been primarily concerned with saturated steam/water mixtures or air/water mixtures. Wallis (2) has suggested that saturated CCFL can be correlated by an equation of the form

$$\dot{j}_g^{*\,1/2} + m\, j_f^{*\,1/2} = C \qquad (1)$$

where

$$\dot{j}_g^{*} = \dot{j}_g \rho_g^{1/2} [g D (\rho_f - \rho_g)]^{-1/2}$$
$$j_f^{*} = \dot{j}_f \rho_f^{1/2} [g D (\rho_f - \rho_g)]^{-1/2} \qquad (2)$$

and

$$\dot{j}_g = \frac{\dot{M}_g}{A \rho_g}$$
$$\dot{j}_f = \frac{\dot{M}_f}{A \rho_f} \qquad (3)$$

and m and C are constants. This type of correlation has adequately correlated saturated CCFL data from small dimension geometries (2, 1). However, in a later paper describing a series of hanging film experiments (i.e., where $j_f = 0$; $j_g = j_g^*$), Wallis and Makkenchery (5) suggest that saturated CCFL data can be better correlated by using the Kutatelaze number (5)

$$K = \frac{\dot{j}_g \rho_g^{1/2}}{[g \sigma (\rho_f - \rho_g)]^{1/4}} \qquad (4)$$

The Kutateladze number is a dimensionless term describing the balance between the inertial, buoyancy and surface tension forces. This suggests that two dimensionless terms defined as

$$K_f \equiv \frac{\dot{j}_f \rho_f^{1/2}}{[g \sigma (\rho_f - \rho_g)]^{1/4}} \qquad a.$$

$$K_g \equiv \frac{\dot{j}_g \rho_g^{1/2}}{[g \sigma (\rho_f - \rho_g)]^{1/4}} \qquad b. \qquad (5)$$

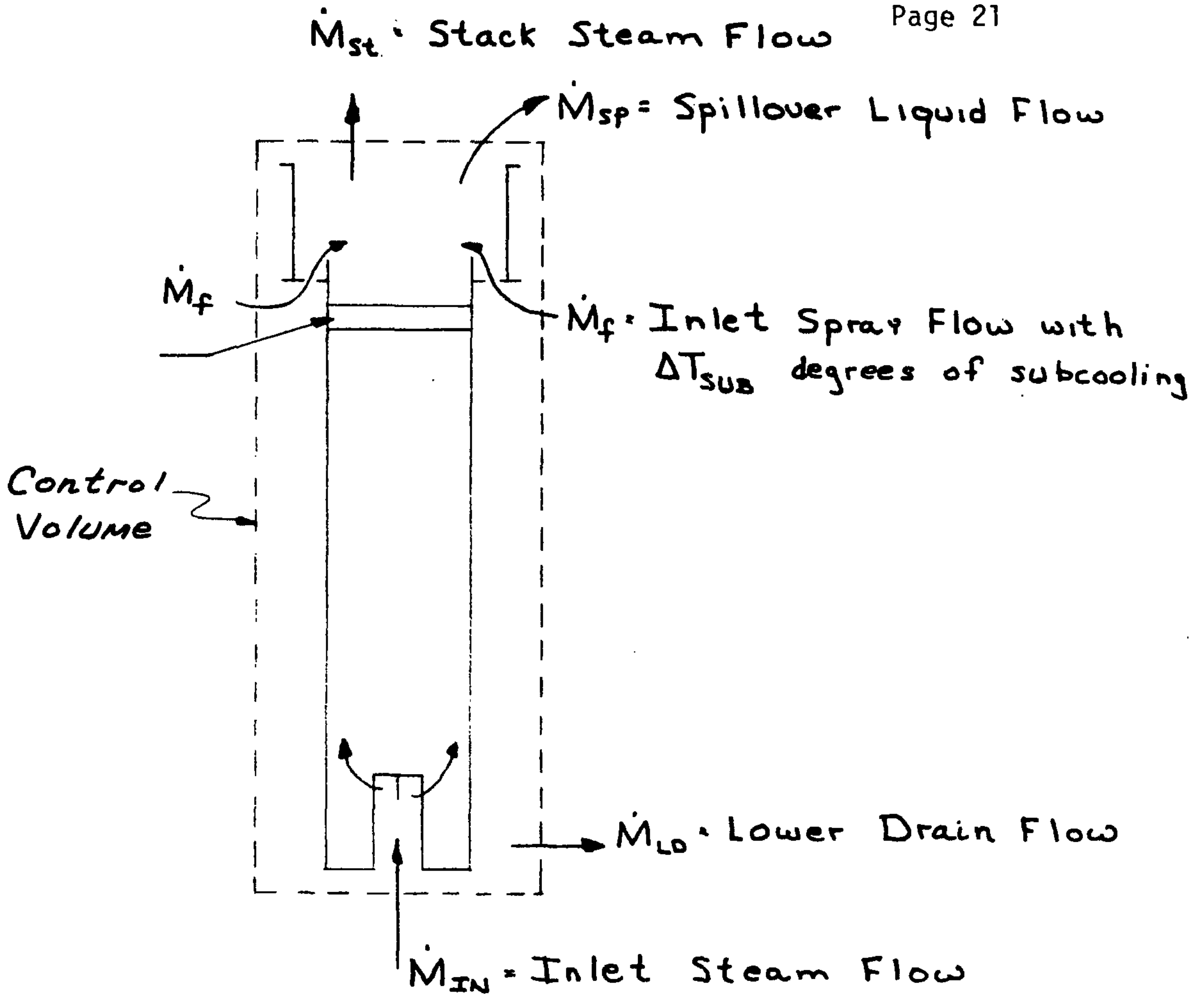
may be used to examine CCFL data.

5.2 Subcooled CCFL

The effect of subcooled liquid injected into the test section will be to decrease, by condensation, the steam flow in that region. The steam flow that can be condensed by a given flow of subcooled water, $\dot{M}_f$, with ΔT_{sub} degrees of subcooling, is given by

$$\dot{M}_{IN_c} = \frac{\dot{M}_f C_p \Delta T_{SUB}}{h_{fg}} \tag{6}$$

Equation 6 is derived for the control volume shown in Figure 10, for the case when the liquid leaving the control volume is assumed saturated. In the presentation of data which follows, equation 6 has been plotted to indicate this critical steam flow for each test.



MASS AND ENERGY BALANCE ON CONTROL VOLUME

1. MASS BALANCE

$$\dot{M}_{LD} + \dot{M}_{sp} + \dot{M}_{St} = \dot{M}_{IN} + \dot{M}_f$$

But, for complete condensation,

$$\dot{M}_{St} = 0$$

$$\therefore \quad \dot{M}_{LD} + \dot{M}_{sp} = \dot{M}_{IN} + \dot{M}_f$$

2. ENERGY BALANCE – Assume $\dot{M}_{sp}$ and $\dot{M}_{LD}$ are saturated. Then,

$$\dot{M}_f h_{sub} + \dot{M}_{IN} h_g = (\dot{M}_{IN} + \dot{M}_f) h_f$$

$$\therefore \dot{M}_f (h_f - h_{sub}) = \dot{M}_{IN} (h_g - h_f)$$

But,

$$h_f - h_{sub} = C_p \Delta T_{sub}$$

$$\therefore \quad \dot{M}_f C_p \Delta T_{sub} = \dot{M}_{IN} h_{fg}$$

$$\boxed{\dot{M}_{IN} = \dot{M}_{IN_c} = \frac{\dot{M}_f C_p \Delta T_{sub}}{h_{fg}}}$$

TEST SECTION CONTROL VOLUME

Figure 10

6.0 TEST RESULTS

6.1 Phase 1, Saturated CCFL

As stated in Section 2.0, the CCFL test program was divided into two phases. Phase 1 tests were conducted with ~205°F (96.1°C) water with no channel extension, spillover liquid injection and the capped steam sparger. The remaining tests in the experimental matrix comprised Phase 2. All of the data presented in the following sections has been tabulated in Appendix C.

The Phase 1 data are plotted in Figure 11. These data are the basis for comparing the effects of subcooling determined in the Phase 2 tests.

6.2 Phase 2, Subcooled CCFL

6.2.1 Transient Tests

As discussed in Section 4.2, several transient subcooled tests were performed to aid in the understanding of the CCFL behavior with subcooled liquid injection. In these tests, steam was first injected into the test section and then the spray flow was started. The spray flow was initially 205°F (96.1°C) and then decreased to 100°F (37.8°C). It was intended that in this way it would be possible to associate a specific tie plate temperature with the occurrence of CCFL breakdown. However, it was found that because of the speed of the transient once breakdown occurs, it is very difficult to pinpoint a specific temperature at which breakdown occurred. It was possible, however, to determine, by observation, if the test section was limited for given values of $\dot{M}_f$ and $\dot{M}_{IN}$. Thus, in Figure 12, the data from the transient tests have been plotted as $\dot{M}_f$ vs $\dot{M}_{IN}$, with an indication that CCFL was or was not observed at those values. All of the "no CCFL observed" data points are to the left of the complete condensation line given by equation (6), and all but seven of the "CCFL observed" points are to the right of this line. Thus, the transient tests demonstrate that CCFL breakdown (i.e., when CCFL ceases to exist in the test section) did not occur until $\dot{M}_{IN}$ was less than $\dot{M}_{IN_c}$, the critical steam flow defined by equation (6).

6.2.2 Steady State Tests

Phase 2 was further divided into three tasks. Task 1 consisted of tests to determine the basic subcooling characteristics of the BWR upper fuel region and to determine the effects of flow rate and subcooling. The

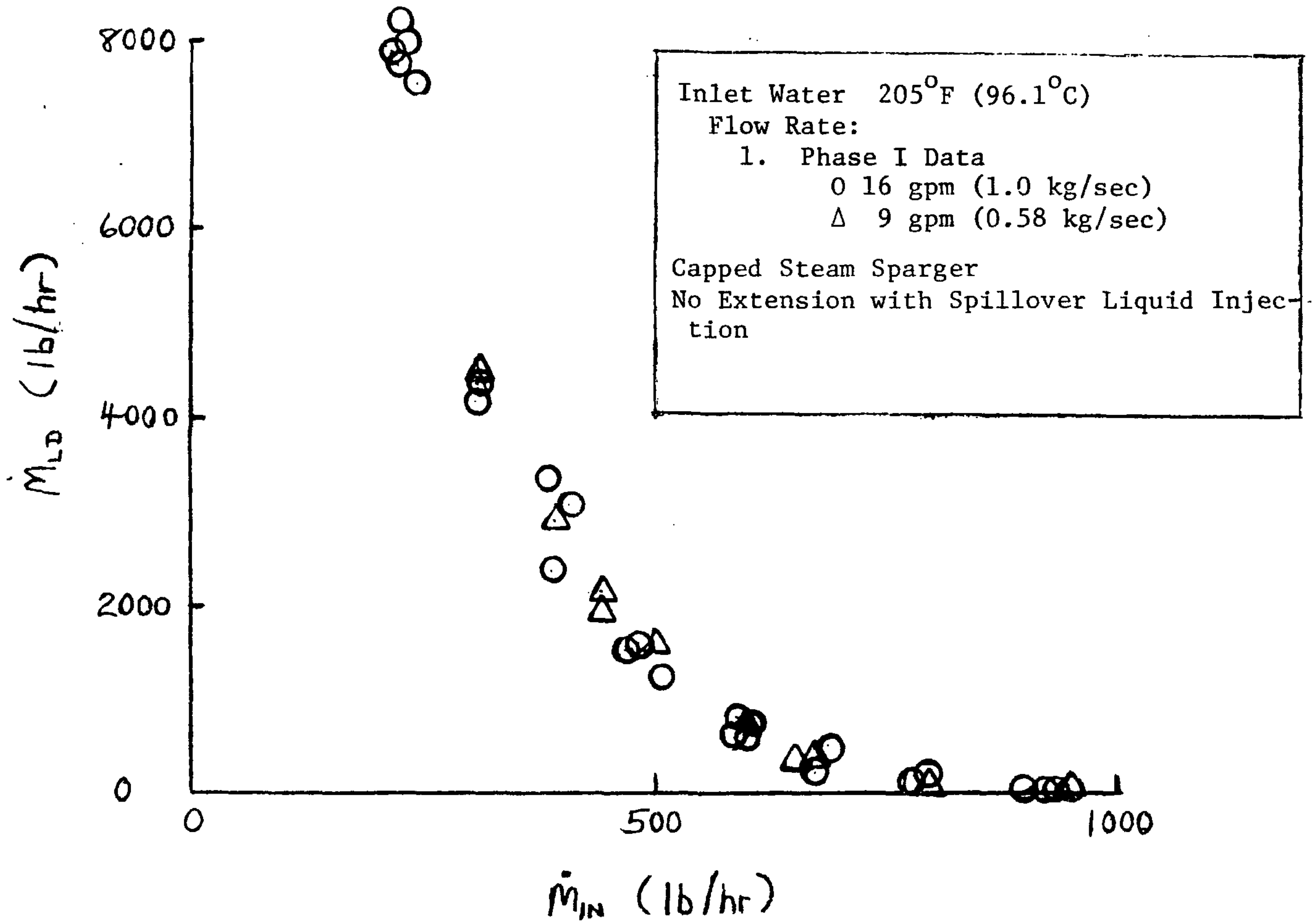


Figure 11 - Phase I Data

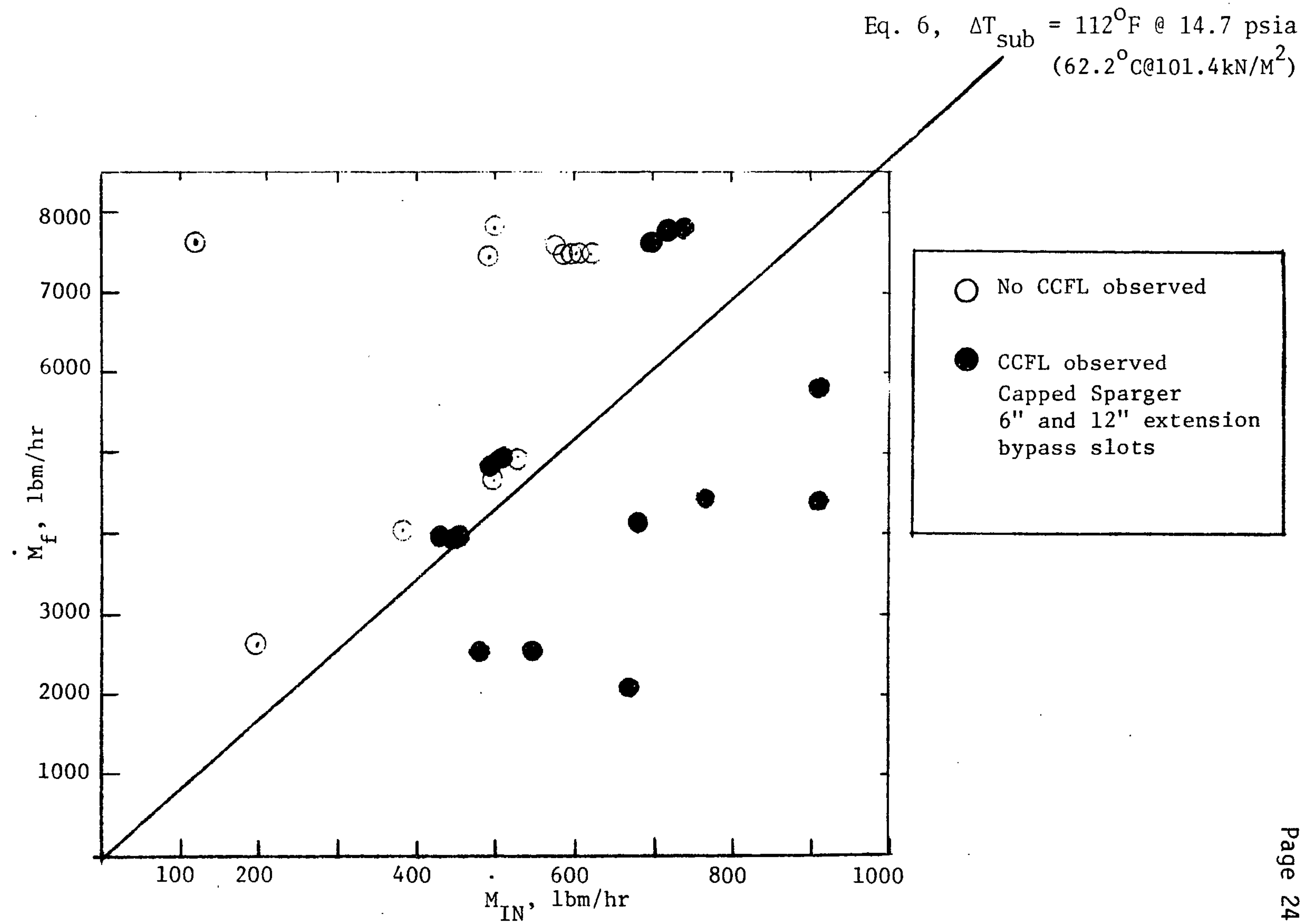


Figure 12 - Data From Transient Tests

purpose of Task 2 was to determine the effects, if any, of the liquid injection method. Task 3 was designed to evaluate the effect of the steam injection method. The Task 1 tests were all done with the 6" or 12" channel extensions with the bypass slots and the capped steam sparger. In Task 2, the inlet water injection method was varied from the bypass slots to spillover and cross flow. Task 3 tests were done with bypass slots and cross flow with the three different steam spargers.

6.2.2.1 Task 1 - Subcooled CCFL Characteristics

Figures 13 and 14 show typical $\dot{M}_{LD}$ vs $\dot{M}_{IN}$ results for representative Phase 2, Task 1 tests. Also plotted in these figures are two of the tie plate pool temperatures (see Section 3.1). These particular thermocouples were located directly above (TC #11) and below (TC #14) the tie plate in a vertical line with each other. It was found during these tests, that the temperatures in the tie plate pool were fairly uniform. That is, for a given steam flow, there was only a small temperature variation among the ten tie plate pool thermocouples. (c.f. Section 6.2.2.1.2 for further discussion of the temperature distribution in the tie plate pool). Thus, the two thermocouples plotted are representative of the tie plate pool temperature data. Equation (6) has also been plotted to indicate the $\dot{M}_{IN_C}$.

The data shown in Figures 13 and 14 indicate that as the inlet steam flow is increased, CCFL occurs when the inlet liquid can no longer condense all of the vapor flow (i.e., when eq. (6) is satisfied). This is evidenced by the sudden drop in $\dot{M}_{LD}$ and the increase in the tie plate temperatures for $\dot{M}_{IN} > \dot{M}_{IN_C}$. The $\dot{M}_{LD}$ data which indicate this transition are indicated by a ⊕ on Figures 13 and 14. The tie plate temperatures indicate that the flow through the tie plate remains subcooled until $\dot{M}_{IN} \geq \dot{M}_{IN_C}$. Once this occurs, the tie plate becomes limited and the pool temperatures jump to saturation. The increase in $\dot{M}_{LD}$ as the steam flow is increased, for $\dot{M}_{IN} < \dot{M}_{IN_C}$, is due to condensation of that steam flow by the subcooled water. Similarly, as the steam flow is decreased, the $\dot{M}_{LD}$ data coincide with the saturated $\dot{M}_{LD}$ data until $\dot{M}_{IN} < \dot{M}_{IN_C}$, at which point they begin to deviate upward from the saturated data until no limiting is observed. This transition is accompanied by a simultaneous drop in the tie plate temperatures.

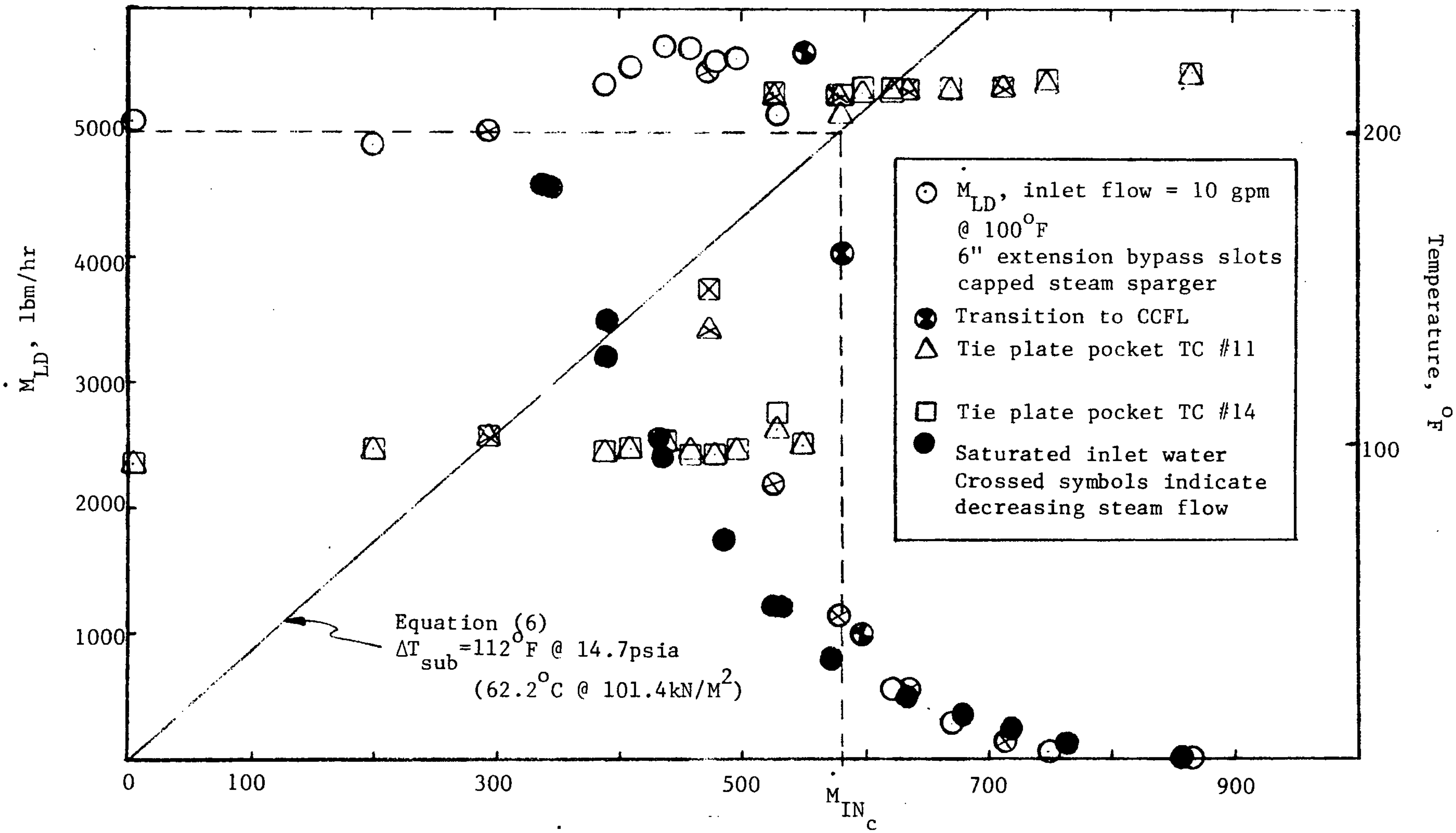


Figure 13 - Basic Subcooled CCFL Characteristics

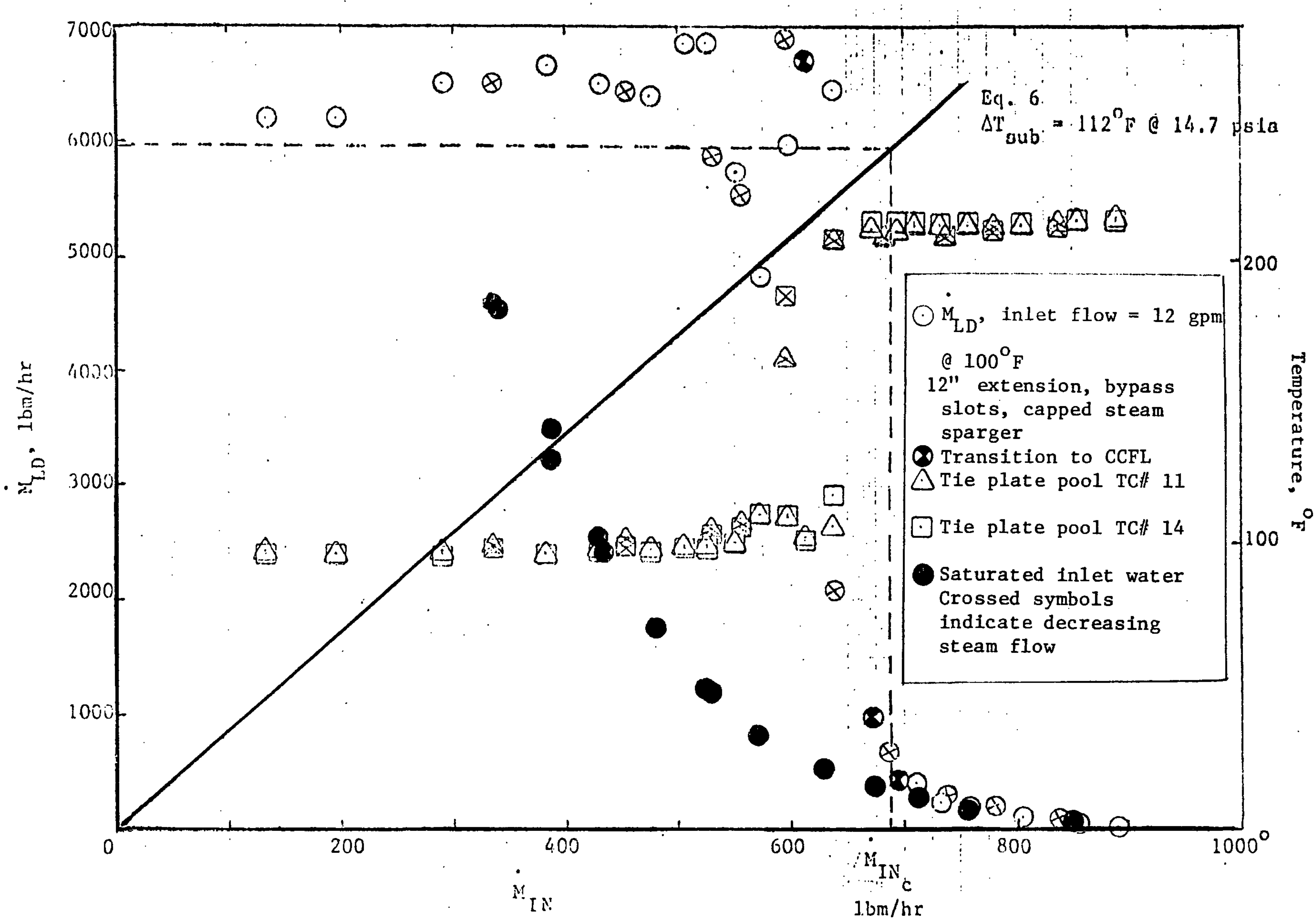


FIGURE 14 - Subcooled CCFL Characteristics

6.2.2.1.1 Effect of Liquid Inlet Flow Rate and Amount of Subcooling

The upper plenum pressure (see Fig. 3) changed from one data point to the next. This was caused by steam in the upper plenum, which pressurized the system to a value equal to atmospheric pressure plus the pressure drop across the stack steam orifice. To eliminate the effect of system pressure from the results, the $\dot{M}_{LD}$ vs $\dot{M}_{IN}$ data can be non-dimensionalized with the parameters given by equations (5a) and (5b). For comparison purposes, the portion of the $\dot{M}_{LD}$ vs $\dot{M}_{IN}$ curve of interest is the CCFL portion. That is, that portion of the curve in which the sub-cooled results are essentially the same as a saturated CCFL test. Thus, in the dimensionless plots which follow, only those data points that are in CCFL have been included.

Figures 15 and 16 indicate the effect of increasing the inlet liquid flow rate. Figure 16 is in the non-dimensional form discussed above. Saturated CCFL data for identical flow geometries are also included on Figure 15. Referring to Figure 15, the 5 gpm (0.315 kg/sec) data (for increasing steam flow) lie below the saturated data by approximately 250 lb/hr, for a given steam flow, in the transition region from full flow through the tie plate to complete limiting. For the 5 gpm (0.315 kg/sec) case, there is no noticeable difference between the increasing and decreasing steam flow data. The 8 and 10 gpm data (for increasing steam flow) tend to coincide and be approximately 250 lb/hr above the saturated data in the same transition region. As the steam flow is decreased, the 8 and 10 gpm data compare well with the increasing steam flow data, until $\dot{M}_{IN} < \dot{M}_{IN_C}$. At this point, the data tend to be parallel to the saturated data until the steam flow is low enough to allow CCFL breakdown. At this point the data rise above the saturated data until full flow through the tie plate is achieved. Figure 16 indicates that since the data do not collapse to a single curve, these differences cannot be attributed to system pressure.

Figures 17 and 18 indicate the effect of varying the amount of subcooling. The same data are plotted on each figure with Figure 18 in non-dimensional form. The critical steam flows predicted by equation 6 are also indicated on Figure 17. These data indicate that for increasing steam flow, the initiation of CCFL is delayed until $\dot{M}_{IN} > \dot{M}_{IN_C}$. Once the inlet steam flow is greater than the condensing capability of the subcooled liquid flow, i.e. $\dot{M}_{IN} > \dot{M}_{IN_C}$, both figures show that the data compare well with the near-saturated

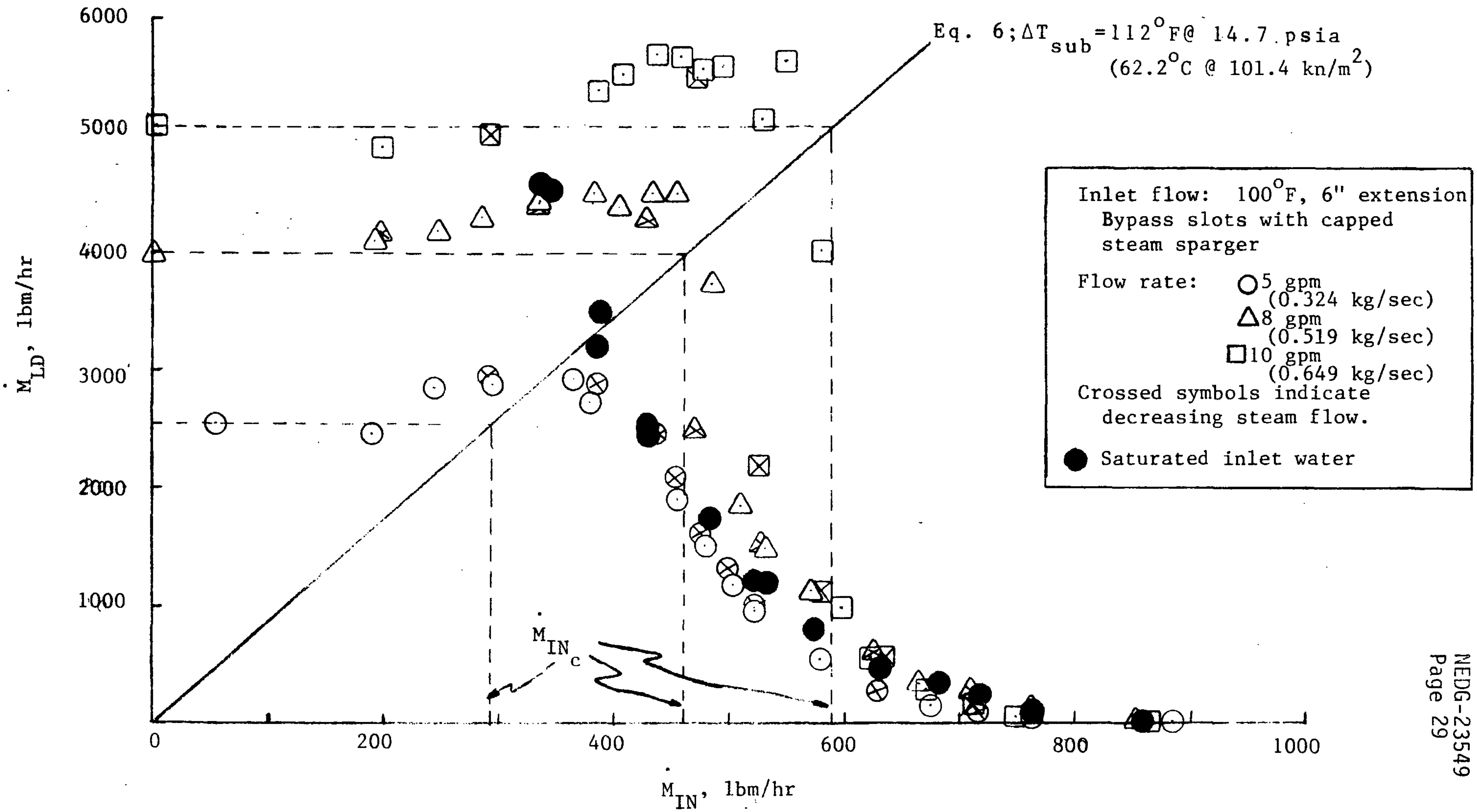


Figure 15 - Effect of Flow Rate

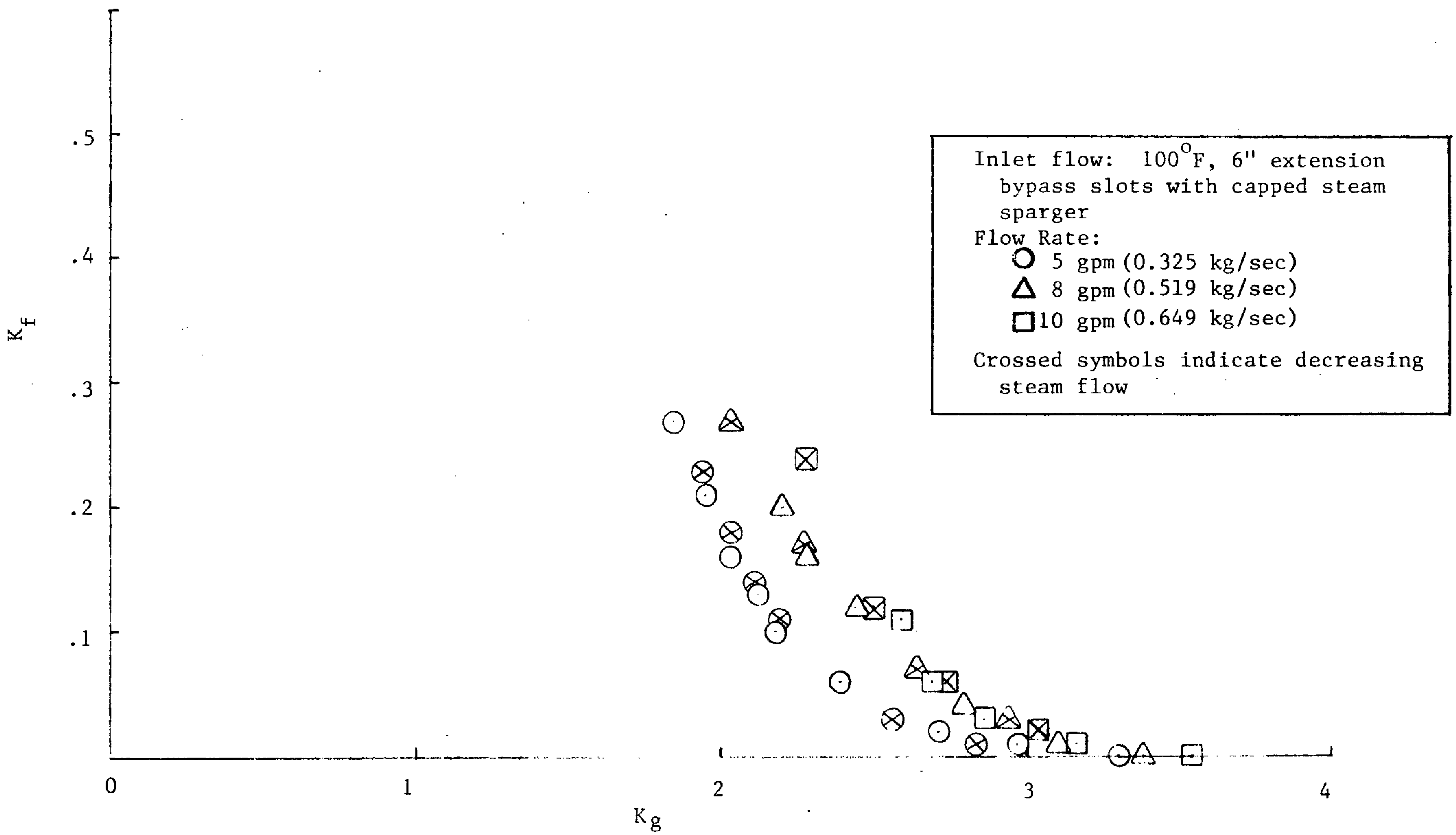


Figure 16 - Effect of Flow Rate

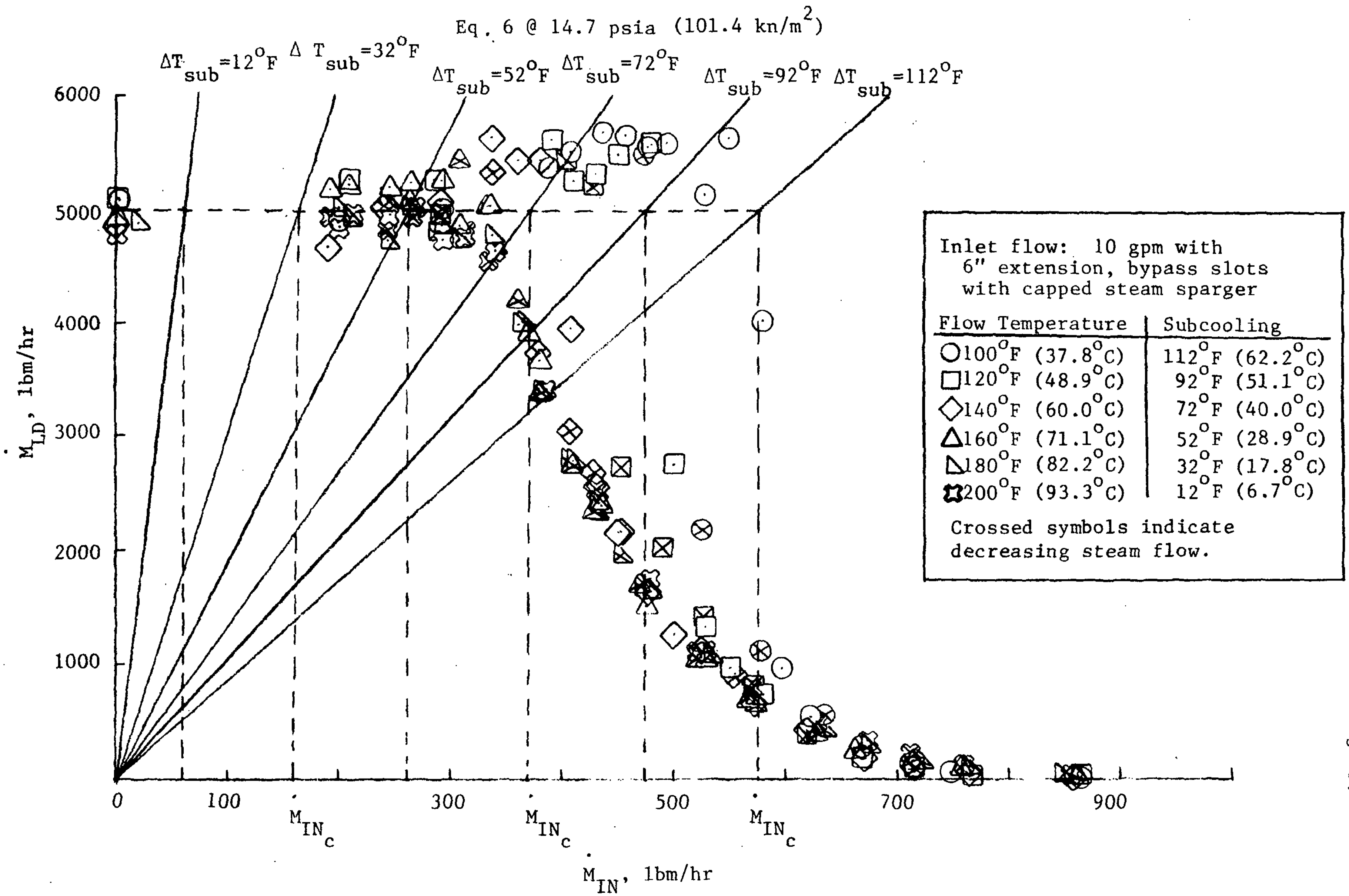


Figure 17 - Effect of Subcooling

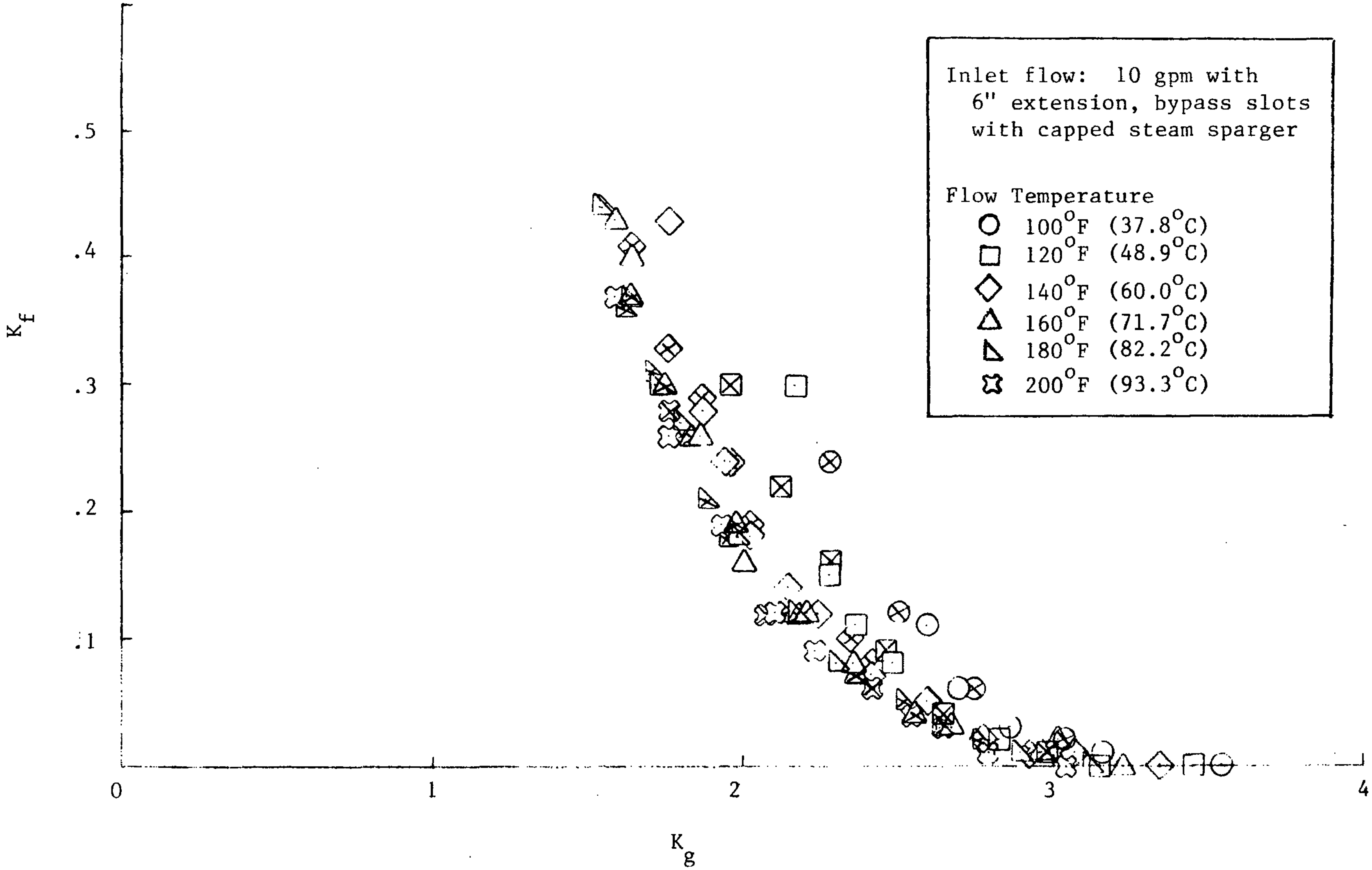


Figure 18 - Effect of Subcooling

inlet water test (the 200°F case). As the steam flow is decreased, CCFL occurs until $\dot{M}_{IN} < \dot{M}_{IN_C}$.

For those cases, on Figures 17 and 18, where the critical steam flow is less than that required to cause CCFL with saturated inlet water (such as the ΔT_{sub} = 52°F case), the data are essentially the same as the saturated (the 200°F case) CCFL test. Thus, in those cases, the subcooled liquid has no effect on the CCFL characteristics.

The data presented here indicate that the liquid flow rate and amount of subcooling do affect the CCFL characteristics. The effect of flow rate has only been identified here and it is possible that future studies may wish to address this effect in greater detail. The effect of the amount of subcooling can be adequately predicted with equation 6 and the idealization that for $\dot{M}_{IN} > \dot{M}_{IN_C}$, the CCFL characteristics are the same as those for cases with saturated inlet water.

6.2.2.1.2 <u>Temperature Distribution in the Tie Plate Pool</u>

Temperature data from the ten tie plate pool thermocouples (c.f. Figure 4) are plotted in Figure 19 for each of the liquid injection methods. The data plotted are for test runs with 100°F (37.8°C) inlet water and $\dot{M}_{IN}$ ~850 lb/hr (0.107 kg/sec), which in all cases is sufficient steam flow to cause CCFL. The saturation temperature for each case is indicated on the graphs and in all cases, except for the 8-1/8" holes cross flow case, the temperatures tend to be near the saturation temperature. Figure 19-B indicates that the 12" extension, spillover method results in the most uniform temperature in the tie plate pool. This is reasonable since this method places the incoming subcooled liquid nearly 14" (935.6 cm) above the tie plate. Similarly, the bypass slots method places the cold water nearest the tie plate, so that Figure 19-A indicates less uniform temperatures, but all are greater than 200°F (93.3°C). The cross flow methods (Figs. 19-C and 19-D) indicate fairly uniform temperatures with the exception of one or two thermocouples which vary by a few degrees from the majority of the data. In general, these results are evidence that the liquid injection method does affect the temperature distribution in the tie plate pool to the extent that the distribution tends to be more uniform if the water is injected at the top of the pool.

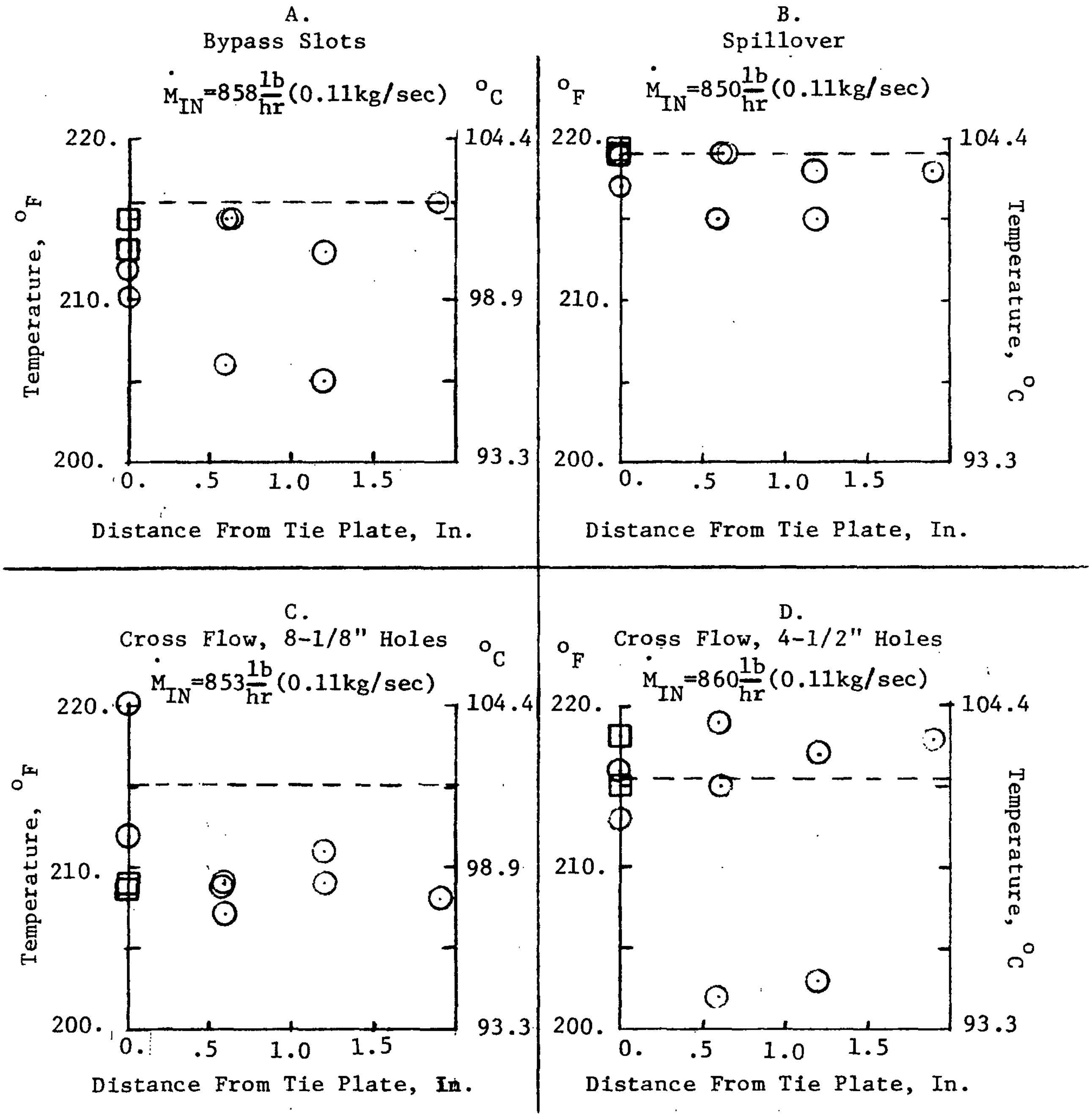
6.2.2.2 <u>Task 2 - Effect of Liquid Injection Geometry</u>

Task 2 data to investigate the effect of the liquid injection method are shown in Figure 20 and in dimensionless form in Figure 21. Figure 20 demonstrates that CCFL occurs when the condensing capacity is no longer sufficient for all of the steam, regardless of the liquid injection method. For $\dot{M}_{IN} > \dot{M}_{IN_C}$, there is a noticeable spread in the data. Using the 6" extension with bypass slots as the base case, two injection methods resulted in greater lower drain flow rates and two resulted in smaller drain flows. The 12" extension with bypass slots and the 4-1/2" holes cross flow method allow the greater drain flows. The smaller drain flows were obtained with the 12" extension with spillover and the 8-1/8" holes cross flow method. Referring to Figure 19, which shows the tie plate pool temperatures for each of these liquid injection techniques, graphs A and D show that thermocouples number 3 and 10 are both noticeably colder than the rest of the tie plate pool temperatures. This indicates that both the 12" extension with bypass slots and the 4-1/2" holes cross flow method produce similar flow patterns which may result in the greater $\dot{M}_{LD}$'s. However, even though the 12" extension with spillover and the 8-1/8" holes cross flow method result in very nearly the same $\dot{M}_{LD}$ data, their temperature distribution graphs, Figures 19-B and C, are not at all similar. Since Figure 21 indicates that the four sets of data do not collapse to a single curve when the effect of system pressure is removed, the data show that the different flow patterns of the liquid injection methods do affect the CCFL performance.

6.2.2.3 Task 3 - Effect of Steam Injection Geometry

The effect of varying the steam inlet geometry (Phase 2, Task 3) is shown in Figures 22 - 25. Figures 22 and 24 are for 10 gpm (0.63 kg/sec) inlet flow rate while Figures 23 and 25 are for 15 gpm (0.94 kg/sec) inlet flow. Figure 22 indicates again that CCFL occurs when the condensing capacity is insufficient for all the steam flow, regardless of the type of steam sparger used. However, in Figure 22, there is a considerable variation in the data for $\dot{M}_{IN} > \dot{M}_{IN_C}$. The clarinet and lower tie plate spargers allow much greater lower drain flows at the high steam flows. Figures 24 and 25 again indicate that the differences in the data cannot be attributed to the system pressure differences, because the data do not collapse to a single curve. The differences may be attributable to the effects of liquid entrainment in the steam flow and/or steam velocity distribution. Recent air/water CCFL tests by other experimenters using an air sparger very similar to the capped sparger, have shown that the design of the capped sparger can cause water to accumulate on top of the sparger so that the entrainment of liquid

All Cases: 10 gpm (0.63kg/sec) Spray Flow
12" (30.48 in) Extension with Capped Sparger
Spray Temp. = 100°F (37.8°C)
⊙ TC located above Tie Plate
⊡ TC located below Tie Plate
------Saturation Temperature



Temperatures in the Tie Plate Pool

Figure 19

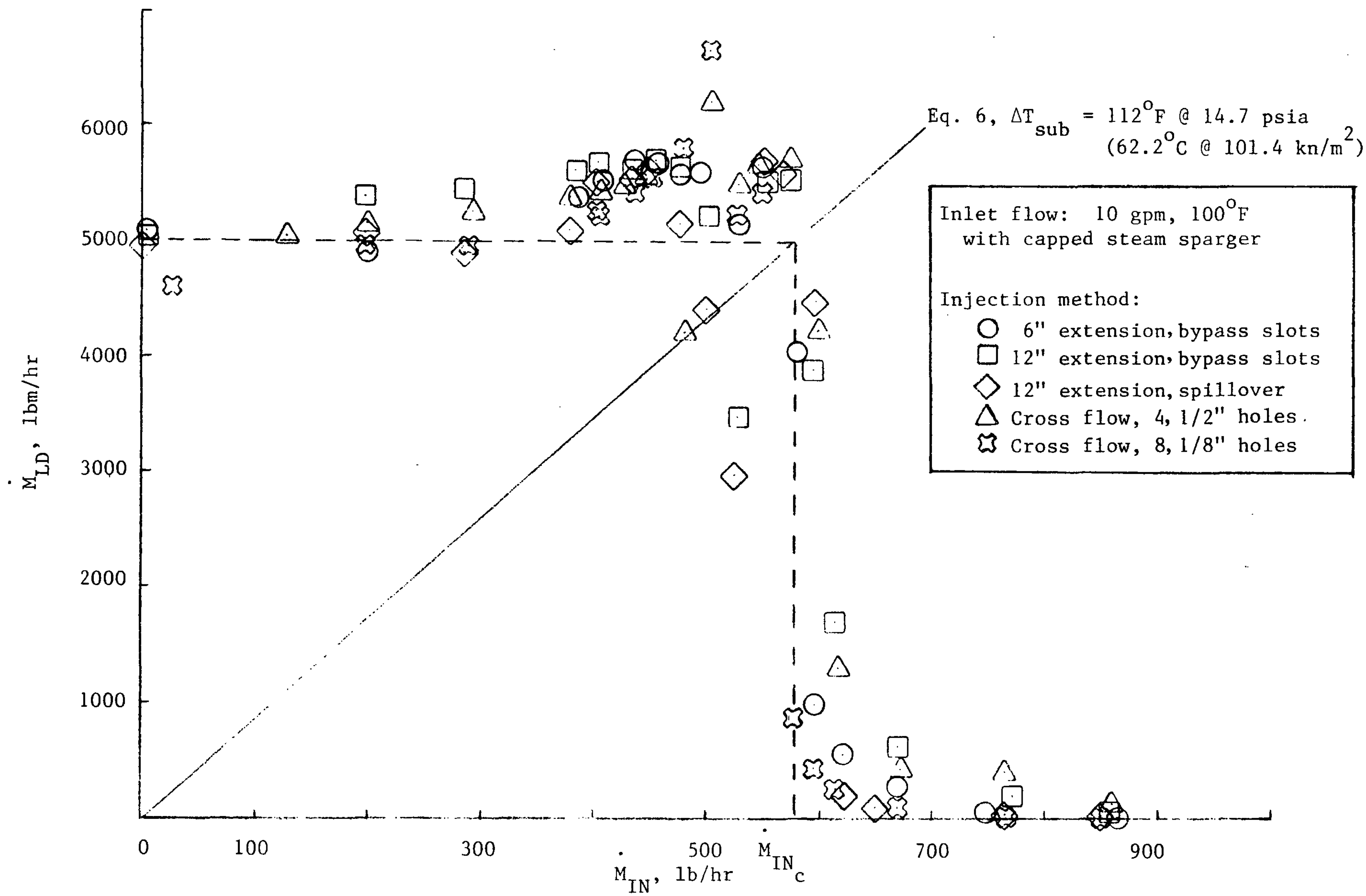


Figure 20 - Effect of Liquid Injection

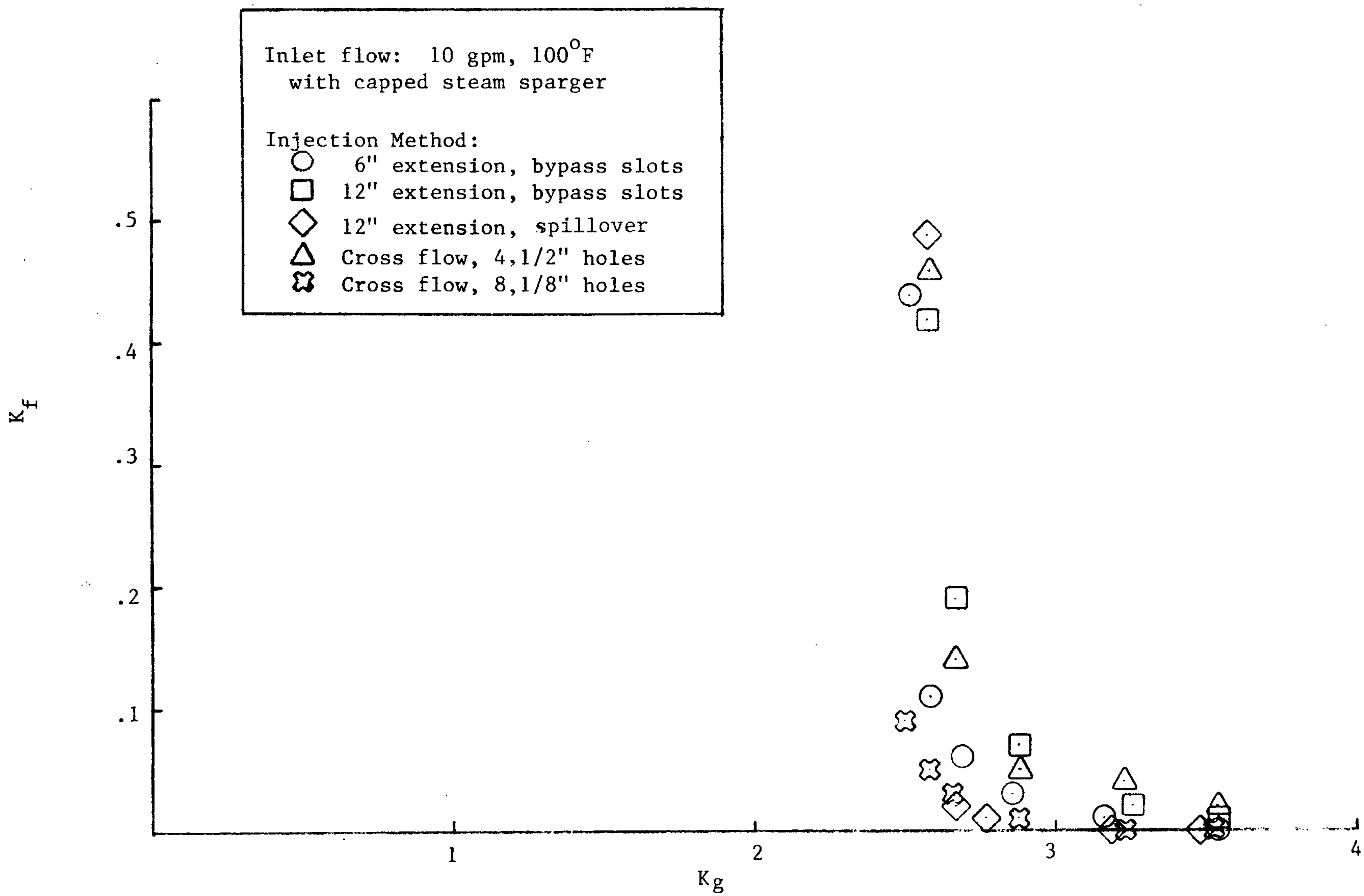


Figure 21 - Effect of Liquid Injection

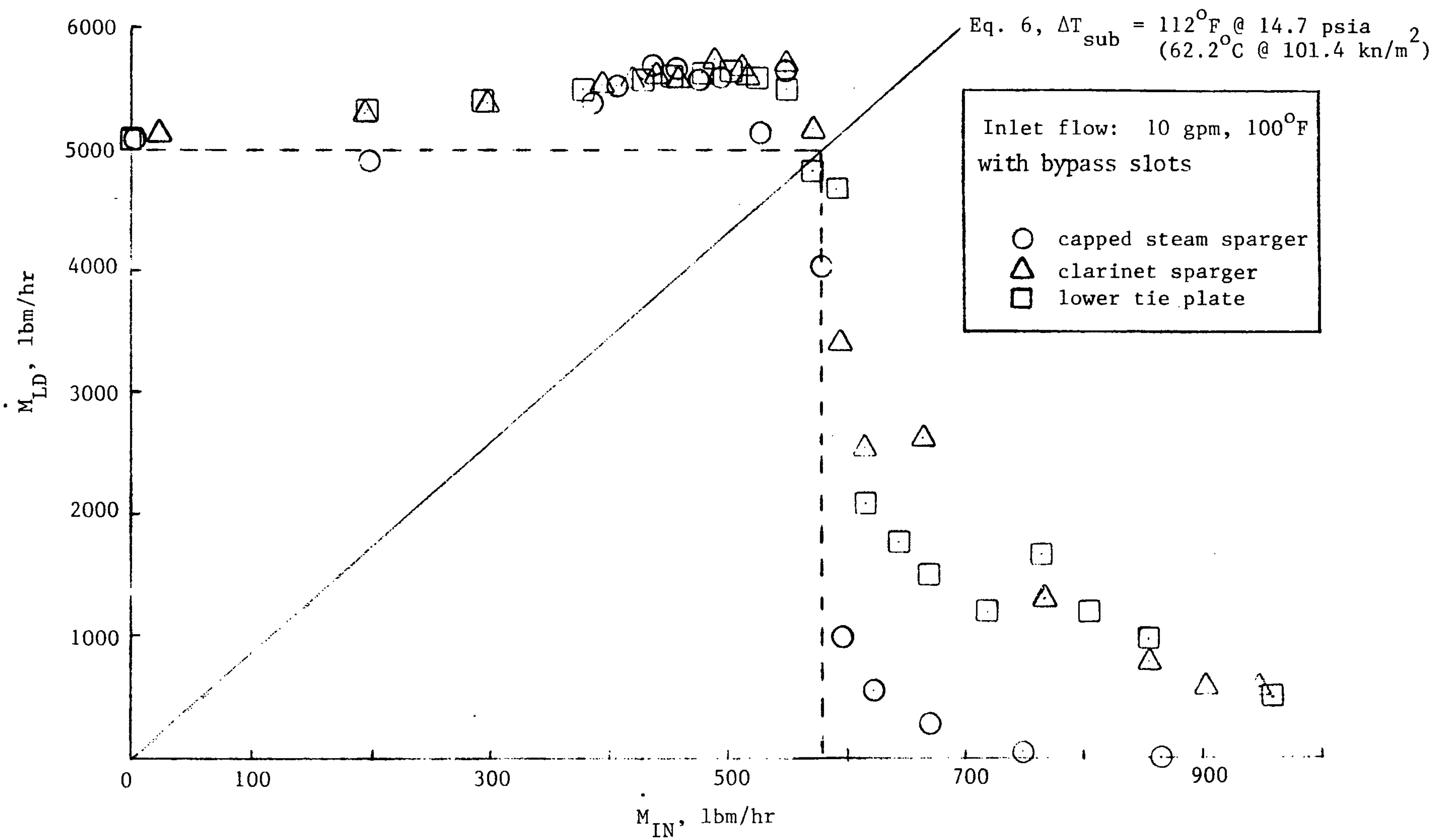


Figure 22 - Effect of Steam Injection

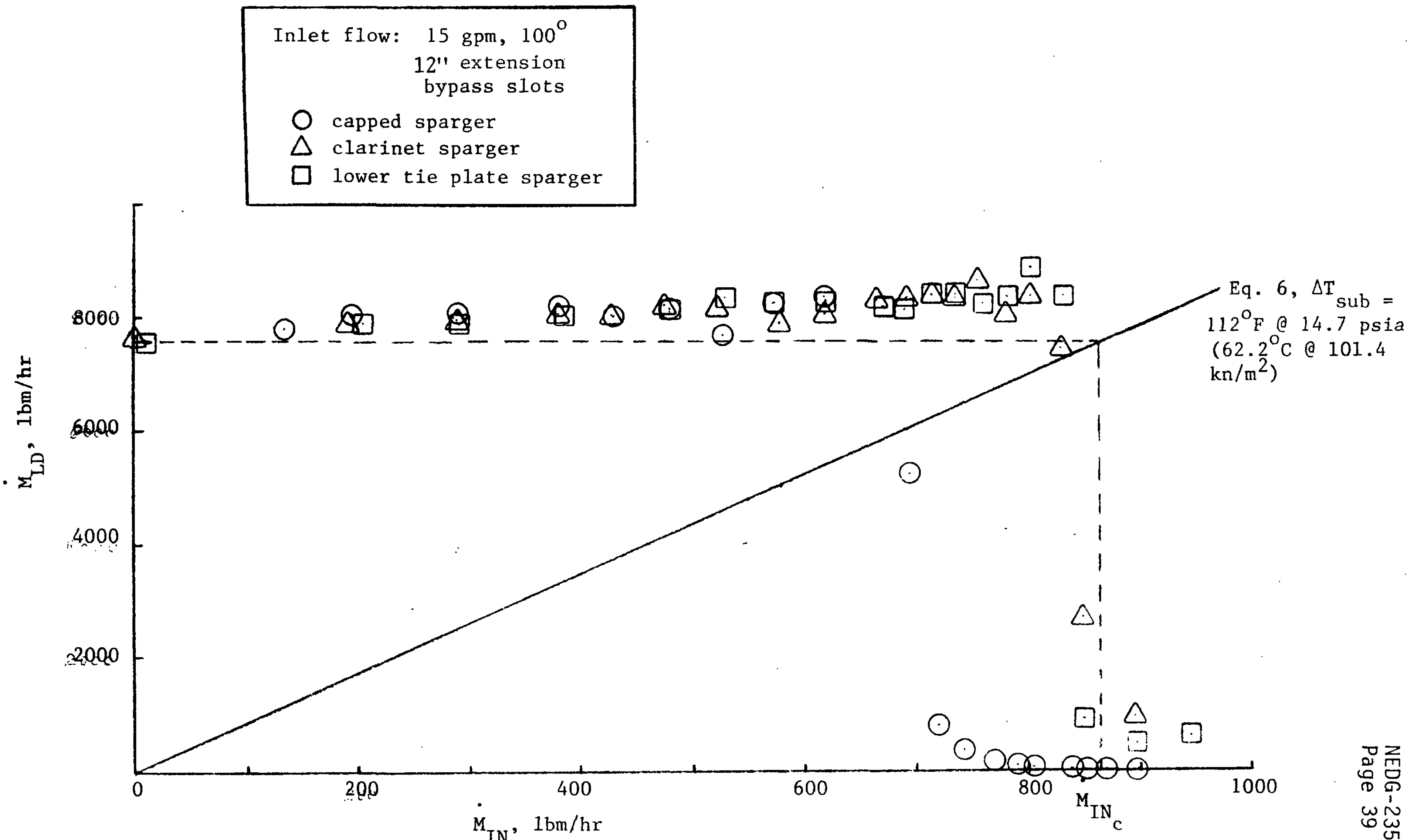


Figure 23 - Effect of Steam Injection

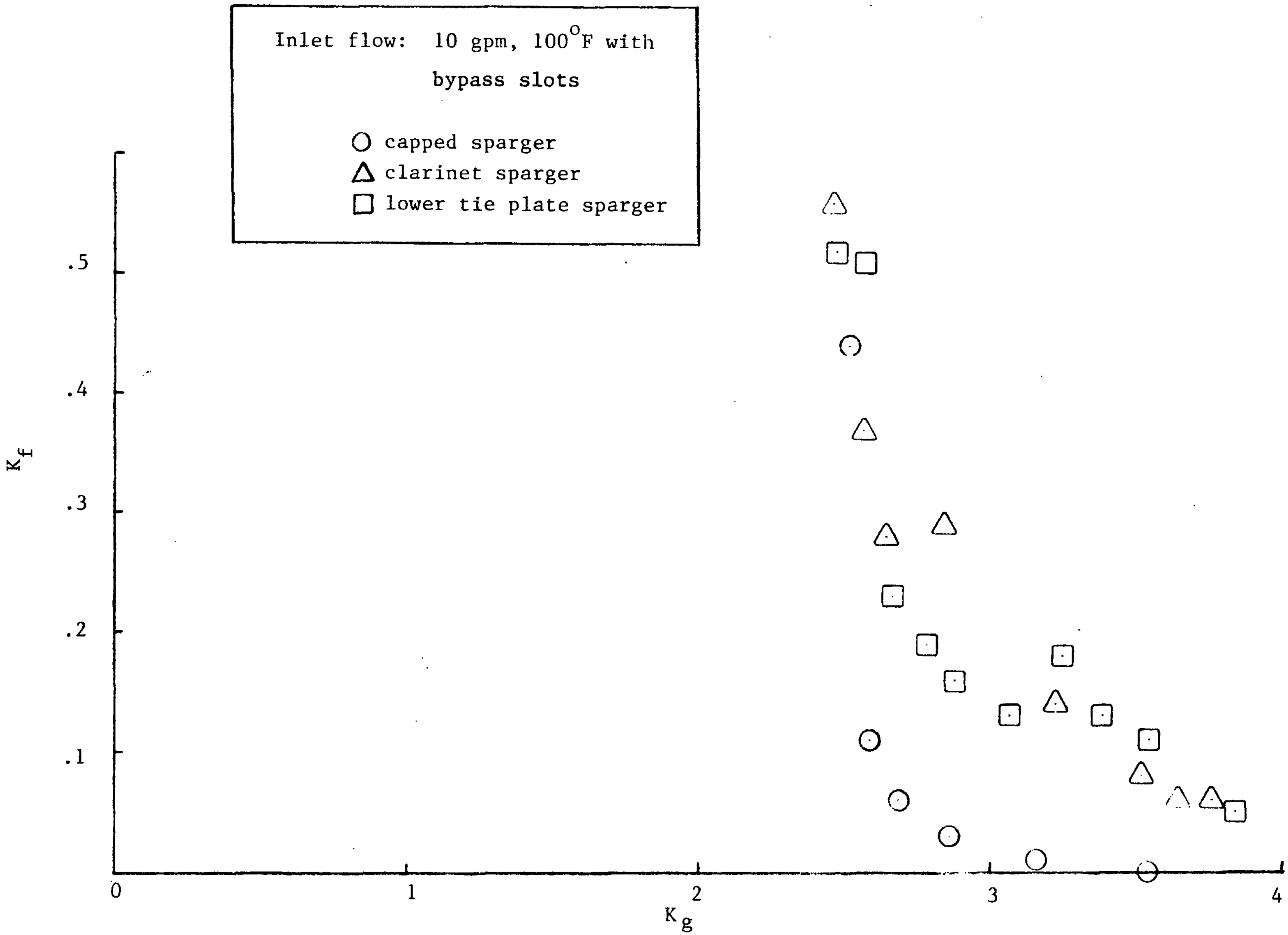


Figure 24 - Effect of Steam Injection

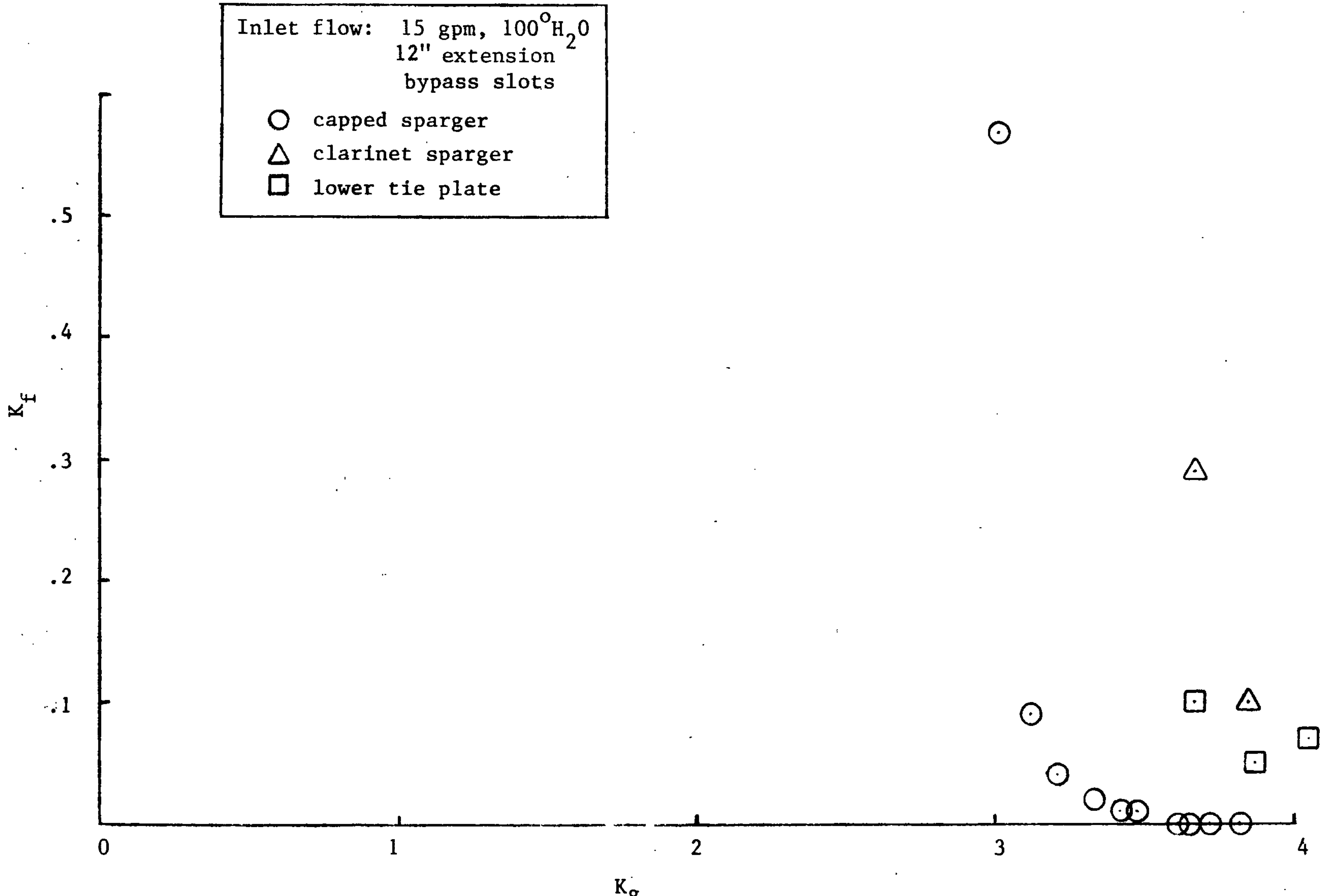


Figure 25 - Effect of Steam Injection

in the injected air is increased, thus increasing the density of the gas at the tie plate and decreasing the lower drain flow. It is also possible that these spargers produced a non-uniform steam distribution. If the steam tended to be concentrated near the center of the fuel channel, the liquid could fall down the perimeter of the channel without completely mixing with the steam, thus allowing greater lower drain flow for a given steam flow.

Figure 26 illustrates the anomalies of the data obtained with the capped steam sparger. Note that for the 10 and 12 gpm cases the $\dot{M}_{LD}$ data drops off for values of $\dot{M}_{IN}$ just less than $\dot{M}_{IN_C}$ (solid data points). The drop is especially evident in the 12 gpm data. Also, note that the 15 gpm data becomes limited at a steam flow much less than the $\dot{M}_{IN_C}$ predicted by the energy balance of equation (6). Thus, this behavior appears to be a function of the liquid injection rate. The drop in the $\dot{M}_{LD}$ values is relatively insignificant for the 10 gpm case, becomes more pronounced for the 12 gpm case and is dominant in the 15 gpm case such that the test section becomes limited at a steam inlet rate less than $\dot{M}_{IN_C}$. This type of behavior was not observed with either of the other steam spargers, leading to the conclusion that this behavior is caused by the design of the capped steam sparger.

The results of the Task 3 steam sparger investigation indicate that the design of the steam inlet and lower bundle geometry is very important in obtaining CCFL data. Each of the steam sparger designs, with the exception of the capped sparger as discussed above, verify that the condensing capacity given by equation (6) determine the onset of CCFL, for increasing steam flow. However, each design produces different results for $\dot{M}_{IN} > \dot{M}_{IN_C}$. In future CCFL testing, therefore, design of the steam inlet portion of the test section must be given careful consideration.

6.2.2.4 Effect of Bundle Components

The results of tests to evaluate the effects of the various bundle components are presented in Figure 27. These results indicate that the full bundle assembly is the most restrictive configuration of the test section. On an individual component basis, the results tend to indicate that the spacer may be the more limiting bundle component. However, it is important to note that the comparison in Figure 27 is made with tests with different liquid and steam injection methods. Thus, in view of the previous discussion of the effects of the steam and liquid injection methods, it is not possible to make a specific conclusion regarding the effects of the individual components of the bundle assembly.

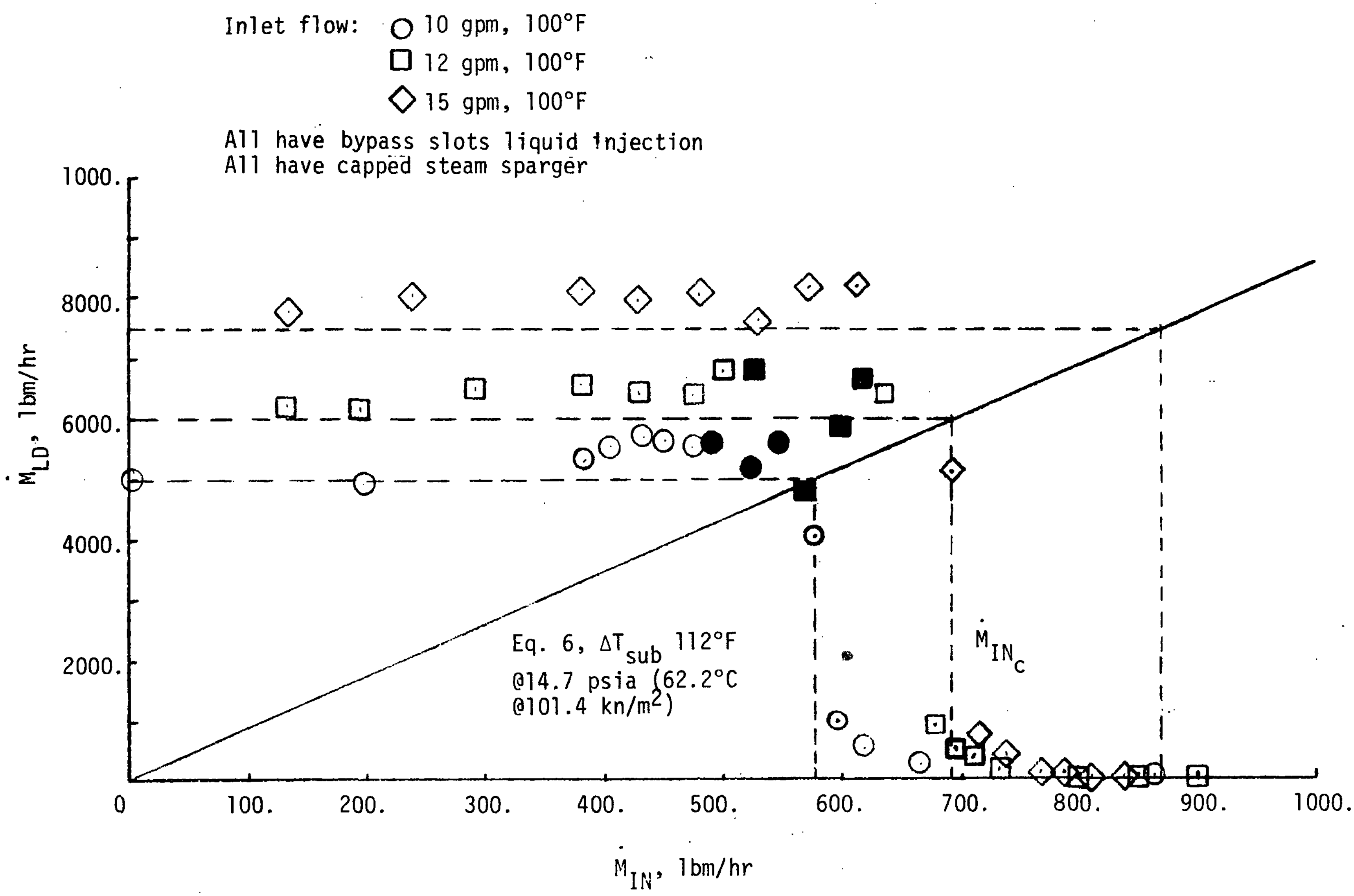


Figure 26 - Capped Sparger Data

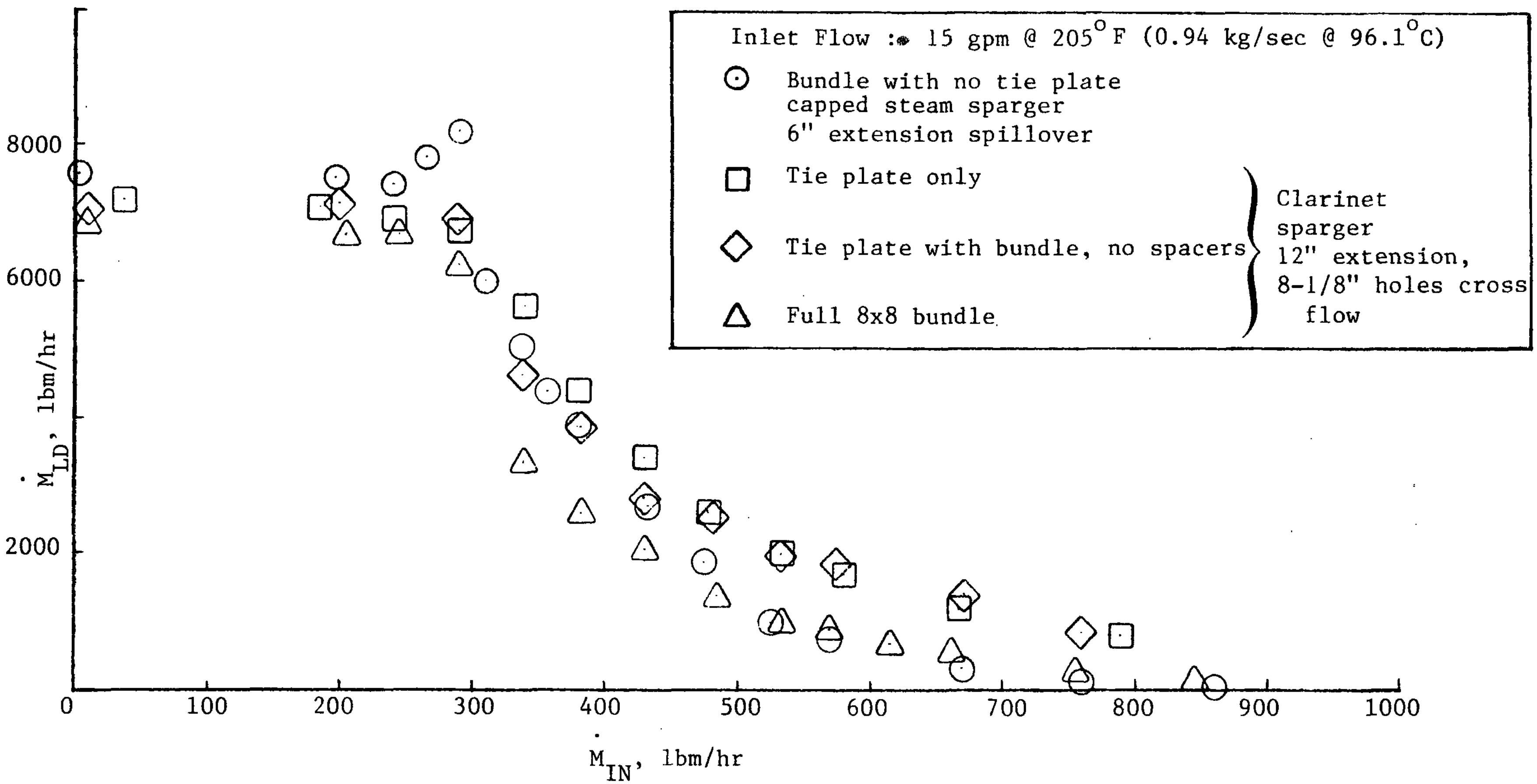


Figure 27 - Characteristics of Bundle Components

7.0 DISCUSSION

Work by Wallis, Crowley, and Block (1) and Tien (4) to describe and model subcooled CCFL behavior has been reported in the literature. This work also indicates that the effect of subcooling can be accounted for simply by determining the restriction steam flow as the inlet steam flow minus the steam condensed by the subcooled liquid downflow. The model proposed by Tien (4) applies a condensation efficiency factor, f, to the calculation of the restriction steam flow. Tien's model may be characterized by writing an effective dimensionless vapor flow, K_{ge}, as

$$K_{ge} = K_g - f K_f \left(\frac{C_p \Delta T_{SUB}}{h_{fg}}\right)\left(\frac{\rho_f}{\rho_g}\right)^{1/2} \qquad (7)$$

Referring to Figure 28, the curve A-B-C was generated using equation 7, with f = 1, to determine the steam flow. The curve indicated by the dashed lines, E-D-A-C-B-D-E, is the postulated plot of $\dot{M}_{LD}$ vs $\dot{M}_{IN}$, which would result from Tien's model as the steam flow is increased (E-D-A-C) and decreased (C-B-D-E). Tien assumes that the value of f remains constant as a function of steam flow. Thus, for any value of $f < 1$, this is equivalent to assuming that the condensation takes place below the tie plate, since the effect of condensation is to reduce the tie plate steam flow. The tie plate steam flow is thus less than $\dot{M}_{IN}$, even when $\dot{M}_{IN}$ is greater than $\dot{M}_{IN_C}$. The onset of CCFL is, therefore, offset by the maximum amount of steam which can be condensed.

The results of the present subcooled CCFL tests have been generalized in Figure 29 by plotting equation 6 with a typical saturated CCFL curve. The present tests indicate that for $\dot{M}_{IN} \leq \dot{M}_{IN_C}$, there will be zero steam flow through the tie plate because all of the incoming steam is condensed below the tie plate. As the steam flow is increased beyond $\dot{M}_{IN_C}$, the tie plate steam flow equals $\dot{M}_{IN}$ and the CCFL characteristics are essentially the same as a saturated inlet water test.

Two possible cases are diagrammed in Figure 29. For Case I, the tie plate will not be limited (i.e., no water builds up on the tie plate) because there is zero steam flow at the tie plate until $\dot{M}_{IN} > \dot{M}_{IN_C}$ (point A). As the steam flow is increased from point B to C, the tie plate is limited. Once this occurs, the pool of water which forms is saturated because the inlet water is being saturated by steam condensation. Thus, there is no subcooling

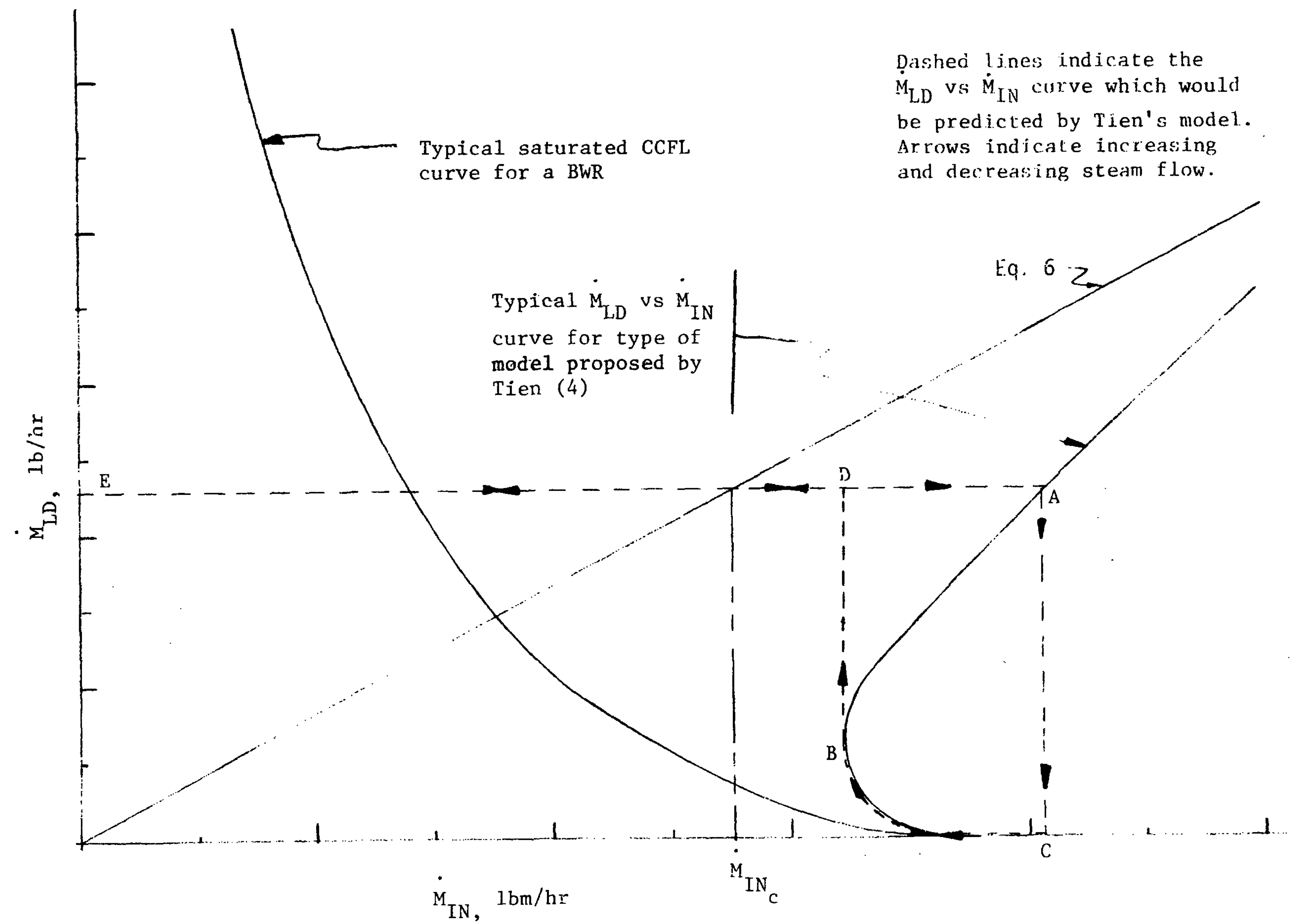
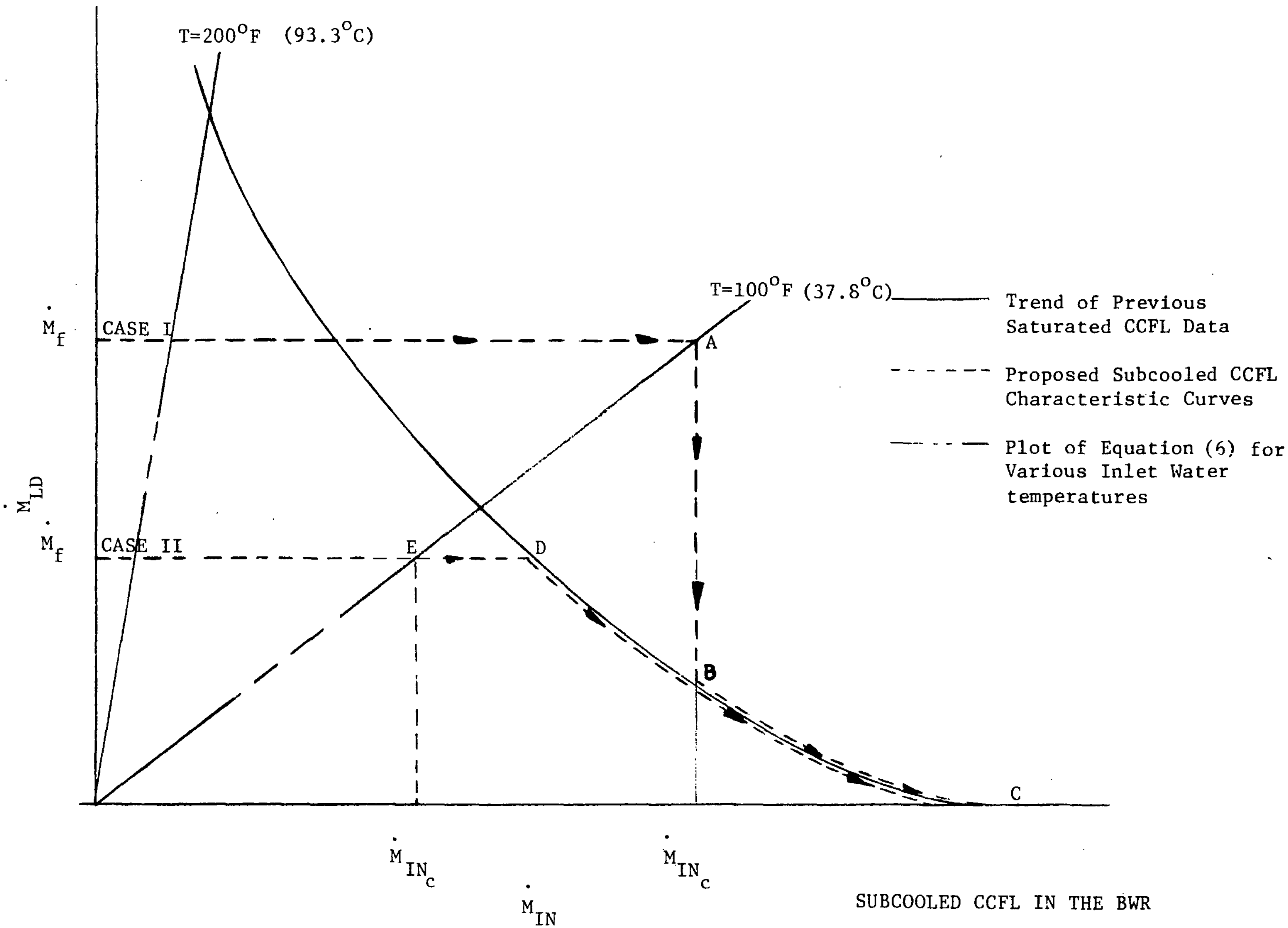


Figure 28 - Subcooled CCFL Model by Tien (4)



SUBCOOLED CCFL IN THE BWR

Figure 29

available for steam condensation below the tie plate, so the tie plate steam flow is then equal to $\dot{M}_{IN}$. Therefore, the CCFL performance of the test section becomes that of a saturated inlet water test. For Case II, the condensing capacity of the inlet spray flow (point E) is not sufficient to cause CCFL at the tie plate (point E). As the steam flow is increased from E to D the liquid down flow at the tie plate is saturated and since no steam condensation is occuring below the tie plate, the CCFL performance of the test is identical to that of a saturated inlet water test. This is shown in Figure 29 as the steam flow increases from D to C.

The steam condensation in the bundle can be envisioned as a condensation front above which there is zero steam flow. The front starts at the bottom of the bundle and moves up as the inlet steam flow is increased. The condensation front will be below the tie plate for $\dot{M}_{IN} < \dot{M}_{IN_C}$ and right at the tie plate as $\dot{M}_{IN} = \dot{M}_{IN_C}$. As the steam flow is increased beyond $\dot{M}_{IN_C}$, the front moves above the tie plate so that the tie plate steam flow equals $\dot{M}_{IN}$. This effect is indicated in Figure 30 which shows the axial temperature distribution in the channel below the tie plate, for a typical subcooled liquid test as the steam flow is increased. Figure 30 shows graphically how the condensation front, below which temperatures are near saturation, moves up the channel with increasing steam flow.

Therefore, based on results from this test program, the model proposed by Tien (4) correctly accounts for the effect of subcooled liquid injection, for increasing steam, if the condensation efficiency factor, f, is set to unity for $\dot{M}_{IN} < \dot{M}_{IN_C}$ and to zero for $\dot{M}_{IN} > \dot{M}_{IN_C}$. This accounts for the transition from condensation below the tie plate to condensation above the tie plate.

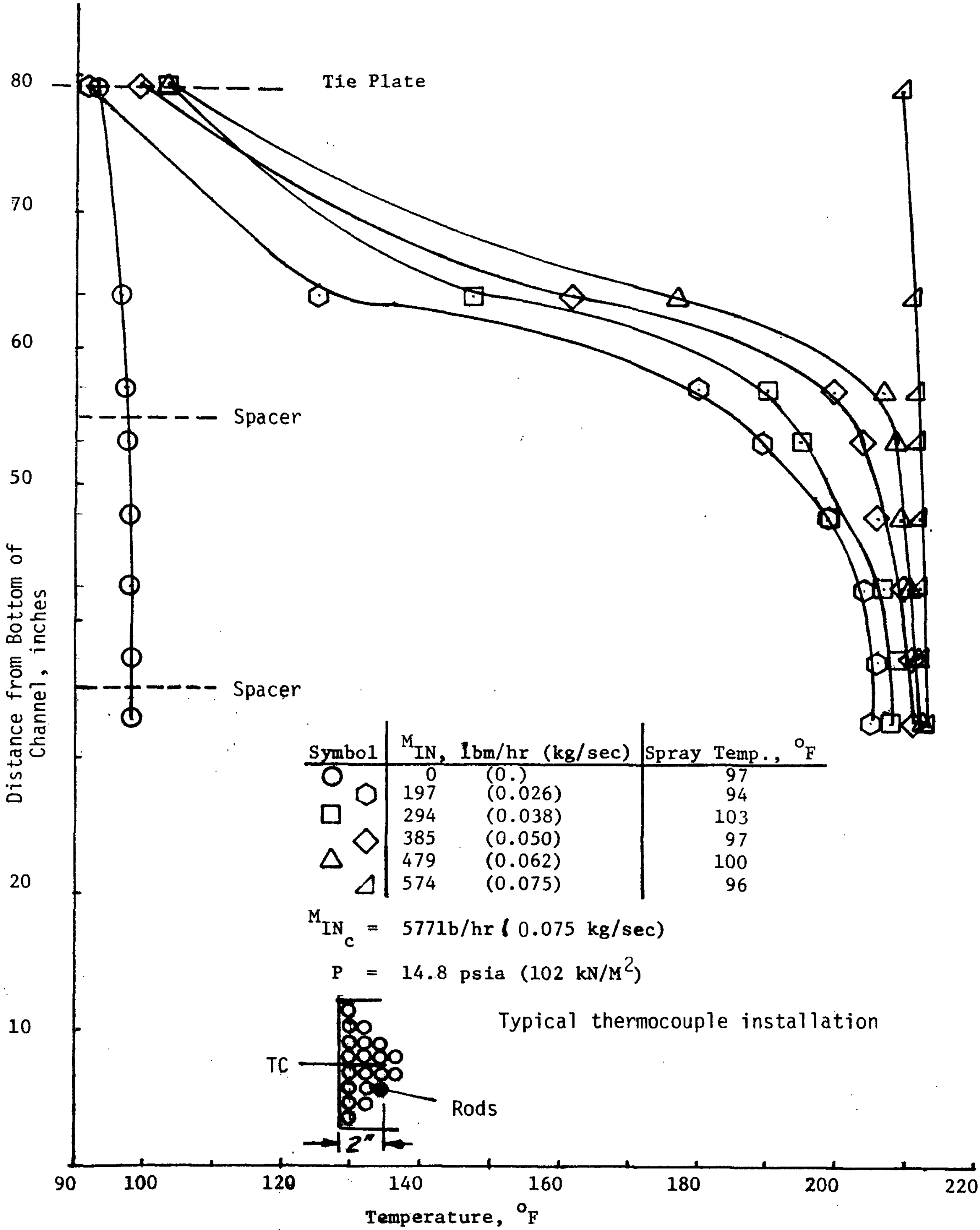


Figure 30 - Axial Temperature Distribution for Various Steam Flows

8.0 CONCLUSIONS

1. Onset of CCFL in the upper region of a BWR fuel bundle with subcooled liquid injection is determined by

$$\dot{M}_{IN_C} = \frac{\dot{M}_f C_p \Delta T_{SUB}}{h_{fg}}$$

It was also found that the liquid flow rate and amount of subcooling have an effect on the CCFL characteristics which is not predicted using the idealization obtained from the above equation (Figure 29).

2. The method of liquid injection was found to moderately affect the CCFL results.

3. The steam inlet geometry greatly affects the CCFL data. It is possible that the capped steam sparger has a droplet entrainment effect which results in increased steam density at the tie plate and decreased lower drain flow.

4. The temperature distribution in the tie plate pool is affected by the method of liquid injection. The distribution tends to be more uniform when the liquid is injected near the top of the channel extensions.

5. The subcooled CCFL model proposed by Tien (4) is adequate, for increasing steam, if the condensing efficiency, f, is set to unity for $\dot{M}_{IN} < \dot{M}_{IN_C}$ and to zero for $\dot{M}_{IN} > \dot{M}_{IN_C}$.

9.0 ACKNOWLEDGEMENTS

It is difficult to thank all of those who have contributed so much time to this test program. However, I would like to extend a special thanks to Mr. Jim Leonard and Dr. Chang L. Tien for their technical advice and continued support during the long period of report preparation; to Ms. Marge Brothers for her invaluable aid in reducing the data; to Mr. Yuzuru Okamoto for his help in designing the test sections and the instrumentation; to Mr. Sam Cuilla for his leadership in the operation and installation of the many different test sections; and to Mrs. Dot Magrath and Miss Cheryl Tutalak for their typing skills. I am especially grateful to Cheryl who, through all of the revisions and retyping, remained smiling to make the job so much easier.

SYMBOLS

A - Open flow cross sectional area, ft.^{2}

C_p - Specific heat BTU/lb - °F

ΔT_{sub} - Amount of subcooling, °F

$\dot{M}_f$ - Spray flow rate - lb/hr

$\dot{M}_g$ - Steam flow rate at tie plate, lb/hr

$\dot{M}_{IN}$ - Inlet steam flow rate, lb/hr

$\dot{M}_{LD}$ - Mass of water draining from bottom of bundle, lb/hr

$\dot{M}_{IN_c}$ - Critical steam flow for subcooled CCFL, lb/hr

σ - Surface tension, lb_f/ft

g - Acceleration of gravity ft/sec^2

K - Kutateladze number

j - Volumetric flux, defined as the volumetric flow rate divided by open flow cross-sectional area, ft/sec

h_{fg} - Latent heat of vaporization BTU/lb

D - Characteristic dimension, ft

ρ - Density, lbm/ft^3

SUBSCRIPTS

f - Designates liquid phase

g - Designates vapor phase

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APPENDIX A - DRAIN TANK MEASUREMENT

Holding tanks with differential pressure transducers, as shown schematically in Figure A-1, were used to measure the upper and lower drain.

The tanks are equipped with automatic level switches which actuate drain pumps to drain the tanks at preset levels. Thus, depending on the drain flow, each data set is comprised of a number of fill and drain cycles, as shown in the typical tank ΔP vs time plot (Figure A-2).

The drain tank flow is then calculated as

$$\dot{M}_{DRAIN} = \frac{\Delta P}{\Delta t} A_{tank} \rho_{LIQ} \qquad \text{(A-1)}$$

where ΔP = tank pressure differential, in. of H_2O
Δt = time interval, hr.
A_{tank} = cross sectional area of drain tank, ft^2
P_{liq} = density of draining liquid, lbm/ft^3

In order to reduce each data set to a single value for the lower drain tank flow, the following method was used. First, the $\Delta P/\Delta t$ in equation A-1 was selected to be the overall fill cycle $\Delta P/\Delta t$. That is,

$$\frac{\Delta P}{\Delta t} = \frac{\Delta P_1 - \Delta P_2}{\Delta t_{cycle}} \qquad \text{(A-2)}$$

where ΔP_1 = tank ΔP at beginning of fill cycle

ΔP_2 = tank ΔP at end of fill cycle

Δt_{cycle} = total time interval of fill cycle

Using the data set of Figure A-2 as an example, there are three fill cycles so three cycle average drain flows are calculated. The large jump in the measured tank pressure differential is caused by an electronically impressed signal which is activated when the automatic level switch drains the holding tank. This serves to signal the data reduction computer code that the tank is draining. Once the three cycle average drain flows are calculated, these three flows are arithmetically averaged to provide the data set average drain tank flow. It is this average which is reported as the drain tank flow for a given steam flow.

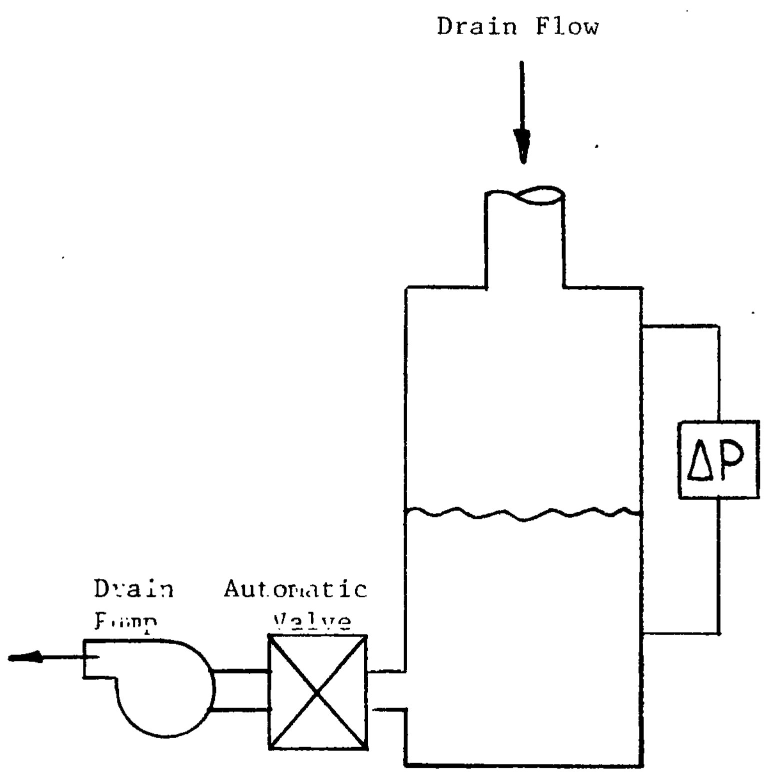

Figure A-1 - Drain Holding Tank

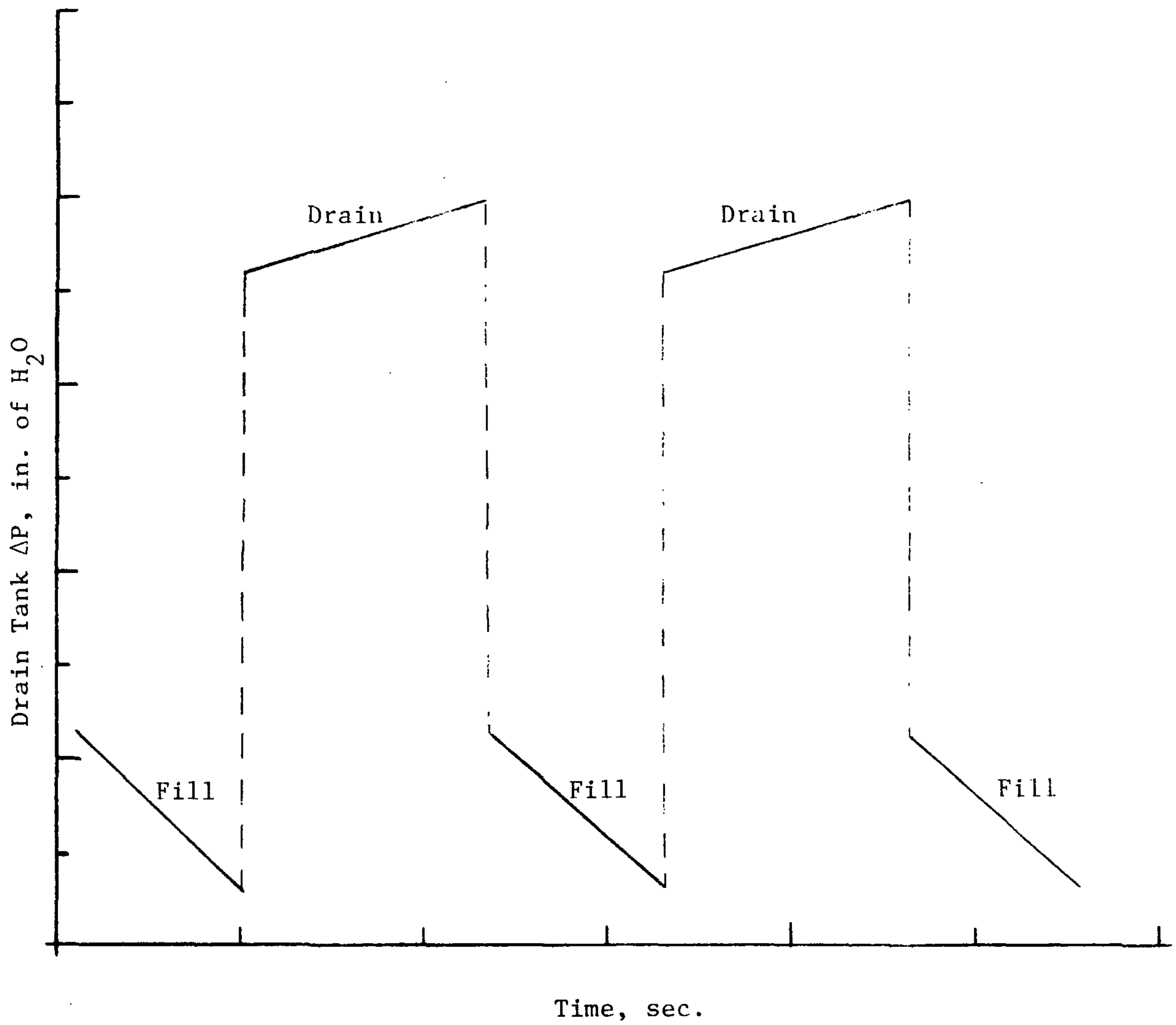

Figure A-2 - Typical Drain Tank Cycles

APPENDIX B - TEST RUN LOG

The following is a complete listing of each test run which was made and the basic parameters for that run.

RUN #	SPRAY FLOW, GPM	SPRAY TEMP, °F	BASIC HARDWARE CONFIGURATION	TYPE	PURPOSE
1	16	200		SS	
2	16	200			Verify
3	9	200	No Extension,		repeatibility
4	16	200	Spillover		of Saturated
5	0	---	Capped Sparger		Data
6	16	200			
7	16	200			
8	9	200			
9	16	180			
10	16	180			Development
11	9	180			of Subcooled
12	9	160			Model
13	9	100			
14	9	120	6" Extension	SS	
15	9	200→100	Bypass Slots	T	
16	9	200→100	Capped Sparger	T	
17	5	200		SS	
18	5	200→100		T	
19	5	100		SS	
20	5	120		SS	
21	8	200		SS	

RUN #	SPRAY FLOW, GPM	SPRAY TEMP, °F	BASIC HARDWARE CONFIGURATION	TYPE	PURPOSE
22	8	200→100	↑	T	
23	8	200→100		T	
24	8	200		SS	
25	8	200→100		T	
26	10	200		SS	
27	10	200→100		T	
28	10	200→100		T	
29	10	200→100		T	
30	8	200→100		T	
31	8	100		SS	
32	8	100		SS	
33	8	100		SS	
34	8	100		SS	
35	5	100		SS	
36	7	100		SS	Development
37	8	100		SS	of Subcooled
38	10	100		SS	Model.
39	5	120	6" Extension	SS	
40	8	120	Bypass Slots.	SS	
41	10	120	Capped Sparger	SS	
42	5	140		SS	
43	8	140		SS	
44	8	140		SS	
45	10	140		SS	
46	5	160	↓	SS	

RUN #	SPRAY FLOW, GPM	SPRAY TEMP, °F	BASIC HARDWARE CONFIGURATION	TYPE	PURPOSE
47	8	160	↑	SS	↑
48	10	160	6" Extension	SS	Development
49	10	180	Bypass Slots	SS	of Subcooled
50	5	180	Capped Sparger	SS	Model.
51	8	180	│	SS	│
52	8	200	│	SS	│
53	5	200	│	SS	│
54	10	200	│	SS	│
55	Variable	Variable	↓	T	↓
56	8	100	12" Extension	SS	↑
57	15	100	Bypass Slots	T	│
58	15	100	Capped Sparger	T	│
59	15	100	│	T	│
60	10	100	│	SS	│
61	12	100	│	SS	│
62	15	100	│	SS	│
63	15	100	│	T	│
64	15	100	│	T	Determine
65	8	100	│	SS	Effect of
66	15	200→100	│	T	Injection
67	15	200→100	│	T	Method
68	8	200	│	SS	│
69	10	200	│	SS	│
70	12	200	│	SS	│
71	5	100	↓	SS	│
72	10	100	12" Extension, Spillover	SS	│
73	10	100	Capped Sparger	SS	↓

RUN #	SPRAY FLOW, GPM	SPRAY TEMP, °F	BASIC HARDWARE CONFIGURATION	TYPE	PURPOSE
74	15	80	12" Extension Spillover	T	(same as runs
75	15	80	Capped Sparger	T	56 thru 71
76	9	200	6" Extension	SS	Sat. Data
77	16	200	Spillover	SS	with Spillover
78	16	200	Capped Sparger	SS	↓
79	15	200→100	6" Extension	T	Subcooled
80	15	200→100	Bypass Slots	T	Model
81	15	200→100	Capped Sparger	T	Development
82	9	200	6" Extension, Spillover	SS	Evaluate Hard-
83	16	200	Capped Sparg. No Tie Plate	SS	ware Components
84	5	100	↑	SS	↑
85	10	100	12" Extension	SS	
86	15	100	Cross Flow, 4, 1/2"	SS	Determine
87	5	200	Holes, Capped	SS	Effect of
88	10	200	Sparger	SS	Liquid Inject.
89	15	100		SS	Method
90	15	100		SS	
91	15	200	↓	SS	↓
92	5	100	12" Extension	SS	Determine
93	5	100	Cross Flow, 4	SS	Effect of
94	10	100	Plates, each with 8, 1/8"	SS	Liquid Injection
95	15	100	Holes Capped Sparger	SS	Method
96	10	200		SS	
97	10	100	↓	SS	↓

RUN #	SPRAY FLOW, GPM	SPRAY TEMP, °F	BASIC HARDWARE CONFIGURATION	TYPE	PURPOSE
98	10	100	12" Extension	SS	Determine
99	10	100	Cross Flow, Plates, each	SS	Effect of
100	15	100	with 8, 1/8" holes	SS	Liquid Injection
101	15	100	Capped Sparger	SS	Method
102	10	100		SS	
103	10	100		SS	
104	10	100	Same as 92-103,	SS	Determine
105	10	100	But No Spacers	SS	Effect of steam
106	15	100	in Bundle	SS	Sparger and
107	15	100		SS	Evaluate Hard-
108	15	100		SS	ware Components
109	10	100	Same as 92-103,	SS	
110	15	100	But Tie Plate	SS	
111	15	200	only	SS	
112	10	100	Same as 121-127	SS	
113	15	100	But Tie Plate only	SS	
114	15	200		SS	
115	10	100	Same as 121-127	SS	
116	10	100	But with Bundle	SS	
117	10	200	With no Spacers	SS	
118	10	100		SS	
119	15	100		SS	
120	15	200		SS	

RUN #	SPRAY FLOW, GPM	SPRAY TEMP, °F	BASIC HARDWARE CONFIGURATION	TYPE	PURPOSE
121	10	100	12" Extension	SS	↑
122	12	100	Cross Flow, 4 Plates	SS	
123	15	100	Each With 8, 1/8"	SS	
124	15	200	Holes	SS	
125	10	120	Clarinet	SS	Determine
126	15	120	Sparger	SS	Effect
127	10	200	↓	SS	of Steam
128	10	100	12" Extension,	SS	Sparger
129	10	100	Bypass Slots	SS	
130	15	100	Clarinet Sparger	SS	
131	10	100	12" Spillover Clarinet	SS	
132	10	100	12" Spillover, Capped Sparger	SS	
133	10	100	12" Extension,	SS	
134	15	100	Bypass Slots	SS	
135	10	200	Low, Tie Plate Sparger	SS	↓

SS = Steady State

T = Transient

APPENDIX C - DATA TABULATION

Data presented in this report are tabulated in the following tables.

ZERO POWER LOOP CCFL DATA

		FLOW (LB/HR)								TIE PLATE POCKET TEMPS (F)									
RUN NO.	PRES PSIA	MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	#1	#3	#4	#5	#8	#10	#11	#12	#13	#14
1- 1	14.6	7775.	10.	7779.	0.	0.			207.5	206.	205.	204.	205.	206.	205.	205.	205.	205.	205.
1- 2	14.9	7771.	244.	7550.	2.	124.			203.1	213.	214.	211.	214.	213.	213.	212.	213.	214.	214.
1- 3	15.5	7750.	308.	4130.	303.	218.			207.1	214.	215.	210.	216.	213.	214.	211.	212.	214.	211.
1- 4	17.3	7685.	506.	1238.	221.	373.			205.9	209.	218.	201.	219.	211.	204.	204.	207.	203.	212.
1- 5	20.0	7564.	687.	518.	4176.	515.			210.5	217.	224.	215.	225.	221.	215.	217.	217.	218.	222.
1- 6	19.8	7743.	892.	25.	5374.	513.			171.8	220.	224.	221.	224.	222.	217.	221.	219.	221.	223.
3- 1	14.7	4330.	153.	4501.	0.	54.	0.49	0.66	202.4	198.	199.	198.	199.	199.	196.	197.	196.	199.	199.
3- 2	15.3	4298.	265.	4566.	4.	167.	0.50	1.13	205.2	215.	216.	215.	216.	215.	214.	213.	214.	215.	215.
3- 3	15.7	4318.	333.	4639.	4.	224.	0.50	1.40	201.0	216.	218.	216.	218.	217.	215.	214.	215.	217.	216.
3- 4	16.3	4327.	409.	3044.	544.	284.	0.33	1.70	198.9	215.	217.	214.	218.	216.	212.	212.	212.	215.	215.
3- 5	17.6	4303.	501.	1645.	2784.	376.	0.18	2.01	203.7	216.	220.	215.	220.	218.	211.	211.	213.	215.	217.
3- 6	19.3	4273.	603.	723.	2164.	465.	0.08	2.32	207.1	220.	225.	219.	224.	222.	215.	216.	217.	219.	221.
3- 7	20.4	4279.	667.	229.	3318.	512.	0.04	2.51	206.5	226.	228.	225.	228.	227.	222.	223.	223.	225.	226.
3- 8	22.6	4250.	786.	111.	4205.	602.	0.01	2.82	209.2	232.	234.	231.	233.	233.	230.	230.	230.	232.	232.
3- 9	25.0	4258.	925.	22.	2065.	687.	0.	3.18	204.5	237.	239.	236.	239.	238.	235.	235.	235.	237.	237.
3-10	20.2	4351.	649.	406.	2922.	502.	0.04	2.45	207.3	225.	227.	225.	227.	226.	222.	223.	223.	224.	226.
3-11	17.2	4407.	451.	2034.	911.	342.	0.22	1.83	199.8	219.	220.	218.	220.	219.	217.	217.	218.	219.	218.
3-12	17.0	4394.	452.	2262.	2170.	332.	0.25	1.84	202.7	216.	218.	215.	217.	216.	213.	214.	213.	215.	216.
3-13	15.5	4388.	287.	4588.	9.	190.	0.50	1.22	206.0	214.	215.	213.	214.	214.	212.	212.	212.	213.	213.
4- 1	14.7	7733.	65.	7836.	0.	0.			202.2	188.	189.	183.	183.	187.	187.	187.	183.	192.	189.
4- 2	15.6	7711.	308.	4334.	305.	213.			207.4	201.	203.	199.	196.	197.	202.	198.	198.	203.	203.
4- 3	18.5	7595.	593.	654.	4326.	431.			206.9	215.	216.	212.	216.	212.	213.	213.	212.	213.	214.
4- 4	22.8	7758.	930.	4.	960.	623.			202.4	228.	229.	228.	229.	227.	224.	226.	226.	227.	225.
4- 5	23.1	7742.	936.	7.	1390.	637.			202.9	230.	231.	229.	230.	229.	226.	228.	228.	229.	227.
4- 6	23.1	7742.	936.	18.	3195.	639.			203.8	231.	232.	230.	231.	230.	227.	230.	230.	230.	228.
4- 7	23.1	7725.	938.	11.	230.	643.			204.0	232.	232.	231.	232.	231.	229.	231.	230.	230.	229.
4- 8	19.2	7904.	672.	250.	2041.	475.			204.0	222.	223.	221.	222.	222.	220.	221.	221.	221.	219.
4- 9	14.9	8060.	224.	8151.	0.	95.			201.4	210.	211.	210.	211.	210.	209.	210.	210.	210.	209.
4-10	14.8	7715.	215.	7866.	215.	46.			197.0	209.	210.	208.	209.	209.	209.	209.	209.	210.	208.
6- 1	14.6	7757.	5.	8070.	0.	-27.			206.9	206.	206.	207.	207.	207.	206.	206.	207.	207.	206.
6- 2	14.9	7756.	229.	7979.	0.	87.			202.2	204.	206.	213.	213.	214.	204.	210.	212.	205.	209.
6- 3	16.3	7693.	382.	3359.	338.	280.			209.8	214.	213.	218.	216.	217.	214.	216.	216.	217.	215.
6- 4	17.9	7636.	588.	860.	1125.	397.			201.1	221.	221.	223.	223.	223.	221.	222.	222.	223.	222.
6- 5	23.1	7758.	916.	25.	4167.	636.			211.8	236.	236.	238.	237.	237.	236.	236.	237.	238.	236.
6- 6	23.5	7736.	925.	4.	2851.	653.			202.3	237.	238.	239.	239.	238.	237.	238.	237.	239.	237.
6- 7	23.2	7769.	934.	4.	1665.	642.			209.4	237.	237.	237.	237.	237.	237.	237.	236.	238.	237.
6- 8	14.7	7747.	15.	6849.	7508.	-35.			204.4	203.	203.	203.	203.	203.	202.	203.	203.	203.	203.
6- 9	16.5	7654.	389.	2364.	191.	300.			208.6	219.	218.	219.	219.	219.	218.	218.	219.	219.	218.
6-10	18.7	7576.	586.	657.	2112.	443.			208.0	225.	225.	226.	225.	225.	225.	225.	225.	226.	225.
6-11	21.1	7713.	777.	171.	1045.	552.			204.8	232.	231.	232.	232.	232.	231.	231.	231.	232.	231.
6-12	23.4	7626.	911.	21.	1123.	647.			207.9	237.	237.	238.	238.	238.	237.	237.	236.	238.	237.
6-13	20.0	7765.	675.	360.	1460.	507.			208.6	229.	228.	229.	229.	229.	229.	228.	228.	229.	228.
6-14	17.3	7875.	470.	1560.	2385.	360.			205.4	221.	220.	221.	220.	221.	221.	220.	220.	221.	220.

ZERO POWER LOOP CCFL DATA

RUN	PRES	FLOW (LB/HR)					KF	KG	SPRAY	TIE PLATE POCKET TEMPS (F)									
NO.	PSIA	MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM			TEMP	#1	#3	#4	#5	#8	#10	#11	#12	#13	#14
6-15	15.0	7700.	219.	7764.	0.	90.			202.4	213.	212.	213.	212.	213.	212.	212.	212.	213.	212.
35- 1	14.5	2486.	55.	2547.	0.	16.			95.2	101.	97.	99.	97.	97.	97.	97.	100.	97.	97.
35- 2	14.6	2492.	191.	2461.	0.	16.			96.1	100.	97.	98.	97.	98.	98.	98.	100.	98.	98.
35- 3	14.7	2533.	245.	2850.	0.	15.			100.8	106.	102.	109.	102.	140.	102.	104.	103.	102.	106.
35- 4	14.7	2534.	295.	2873.	0.	12.			100.9	142.	105.	156.	104.	191.	104.	164.	110.	103.	172.
35- 5	14.7	2537.	365.	2929.	0.	17.			96.2	208.	188.	209.	182.	214.	174.	214.	187.	186.	214.
35- 6	14.8	2484.	380.	2736.	2.	86.			96.3	215.	210.	215.	209.	215.	210.	214.	199.	211.	215.
35- 7	15.0	2526.	429.	2442.	103.	126.			96.3	216.	213.	216.	210.	216.	211.	216.	200.	212.	216.
35- 8	15.0	2521.	429.	2511.	327.	129.	0.27	1.85	94.9	216.	213.	216.	211.	215.	211.	216.	207.	212.	216.
35- 9	15.3	2518.	456.	1899.	1138.	188.	0.21	1.95	101.1	218.	215.	218.	213.	217.	215.	217.	213.	215.	217.
35-10	15.5	2522.	479.	1506.	1377.	216.	0.16	2.03	98.4	218.	215.	218.	213.	217.	214.	217.	212.	215.	217.
35-11	15.7	2549.	503.	1174.	1704.	238.	0.13	2.12	98.7	218.	215.	218.	213.	218.	215.	217.	213.	216.	217.
35-12	16.0	2545.	522.	960.	2019.	256.	0.10	2.18	99.6	218.	216.	218.	214.	218.	215.	217.	213.	216.	218.
35-13	16.4	2531.	578.	538.	2266.	300.	0.06	2.39	96.1	220.	218.	220.	216.	220.	217.	219.	214.	219.	219.
35-14	17.5	2516.	674.	156.	2666.	391.	0.02	2.71	96.5	223.	220.	223.	219.	223.	220.	223.	218.	222.	223.
35-15	18.8	2507.	762.	56.	2641.	453.	0.01	2.97	96.2	227.	226.	227.	223.	227.	225.	227.	223.	227.	227.
35-16	20.8	2460.	885.	14.	2045.	548.	0.	3.30	96.3	232.	231.	233.	229.	232.	231.	232.	229.	232.	232.
35-17	18.2	2511.	715.	90.	2741.	421.	0.01	2.83	97.0	225.	224.	225.	221.	225.	223.	225.	222.	224.	225.
35-18	17.0	2535.	628.	271.	2597.	348.	0.03	2.56	97.4	221.	219.	221.	217.	221.	218.	221.	217.	220.	221.
35-19	15.9	2533.	522.	993.	1968.	248.	0.11	2.19	97.6	218.	216.	218.	214.	218.	215.	218.	214.	217.	218.
35-20	15.6	2542.	498.	1318.	1468.	225.	0.14	2.11	97.4	218.	215.	217.	213.	217.	214.	217.	213.	216.	217.
35-21	15.4	2536.	475.	1613.	1237.	202.	0.18	2.02	97.0	217.	215.	217.	213.	216.	213.	216.	213.	213.	217.
35-22	15.2	2537.	453.	2085.	682.	173.	0.23	1.94	96.5	217.	214.	216.	211.	215.	213.	215.	212.	211.	215.
35-23	15.1	2532.	434.	2462.	335.	150.			96.3	216.	213.	216.	211.	215.	212.	215.	212.	211.	215.
35-24	14.9	2521.	385.	2880.	29.	98.			96.2	215.	211.	215.	210.	215.	210.	214.	211.	212.	215.
35-25	14.7	2536.	290.	2450.	-3.	-20.			96.1	215.	208.	214.	206.	214.	207.	214.	208.	210.	214.
37- 1	14.7	3974.	1.	3989.	1.	-8.			98.2	100.	100.	100.	99.	100.	101.	101.	103.	100.	101.
37- 2	14.7	3964.	192.	4099.	0.	-7.			95.0	96.	96.	96.	96.	96.	96.	96.	99.	96.	96.
37- 3	14.7	3963.	247.	4190.	0.	-10.			98.5	99.	99.	99.	99.	100.	100.	101.	101.	99.	101.
37- 4	14.7	3958.	285.	4306.	0.	-10.			99.3	100.	101.	101.	99.	101.	101.	107.	102.	100.	106.
37- 5	14.8	3959.	336.	4454.	0.	-12.			99.2	100.	101.	101.	100.	101.	101.	111.	102.	100.	111.
37- 6	14.7	3964.	382.	4516.	0.	-13.			100.9	103.	112.	103.	102.	105.	104.	133.	104.	101.	133.
37- 7	14.8	3958.	405.	4394.	0.	-13.			97.8	101.	114.	103.	99.	103.	102.	129.	102.	99.	131.
37- 8	14.7	3959.	432.	4515.	0.	-13.			98.1	103.	121.	105.	100.	105.	104.	144.	103.	99.	148.
37- 9	14.7	3961.	454.	4510.	0.	-13.			99.0	109.	149.	114.	104.	120.	115.	181.	107.	108.	190.
37-10	14.7	3951.	485.	3741.	3.	-2.	0.41	2.11	99.3	197.	209.	200.	199.	210.	205.	212.	181.	211.	213.
37-11	14.9	3959.	509.	1847.	2240.	74.	0.20	2.20	98.9	207.	207.	210.	207.	211.	204.	214.	207.	211.	214.
37-12	15.0	3955.	530.	1492.	3036.	112.	0.16	2.28	99.2	210.	210.	213.	209.	213.	206.	215.	209.	212.	215.
37-13	15.2	3984.	571.	1123.	3392.	155.	0.12	2.44	100.2	210.	210.	214.	208.	214.	205.	215.	211.	211.	215.
37-14	15.9	3994.	664.	334.	4062.	252.	0.04	2.79	101.9	212.	214.	216.	210.	216.	213.	217.	213.	213.	218.
37-15	17.0	3923.	762.	118.	4319.	341.	0.01	3.10	101.9	215.	217.	220.	212.	219.	214.	221.	218.	217.	221.
37-16	18.0	3889.	852.	29.	4086.	408.	0.	3.38	99.4	217.	220.	223.	214.	221.	217.	224.	220.	220.	224.
37-17	16.4	3915.	710.	264.	4148.	295.	0.03	2.94	99.6	212.	216.	218.	210.	216.	213.	219.	216.	215.	219.

ZERO POWER LOOP CCFL DATA

RUN	PRES	FLOW (LB/HR)							SPRAY	TIE PLATE POCKET TEMPS (F)									
NO.	PSIA	MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	TEMP	#1	#3	#4	#5	#8	#10	#11	#12	#13	#14
37-18	15.6	4011.	625.	602.	3782.	207.	0.07	2.64	100.4	211.	212.	215.	207.	214.	209.	216.	213.	212.	217.
37-19	15.0	4028.	527.	1532.	3162.	102.	0.17	2.27	100.6	209.	208.	212.	206.	213.	205.	214.	210.	210.	214.
37-20	14.8	4016.	469.	2493.	2116.	-5.	0.27	2.03	97.0	207.	209.	210.	207.	211.	205.	213.	206.	209.	214.
37-21	14.8	4010.	427.	4292.	100.	-17.			97.8	205.	212.	201.	206.	211.	210.	213.	202.	210.	214.
37-22	14.8	4011.	334.	4427.	0.	-24.			97.6	112.	113.	115.	107.	109.	110.	113.	123.	107.	111.
37-23	14.8	4013.	198.	4181.	0.	-23.			97.1	107.	105.	111.	104.	105.	105.	105.	116.	104.	104.
38- 1	14.7	4959.	3.	5089.	2.	-20.			92.8	94.	93.	93.	93.	94.	94.	94.	98.	93.	94.
38- 2	14.7	4934.	199.	4911.	0.	-19.			98.9	99.	99.	99.	98.	99.	99.	99.	101.	99.	99.
38- 3	14.7	4930.	387.	5389.	0.	-19.			97.5	98.	97.	97.	97.	98.	98.	98.	100.	98.	98.
38- 4	14.7	5008.	408.	5536.	0.	-19.			99.0	99.	99.	99.	98.	99.	99.	99.	101.	99.	99.
38- 5	14.7	5021.	437.	5701.	2.	-19.			100.6	101.	101.	100.	100.	101.	101.	101.	102.	101.	101.
38- 6	14.7	5010.	457.	5675.	-2.	-19.			97.5	97.	97.	97.	97.	97.	97.	98.	99.	97.	97.
38- 7	14.7	5008.	477.	5570.	0.	-19.			97.1	97.	96.	96.	96.	97.	97.	97.	98.	97.	97.
38- 8	14.7	5000.	496.	5607.	0.	-18.			97.8	97.	97.	97.	97.	97.	98.	98.	99.	98.	98.
38- 9	14.7	5005.	528.	5157.	89.	-17.			97.7	100.	100.	99.	101.	102.	100.	105.	102.	102.	110.
38-10	14.7	4996.	549.	5654.	3.	-18.			99.0	99.	99.	99.	99.	99.	100.	100.	101.	99.	100.
38-11	14.7	4990.	581.	4036.	408.	-13.	0.44	2.52	99.8	178.	191.	167.	189.	201.	183.	206.	170.	207.	212.
38-12	14.8	4976.	597.	984.	4275.	61.	0.11	2.59	99.2	207.	209.	209.	203.	210.	205.	213.	208.	207.	214.
38-13	14.9	4968.	622.	560.	4502.	101.	0.06	2.69	101.5	208.	210.	208.	204.	211.	208.	213.	207.	210.	214.
38-14	15.2	4943.	669.	275.	5028.	165.	0.03	2.86	102.0	206.	210.	211.	206.	212.	208.	214.	211.	211.	215.
38-15	15.7	4908.	748.	56.	5076.	242.	0.01	3.16	102.7	211.	213.	213.	209.	214.	211.	216.	212.	214.	217.
38-16	16.8	4955.	864.	3.	5284.	333.	0.	3.54	101.5	212.	219.	216.	214.	217.	218.	219.	213.	218.	220.
38-17	15.4	4977.	712.	139.	5419.	188.	0.02	3.03	98.7	208.	213.	210.	206.	211.	211.	215.	209.	211.	215.
38-18	15.0	4971.	636.	563.	4918.	106.	0.06	2.74	98.6	206.	210.	210.	203.	210.	207.	214.	211.	209.	214.
38-19	14.8	4955.	578.	1130.	4585.	42.	0.12	2.50	101.4	207.	209.	207.	203.	209.	206.	212.	207.	208.	213.
38-20	14.7	4935.	525.	2188.	3390.	-13.	0.24	2.28	99.9	207.	206.	205.	200.	207.	202.	212.	206.	206.	213.
38-21	14.7	4962.	473.	5505.	21.	-18.	0.60	2.05	100.8	123.	124.	120.	126.	131.	123.	137.	136.	138.	150.
38-22	14.8	4951.	292.	5018.	3.	-18.			97.3	107.	103.	107.	103.	104.	104.	103.	117.	103.	103.
41- 1	14.7	5012.	1.	5105.	0.	15.			117.5	117.	117.	117.	117.	117.	117.	118.	118.	117.	117.
41- 2	14.7	5003.	209.	5276.	0.	15.			118.1	118.	118.	118.	118.	118.	118.	118.	118.	118.	118.
41- 3	14.7	5001.	284.	5273.	0.	15.			119.3	120.	120.	120.	120.	120.	120.	120.	120.	120.	120.
41- 4	14.7	5000.	391.	5633.	0.	16.			119.9	120.	120.	120.	120.	121.	121.	121.	121.	121.	121.
41- 5	14.7	4998.	411.	5267.	0.	15.			118.7	119.	119.	119.	119.	119.	119.	119.	120.	119.	120.
41- 6	14.7	5001.	430.	5322.	2.	14.			118.8	119.	119.	119.	119.	119.	119.	120.	120.	119.	120.
41- 7	14.8	4996.	450.	5502.	0.	15.			119.8	120.	120.	120.	120.	120.	120.	121.	120.	120.	121.
41- 8	14.7	4993.	479.	5591.	0.	15.			119.4	156.	179.	144.	176.	190.	167.	199.	158.	201.	209.
41- 9	14.8	4996.	501.	2762.	1283.	31.	0.30	2.17	118.4	204.	205.	201.	200.	209.	201.	213.	198.	208.	214.
41-10	14.9	4988.	527.	1337.	4700.	96.	0.15	2.28	118.3	210.	209.	211.	207.	213.	207.	214.	210.	211.	215.
41-11	15.1	4987.	550.	992.	4424.	122.	0.11	2.36	119.1	210.	212.	210.	207.	212.	210.	215.	211.	210.	215.
41-12	15.2	4979.	580.	744.	4802.	157.	0.08	2.48	119.8	210.	213.	213.	208.	214.	211.	216.	212.	213.	216.
41-13	15.8	4966.	670.	170.	5570.	242.	0.02	2.82	120.0	211.	215.	215.	211.	216.	214.	218.	214.	216.	218.
41-14	16.7	4946.	768.	35.	5765.	323.	0.	3.15	120.1	216.	220.	219.	214.	220.	219.	221.	218.	220.	222.
41-15	17.8	4920.	864.	17.	4994.	401.	0.	3.45	120.2	219.	223.	221.	219.	223.	222.	224.	221.	224.	225.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
41-16	16.2	4947.	717.	104.	5317.	282.	0.01	2.98	120.1	216.	217.	216.	212.	218.	216.	219.	217.	217.	220.
41-17	15.4	4955.	620.	389.	5044.	191.	0.04	2.64	119.4	211.	214.	212.	210.	214.	212.	216.	213.	213.	216.
41-18	15.1	4961.	572.	810.	4729.	136.	0.09	2.46	118.2	211.	212.	212.	208.	212.	211.	215.	212.	212.	216.
41-19	14.9	4958.	527.	1437.	4035.	93.	0.16	2.28	118.0	209.	210.	211.	207.	212.	208.	215.	212.	212.	215.
41-20	14.8	4964.	489.	2038.	3342.	49.	0.22	2.12	118.1	211.	209.	210.	208.	213.	207.	214.	212.	212.	215.
41-21	14.8	4960.	452.	2755.	2447.	6.	0.30	1.96	117.8	210.	209.	208.	205.	211.	206.	214.	210.	209.	215.
41-22	14.8	4966.	427.	5232.	40.	0.			118.1	174.	188.	164.	186.	199.	181.	202.	179.	206.	211.
41-23	14.8	4957.	402.	5434.	3.	-11.			118.3	126.	124.	127.	124.	125.	125.	125.	135.	124.	125.
41-24	14.8	4962.	289.	4978.	0.	-11.			117.9	124.	121.	124.	122.	122.	122.	122.	130.	122.	122.
45- 1	14.7	4961.	0.	4872.	0.	15.			140.8	140.	140.	140.	140.	140.	141.	141.	141.	140.	141.
45- 2	14.7	4960.	191.	4681.	2.	15.			140.6	141.	141.	141.	141.	141.	141.	141.	141.	141.	141.
45- 3	14.7	4955.	291.	5092.	-2.	14.			140.9	141.	141.	141.	141.	141.	141.	141.	141.	141.	141.
45- 4	14.7	4958.	337.	5659.	0.	14.			141.3	141.	141.	141.	141.	141.	141.	141.	141.	141.	142.
45- 5	14.7	4950.	360.	5461.	0.	15.			141.1	141.	142.	141.	142.	143.	142.	147.	142.	143.	152.
45- 6	14.7	4943.	379.	5461.	0.	9.			140.2	166.	184.	154.	188.	197.	177.	199.	171.	207.	210.
45- 7	14.8	4929.	408.	3967.	1003.	27.	0.43	1.77	139.8	209.	210.	208.	208.	212.	208.	214.	203.	212.	215.
45- 8	14.9	4933.	432.	2547.	3019.	85.	0.28	1.87	140.0	210.	211.	211.	208.	212.	210.	214.	210.	212.	215.
45- 9	14.9	4917.	450.	2169.	3261.	111.	0.24	1.94	139.9	211.	212.	212.	209.	213.	210.	215.	211.	212.	215.
45-10	15.1	4909.	478.	1660.	3617.	146.	0.18	2.05	140.2	212.	213.	213.	211.	214.	212.	214.	212.	214.	215.
45-11	15.2	4911.	501.	1276.	3803.	164.	0.14	2.14	140.1	212.	213.	212.	211.	213.	211.	215.	212.	214.	216.
45-12	15.4	4894.	526.	1134.	4407.	192.	0.12	2.24	140.1	213.	214.	214.	211.	213.	213.	216.	213.	213.	216.
45-13	15.7	4890.	572.	685.	4702.	229.	0.07	2.41	139.9	214.	215.	214.	212.	215.	215.	217.	214.	215.	217.
45-14	16.1	4882.	620.	414.	4672.	272.	0.05	2.59	140.0	215.	218.	217.	214.	218.	217.	219.	217.	217.	220.
45-15	16.6	4876.	672.	181.	5296.	314.	0.02	2.77	138.8	216.	218.	218.	216.	219.	218.	220.	217.	219.	220.
45-16	17.6	4855.	764.	63.	5203.	386.	0.01	3.06	138.8	220.	222.	221.	219.	222.	222.	223.	221.	222.	224.
45-17	18.9	4829.	859.	17.	5566.	459.	0.	3.34	138.9	222.	226.	225.	224.	227.	225.	227.	224.	227.	227.
45-18	17.1	4859.	718.	104.	5304.	351.	0.01	2.92	138.7	218.	221.	219.	217.	220.	220.	222.	218.	221.	222.
45-19	15.7	4892.	574.	756.	4935.	224.	0.08	2.42	138.8	213.	215.	214.	213.	215.	215.	217.	213.	215.	217.
45-20	15.5	4898.	554.	930.	4105.	200.	0.10	2.35	137.9	212.	215.	214.	211.	215.	214.	216.	213.	215.	217.
45-21	15.0	4910.	477.	1708.	3769.	126.	0.19	2.05	137.8	211.	212.	212.	209.	213.	211.	214.	211.	213.	215.
45-22	14.9	4909.	453.	2178.	2998.	100.	0.24	1.96	138.1	210.	211.	212.	209.	212.	210.	214.	212.	212.	215.
45-23	14.8	4917.	431.	2694.	2958.	65.	0.29	1.87	138.0	212.	210.	211.	208.	212.	208.	214.	212.	211.	214.
45-24	14.8	4919.	407.	3069.	2318.	48.	0.33	1.76	139.4	212.	211.	211.	207.	211.	209.	213.	210.	210.	214.
45-25	14.8	4920.	381.	3751.	821.	15.	0.41	1.65	139.0	211.	210.	211.	208.	211.	208.	213.	209.	211.	214.
45-26	14.8	4920.	337.	5338.	34.	-6.			138.9	190.	197.	182.	199.	204.	194.	205.	194.	209.	211.
45-27	14.7	4919.	240.	5001.	3.	-11.			138.4	144.	142.	145.	142.	143.	143.	143.	150.	142.	142.
48- 1	14.8	4965.	0.	4935.	0.	12.			161.1	161.	162.	162.	162.	162.	162.	162.	162.	162.	162.
48- 2	14.8	4957.	192.	5187.	0.	4.			160.7	161.	161.	161.	161.	161.	161.	161.	161.	161.	161.
48- 3	14.8	4953.	211.	5239.	0.	3.			160.9	161.	161.	161.	161.	162.	162.	162.	161.	162.	162.
48- 4	14.8	4952.	246.	5210.	0.	6.			161.1	161.	161.	161.	161.	162.	162.	162.	161.	162.	162.
48- 5	14.8	4950.	265.	5254.	0.	0.			161.3	162.	162.	161.	162.	162.	162.	162.	162.	162.	162.
48- 6	14.8	4945.	292.	5272.	0.	-4.			161.3	201.	209.	194.	210.	211.	209.	212.	199.	213.	214.
48- 7	14.8	4947.	307.	4876.	3.	16.			161.3	213.	213.	211.	213.	214.	213.	214.	208.	214.	215.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
48- 8	14.8	4943.	336.	5046.	442.	48.			160.8	213.	213.	212.	212.	213.	212.	214.	207.	213.	214.
48- 9	15.0	4942.	370.	3938.	1343.	101.	0.43	1.59	160.8	213.	212.	212.	212.	214.	212.	214.	212.	214.	215.
48-10	15.0	4940.	381.	3686.	1937.	121.	0.40	1.64	160.8	213.	213.	213.	212.	214.	212.	215.	212.	214.	215.
48-11	15.3	4931.	435.	2410.	3211.	176.	0.26	1.86	160.8	214.	215.	214.	213.	215.	214.	216.	213.	215.	216.
48-12	15.6	4934.	474.	1513.	3800.	220.	0.16	2.01	160.7	215.	215.	215.	213.	216.	214.	217.	215.	216.	217.
48-13	16.1	4932.	528.	1058.	3999.	266.	0.12	2.20	161.1	216.	217.	216.	215.	217.	217.	218.	216.	217.	219.
48-14	16.4	4934.	567.	707.	3940.	299.	0.08	2.35	161.3	217.	218.	217.	216.	218.	218.	219.	218.	218.	219.
48-15	17.5	4941.	663.	247.	5150.	375.	0.03	2.67	161.2	220.	221.	220.	219.	222.	221.	223.	221.	222.	223.
48-16	18.7	4923.	758.	83.	5148.	449.	0.01	2.96	161.3	224.	226.	225.	224.	226.	225.	227.	225.	227.	227.
48-17	20.7	4480.	863.	17.	4615.	543.	0.	3.22	160.7	229.	231.	230.	229.	231.	231.	232.	230.	231.	232.
48-18	18.3	4814.	714.	150.	4974.	427.	0.02	2.81	160.9	223.	224.	223.	222.	225.	224.	225.	224.	225.	226.
48-19	17.1	4909.	627.	397.	4877.	348.	0.04	2.55	160.4	219.	220.	218.	218.	220.	220.	221.	219.	221.	222.
48-20	16.5	4910.	572.	668.	4991.	306.	0.07	2.36	160.6	217.	219.	218.	216.	219.	218.	219.	217.	219.	220.
48-21	16.0	4929.	521.	1059.	3936.	258.	0.12	2.18	160.4	216.	216.	216.	214.	217.	216.	217.	216.	217.	218.
48-22	15.6	4945.	469.	1710.	3809.	213.	0.19	1.98	160.8	214.	215.	215.	213.	215.	214.	216.	214.	215.	217.
48-23	15.3	4952	428.	2363.	3014.	165.	0.26	1.83	160.7	214.	214.	213.	212.	214.	213.	215.	214.	214.	216.
48-24	15.2	4946.	410.	2765.	2191.	146.	0.30	1.75	160.8	213.	214.	213.	212.	214.	213.	214.	212.	213.	215.
48-25	15.0	4943.	381.	3398.	2080.	112.	0.37	1.64	160.7	213.	213.	213.	212.	214.	212.	214.	213.	214.	215.
48-26	14.9	4941.	361.	4220.	864.	91.			160.5	213.	213.	212.	212.	214.	212.	214.	212.	214.	214.
48-27	14.8	4941.	333.	5044.	487.	61.			160.1	213.	213.	211.	212.	214.	212.	214.	211.	213.	214.
48-28	14.8	4941.	307.	5449.	72.	23.			160.2	213.	213.	211.	213.	213.	212.	214.	212.	213.	214.
48-29	14.8	4941.	263.	5081.	7.	-11.			160.6	212.	213.	209.	212.	213.	213.	213.	211.	213.	214.
49- 1	14.8	4920.	19.	4886.	0.	-11.			181.4	184.	183.	183.	183.	183.	183.	183.	185.	183.	183.
49- 2	14.8	4904.	201.	5021.	0.	-11.			179.1	204.	207.	200.	208.	209.	207.	210.	204.	210.	212.
49- 3	14.8	4893.	211.	4939.	0.	-3.			180.8	213.	213.	211.	213.	213.	213.	214.	211.	213.	214.
49- 4	14.8	4892.	242.	4741.	0.	69.			182.4	214.	214.	212.	213.	214.	214.	214.	211.	214.	214.
49- 5	14.9	4887.	263.	5027.	3.	93.			182.7	215.	214.	213.	214.	214.	214.	215.	212.	215.	215.
49- 6	15.0	4886.	292.	4877.	2.	117.			181.8	215.	215.	213.	214.	215.	214.	215.	212.	215.	215.
49- 7	15.1	4892.	308.	4776.	2.	135.			182.2	215.	215.	213.	214.	215.	215.	215.	212.	215.	215.
49- 8	15.3	4889.	337.	4792.	183.	159.			181.3	215.	215.	214.	214.	215.	214.	215.	212.	215.	215.
49- 9	15.4	4890.	362.	4006.	973.	181.	0.44	1.54	180.0	215.	215.	214.	214.	215.	214.	216.	214.	215.	216.
49-10	15.5	4892.	383.	3414.	2340.	203.	0.37	1.63	180.1	215.	215.	215.	214.	216.	214.	216.	215.	215.	216.
49-11	15.8	4879.	410.	2798.	1841.	233.	0.30	1.72	180.6	216.	216.	215.	215.	216.	215.	217.	216.	216.	217.
49-12	16.0	4875.	430.	2450.	2900.	257.	0.27	1.80	182.0	217.	217.	216.	216.	217.	216.	218.	216.	217.	218.
49-13	16.5	4874.	480.	1665.	3601.	306.	0.18	1.98	182.7	218.	219.	218.	217.	219.	218.	219.	218.	219.	219.
49-14	17.1	4866.	534.	1074.	3756.	349.	0.12	2.17	183.3	220.	220.	219.	219.	220.	220.	221.	220.	220.	221.
49-15	17.6	4832.	573.	721.	4478.	381.	0.08	2.30	183.8	222.	222.	221.	220.	222.	222.	222.	221.	222.	222.
49-16	18.8	4824.	676.	268.	4548.	453.	0.03	2.63	181.2	225.	225.	224.	224.	226.	226.	226.	225.	226.	227.
49-17	20.1	4810.	763.	94.	4576.	516.	0.01	2.89	181.9	228.	229.	228.	228.	229.	229.	229.	229.	229.	230.
49-18	21.5	4788.	849.	24.	4774.	579.	0.	3.12	182.4	231.	232.	231.	231.	233.	232.	233.	232.	233.	233.
49-19	19.6	4812.	721.	167.	4971.	495.	0.02	2.76	182.7	227.	228.	226.	226.	228.	228.	228.	227.	228.	228.
49-20	18.2	4848.	634.	417.	4935.	418.	0.05	2.51	179.6	223.	223.	222.	222.	224.	223.	224.	223.	224.	224.
49-21	17.0	4878.	526.	1067.	4107.	343.	0.12	2.14	182.2	220.	220.	219.	219.	220.	220.	221.	219.	220.	221.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
49-22	16.5	4866.	473.	1683.	3289.	305.	0.18	1.95	183.6	218.	218.	218.	217.	218.	218.	219.	218.	218.	219.
49-23	16.3	4865.	453.	1969.	3544.	283.	0.21	1.88	182.3	217.	218.	217.	217.	218.	217.	218.	217.	218.	218.
49-24	16.0	4872.	433.	2345.	2376.	252.	0.26	1.81	180.9	216.	216.	215.	215.	216.	216.	217.	216.	216.	217.
49-25	15.8	4875.	406.	2809.	2469.	229.	0.31	1.71	180.6	216.	215.	215.	214.	216.	215.	216.	216.	216.	217.
49-26	15.6	4880.	383.	3351.	1446.	204.	0.36	1.62	180.2	215.	215.	214.	214.	216.	214.	216.	215.	215.	216.
49-27	15.4	4890.	364.	4036.	683.	183.	0.44	1.55	180.0	215.	215.	214.	214.	215.	214.	215.	214.	215.	216.
49-28	15.3	4891.	340.	4687.	189.	160.			179.6	215.	214.	213.	214.	215.	214.	215.	214.	215.	215.
49-29	15.0	4904.	289.	4820.	12.	102.			179.0	214.	214.	212.	213.	214.	214.	214.	213.	214.	214.
49-30	14.9	4894.	244.	5097.	10.	68.			183.2	214.	213.	212.	213.	213.	213.	214.	212.	214.	214.
54- 1	14.8	4858.	-3.	4787.	0.	-6.			201.6	203.	203.	203.	202.	203.	203.	203.	204.	203.	203.
54- 2	15.0	4851.	201.	4864.	3.	115.			201.5	216.	215.	215.	215.	215.	215.	215.	214.	215.	216.
54- 3	15.1	4856.	212.	4979.	2.	130.			202.5	216.	215.	215.	215.	215.	215.	215.	214.	215.	216.
54- 4	15.3	4853.	244.	4967.	3.	169.			202.9	216.	216.	216.	215.	216.	216.	216.	215.	216.	216.
54- 5	15.4	4851.	268.	5034.	3.	185.			201.5	217.	217.	216.	216.	216.	217.	217.	216.	217.	217.
54- 6	15.6	4846.	292.	4744.	41.	212.			202.1	217.	217.	217.	216.	217.	217.	217.	216.	217.	217.
54- 7	15.8	4841.	312.	4771.	134.	229.			202.6	218.	218.	217.	217.	218.	218.	218.	217.	218.	218.
54- 8	16.0	4841.	340.	4653.	5.	253.			202.8	218.	218.	218.	218.	218.	218.	218.	217.	219.	218.
54- 9	16.4	4826.	385.	3422.	1491.	292.	0.37	1.59	202.7	219.	219.	219.	218.	219.	219.	219.	219.	219.	219.
54-10	16.9	4827.	432.	2427.	2577.	333.	0.26	1.76	201.7	221.	221.	220.	220.	221.	221.	221.	221.	221.	221.
54-11	17.4	4832.	478.	1763.	3140.	371.	0.19	1.93	202.0	223.	223.	223.	222.	223.	223.	223.	223.	223.	224.
54-12	18.1	4821.	529.	1117.	3710.	412.	0.12	2.10	203.7	225.	225.	224.	224.	225.	225.	225.	224.	225.	226.
54-13	18.6	4808.	571.	791.	4022.	444.	0.09	2.23	203.6	226.	226.	226.	226.	226.	226.	226.	226.	226.	227.
54-14	20.0	4796.	674.	341.	4842.	515.	0.04	2.55	203.3	230.	230.	229.	229.	230.	230.	230.	229.	230.	230.
54-15	21.5	4779.	759.	125.	4744.	579.	0.01	2.79	204.3	234.	234.	233.	233.	234.	234.	235.	233.	235.	235.
54-16	23.2	4763.	856.	28.	4814.	647.	0.	3.04	204.4	237.	238.	237.	237.	238.	238.	238.	237.	238.	238.
54-17	20.9	4796.	713.	230.	4932.	555.	0.03	2.65	204.7	232.	232.	231.	231.	233.	232.	233.	232.	232.	233.
54-18	19.4	4809.	628.	511.	4522.	486.	0.06	2.41	202.6	228.	228.	227.	228.	228.	228.	228.	228.	229.	229.
54-19	18.0	4820.	522.	1133.	4049.	411.	0.12	2.07	201.9	225.	225.	224.	224.	225.	225.	225.	224.	225.	225.
54-20	16.8	4820.	431.	2545.	2476.	329.	0.28	1.76	200.8	221.	221.	220.	221.	221.	221.	221.	221.	221.	222.
54-21	16.3	4821.	384.	3401.	2147.	282.	0.37	1.59	199.6	219.	219.	218.	218.	219.	219.	219.	219.	219.	220.
54-22	15.9	4822.	335.	4558.	55.	247.			201.1	218.	218.	217.	218.	218.	218.	218.	218.	218.	218.
54-23	15.7	4830.	314.	4815.	98.	222.			200.1	218.	218.	216.	216.	217.	217.	217.	217.	218.	218.
54-24	15.6	4833.	293.	4981.	9.	205.			201.0	217.	217.	215.	216.	217.	217.	216.	216.	217.	217.
54-25	15.3	4836.	267.	4961.	10.	175.			200.4	216.	216.	215.	216.	216.	216.	216.	216.	216.	216.
54-26	15.2	4834.	242.	4837.	10.	148.			201.0	216.	216.	214.	215.	216.	215.	215.	215.	216.	216.
54-27	15.0	4847.	193.	4961.	9.	97.			200.8	215.	215.	213.	214.	215.	215.	214.	214.	215.	215.
60- 1	14.8	5027.	3.	5033.	0.	13.			94.5	98.	97.	98.	96.	97.	97.	97.	101.	97.	97.
60- 2	14.7	5016.	198.	5388.	0.	11.			96.0	98.	97.	98.	96.	97.	97.	97.	100.	97.	97.
60- 3	14.8	5010.	284.	5461.	0.	14.			96.2	97.	97.	97.	96.	97.	97.	97.	100.	97.	97.
60- 4	14.8	5015.	384.	5619.	0.	13.			96.4	98.	97.	98.	96.	97.	97.	97.	99.	97.	97.
60- 5	14.7	5023.	406.	5687.	2.	10.			96.8	98.	97.	98.	97.	98.	98.	98.	99.	97.	98.
60- 6	14.8	5014.	434.	5620.	2.	13.			97.1	98.	97.	98.	97.	98.	98.	98.	99.	98.	98.
60- 7	14.7	5015.	454.	5715.	2.	9.			97.8	98.	98.	98.	97.	98.	98.	98.	99.	97.	98.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
60- 8	14.7	5017.	478.	5649.	2.	8.			98.5	99.	99.	99.	98.	99.	99.	99.	99.	98.	99.
60- 9	14.8	5015.	503.	5239.	5.	5.			98.5	99.	99.	100.	98.	100.	100.	100.	101.	99.	100.
60-10	14.8	5013.	527.	4400.	7.	8.			98.2	100.	103.	100.	101.	105.	102.	107.	102.	103.	109.
60-11	14.8	5019.	554.	5521.	3.	5.			98.9	98.	98.	99.	98.	99.	99.	99.	100.	98.	100.
60-12	14.8	5017.	576.	5545.	3.	6.			99.3	145.	153.	137.	160.	175.	146.	184.	150.	180.	199.
60-13	14.8	5019.	596.	3885.	1664.	33.	0.42	2.58	98.3	204.	202.	205.	199.	207.	200.	210.	208.	206.	214.
60-14	14.8	5016.	616.	1708.	2865.	42.	0.19	2.67	98.8	209.	206.	211.	208.	212.	207.	207.	207.	212.	212.
60-15	15.0	5021.	670.	617.	4016.	113.	0.07	2.80	99.6	212.	206.	212.	208.	213.	205.	210.	211.	212.	214.
60-16	15.7	5003.	772.	202.	4617.	226.	0.02	3.26	102.8	216.	209.	217.	213.	217.	209.	214.	216.	215.	217.
60-17	16.5	4988.	858.	56.	4872.	310.	0.01	3.54	102.9	218.	210.	219.	215.	219.	210.	217.	219.	217.	220.
60-18	15.3	5007.	708.	369.	4705.	177.	0.04	3.02	102.8	214.	209.	215.	210.	216.	208.	212.	215.	214.	215.
60-19	14.8	5011.	615.	1504.	3553.	73.	0.16	2.66	101.9	210.	205.	212.	207.	212.	205.	211.	212.	211.	214.
60-20	14.8	4995.	572.	3081.	2157.	27.	0.33	2.48	100.4	209.	205.	211.	205.	210.	204.	210.	211.	209.	214.
60-21	14.8	4984.	552.	4408.	1228.	12.			100.9	206.	204.	210.	202.	208.	202.	212.	210.	206.	214.
60-22	14.8	4976.	507.	5243.	424.	0.			101.8	181.	190.	170.	187.	198.	180.	201.	181.	204.	210.
60-23	14.7	4988.	503.	5524.	9.	-5.			102.1	111.	110.	111.	109.	114.	109.	117.	114.	113.	129.
60-24	14.8	4968.	473.	5843.	3.	-7.			101.0	106.	105.	106.	104.	105.	105.	105.	110.	104.	105.
60-25	14.8	4969.	446.	4829.	0.	-11.			100.3	104.	103.	105.	102.	104.	104.	103.	107.	102.	103.
60-26	14.7	4967.	434.	5507.	0.	-11.			99.6	102.	101.	102.	101.	102.	102.	102.	104.	101.	101.
60-27	14.7	4966.	406.	5590.	0.	-11.			99.0	101.	100.	101.	100.	101.	101.	101.	102.	100.	101.
60-28	14.7	4977.	380.	5576.	0.	-11.			98.9	100.	99.	100.	99.	100.	100.	100.	101.	99.	100.
60-29	14.7	4976.	336.	5407.	0.	-11.			98.2	99.	99.	99.	98.	99.	99.	99.	100.	98.	99.
60-30	14.7	4971.	243.	5349.	0.	-12.			97.4	98.	97.	98.	97.	98.	98.	98.	99.	97.	98.
61- 1	14.8	5887.	132.	6207.	2.	15.			95.7	97.	97.	99.	96.	97.	96.	97.	99.	95.	96.
61- 2	14.8	5949.	195.	6202.	-2.	15.			95.8	96.	96.	97.	95.	96.	95.	96.	98.	95.	96.
61- 3	14.8	6015.	291.	6500.	2.	15.			96.5	96.	96.	97.	96.	97.	96.	97.	98.	95.	96.
61- 4	14.8	6023.	383.	6663.	0.	15.			97.1	96.	96.	97.	96.	97.	95.	96.	97.	95.	96.
61- 5	14.8	6026.	430.	6501.	0.	15.			98.4	98.	98.	98.	97.	98.	97.	98.	99.	97.	97.
61- 6	14.8	6029.	476.	6389.	0.	15.			98.3	97.	98.	98.	97.	98.	97.	98.	99.	96.	97.
61- 7	14.8	6037.	505.	6855.	-3.	15.			99.2	99.	99.	99.	98.	100.	98.	99.	100.	97.	98.
61- 8	14.8	6026.	526.	6865.	0.	15.			99.6	98.	98.	99.	97.	99.	97.	99.	99.	97.	98.
61- 9	14.8	6026.	551.	5730.	2.	16.			100.3	100.	100.	100.	98.	100.	98.	100.	100.	98.	100.
61-10	14.8	5993.	573.	4846.	469.	22.			100.2	104.	107.	104.	105.	108.	106.	110.	106.	106.	110.
61-11	14.8	5989.	597.	5991.	390.	17.			100.9	104.	106.	104.	104.	108.	105.	109.	108.	105.	110.
61-12	14.8	5983.	613.	6710.	9.	15.			101.9	102.	102.	102.	101.	102.	101.	102.	103.	101.	101.
61-13	14.8	5986.	637.	6459.	7.	15.			102.3	103.	103.	103.	103.	103.	102.	106.	104.	104.	117.
61-14	14.8	5984.	672.	967.	4477.	41.			101.5	209.	201.	210.	201.	211.	198.	211.	211.	208.	213.
61-15	14.9	5986.	694.	438.	5067.	65.			103.2	212.	203.	213.	204.	212.	200.	210.	213.	209.	213.
61-16	15.0	6006.	711.	414.	5235.	102.			105.5	212.	203.	213.	203.	213.	201.	212.	214.	208.	213.
61-17	15.1	6004.	733.	236.	5666.	125.			104.8	210.	202.	212.	200.	211.	199.	212.	214.	206.	213.
61-18	15.2	5999.	758.	181.	5840.	146.			104.5	212.	203.	213.	199.	212.	200.	212.	215.	205.	213.
61-19	15.4	5995.	804.	104.	5813.	188.			104.4	214.	206.	215.	201.	214.	203.	212.	216.	206.	213.
61-20	15.8	5991.	856.	59.	6070.	236.			103.6	213.	207.	214.	198.	214.	202.	214.	216.	204.	214.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
61-21	16.1	5986.	891.	24.	5914.	267.			103.3	214.	205.	214.	195.	214.	202.	215.	217.	202.	214.
61-22	15.7	6003.	838.	90.	5821.	219.			103.2	213.	204.	211.	192.	212.	201.	213.	216.	199.	212.
61-23	15.3	6032.	779.	201.	5938.	163.			102.5	209.	203.	209.	189.	210.	200.	212.	215.	195.	210.
61-24	15.0	6024.	737.	254.	5761.	118.			102.1	212.	203.	210.	192.	210.	201.	208.	213.	196.	209.
61-25	14.9	6023.	686.	675.	5255.	71.			102.0	210.	200.	208.	189.	209.	198.	208.	213.	194.	208.
61-26	14.8	6035.	637.	2088.	4169.	29.			101.7	207.	199.	207.	183.	206.	198.	207.	212.	190.	207.
61-27	14.8	6028.	596.	6901.	322.	14.			100.3	135.	148.	135.	125.	147.	142.	165.	145.	141.	187.
61-28	14.8	6000.	554.	5542.	3.	15.			101.9	110.	110.	105.	83.	109.	107.	107.	113.	96.	105.
61-29	14.8	5990.	529.	5878.	10.	13.			102.5	106.	105.	102.	81.	104.	104.	105.	110.	94.	103.
61-30	14.8	5994.	452.	6443.	0.	14.			102.4	104.	103.	100.	82.	103.	102.	101.	107.	93.	98.
61-31	14.8	5996.	333.	6510.	0.	15.			101.9	103.	102.	100.	83.	102.	101.	99.	105.	93.	98.
62- 1	14.8	7484.	136.	7817.	-2.	14.			99.7	100.	99.	96.	84.	100.	99.	96.	102.	92.	97.
62- 2	14.8	7476.	196.	8055.	-2.	15.			97.6	97.	96.	93.	82.	97.	96.	93.	99.	89.	93.
62- 3	14.8	7483.	288.	8104.	0.	14.			97.5	97.	96.	94.	83.	97.	96.	93.	98.	89.	93.
62- 4	14.8	7478.	381.	8235.	86.	15.			97.7	97.	96.	94.	84.	97.	96.	93.	98.	89.	93.
62- 5	14.8	7478.	429.	8010.	3.	15.			98.9	97.	96.	94.	85.	97.	96.	94.	98.	90.	94.
62- 6	14.8	7480.	481.	8169.	0.	14.			99.0	98.	97.	95.	85.	98.	97.	94.	99.	90.	94.
62- 7	14.8	7481.	527.	7689.	0.	13.			99.3	98.	97.	96.	86.	99.	97.	95.	100.	91.	95.
62- 8	14.8	7500.	573.	8267.	0.	15.			101.0	100.	99.	97.	88.	100.	99.	96.	101.	92.	96.
62- 9	14.8	7502.	618.	8369.	0.	12.			100.8	100.	99.	97.	88.	100.	99.	96.	101.	93.	96.
62-11	14.8	7497.	695.	5258.	1497.	9.	0.57	3.01	99.2	117.	131.	112.	109.	126.	131.	126.	122.	124.	133.
62-12	14.8	7501.	720.	793.	4579.	12.	0.09	3.12	100.9	195.	201.	188.	164.	203.	199.	200.	202.	187.	200.
62-13	14.8	7522.	742.	346.	4746.	15.	0.04	3.21	104.2	198.	204.	196.	168.	204.	202.	203.	203.	186.	200.
62-14	14.8	7517.	769.	160.	6189.	29.	0.02	3.33	106.8	201.	205.	203.	177.	206.	203.	204.	206.	186.	200.
62-15	14.8	7531.	790.	115.	7082.	60.	0.01	3.42	108.4	202.	206.	204.	177.	206.	203.	205.	206.	186.	199.
62-16	14.9	7540.	805.	56.	7673.	80.	0.01	3.48	109.2	202.	208.	205.	183.	207.	206.	205.	207.	187.	199.
62-17	15.1	7510.	840.	35.	7141.	137.	0.	3.61	113.7	204.	208.	206.	183.	207.	206.	206.	208.	187.	200.
62-18	15.2	7497.	852.	7.	7604.	147.	0.	3.65	112.7	206.	207.	206.	189.	207.	204.	207.	210.	188.	200.
62-19	15.3	7496.	871.	7.	7570.	167.	0.	3.72	112.7	206.	207.	205.	190.	207.	205.	207.	209.	189.	201.
62-20	15.4	7489.	898.	7.	7550.	189.	0.	3.82	112.7	207.	207.	207.	193.	207.	204.	207.	209.	190.	202.
62-21	15.1	7502.	834.	63.	7579.	126.	0.01	3.58	112.3	207.	207.	206.	194.	208.	204.	207.	209.	192.	202.
62-22	14.9	7506.	803.	73.	7289.	97.	0.01	3.47	112.6	206.	206.	206.	183.	207.	203.	208.	209.	191.	202.
62-23	14.8	7505.	780.	111.	7417.	72.	0.01	3.38	112.5	201.	206.	204.	185.	206.	203.	207.	208.	192.	202.
62-24	14.8	7508.	756.	237.	7249.	53.	0.03	3.27	112.6	206.	207.	204.	190.	207.	203.	207.	207.	195.	202.
62-25	14.8	7517.	738.	281.	7046.	29.	0.03	3.20	111.7	203.	208.	205.	192.	207.	204.	207.	208.	196.	204.
62-26	14.8	7509.	715.	355.	6487.	11.	0.04	3.10	111.3	203.	205.	204.	190.	207.	201.	207.	208.	195.	204.
62-27	14.8	7506.	669.	713.	4651.	1.	0.08	2.90	111.7	201.	205.	200.	189.	207.	201.	205.	207.	196.	204.
62-28	14.8	7522.	614.	7691.	201.	-9.			111.7	117.	127.	114.	109.	117.	132.	117.	123.	112.	115.
62-29	14.7	7490.	575.	7391.	1100.	-6.			109.5	115.	119.	112.	107.	119.	117.	120.	120.	110.	118.
62-30	14.7	7502.	529.	8333.	7.	-9.			107.0	107.	107.	106.	99.	107.	107.	106.	111.	100.	102.
62-31	14.7	7503.	468.	7866.	0.	-11.			104.6	105.	105.	104.	98.	106.	105.	104.	108.	99.	101.
62-32	14.7	7374.	434.	8019.	-2.	-11.			101.7	102.	101.	101.	95.	102.	101.	100.	104.	96.	97.
62-33	14.7	7495.	339.	8074.	2.	-11.			99.3	99.	99.	98.	93.	99.	98.	97.	101.	94.	95.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	#1	#3	#4	#5	#8	#10	#11	#12	#13	#14
		FLOW (LB/HR)								TIE PLATE POCKET TEMPS (F)									
62-34	14.7	7488.	244.	7934.	0.	-11.			96.3	96.	95.	95.	90.	96.	95.	94.	98.	91.	92.
69- 1	14.8	4827.	6.	4696.	65.	14.			202.2	201.	200.	200.	200.	201.	201.	201.	201.	200.	201.
69- 2	15.1	4814.	197.	4660.	96.	127.			203.3	215.	214.	214.	214.	214.	215.	215.	215.	214.	215.
69- 3	15.1	4820.	221.	4566.	107.	141.			200.6	215.	214.	214.	214.	214.	215.	215.	215.	214.	215.
69- 4	15.2	4827.	243.	4837.	100.	157.			200.9	215.	214.	214.	214.	215.	215.	215.	215.	214.	215.
69- 5	15.4	4847.	265.	4853.	117.	177.			199.4	215.	215.	214.	215.	215.	216.	216.	216.	215.	216.
69- 6	15.4	4842.	270.	4886.	119.	183.			199.2	215.	215.	214.	215.	215.	216.	216.	216.	215.	216.
69- 7	15.6	4853.	316.	4792.	141.	214.			198.8	216.	215.	215.	215.	216.	216.	216.	216.	216.	217.
69- 8	15.9	4847.	337.	4685.	426.	233.	0.51	1.41	198.6	216.	215.	215.	215.	216.	216.	216.	216.	216.	217.
69- 9	16.2	4838.	382.	3717.	1186.	271.	0.40	1.59	199.7	217.	216.	216.	216.	217.	217.	218.	218.	217.	218.
69-10	16.8	4831.	436.	2623.	1985.	327.	0.29	1.78	202.9	219.	218.	219.	218.	219.	219.	220.	220.	219.	220.
69-11	17.3	4822.	475.	2086.	2567.	363.	0.23	1.92	202.6	221.	220.	220.	219.	220.	221.	222.	222.	221.	222.
69-12	17.8	4819.	526.	1498.	3027.	397.	0.16	2.10	200.9	222.	221.	221.	221.	222.	222.	223.	223.	222.	223.
69-13	18.4	4812.	570.	1095.	3251.	429.	0.12	2.24	201.0	223.	222.	222.	222.	223.	223.	225.	224.	223.	225.
69-14	19.8	4785.	667.	452.	3691.	504.	0.05	2.54	202.4	227.	226.	226.	226.	227.	227.	228.	228.	227.	229.
69-15	21.5	4758.	766.	184.	3913.	576.	0.02	2.81	206.0	232.	230.	230.	229.	231.	232.	233.	233.	231.	233.
69-16	23.2	4747.	863.	59.	4051.	647.	0.01	3.06	208.3	236.	234.	234.	233.	235.	236.	237.	237.	235.	237.
69-17	20.7	4857.	721.	264.	4039.	546.	0.03	2.69	204.3	229.	228.	227.	227.	229.	229.	230.	230.	229.	230.
69-18	19.1	4878.	618.	807.	3669.	471.	0.09	2.39	202.2	225.	224.	223.	223.	225.	225.	226.	226.	225.	227.
69-19	17.7	4826.	527.	1613.	2970.	387.	0.18	2.11	196.0	221.	219.	219.	218.	221.	221.	222.	222.	220.	222.
69-20	16.5	4847.	428.	2906.	1948.	307.	0.32	1.77	197.6	217.	216.	216.	215.	217.	218.	219.	219.	217.	219.
69-21	16.2	4840.	382.	3653.	1364.	277.	0.40	1.59	201.8	216.	215.	215.	214.	216.	217.	217.	217.	216.	217.
69-22	16.0	4832.	337.	4458.	437.	253.	0.49	1.41	203.3	216.	215.	214.	214.	216.	216.	217.	216.	216.	217.
69-23	15.7	4838.	311.	4834.	136.	227.			201.9	216.	214.	214.	214.	215.	216.	216.	216.	215.	216.
69-24	15.6	4846.	290.	4769.	127.	205.			201.3	215.	214.	214.	214.	215.	215.	215.	215.	214.	215.
69-25	15.3	4849.	265.	4755.	119.	174.			199.8	214.	213.	213.	213.	214.	214.	214.	214.	214.	214.
69-26	15.2	4847.	239.	4836.	115.	151.			200.4	214.	213.	212.	213.	214.	214.	214.	214.	213.	214.
69-27	15.0	4855.	196.	4710.	113.	105.			200.4	213.	212.	211.	212.	213.	213.	213.	213.	213.	213.
73- 1	14.9	4954.	-6.	4946.	0.	15.			95.4	107.	105.	107.	104.	107.	105.	106.	107.	105.	106.
73- 2	14.9	4899.	198.	5067.	0.	15.			96.3	99.	99.	99.	98.	99.	99.	99.	100.	98.	99.
73- 3	14.9	4522.	285.	4908.	0.	15.			97.4	99.	97.	98.	97.	112.	97.	100.	99.	97.	100.
73- 4	14.9	4650.	380.	5109.	0.	15.			99.2	105.	100.	105.	99.	142.	99.	110.	102.	99.	113.
73- 5	14.9	4962.	406.	5514.	0.	15.			97.9	98.	98.	98.	97.	104.	98.	98.	98.	97.	98.
73- 6	14.9	4888.	434.	5557.	3.	15.			98.4	99.	98.	98.	97.	107.	98.	99.	98.	97.	98.
73- 7	14.9	4818.	450.	5621.	0.	15.			97.6	99.	97.	99.	97.	116.	97.	100.	98.	97.	99.
73- 8	14.9	4734.	477.	5164.	5.	14.			96.9	97.	97.	97.	96.	102.	97.	98.	97.	96.	98.
73- 9	14.9	4860.	501.	4414.	9.	13.			97.2	99.	99.	98.	98.	103.	98.	104.	99.	99.	104.
73-10	14.9	4898.	526.	2967.	10.	16.			97.6	102.	102.	102.	101.	111.	101.	108.	104.	102.	109.
73-11	14.9	4996.	553.	5701.	7.	14.			98.4	108.	99.	112.	99.	126.	100.	105.	104.	98.	109.
73-12	14.9	4906.	570.	5582.	9.	15.			97.6	198.	182.	200.	194.	208.	172.	204.	174.	205.	210.
73-13	14.9	4974.	597.	4485.	12.	15.	0.49	2.58	98.7	197.	196.	197.	203.	206.	194.	195.	189.	209.	204.
73-14	15.1	4686.	623.	197.	4010.	65.	0.02	2.67	97.7	211.	211.	211.	210.	212.	211.	213.	208.	212.	213.
73-15	15.3	5059.	649.	90.	4135.	127.	0.01	2.77	104.5	213.	214.	213.	213.	214.	214.	215.	211.	214.	215.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
73-16	16.1	4987.	765.	24.	4660.	240.	0.	3.19	106.0	215.	217.	216.	215.	217.	217.	217.	213.	217.	217.
73-17	16.8	4922.	850.	17.	4613.	313.	0.	3.48	99.5	217.	219.	218.	217.	219.	218.	219.	215.	219.	219.
73-18	15.6	5113.	705.	17.	4650.	186.	0.	2.98	101.8	213.	215.	214.	214.	215.	215.	215.	211.	215.	216.
73-19	15.1	5026.	618.	226.	4195.	84.	0.02	2.65	97.4	213.	213.	213.	212.	214.	213.	214.	210.	214.	215.
73-20	15.1	5046.	572.	509.	3669.	42.	0.06	2.46	101.1	212.	212.	212.	212.	213.	212.	213.	210.	214.	215.
73-21	15.1	5010.	549.	702.	3591.	37.	0.08	2.36	102.2	212.	212.	212.	211.	214.	212.	214.	210.	213.	215.
73-22	15.0	5011.	521.	1058.	3370.	24.	0.11	2.24	101.8	212.	211.	212.	211.	213.	211.	213.	209.	213.	215.
73-23	15.0	4982.	502.	1259.	3210.	15.	0.14	2.16	102.0	211.	211.	211.	211.	213.	211.	213.	209.	213.	214.
73-24	15.0	4944.	465.	3097.	2048.	11.	0.34	2.00	101.8	208.	208.	208.	210.	211.	208.	210.	206.	213.	213.
73-25	14.9	4939.	452.	5085.	34.	9.			101.2	206.	206.	206.	206.	208.	204.	207.	205.	211.	211.
73-26	14.9	4931.	433.	5470.	5.	15.			99.8	132.	119.	137.	120.	166.	118.	128.	122.	123.	131.
73-27	14.9	4923.	407.	5340.	0.	14.			98.9	106.	104.	106.	104.	109.	104.	105.	106.	104.	105.
73-28	14.9	4925.	380.	5285.	3.	14.			98.0	102.	101.	102.	101.	106.	101.	102.	102.	101.	101.
73-29	14.9	4932.	335.	5202.	2.	14.			97.7	99.	98.	99.	98.	105.	99.	99.	99.	98.	99.
73-30	14.9	5018.	237.	5065.	2.	13.			98.3	99.	99.	99.	98.	99.	99.	99.	99.	99.	99.
76- 1	14.8	4372.	2.	3900.	279.	14.			201.8	201.	200.	199.	200.	201.	201.	201.	202.	200.	201.
76- 2	15.1	4359.	198.	4242.	283.	127.			202.0	214.	213.	212.	212.	213.	213.	214.	212.	212.	214.
76- 3	15.3	4347.	218.	4010.	282.	152.			201.6	214.	213.	212.	213.	213.	214.	214.	213.	213.	214.
76- 4	15.3	4344.	242.	4132.	289.	171.			200.8	215.	213.	213.	213.	213.	214.	215.	213.	213.	215.
76- 5	15.5	4346.	263.	4120.	270.	189.			200.8	215.	214.	213.	214.	214.	215.	215.	214.	214.	215.
76- 6	15.6	4340.	287.	3959.	287.	214.			201.1	216.	215.	214.	215.	215.	215.	216.	215.	215.	216.
76- 7	15.8	4327.	310.	3932.	292.	231.			201.2	216.	215.	215.	215.	215.	216.	216.	215.	215.	216.
76- 8	15.8	4359.	337.	3685.	358.	240.	0.40	1.42	201.4	217.	216.	215.	216.	216.	216.	217.	216.	216.	217.
76- 9	16.1	4405.	360.	3479.	981.	265.	0.38	1.50	201.4	217.	217.	216.	217.	217.	217.	218.	217.	217.	218.
76-10	16.3	4400.	380.	3060.	1372.	286.	0.33	1.58	201.4	218.	218.	217.	217.	217.	218.	218.	218.	218.	218.
76-11	16.8	4394.	431.	1906.	2096.	327.	0.21	1.76	201.3	219.	219.	218.	218.	218.	219.	220.	219.	219.	220.
76-12	17.4	4392.	476.	1577.	2646.	368.	0.17	1.92	201.9	221.	221.	219.	221.	221.	221.	222.	221.	221.	221.
76-13	18.0	4394.	526.	929.	3070.	405.	0.10	2.09	202.0	223.	222.	221.	222.	222.	223.	223.	223.	222.	223.
76-14	18.6	4379.	570.	681.	3164.	442.	0.07	2.23	202.6	225.	224.	223.	224.	224.	225.	225.	224.	224.	225.
76-15	19.9	4375.	669.	264.	3452.	509.	0.03	2.54	200.7	228.	227.	226.	227.	227.	228.	228.	228.	227.	228.
76-16	21.4	4369.	762.	104.	3694.	575.	0.01	2.80	201.6	231.	231.	230.	231.	231.	231.	232.	231.	231.	231.
76-17	23.2	4351.	863.	31.	3689.	645.	0.	3.06	202.6	236.	235.	235.	235.	235.	236.	237.	236.	235.	236.
76-18	20.8	4373.	714.	160.	3555.	549.	0.02	2.66	201.3	230.	230.	229.	229.	229.	230.	231.	230.	229.	230.
76-19	19.3	4385.	612.	483.	3297.	476.	0.05	2.36	200.5	226.	226.	224.	226.	225.	226.	227.	226.	225.	226.
76-20	18.1	4387.	526.	991.	2911.	413.	0.11	2.08	201.4	223.	222.	221.	222.	222.	223.	224.	223.	222.	223.
76-21	16.9	4393.	423.	2142.	2182.	326.	0.23	1.73	200.6	219.	219.	218.	218.	218.	219.	219.	219.	218.	219.
76-22	16.4	4403.	382.	2845.	1601.	286.	0.31	1.58	199.6	218.	217.	216.	217.	217.	218.	218.	217.	217.	218.
76-23	16.0	4399.	338.	3979.	804.	251.			201.0	216.	216.	215.	216.	216.	216.	216.	216.	216.	217.
76-24	15.9	4404.	311.	4378.	303.	237.			200.9	216.	215.	214.	215.	215.	216.	216.	215.	215.	216.
76-25	15.7	4399.	290.	3945.	296.	214.			200.7	216.	214.	214.	214.	214.	215.	215.	214.	214.	215.
76-26	15.4	4400.	263.	4043.	293.	180.			200.4	215.	213.	213.	213.	213.	214.	214.	213.	213.	214.
76-27	15.3	4405.	238.	4174.	297.	156.			201.1	214.	213.	213.	213.	213.	213.	214.	213.	213.	214.
76-28	15.0	4402.	195.	4085.	290.	110.			200.9	214.	213.	212.	213.	213.	214.	214.	213.	212.	214.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
83- 1	14.8	7729.	3.	7580.	5.	-10.			199.7	197.	196.	195.	198.	196.	196.	197.	197.	195.	195.
83- 2	14.8	7730.	197.	7535.	12.	57.			200.7	212.	210.	211.	213.	211.	209.	210.	211.	209.	208.
83- 3	15.1	7726.	240.	7433.	12.	124.			203.5	213.	211.	211.	214.	212.	211.	212.	212.	210.	210.
83- 4	15.2	7715.	265.	7840.	10.	162.			205.7	214.	212.	211.	215.	212.	212.	212.	213.	211.	211.
83- 5	15.4	7717.	290.	8231.	105.	182.			205.4	214.	213.	212.	215.	213.	213.	214.	214.	211.	212.
83- 6	15.4	7718.	311.	6023.	1279.	192.			204.1	214.	213.	212.	216.	214.	213.	214.	214.	212.	213.
83- 7	15.6	7709.	337.	5060.	2322.	213.			203.1	215.	214.	213.	217.	214.	214.	215.	215.	213.	214.
83- 8	15.9	7674.	357.	4394.	2705.	245.			205.7	216.	215.	215.	218.	216.	216.	216.	216.	214.	215.
83- 9	16.1	7676.	381.	3870.	2969.	261.			205.0	217.	216.	215.	218.	216.	216.	217.	217.	215.	216.
83-10	16.6	7657.	433.	2691.	4099.	313.			206.7	218.	218.	217.	219.	218.	218.	218.	218.	217.	218.
83-11	17.0	7610.	476.	1853.	5019.	347.			205.1	220.	219.	218.	220.	219.	219.	220.	220.	218.	219.
83-12	17.5	7642.	526.	984.	5314.	375.			204.6	221.	220.	220.	221.	221.	221.	221.	221.	219.	220.
83-13	18.0	7647.	570.	721.	5272.	408.			205.2	223.	222.	221.	223.	222.	222.	223.	223.	221.	222.
83-14	19.0	7572.	669.	306.	5808.	467.			202.9	225.	225.	224.	225.	225.	225.	226.	226.	224.	225.
83-15	20.1	7652.	761.	122.	6246.	521.			201.3	229.	228.	227.	228.	228.	228.	229.	229.	227.	228.
83-16	21.5	7688.	861.	38.	6083.	581.			201.4	232.	231.	230.	231.	231.	231.	232.	232.	230.	231.
83-17	19.7	7722.	716.	223.	6204.	498.			201.9	227.	226.	226.	227.	226.	227.	227.	227.	225.	226.
83-18	18.2	7838.	611.	515.	6013.	420.			200.7	223.	222.	222.	223.	222.	222.	223.	223.	222.	222.
83-19	17.3	7856.	526.	1232.	5395.	365.			200.8	220.	219.	219.	221.	220.	220.	221.	220.	219.	220.
83-20	16.1	7865.	430.	2507.	4739.	275.			199.2	217.	216.	215.	216.	217.	217.	217.	217.	215.	216.
83-21	16.0	7816.	378.	3677.	3497.	251.			203.5	216.	215.	214.	217.	215.	215.	217.	216.	214.	215.
83-22	15.6	7809.	340.	5068.	2299.	215.			202.9	215.	214.	214.	216.	215.	215.	215.	215.	214.	214.
83-23	15.3	7829.	311.	6315.	1611.	181.			202.3	214.	214.	213.	215.	214.	214.	214.	214.	213.	214.
83-24	15.2	7842.	287.	7108.	454.	154.			200.8	213.	213.	212.	215.	213.	213.	214.	214.	213.	213.
83-25	15.1	7862.	263.	7688.	24.	128.			199.5	214.	212.	212.	215.	213.	212.	213.	213.	212.	212.
83-26	15.0	7808.	238.	7884.	19.	104.			202.4	213.	212.	212.	214.	212.	212.	213.	212.	211.	211.
83-27	14.9	7744.	215.	6945.	17.	88.			202.0	213.	212.	212.	214.	212.	212.	212.	213.	211.	211.
85- 1	14.7	4954.	127.	5055.	2.	15.			98.8	100.	97.	102.	99.	98.	97.	98.	98.	98.	98.
85- 2	14.7	4928.	201.	5159.	0.	15.			96.5	97.	95.	98.	98.	97.	96.	96.	97.	96.	96.
85- 3	14.7	4928.	293.	5262.	3.	15.			97.1	97.	96.	98.	98.	97.	96.	97.	97.	96.	96.
85- 4	14.7	4945.	379.	5378.	-2.	15.			98.1	97.	97.	98.	98.	97.	97.	97.	98.	97.	97.
85- 5	14.7	4961.	408.	5438.	0.	15.			99.4	99.	98.	99.	100.	99.	99.	99.	99.	99.	99.
85- 6	14.7	4965.	428.	5482.	0.	15.			100.9	100.	100.	101.	101.	100.	100.	100.	101.	100.	100.
85- 7	14.7	4966.	447.	5574.	0.	15.			102.0	101.	101.	101.	102.	101.	101.	101.	102.	101.	101.
85- 8	14.7	4975.	480.	4216.	9.	14.			101.9	102.	102.	103.	103.	103.	102.	103.	103.	102.	104.
85- 9	14.8	4967.	505.	6217.	10.	14.			100.0	100.	100.	101.	101.	100.	101.	101.	100.	100.	101.
85-10	14.8	4971.	529.	5505.	3.	15.			98.2	104.	104.	107.	102.	100.	115.	98.	100.	98.	98.
85-11	14.7	4985.	547.	5671.	2.	15.			97.4	102.	102.	105.	100.	98.	114.	97.	98.	97.	97.
85-12	14.7	4969.	574.	5727.	7.	14.			99.0	162.	195.	163.	161.	153.	199.	137.	140.	152.	143.
85-13	14.8	4981.	599.	4236.	1163.	42.	0.46	2.59	99.6	211.	194.	211.	212.	209.	197.	193.	210.	213.	197.
85-14	14.8	4965.	617.	1307.	3316.	66.	0.14	2.67	99.6	211.	202.	212.	212.	210.	203.	200.	211.	213.	208.
85-15	15.0	4920.	672.	424.	4102.	131.	0.05	2.89	101.3	212.	201.	212.	211.	210.	203.	205.	213.	213.	210.
85-16	15.7	4940.	766.	400.	4334.	222.	0.04	3.23	101.9	214.	199.	214.	211.	211.	200.	212.	215.	213.	215.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
85-17	16.6	4971.	860.	139.	4754.	311.	0.02	3.54	103.7	217.	202.	218.	213.	215.	203.	216.	219.	215.	218.
85-18	15.2	4983.	669.	546.	4148.	154.	0.06	2.86	104.6	213.	202.	213.	214.	211.	205.	204.	213.	213.	210.
85-19	15.0	4966.	614.	1448.	3783.	105.	0.16	2.64	104.8	211.	199.	212.	213.	209.	202.	201.	213.	212.	209.
85-20	14.8	4986.	572.	2116.	3382.	45.	0.23	2.48	101.4	210.	197.	211.	212.	208.	201.	197.	211.	212.	202.
85-21	14.8	4953.	548.	4515.	1013.	17.			97.4	210.	192.	211.	211.	207.	196.	186.	208.	211.	194.
85-22	14.8	4922.	530.	5065.	415.	5.			99.4	208.	193.	210.	209.	205.	195.	187.	206.	209.	189.
85-23	14.8	4970.	500.	5548.	38.	7.			101.0	178.	178.	189.	152.	139.	195.	119.	145.	126.	114.
85-24	14.7	4952.	471.	5492.	7.	6.			101.7	122.	106.	136.	111.	106.	114.	104.	109.	102.	103.
85-25	14.7	4963.	455.	5128.	176.	1.			101.7	117.	103.	130.	109.	104.	106.	103.	108.	102.	103.
85-26	14.7	4966.	433.	5385.	3.	1.			101.7	111.	101.	120.	107.	103.	104.	102.	105.	101.	101.
85-27	14.7	5000.	411.	5345.	3.	-1.			98.8	108.	99.	116.	103.	100.	102.	99.	102.	97.	98.
85-28	14.7	4994.	384.	5166.	3.	-4.			96.5	104.	96.	110.	100.	97.	98.	96.	99.	95.	96.
85-29	14.7	4969.	338.	5313.	3.	-6.			97.1	103.	96.	108.	101.	97.	98.	97.	99.	95.	97.
85-30	14.7	4974.	246.	5171.	3.	-5.			96.2	101.	95.	105.	99.	96.	96.	96.	97.	94.	95.
88- 1	14.8	4850.	1.	4579.	2.	-1.			202.1	176.	169.	177.	200.	162.	164.	180.	172.	142.	156.
88- 2	15.0	4860.	199.	4852.	5.	110.			200.6	189.	182.	189.	211.	173.	173.	188.	184.	153.	165.
88- 3	15.0	4858.	217.	4831.	5.	123.			199.6	189.	180.	188.	211.	174.	174.	188.	186.	155.	165.
88- 4	15.3	4865.	243.	4858.	7.	154.			200.5	189.	179.	189.	212.	174.	177.	189.	187.	155.	167.
88- 5	15.2	4865.	263.	4962.	9.	164.			198.2	188.	178.	189.	212.	173.	177.	190.	188.	156.	168.
88- 6	15.3	4866.	284.	4790.	9.	180.			197.2	188.	178.	188.	212.	173.	179.	192.	189.	157.	170.
88- 7	15.6	4833.	310.	4965.	36.	214.			199.9	189.	178.	187.	213.	174.	179.	193.	190.	157.	172.
88- 8	15.7	4834.	337.	3684.	868.	225.	0.40	1.42	196.0	185.	175.	184.	215.	171.	178.	193.	190.	157.	170.
88- 9	16.2	4849.	380.	2660.	1983.	272.	0.29	1.58	200.1	182.	171.	183.	215.	170.	176.	193.	187.	158.	169.
88-10	16.9	4796.	436.	1874.	2705.	337.	0.20	1.78	205.1	182.	171.	182.	217.	170.	177.	196.	189.	158.	170.
88-11	17.2	4809.	479.	1171.	3254.	367.	0.13	1.94	202.2	183.	171.	182.	218.	171.	178.	196.	188.	158.	171.
88-12	18.0	4801.	528.	848.	3483.	411.	0.09	2.10	204.6	183.	173.	181.	218.	171.	178.	197.	189.	156.	171.
88-13	18.4	4810.	568.	657.	3629.	436.	0.07	2.23	202.8	183.	174.	181.	219.	172.	179.	198.	190.	154.	172.
88-14	19.9	4816.	668.	243.	4043.	510.	0.03	2.54	203.5	185.	179.	181.	219.	173.	180.	199.	193.	154.	174.
88-15	21.1	4854.	760.	48.	4215.	567.	0.01	2.81	201.1	187.	182.	181.	226.	176.	183.	201.	195.	156.	175.
88-16	22.7	4846.	858.	14.	4245.	631.	0.	3.07	200.7	190.	186.	182.	234.	178.	186.	203.	198.	159.	178.
88-17	20.7	4838.	713.	153.	4124.	549.	0.02	2.66	204.1	189.	182.	183.	230.	178.	184.	201.	196.	159.	177.
88-18	19.5	4843.	622.	417.	3955.	490.	0.05	2.38	204.2	188.	181.	182.	228.	177.	183.	199.	195.	159.	175.
88-19	18.1	4858.	523.	847.	3475.	417.	0.09	2.07	203.1	188.	179.	183.	223.	177.	181.	198.	193.	163.	174.
88-20	16.8	4892.	430.	1756.	2813.	329.	0.19	1.76	199.6	188.	179.	184.	218.	176.	181.	197.	191.	164.	174.
88-21	16.1	4920.	383.	2411.	2478.	269.	0.26	1.60	195.9	188.	178.	184.	218.	175.	180.	195.	190.	164.	174.
88-22	15.8	4929.	338.	3433.	1624.	234.	0.37	1.42	198.3	186.	178.	184.	217.	176.	180.	194.	189.	165.	174.
88-23	15.5	4947.	312.	4736.	426.	189.	0.51	1.32	193.2	187.	179.	187.	215.	176.	179.	193.	188.	166.	173.
88-24	15.4	4927.	289.	4933.	115.	190.			198.6	188.	181.	188.	215.	178.	180.	193.	188.	166.	174.
88-25	15.3	4922.	265.	4946.	26.	180.			201.7	189.	182.	189.	215.	179.	180.	193.	188.	166.	174.
88-26	15.2	4891.	239.	4943.	21.	163.			204.1	190.	183.	189.	215.	180.	180.	193.	188.	166.	174.
88-27	15.0	4826.	196.	4875.	14.	121.			205.4	191.	185.	189.	215.	180.	181.	192.	189.	166.	174.
91- 1	14.7	7341.	15.	7272.	21.	-11.			204.8	201.	199.	200.	206.	200.	200.	201.	200.	198.	199.
91- 2	14.8	7299.	196.	7381.	3.	43.			197.0	210.	209.	208.	213.	207.	209.	208.	208.	204.	207.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
91- 3	15.1	7257.	290.	4912.	1707.	144.			197.3	211.	210.	210.	216.	209.	210.	211.	210.	208.	209.
91- 4	15.7	7227.	382.	2638.	3943.	239.			200.5	214.	212.	212.	218.	212.	212.	213.	212.	210.	212.
91- 5	16.5	7186.	425.	2152.	4352.	308.			206.6	216.	214.	214.	220.	214.	214.	215.	215.	212.	214.
91- 6	17.1	7191.	477.	1308.	5068.	353.			205.9	218.	217.	216.	223.	217.	217.	218.	217.	214.	216.
91- 7	17.2	7184.	503.	1046.	5211.	362.			203.9	219.	218.	216.	223.	218.	217.	218.	218.	214.	216.
91- 8	17.4	7214.	522.	855.	5314.	378.			204.2	220.	218.	218.	223.	218.	218.	219.	218.	216.	217.
91- 9	17.6	7219.	547.	751.	5466.	389.			203.1	220.	218.	218.	224.	219.	218.	219.	219.	216.	218.
91-10	17.8	6892.	574.	534.	5341.	406.			200.9	221.	219.	219.	225.	220.	219.	220.	220.	217.	218.
91-11	18.0	7195.	594.	504.	5582.	417.			201.4	221.	220.	219.	226.	221.	220.	221.	221.	218.	219.
91-12	18.4	7354.	617.	396.	5777.	435.			202.1	222.	221.	221.	226.	221.	221.	222.	221.	218.	221.
91-13	18.5	7390.	645.	279.	5983.	447.			200.7	223.	221.	221.	227.	222.	221.	222.	222.	219.	221.
91-14	19.1	7343.	674.	223.	5920.	476.			202.8	224.	223.	222.	228.	223.	223.	223.	223.	221.	222.
91-15	19.2	7326.	689.	191.	6164.	482.			201.7	225.	223.	223.	229.	223.	223.	224.	223.	221.	223.
91-16	19.5	7304.	713.	125.	5994.	497.			201.4	226.	224.	223.	229.	225.	224.	225.	224.	222.	223.
91-17	19.8	7281.	732.	108.	6118.	512.			201.8	226.	225.	224.	230.	226.	225.	226.	226.	223.	224.
91-18	20.2	7257.	763.	63.	6065.	530.			201.3	227.	226.	226.	231.	226.	226.	227.	226.	224.	226.
91-19	20.7	7262.	799.	31.	6060.	551.			201.3	229.	227.	227.	233.	228.	227.	228.	228.	225.	227.
91-20	21.5	7239.	851.	14.	6185.	584.			201.3	231.	229.	229.	234.	230.	229.	230.	230.	227.	229.
91-21	20.6	7238.	779.	49.	6170.	544.			201.4	228.	227.	226.	232.	227.	226.	227.	227.	225.	226.
91-22	19.6	7316.	718.	115.	6078.	503.			201.1	226.	224.	224.	229.	225.	224.	225.	225.	223.	224.
91-23	18.9	7360.	668.	236.	5926.	464.			200.4	224.	222.	222.	227.	223.	222.	223.	223.	220.	222.
91-24	18.7	7343.	642.	299.	5925.	451.			201.3	223.	222.	221.	226.	222.	222.	222.	222.	220.	221.
91-25	18.4	7335.	616.	386.	5770.	434.			201.3	222.	221.	220.	225.	221.	221.	222.	222.	219.	221.
91-26	18.1	7382.	596.	447.	5698.	416.			200.1	222.	220.	220.	225.	220.	220.	220.	221.	218.	220.
91-27	17.7	7324.	571.	602.	5647.	394.			199.7	220.	219.	219.	224.	220.	219.	220.	220.	217.	219.
91-28	17.5	7303.	553.	652.	5572.	379.			199.1	220.	218.	218.	223.	219.	218.	219.	219.	216.	218.
91-29	17.3	7303.	523.	880.	5379.	363.			200.1	219.	217.	217.	222.	219.	217.	218.	219.	216.	217.
91-30	16.2	7357.	428.	1852.	4786.	279.			198.1	216.	214.	214.	219.	215.	214.	215.	215.	213.	214.
91-31	15.4	7357.	311.	4546.	2675.	183.			200.2	213.	212.	211.	216.	212.	211.	212.	212.	210.	212.
91-32	14.8	7264.	245.	7072.	275.	80.			195.8	211.	210.	210.	212.	210.	210.	210.	210.	207.	210.
96- 1	14.7	4891.	29.	4751.	206.	14.			202.0	200.	199.	200.	204.	198.	200.	200.	198.	198.	198.
96- 2	15.0	4876.	198.	4670.	141.	114.			202.6	211.	210.	211.	215.	209.	211.	212.	209.	209.	210.
96- 3	15.0	4881.	220.	4811.	140.	123.			200.5	212.	211.	211.	215.	210.	211.	212.	210.	210.	210.
96- 4	15.1	4881.	243.	4764.	163.	153.			201.1	212.	211.	212.	216.	210.	212.	212.	211.	210.	211.
96- 5	15.2	4897.	264.	4699.	170.	162.			197.4	213.	212.	212.	216.	211.	212.	213.	211.	211.	211.
96- 6	15.4	4879.	284.	4821.	172.	184.			200.0	213.	212.	213.	217.	211.	212.	214.	212.	211.	212.
96- 7	15.6	4868.	310.	4340.	672.	223.	0.47	1.31	203.6	215.	213.	214.	218.	213.	214.	215.	214.	213.	213.
96- 8	15.9.	4873.	382.	2470.	1747.	251.	0.37	1.42	200.8	215.	214.	214.	219.	213.	214.	215.	214.	213.	214.
96- 9	16.6	4848.	427.	1838.	2718.	319.	0.27	1.60	203.2	218.	216.	217.	221.	216.	217.	218.	217.	216.	217.
96-10	17.2	4844.	479.	1248.	3157.	357.	0.20	1.76	200.9	219.	218.	218.	223.	218.	218.	220.	219.	217.	218.
96-11	17.7	4843.	530.	908.	3497.	393.	0.14	1.94	200.5	221.	219.	220.	225.	219.	220.	221.	221.	218.	220.
96-12	18.3	4826.	570.	612.	3634.	429.	0.10	2.12	202.0	222.	221.	221.	226.	221.	221.	222.	222.	219.	221.
96-13	19.6	4814.	669.	303.	3902.	498.	0.07	2.25	202.2	227.	224.	225.	230.	225.	225.	226.	226.	224.	225.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	FLOW (LB/HR) INLET STEAM	FLOW (LB/HR) LOWER DRAIN	FLOW (LB/HR) UPPER DRAIN	FLOW (LB/HR) STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
96-14	21.1	4798.	761.	80.	4166.	565.	0.03	2.56	202.6	230.	228.	229.	234.	228.	229.	230.	230.	227.	229.
96-15	22.7	4780.	861.	21.	4118.	632.	0.01	2.82	203.0	234.	232.	233.	238.	232.	233.	233.	234.	231.	232.
96-16	20.7	4797.	721.	174.	4125.	547.	0.	3.09	203.7	229.	228.	228.	233.	228.	228.	229.	229.	226.	228.
96-17	19.1	4807.	616.	447.	3796.	473.	0.02	2.69	202.5	225.	224.	224.	229.	224.	224.	225.	225.	223.	224.
96-18	17.7	4819.	513.	995.	3416.	395.	0.05	2.38	199.8	221.	220.	220.	224.	220.	220.	221.	221.	219.	220.
96-19	16.7	4837.	427.	1796.	2792.	320.	0.11	2.05	199.6	218.	217.	217.	221.	217.	217.	218.	218.	215.	217.
96-20	16.2	4850.	380.	2492.	2281.	274.	0.20	1.75	199.3	216.	215.	215.	219.	216.	215.	216.	216.	214.	216.
96-21	15.8	4864.	333.	3324.	1487.	234.	0.26	1.58	200.4	216.	214.	214.	218.	215.	214.	216.	215.	213.	215.
96-22	15.4	4879.	308.	3996.	1027.	205.	0.37	1.40	199.3	215.	214.	214.	217.	214.	214.	215.	215.	213.	214.
96-23	15.4	4876.	291.	4520.	491.	184.	0.43	1.31	197.0	214.	213.	213.	217.	213.	213.	214.	214.	212.	214.
96-24	15.1	4881.	263.	4649.	175.	147.	0.49	1.24	194.3	213.	212.	212.	215.	212.	212.	213.	213.	211.	212.
96-25	14.9	4892.	235.	4717.	165.	100.	0.50	1.13	191.2	213.	212.	212.	215.	212.	212.	213.	212.	211.	212.
96-26	14.9	4882.	192.	4831.	151.	79.			197.8	212.	212.	211.	215.	211.	211.	212.	212.	211.	212.
97- 1	14.7	5032.	26.	4607.	191.	-12.			100.3	103.	105.	102.	106.	102.	105.	103.	103.	101.	103.
97- 2	14.7	4960.	197.	4987.	110.	-11.			94.9	96.	97.	96.	99.	95.	97.	97.	96.	95.	96.
97- 3	14.7	4951.	289.	4963.	112.	-12.			95.6	96.	97.	95.	99.	95.	97.	96.	95.	94.	95.
97- 4	14.7	4961.	402.	5271.	118.	-12.			96.5	96.	97.	96.	99.	96.	97.	97.	96.	95.	96.
97- 5	14.7	4958.	433.	5357.	117.	-12.			97.9	97.	98.	97.	100.	97.	97.	97.	97.	96.	97.
97- 6	14.7	4962.	480.	5818.	125.	-11.			99.5	99.	99.	98.	101.	98.	98.	99.	99.	98.	98.
97- 7	14.7	4966.	504.	6665.	124.	-12.			101.1	100.	101.	99.	102.	99.	100.	100.	100.	99.	99.
97- 8	14.7	4967.	540.	5338.	132.	-10.			99.6	112.	165.	110.	137.	122.	144.	135.	105.	141.	149.
97-12	14.8	4978.	578.	872.	3276.	13.	0.09	2.50	97.1	208.	209.	208.	211.	208.	208.	210.	209.	210.	211.
97-13	14.8	4951.	595.	438.	3982.	16.	0.05	2.58	96.7	210.	207.	210.	212.	210.	207.	210.	210.	210.	211.
97-14	14.8	4958.	614.	254.	4078.	52.	0.03	2.66	100.4	211.	209.	211.	213.	210.	209.	211.	211.	210.	211.
97-15	15.1	4957.	671.	90.	4413.	136.	0.01	2.88	103.8	212.	211.	212.	214.	211.	210.	213.	212.	211.	212.
97-16	15.7	4975.	767.	10.	5063.	229.	0.	3.24	102.9	214.	214.	214.	217.	214.	214.	215.	215.	214.	214.
97-17	16.4	4960.	851.	7.	4934.	295.	0.	3.52	100.0	217.	217.	217.	219.	217.	216.	217.	217.	216.	217.
97-18	15.2	4976.	713.	10.	5106.	164.	0.	3.05	98.7	213.	212.	213.	216.	213.	212.	213.	213.	212.	213.
97-19	14.8	4989.	612.	310.	4830.	42.	0.03	2.65	96.8	211.	210.	211.	213.	211.	210.	212.	211.	211.	212.
97-20	14.7	4975.	567.	529.	4512.	-9.	0.06	2.46	96.0	211.	208.	210.	213.	210.	208.	210.	211.	210.	211.
97-21	14.7	4959.	550.	645.	3966.	-3.	0.07	2.39	97.4	210.	209.	210.	213.	210.	208.	210.	211.	210.	211.
97-22	14.7	4953.	522.	908.	3625.	-8.	0.10	2.27	101.0	210.	209.	210.	213.	210.	208.	210.	210.	210.	211.
97-23	14.7	4964.	498.	1401.	3382.	-10.	0.15	2.16	101.8	210.	208.	210.	213.	209.	208.	209.	209.	210.	211.
97-24	14.7	5008.	475.	5316.	217.	-13.			98.3	113.	163.	114.	124.	113.	134.	121.	106.	122.	135.
97-25	14.7	5011.	455.	4954.	115.	-13.			95.8	97.	99.	97.	100.	96.	99.	97.	97.	96.	97.
97-26	14.7	4993.	433.	5330.	115.	-14.			95.3	96.	97.	96.	99.	96.	98.	96.	96.	95.	96.
97-27	14.7	4947.	405.	5178.	113.	-13.			95.2	95.	96.	95.	98.	95.	96.	95.	95.	94.	95.
97-28	14.7	4945.	366.	5002.	115.	-13.			97.3	97.	97.	96.	99.	97.	97.	97.	97.	96.	96.
97-29	14.7	4951.	338.	5131.	117.	-14.			98.0	97.	98.	97.	99.	97.	97.	97.	97.	96.	97.
97-30	14.7	4949.	250.	4788.	117.	-14.			98.2	98.	98.	97.	100.	97.	97.	98.	98.	96.	97.
97- 5	14.7	4957.	407.	5227.	117.	-12.			98.4	98.	99.	98.	100.	97.	98.	98.	98.	97.	97.
97- 6	14.7	4958.	438.	5421.	117.	-12.			97.3	97.	97.	96.	99.	96.	97.	97.	97.	95.	96.
97- 7	14.7	4958.	454.	5577.	117.	-12.			98.0	97.	98.	97.	100.	97.	97.	97.	97.	96.	97.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR)					KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F)									
		MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM				#1	#3	#4	#5	#8	#10	#11	#12	#13	#14
97-10	14.7	4963.	529.	5242.	125.	-12.			99.3	99.	126.	99.	101.	98.	104.	99.	99.	98.	101.
97-11	14.7	4971.	551.	5434.	139.	-9.			99.9	124.	204.	121.	172.	146.	185.	171.	111.	185.	198.
113- 1	14.8	7489.	5.	7139.	177.	15.			96.7	93.	93.	93.	93.	93.	93.	93.	93.	93.	93.
113- 2	14.8	7470.	198.	7791.	170.	18.			92.0	88.	89.	88.	88.	89.	88.	88.	90.	89.	90.
113- 3	14.8	7480.	292.	7764.	177.	11.			96.1	92.	92.	92.	92.	93.	91.	92.	94.	93.	94.
113- 4	14.8	7487.	384.	7965.	186.	11.			96.8	92.	93.	92.	93.	94.	92.	93.	95.	94.	95.
113- 5	14.8	7480.	433.	7761.	179.	11.			97.3	92.	94.	92.	93.	94.	92.	93.	96.	95.	96.
113- 6	14.8	7485.	477.	7467.	179.	17.			97.2	92.	93.	92.	93.	94.	92.	93.	96.	94.	98.
113- 7	14.8	7490.	526.	7915.	179.	20.			98.7	93.	95.	94.	95.	96.	93.	94.	99.	97.	101.
113- 8	14.8	7495.	569.	8070.	182.	15.			99.7	95.	97.	95.	96.	97.	95.	95.	99.	99.	100.
113- 9	14.8	7508.	618.	7929.	179.	16.			100.1	96.	98.	96.	98.	100.	96.	96.	102.	101.	103.
113-10	14.8	7506.	667.	8133.	182.	6.			98.9	94.	98.	94.	96.	98.	94.	95.	103.	99.	105.
113-11	14.8	7507.	690.	8039.	184.	11.			98.4	94.	97.	94.	96.	98.	94.	94.	105.	100.	102.
113-12	14.8	7509.	712.	8386.	184.	13.			98.4	95.	99.	94.	98.	100.	94.	96.	109.	105.	110.
113-13	14.8	7506.	739.	8205.	184.	14.			98.7	95.	102.	95.	99.	103.	95.	96.	115.	106.	116.
113-14	14.8	7515.	762.	8284.	198.	12.			98.2	95.	110.	95.	106.	110.	95.	101.	147.	136.	149.
113-15	14.8	7530.	784.	738.	3140.	15.			97.7	186.	200.	186.	201.	202.	184.	194.	204.	207.	206.
113-16	14.8	7528.	807.	372.	7513.	18.			99.6	207.	208.	207.	207.	208.	207.	208.	208.	208.	208.
113-17	14.8	7544.	834.	264.	8051.	49.			102.6	207.	208.	207.	208.	208.	207.	208.	208.	208.	208.
113-18	14.9	7553.	855.	212.	8190.	84.			105.3	208.	209.	208.	208.	208.	207.	209.	209.	209.	209.
113-19	15.1	7547.	901.	136.	8139.	146.			106.9	208.	209.	209.	209.	209.	208.	209.	209.	209.	209.
113-20	14.9	7550.	833.	250.	8068.	90.			107.4	207.	208.	208.	208.	208.	207.	208.	208.	208.	209.
113-21	14.8	7560.	786.	341.	7748.	38.			107.2	208.	209.	208.	209.	209.	207.	208.	209.	209.	209.
113-22	14.8	7549.	740.	619.	7061.	8.			106.9	207.	208.	207.	208.	208.	207.	208.	209.	209.	209.
113-23	14.8	7570.	716.	819.	6674.	6.			105.5	206.	207.	206.	207.	207.	206.	208.	208.	208.	208.
113-24	14.8	7562.	670.	1928.	5277.	-1.			104.5	202.	206.	202.	206.	206.	200.	205.	206.	208.	207.
113-25	14.7	7550.	617.	7968.	343.	5.			102.4	100.	108.	100.	105.	106.	100.	102.	116.	111.	118.
113-26	14.7	7548.	575.	7907.	172.	8.			99.4	95.	100.	95.	99.	99.	96.	97.	104.	102.	105.
113-27	14.7	7558.	514.	8036.	161.	3.			97.4	93.	96.	92.	95.	95.	93.	94.	99.	97.	99.
113-28	14.7	7557.	474.	7979.	168.	1.			95.5	91.	93.	90.	92.	93.	91.	91.	95.	93.	95.
113-29	14.7	7560.	434.	7942.	175.	1.			94.1	89.	92.	89.	90.	92.	89.	89.	93.	92.	94.
113-30	14.7	7535.	331.	7821.	162.	-5.			96.1	90.	92.	90.	91.	92.	90.	91.	93.	92.	94.
113-31	14.7	7551.	242.	7755.	172.	1.			97.0	92.	92.	91.	92.	92.	91.	92.	94.	93.	93.
114- 1	14.8	7406.	37.	7207.	218.	-11.			204.5	197.	197.	197.	197.	197.	197.	197.	197.	197.	197.
114- 2	14.8	7443.	186.	7098.	273.	76.			200.5	207.	206.	207.	206.	207.	207.	207.	208.	207.	207.
114- 3	15.0	7454.	240.	6934.	286.	114.			199.4	208.	207.	207.	206.	208.	208.	208.	208.	207.	208.
114- 4	15.3	7439.	290.	6764.	452.	175.			200.6	208.	208.	208.	208.	208.	208.	208.	208.	208.	208.
114- 5	15.7	7418.	341.	5659.	1820.	234.			204.2	210.	210.	209.	209.	210.	209.	210.	210.	210.	210.
114- 6	16.1	7379.	379.	4411.	2513.	278.			207.0	211.	211.	210.	210.	211.	211.	211.	212.	211.	211.
114- 7	16.5	7396.	430.	3401.	3719.	309.			204.7	212.	212.	212.	212.	212.	212.	212.	212.	212.	212.
114- 8	17.0	7407.	478.	2621.	4199.	343.			203.7	213.	213.	213.	213.	213.	213.	214.	214.	213.	214.
114- 9	17.5	7410.	533.	1995.	4675.	381.			203.6	215.	215.	215.	214.	215.	215.	216.	216.	215.	215.
114-10	18.1	7397.	579.	1677.	4979.	416.			204.5	217.	217.	216.	216.	217.	217.	217.	217.	216.	217.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
114-11	18.6	7418.	668.	1179.	5505.	445.			196.9	218.	218.	218.	218.	218.	218.	218.	218.	218.	218.
114-12	20.3	7412.	789.	793.	5753.	531.			201.2	223.	223.	223.	222.	223.	223.	223.	223.	223.	223.
120- 1	14.8	7397.	9.	7076.	379.	23.			192.2	189.	187.	189.	189.	189.	189.	189.	189.	189.	-89.
120- 2	14.9	7345.	201.	7158.	456.	91.			202.6	212.	211.	212.	212.	212.	211.	212.	212.	212.	-145.
120- 3	15.3	7268.	288.	6936.	498.	178.			202.6	213.	213.	213.	213.	213.	213.	213.	213.	213.	-191.
120- 4	15.6	7263.	338.	4628.	1767.	209.			202.7	214.	214.	214.	214.	214.	214.	215.	215.	215.	-176.
120- 5	15.9	7253.	382.	3849.	2244.	247.			203.0	215.	216.	215.	216.	216.	215.	216.	216.	216.	-143.
120- 6	16.4	7243.	430.	2812.	2759.	294.			204.2	217.	217.	217.	217.	217.	217.	218.	218.	217.	-104.
120- 7	17.1	7229.	483.	2518.	3305.	350.			205.5	220.	220.	219.	219.	220.	219.	220.	220.	220.	-53.
120- 8	17.8	7217.	533.	1980.	3190.	394.			207.0	222.	222.	221.	222.	222.	221.	222.	223.	222.	-11.
120- 9	18.4	7198.	576.	1841.	3976.	431.			208.7	223.	223.	223.	223.	224.	223.	224.	224.	223.	15.
120-10	19.7	7179.	672.	1402.	4086.	497.			210.0	227.	227.	227.	227.	227.	226.	227.	228.	227.	25.
120-11	21.1	7141.	759.	837.	3970.	560.			211.4	230.	230.	230.	230.	231.	230.	231.	231.	230.	27.
121- 1	14.8	5010.	6.	4913.	138.	15.			97.2	-108.	93.	91.	93.	92.	92.	92.	93.	93.	93.
121- 2	14.8	5001.	197.	5213.	139.	15.			93.6	-118.	118.	87.	90.	88.	88.	89.	89.	91.	89.
121- 3	14.8	4998.	294.	5343.	144.	15.			102.9	-124.	139.	97.	101.	97.	97.	98.	98.	103.	98.
121- 4	14.8	5012.	385.	5432.	150.	15.			97.2	-137.	145.	92.	96.	93.	93.	93.	93.	99.	93.
121- 5	14.8	5011.	406.	5472.	32.	15.			97.9	-139.	151.	92.	97.	93.	93.	93.	94.	100.	94.
121- 6	14.8	5004.	433.	5369.	155.	15.			98.0	-139.	152.	93.	98.	94.	93.	94.	94.	100.	94.
121- 7	14.8	5006.	450.	5493.	151.	15.			99.0	-140.	155.	94.	99.	95.	95.	95.	95.	102.	95.
121- 8	14.8	5011.	479.	5411.	156.	15.			100.1	-141.	159.	95.	101.	96.	95.	97.	97.	103.	97.
121- 9	14.8	4979.	505.	5407.	158.	15.			98.5	-141.	189.	94.	112.	97.	94.	96.	96.	123.	98.
121-10	14.8	4976.	521.	5390.	163.	15.			97.1	-141.	195.	93.	118.	96.	93.	95.	96.	132.	100.
121-11	14.8	4976.	555.	4824.	-162.	14.			96.4	-141.	199.	99.	187.	176.	102.	141.	158.	201.	190.
121-12	14.8	4969.	574.	4840.	575.	13.	0.53	2.49	96.0	-135.	202.	180.	207.	201.	174.	187.	196.	209.	199.
121-13	14.9	4965.	590.	1163.	2198.	35.	0.13	2.55	96.7	-97.	207.	207.	208.	207.	205.	208.	209.	209.	209.
121-14	14.9	4953.	612.	639.	3126.	63.	0.07	2.64	99.4	-181.	206.	208.	208.	208.	208.	209.	209.	209.	210.
121-15	15.1	4960.	667.	282.	3386.	130.	0.03	2.86	102.2	-305.	208.	209.	209.	209.	209.	210.	210.	210.	211.
121-16	15.9	4941.	781.	56.	3423.	239.	0.01	3.28	101.7	-353.	211.	211.	212.	212.	211.	212.	212.	212.	213.
121-17	16.4	4957.	854.	10.	3222.	289.	0.	3.53	97.9	-389.	212.	212.	214.	213.	213.	214.	214.	214.	214.
121-18	15.3	4960.	713.	177.	1430.	157.	0.02	3.04	96.2	-408.	208.	209.	210.	209.	209.	210.	210.	210.	211.
121-19	14.9	4946.	611.	595.	2920.	64.	0.06	2.64	96.1	-430.	206.	207.	208.	208.	208.	209.	209.	209.	210.
121-20	14.8	4941.	551.	1090.	3117.	21.	0.12	2.39	99.6	-468.	206.	207.	209.	207.	207.	208.	208.	209.	209.
121-21	14.8	4941.	527.	1155.	3043.	22.	0.13	2.28	102.2	-506.	205.	207.	208.	207.	207.	208.	208.	209.	209.
121-22	14.8	4938.	496.	1822.	2744.	13.	0.20	2.15	103.6	-536.	205.	206.	208.	206.	206.	207.	208.	209.	209.
121-23	14.8	4957.	477.	5092.	366.	11.			100.1	-552.	201.	146.	196.	192.	153.	176.	189.	203.	198.
121-24	14.8	4949.	449.	5190.	122.	15.			95.8	-504.	161.	92.	99.	94.	94.	97.	97.	98.	96.
121-25	14.8	4935.	430.	5325.	115.	15.			95.8	-474.	152.	92.	96.	92.	93.	95.	95.	95.	94.
121-26	14.8	4935.	398.	5397.	117.	15.			94.8	-451.	145.	90.	94.	92.	92.	93.	93.	94.	92.
121-27	14.8	4935.	382.	5292.	117.	15.			94.1	-435.	142.	89.	93.	90.	90.	92.	92.	93.	92.
121-28	14.8	4936.	332.	5262.	-11.	15.			96.5	-415.	133.	92.	94.	92.	92.	93.	93.	94.	93.
121-29	14.8	4936.	242.	5199.	122.	15.			96.1	-400.	115.	90.	93.	91.	92.	92.	92.	93.	92.
122- 1	14.8	5938.	1.	5716.	115.	15.			98.5	92.	93.	92.	94.	93.	93.	93.	94.	94.	94.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
122- 2	14.8	5921.	200.	6021.	259.	15.			93.2	86.	87.	86.	88.	87.	87.	88.	88.	88.	88.
122- 3	14.8	5845.	294.	5902.	299.	15.			93.8	87.	89.	87.	89.	88.	89.	88.	88.	89.	89.
122- 4	14.8	5797.	378.	6073.	296.	15.			94.9	88.	90.	88.	90.	89.	89.	89.	89.	90.	90.
122- 5	14.8	6066.	428.	6262.	327.	15.			99.4	92.	93.	92.	94.	93.	93.	94.	94.	94.	94.
122- 6	14.8	5984.	453.	6278.	168.	15.			100.4	93.	96.	94.	95.	94.	94.	95.	95.	95.	95.
122- 7	14.7	5968.	473.	6240.	171.	16.			102.7	96.	100.	96.	98.	96.	97.	97.	97.	97.	98.
122- 8	14.8	5964.	507.	6425.	315.	16.			102.2	95.	102.	96.	97.	96.	96.	96.	97.	97.	98.
122- 9	14.8	5959.	526.	6164.	313.	16.			99.9	93.	101.	94.	95.	94.	94.	95.	95.	95.	95.
122-10	14.7	5961.	546.	6450.	115.	16.			98.2	91.	105.	92.	93.	92.	93.	93.	93.	93.	93.
122-11	14.8	5955.	570.	6368.	304.	16.			97.5	91.	136.	91.	94.	92.	92.	92.	93.	94.	93.
122-12	14.8	5953.	595.	6518.	316.	16.			98.3	92.	172.	92.	96.	93.	93.	93.	95.	97.	94.
122-13	14.7	5956.	620.	6434.	317.	18.			99.0	100.	194.	96.	147.	115.	97.	109.	185.	164.	163.
122-14	14.8	5958.	642.	6281.	359.	25.	0.68	2.78	99.7	125.	199.	110.	195.	181.	117.	180.	202.	203.	208.
122-15	14.8	5961.	665.	1085.	2474.	41.	0.12	2.88	97.3	205.	206.	205.	208.	206.	203.	206.	208.	208.	208.
122-16	14.8	5976.	688.	362.	1851.	51.	0.04	2.98	98.9	206.	206.	206.	206.	207.	206.	207.	208.	209.	208.
122-17	14.8	5978.	712.	202.	1976.	77.	0.02	3.08	101.3	207.	206.	207.	208.	207.	207.	208.	209.	209.	209.
122-18	15.0	5988.	760.	90.	938.	110.	0.01	3.27	98.3	207.	207.	207.	206.	207.	207.	208.	208.	209.	209.
122-19	15.5	5981.	867.	17.	167.	203.	0.	3.68	96.8	209.	209.	209.	210.	209.	209.	210.	210.	210.	211.
122-20	14.9	5990.	735.	160.	-120.	81.	0.02	3.17	95.9	206.	206.	206.	208.	207.	207.	208.	208.	208.	208.
122-21	14.8	5962.	663.	299.	3354.	46.	0.03	3.00	95.8	206.	206.	206.	208.	206.	206.	207.	208.	208.	208.
122-22	14.8	5972.	639.	598.	2637.	51.	0.06	2.77	102.2	206.	206.	206.	207.	206.	206.	207.	208.	208.	208.
122-23	14.8	6095.	600.	1518.	-277.	24.	0.16	2.60	101.1	204.	206.	204.	207.	204.	202.	205.	208.	208.	207.
122-24	14.8	6055.	544.	6306.	-90.	15.			98.1	101.	163.	98.	123.	107.	100.	108.	134.	132.	115.
122-25	14.8	6001.	490.	6397.	181.	14.			95.6	90.	94.	90.	93.	92.	92.	93.	93.	94.	93.
122-26	14.8	5993.	466.	6357.	238.	15.			98.0	92.	94.	92.	94.	93.	93.	94.	94.	95.	94.
122-27	14.8	5993.	373.	6231.	304.	15.			98.5	92.	93.	92.	94.	93.	93.	94.	94.	95.	94.
122-28	14.8	5991.	287.	6097.	306.	15.			98.5	91.	93.	92.	94.	93.	93.	93.	93.	94.	94.
123- 1	14.8	7458.	0.	7149.	475.	15.			95.5	89.	90.	89.	91.	90.	90.	90.	90.	91.	91.
123- 2	14.8	7450.	199.	7353.	522.	15.			91.3	86.	86.	86.	87.	86.	86.	87.	87.	87.	87.
123- 3	14.8	7475.	292.	7469.	370.	16.			95.0	88.	88.	88.	89.	88.	89.	89.	89.	89.	89.
123- 4	14.8	7483.	386.	7585.	353.	16.			98.5	91.	91.	92.	93.	92.	92.	93.	93.	93.	93.
123- 5	14.8	7487.	433.	7546.	284.	16.			99.8	93.	93.	93.	94.	93.	93.	94.	94.	94.	95.
123- 6	14.7	7466.	479.	7672.	305.	16.			101.3	94.	94.	95.	95.	95.	95.	95.	95.	95.	96.
123- 7	14.8	7466.	525.	7557.	480.	17.			101.7	95.	95.	95.	96.	95.	95.	95.	96.	96.	96.
123- 8	14.7	7455.	575.	7866.	524.	16.			99.7	93.	93.	94.	95.	94.	94.	94.	94.	94.	95.
123- 9	14.8	7444.	615.	7619.	409.	19.			98.3	92.	92.	92.	93.	92.	93.	93.	93.	93.	94.
123-10	14.8	7507.	662.	7546.	-57.	15.			97.5	91.	91.	92.	93.	92.	92.	92.	93.	92.	93.
123-11	14.8	7654.	690.	8024.	-38.	19.			97.4	91.	92.	92.	93.	92.	92.	92.	93.	92.	93.
123-12	14.8	7590.	715.	8137.	685.	17.			97.6	91.	91.	92.	93.	92.	92.	93.	93.	93.	93.
123-13	14.8	7548.	731.	7900.	538.	20.			97.2	91.	91.	92.	93.	92.	92.	92.	92.	92.	93.
123-14	14.8	7547.	754.	7813.	529.	18.			97.7	93.	98.	92.	97.	93.	93.	95.	138.	101.	118.
123-15	14.8	7620.	788.	1037.	4801.	32.			97.6	200.	205.	197.	205.	203.	196.	203.	208.	207.	208.
123-16	14.8	7496.	802.	112.	6563.	44.			100.6	207.	207.	207.	210.	208.	207.	209.	210.	210.	210.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
123-17	14.8	7190.	834.	28.	8379.	78.			99.8	207.	208.	208.	210.	209.	208.	210.	211.	210.	211.
123-18	14.9	7431.	867.	24.	8272.	86.			99.6	208.	208.	208.	210.	209.	208.	210.	211.	210.	211.
123-19	14.9	7527.	890.	7.	8983.	97.			99.0	208.	208.	208.	211.	209.	208.	210.	211.	211.	211.
123-20	14.8	7517.	716.	1863.	4947.	23.			98.0	200.	207.	196.	210.	202.	194.	197.	208.	210.	205.
123-21	14.8	7483.	667.	7624.	790.	17.			95.5	101.	114.	100.	111.	107.	100.	108.	110.	115.	113.
123-22	14.8	7434.	609.	7500.	504.	18.			97.9	94.	100.	94.	96.	95.	95.	96.	96.	97.	96.
123-23	14.8	7430.	571.	7622.	503.	16.			98.4	94.	97.	94.	96.	95.	95.	96.	96.	96.	96.
123-24	14.8	7431.	525.	7708.	495.	16.			98.1	93.	96.	94.	95.	94.	94.	95.	95.	96.	96.
123-25	14.8	7428.	471.	7469.	508.	19.			97.5	92.	94.	92.	94.	93.	93.	94.	94.	94.	94.
123-26	14.8	7424.	429.	7553.	506.	17.			96.4	91.	92.	92.	93.	92.	92.	92.	93.	93.	93.
123-27	14.8	7428.	381.	7450.	511.	17.			94.5	90.	91.	90.	92.	90.	91.	91.	91.	92.	92.
123-28	14.8	7417.	288.	7411.	489.	17.			93.4	89.	90.	89.	90.	90.	90.	90.	90.	90.	90.
124- 1	14.8	7315.	10.	6857.	497.	24.			196.2	193.	194.	193.	194.	193.	193.	194.	195.	194.	194.
124- 2	14.8	7352.	205.	6696.	558.	66.			193.5	209.	209.	209.	211.	210.	210.	211.	211.	211.	211.
124- 3	15.2	7293.	245.	6710.	567.	161.			204.7	210.	210.	210.	212.	211.	211.	212.	212.	212.	212.
124- 4	15.1	7349.	290.	6253.	618.	141.	0.68	1.24	193.7	209.	209.	210.	210.	210.	210.	211.	211.	210.	211.
124- 5	15.4	7333.	338.	3333.	3562.	181.	0.36	1.44	196.2	209.	210.	210.	211.	211.	211.	211.	212.	211.	212.
124- 6	15.9	7297.	382.	2580.	4156.	248.	0.28	1.60	200.5	211.	211.	212.	212.	212.	212.	212.	213.	213.	213.
124- 7	16.5	7287.	430.	2067.	4470.	302.	0.23	1.77	203.6	212.	213.	213.	215.	213.	214.	214.	215.	214.	215.
124- 8	17.1	7125.	485.	1360.	4960.	352.	0.15	1.97	203.9	215.	215.	215.	216.	215.	215.	216.	217.	216.	217.
124- 9	17.4	7243.	534.	994.	5312.	375.	0.11	2.15	201.5	216.	216.	216.	217.	216.	217.	217.	218.	217.	218.
124-10	17.8	7270.	570.	874.	5316.	397.	0.10	2.27	200.9	217.	217.	217.	218.	218.	218.	219.	219.	219.	219.
124-11	18.2	7265.	614.	668.	5706.	424.	0.07	2.43	200.1	218.	219.	219.	220.	219.	219.	220.	220.	220.	220.
124-12	18.7	7269.	662.	563.	5701.	452.	0.06	2.58	199.2	220.	220.	220.	222.	220.	220.	222.	222.	222.	222.
124-13	20.1	7210.	756.	282.	5972.	522.	0.03	2.86	201.6	223.	224.	224.	225.	224.	225.	225.	225.	225.	225.
124-14	21.6	7165.	845.	139.	6086.	586.	0.02	3.10	203.3	227.	227.	227.	229.	228.	228.	229.	229.	229.	229.
125- 1	14.8	5007.	-1.	4944.	83.	15.			117.4	110.	110.	111.	112.	111.	111.	111.	112.	112.	112.
125- 2	14.8	5009.	204.	5331.	83.	15.			118.0	111.	112.	111.	112.	111.	112.	112.	112.	112.	112.
125- 3	14.8	5006.	291.	5460.	86.	15.			118.9	111.	116.	112.	113.	112.	113.	113.	113.	113.	113.
125- 4	14.8	4997.	337.	5384.	83.	15.			119.5	113.	120.	113.	114.	114.	114.	114.	114.	114.	114.
125- 5	14.8	4999.	378.	5350.	83.	15.			119.3	113.	121.	113.	114.	113.	113.	114.	114.	114.	114.
125- 6	14.8	4990.	402.	5486.	81.	15.			120.8	114.	123.	114.	115.	115.	115.	115.	115.	115.	115.
125- 7	14.8	4988.	428.	5425.	84.	15.			121.3	115.	160.	115.	117.	115.	115.	116.	116.	117.	116.
125- 8	14.8	4989.	450.	5276.	107.	17.			119.3	126.	199.	120.	153.	131.	117.	133.	132.	168.	181.
125- 9	14.8	4988.	472.	5425.	215.	27.			118.4	183.	200.	167.	200.	202.	178.	195.	190.	203.	206.
125-10	14.8	4992.	502.	1541.	3390.	46.			118.3	206.	205.	207.	208.	207.	207.	207.	208.	208.	209.
125-11	14.9	4994.	525.	1212.	3512.	68.			119.2	207.	206.	207.	208.	207.	208.	208.	208.	209.	209.
125-12	15.1	4990.	572.	755.	3932.	123.			120.7	207.	207.	208.	209.	208.	208.	208.	209.	209.	209.
125-13	15.6	4985.	660.	296.	4463.	209.			122.1	209.	209.	209.	211.	210.	210.	211.	211.	211.	212.
125-14	16.4	4969.	755.	94.	4615.	295.			122.3	212.	212.	212.	214.	213.	213.	214.	214.	214.	214.
125-15	17.6	4956.	862.	24.	4638.	384.			123.2	216.	216.	216.	217.	216.	217.	217.	217.	217.	218.
125-16	16.0	4961.	718.	150.	4705.	262.			118.9	211.	211.	211.	212.	212.	212.	212.	212.	212.	213.
125-17	15.3	4979.	615.	480.	4416.	171.			119.5	209.	208.	209.	210.	209.	209.	210.	210.	210.	210.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
125-18	15.0	4980.	572.	633.	4246.	126.			119.5	207.	207.	208.	209.	208.	208.	209.	209.	209.	209.
125-19	14.9	4981.	539.	978.	4027.	92.			118.6	207.	206.	207.	208.	207.	208.	208.	208.	209.	209.
125-20	14.8	4983.	463.	1672.	3329.	30.			118.0	206.	205.	206.	208.	206.	207.	207.	208.	209.	209.
125-21	14.8	4987.	428.	4968.	553.	18.			116.7	193.	203.	182.	205.	201.	185.	194.	200.	208.	202.
125-22	14.8	4993.	377.	5493.	34.	15.			119.7	116.	153.	115.	121.	117.	116.	118.	118.	122.	117.
125-23	14.8	4993.	285.	5302.	26.	15.			119.0	114.	131.	113.	116.	115.	115.	116.	116.	117.	115.
126- 1	14.8	7483.	0.	7434.	421.	15.			117.3	111.	113.	112.	113.	112.	112.	113.	113.	113.	113.
126- 2	14.8	7482.	197.	7517.	418.	15.			115.3	109.	111.	109.	111.	110.	110.	111.	111.	111.	111.
126- 3	14.8	7501.	282.	7459.	422.	15.			116.8	110.	110.	110.	111.	111.	111.	111.	111.	111.	111.
126- 4	14.8	7492.	384.	7661.	425.	15.			118.2	111.	111.	111.	112.	112.	112.	112.	112.	112.	113.
126- 5	14.8	7491.	431.	7994.	420.	15.			119.6	113.	113.	113.	114.	113.	113.	114.	114.	114.	114.
126- 6	14.8	7495.	481.	7708.	419.	15.			121.4	114.	114.	115.	116.	115.	115.	116.	116.	116.	116.
126- 7	14.8	7495.	528.	7810.	408.	15.			123.5	116.	116.	117.	118.	117.	117.	117.	117.	117.	118.
126- 8	14.8	7490.	581.	7849.	424.	15.			121.2	114.	114.	115.	115.	115.	115.	115.	115.	115.	116.
126- 9	14.8	7482.	619.	8013.	420.	17.			118.4	112.	112.	112.	113.	112.	113.	113.	113.	113.	113.
126-10	14.8	7486.	639.	7758.	431.	17.			118.2	120.	143.	114.	140.	148.	120.	117.	133.	152.	149.
126-11	14.8	7485.	661.	1444.	4275.	32.			117.3	203.	205.	201.	208.	203.	198.	201.	206.	209.	205.
126-12	14.8	7497.	688.	350.	5922.	37.			119.9	207.	207.	207.	208.	207.	206.	207.	208.	209.	209.
126-13	14.9	7488.	718.	188.	6697.	76.			122.1	207.	207.	207.	209.	207.	207.	208.	209.	209.	209.
126-14	14.9	7483.	733.	153.	6825.	99.			123.7	207.	207.	207.	209.	208.	207.	208.	209.	209.	209.
126-15	15.1	7492.	769.	56.	7141.	137.			123.6	207.	207.	207.	209.	208.	208.	209.	209.	209.	210.
126-16	15.2	7489.	797.	42.	7179.	158.			122.4	208.	208.	208.	210.	209.	209.	210.	210.	210.	211.
126-17	15.6	7468.	851.	14.	7228.	210.			122.6	210.	210.	210.	212.	211.	210.	212.	212.	212.	212.
126-18	15.1	7482.	766.	63.	7426.	123.			121.1	208.	208.	209.	210.	209.	208.	210.	210.	210.	210.
126-19	14.9	7485.	734.	125.	7441.	90.			121.0	207.	208.	208.	209.	208.	208.	209.	209.	209.	210.
126-20	14.8	7488.	684.	242.	6997.	35.			120.5	207.	207.	207.	209.	208.	207.	208.	209.	209.	209.
126-21	14.8	7469.	639.	824.	5475.	24.			119.0	206.	207.	206.	209.	207.	205.	207.	209.	209.	209.
126-22	14.8	7486.	595.	2100.	4800.	26.			117.3	202.	206.	200.	208.	202.	197.	200.	207.	209.	205.
126-23	14.8	7476.	543.	8031.	316.	15.			117.4	113.	120.	113.	115.	114.	114.	115.	115.	115.	115.
126-24	14.8	7473.	467.	9942.	320.	15.			115.7	110.	115.	110.	112.	111.	111.	112.	112.	112.	112.
126-25	14.8	7482.	427.	7800.	295.	15.			120.6	114.	116.	114.	116.	115.	115.	115.	115.	116.	116.
126-26	14.8	7475.	338.	7638.	323.	15.			119.4	113.	115.	113.	114.	113.	113.	114.	114.	114.	114.
126-27	14.8	7478.	234.	7556.	327.	15.			117.8	111.	112.	111.	112.	112.	112.	112.	112.	112.	112.
128- 1	14.8	4983.	23.	5135.	0.	15.			96.9	91.	89.	90.	92.	90.	90.	90.	90.	90.	91.
128- 2	14.8	4982.	195.	5294.	0.	15.			97.1	92.	90.	90.	92.	90.	91.	92.	91.	90.	107.
128- 3	14.8	4979.	298.	5384.	0.	15.			95.2	89.	88.	88.	90.	88.	88.	91.	88.	88.	109.
128- 4	14.8	4981.	394.	5527.	0.	15.			96.2	91.	88.	88.	90.	89.	89.	92.	89.	89.	113.
128- 5	14.8	4985.	419.	5570.	0.	15.			97.5	94.	91.	90.	92.	92.	92.	94.	92.	91.	118.
128- 6	14.8	4984.	440.	5636.	0.	15.			98.2	95.	92.	91.	93.	92.	93.	95.	92.	92.	125.
128- 7	14.8	4984.	459.	5589.	0.	15.			98.9	96.	93.	92.	93.	93.	93.	96.	93.	93.	124.
128- 8	14.8	4982.	491.	5753.	2.	15.			99.0	96.	94.	92.	94.	93.	94.	97.	94.	93.	123.
128- 9	14.8	4984.	513.	5691.	0.	15.			100.3	102.	100.	94.	96.	95.	96.	103.	95.	94.	155.
128-10	14.8	4989.	517.	5601.	0.	15.			100.6	102.	101.	94.	96.	96.	96.	104.	96.	95.	156.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
128-11	14.8	4991.	550.	5737.	3.	18.			101.3	149.	165.	103.	127.	138.	122.	156.	114.	146.	200.
128-12	14.9	4991.	572.	5189.	312.	33.	0.56	2.47	100.3	197.	193.	182.	189.	194.	192.	202.	192.	197.	206.
128-13	14.9	4991.	595.	3415.	1944.	56.	0.37	2.57	100.4	203.	197.	203.	201.	200.	205.	202.	202.	206.	207.
128-14	15.0	4979.	616.	2542.	2576.	72.	0.28	2.65	100.4	204.	197.	205.	202.	202.	207.	204.	201.	205.	208.
128-15	15.2	4980.	666.	2629.	2531.	133.	0.29	2.85	102.0	204.	204.	204.	207.	205.	199.	200.	203.	208.	204.
128-16	15.8	4975.	767.	1313.	3308.	225.	0.14	3.23	103.6	207.	201.	208.	204.	205.	210.	209.	206.	209.	211.
128-17	16.6	4960.	856.	758.	4075.	309.	0.08	3.52	104.6	211.	203.	211.	208.	209.	213.	211.	207.	212.	214.
128-18	17.2	4951.	902.	589.	4102.	351.	0.06	3.65	105.3	212.	204.	212.	209.	210.	214.	214.	212.	213.	215.
128-19	17.9	4950.	948.	574.	4206.	399.	0.06	3.77	107.6	215.	206.	214.	209.	213.	216.	216.	215.	215.	217.
130- 1	14.8	7444.	1.	7663.	48.	3.			93.0	84.	84.	85.	86.	85.	85.	85.	85.	85.	86.
130- 2	14.8	7454.	192.	7923.	46.	-1.			97.8	89.	88.	89.	89.	89.	89.	90.	90.	89.	90.
130- 3	14.8	7457.	288.	7982.	48.	3.			99.4	90.	90.	90.	91.	91.	91.	91.	91.	91.	92.
130- 4	14.8	7448.	379.	8070.	46.	1.			99.3	90.	90.	90.	90.	90.	90.	91.	91.	90.	91.
130- 5	14.8	7444.	427.	8044.	46.	3.			97.7	89.	89.	90.	90.	90.	90.	90.	90.	90.	90.
130- 6	14.8	7445.	475.	8237.	46.	1.			97.8	90.	89.	90.	90.	90.	90.	90.	90.	90.	90.
130- 7	14.8	7450.	522.	8198.	45.	3.			99.0	90.	90.	90.	91.	91.	91.	91.	92.	91.	92.
130- 8	14.8	7447.	577.	7911.	46.	7.			99.7	91.	91.	92.	92.	92.	92.	92.	92.	93.	93.
130- 9	14.8	7454.	618.	8055.	48.	7.			98.6	91.	91.	91.	92.	91.	91.	92.	92.	92.	92.
130-10	14.8	7443.	664.	8326.	45.	10.			97.8	90.	90.	90.	91.	91.	91.	91.	91.	91.	91.
130-11	14.8	7438.	692.	8363.	45.	12.			97.7	90.	90.	90.	91.	90.	91.	91.	91.	91.	91.
130-12	14.8	7446.	715.	8403.	45.	8.			98.8	91.	91.	91.	92.	92.	92.	92.	92.	93.	93.
130-13	14.8	7457.	735.	8363.	43.	10.			97.0	89.	89.	89.	91.	90.	90.	90.	91.	91.	91.
130-14	14.8	7455.	756.	8669.	43.	10.			96.4	89.	89.	89.	91.	90.	90.	90.	90.	91.	91.
130-15	14.8	7456.	779.	8047.	45.	12.			97.0	96.	95.	91.	120.	93.	93.	98.	95.	144.	127.
130-16	14.8	7448.	802.	8386.	62.	7.			97.5	157.	159.	117.	191.	185.	124.	175.	141.	205.	205.
130-17	14.8	7434.	829.	7448.	1199.	6.	0.81	3.59	97.2	191.	177.	162.	198.	200.	176.	196.	175.	204.	206.
130-18	14.8	7437.	848.	2699.	4714.	48.	0.29	3.67	98.8	202.	193.	195.	194.	197.	206.	205.	205.	200.	207.
130-19	15.0	7507.	895.	960.	6651.	89.	0.10	3.85	100.7	204.	199.	201.	199.	202.	204.	206.	206.	204.	208.
130-20	14.8	7499.	717.	3420.	4084.	5.	0.37	3.11	99.4	187.	192.	182.	194.	193.	193.	197.	198.	200.	206.
130-21	14.8	7473.	665.	7889.	45.	9.			96.5	94.	92.	93.	116.	93.	93.	95.	94.	101.	94.
130-22	14.8	7421.	604.	7990.	43.	11.			95.8	91.	90.	91.	108.	91.	91.	93.	92.	98.	92.
130-23	14.8	7396.	568.	8291.	41.	9.			97.2	92.	91.	92.	105.	92.	92.	93.	93.	98.	93.
130-24	14.8	7392.	465.	8120.	40.	9.			96.7	91.	90.	91.	102.	91.	91.	92.	92.	97.	92.
130-25	14.8	7393.	379.	7924.	41.	12.			96.1	89.	89.	90.	100.	90.	90.	91.	91.	95.	91.
130-26	14.8	7374.	286.	7839.	48.	13.			95.3	89.	88.	89.	97.	89.	89.	90.	90.	93.	90.
133- 1	14.8	4963.	1.	5067.	10.	15.			97.2	95.	95.	95.	96.	95.	96.	95.	95.	95.	96.
133- 2	14.8	4996.	198.	5327.	9.	16.			97.1	95.	95.	95.	95.	95.	95.	95.	95.	95.	95.
133- 3	14.8	4992.	292.	5406.	10.	15.			94.8	93.	93.	93.	93.	93.	93.	97.	93.	93.	95.
133- 4	14.8	4992.	380.	5502.	10.	15.			95.5	94.	94.	94.	95.	94.	95.	103.	94.	94.	97.
133- 5	14.8	4994.	430.	5583.	9.	15.			96.5	96.	96.	95.	96.	95.	96.	105.	96.	95.	99.
133- 6	14.8	4991.	455.	5608.	10.	15.			98.1	97.	97.	97.	98.	97.	98.	108.	97.	97.	101.
133- 7	14.8	4997.	480.	5642.	9.	15.			98.0	97.	97.	97.	98.	97.	98.	108.	98.	97.	101.
133- 8	14.7	4995.	504.	5666.	10.	15.			98.6	97.	97.	97.	98.	97.	98.	109.	97.	97.	102.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
133- 9	14.7	4998.	525.	5599.	9.	15.			99.4	98.	98.	97.	99.	98.	99.	111.	98.	98.	104.
133-10	14.8	5002.	551.	5500.	14.	16.			98.2	97.	97.	96.	98.	97.	98.	115.	97.	97.	105.
133-11	14.8	4993.	572.	4829.	14.	15.	0.52	2.48	95.8	97.	104.	95.	101.	98.	100.	126.	98.	101.	128.
133-12	14.8	4988.	595.	4696.	462.	30.	0.51	2.58	95.8	181.	197.	173.	193.	191.	184.	199.	194.	201.	208.
133-13	14.8	4967.	617.	2087.	2964.	56.	0.23	2.67	95.5	205.	211.	208.	211.	205.	199.	202.	209.	212.	208.
133-14	14.9	4956.	646.	1768.	3194.	90.	0.19	2.79	98.6	205.	211.	209.	212.	206.	201.	202.	210.	212.	207.
133-15	15.0	4955.	669.	1505.	3437.	116.	0.16	2.88	97.9	206.	211.	209.	212.	207.	201.	203.	210.	212.	208.
133-16	15.3	4951.	719.	1195.	3776.	168.	0.13	3.07	98.1	206.	212.	210.	213.	208.	202.	203.	212.	213.	208.
133-17	15.5	4956.	766.	1670.	3690.	210.	0.18	3.25	97.2	209.	204.	211.	207.	211.	212.	209.	212.	212.	213.
133-18	15.8	4944.	805.	1191.	3894.	242.	0.13	3.39	96.9	213.	204.	213.	206.	213.	215.	212.	213.	213.	216.
133-19	16.3	4874.	856.	972.	3993.	290.	0.11	3.55	96.3	215.	205.	214.	208.	214.	216.	213.	214.	214.	217.
133-20	17.7	4659.	960.	490.	4366.	392.	0.05	3.84	95.9	218.	209.	219.	212.	219.	221.	219.	219.	218.	221.
133-21	15.3	4938.	716.	1569.	3467.	171.	0.17	3.06	96.9	210.	201.	210.	204.	210.	213.	208.	210.	209.	214.
133-22	15.1	4932.	675.	1972.	3450.	124.	0.21	2.90	96.4	208.	201.	209.	205.	209.	212.	209.	211.	209.	212.
133-23	14.9	4931.	615.	2751.	2381.	67.	0.30	2.66	95.8	208.	201.	208.	202.	208.	212.	207.	209.	208.	212.
133-24	14.8	4919.	576.	2936.	2063.	44.	0.32	2.49	97.1	207.	201.	208.	203.	207.	211.	207.	208.	208.	212.
133-25	14.8	4925.	524.	4129.	1528.	22.	0.45	2.27	98.3	203.	201.	205.	202.	205.	207.	205.	206.	207.	211.
133-26	14.8	4925.	477.	5670.	50.	15.	0.62	2.07	98.8	107.	109.	105.	113.	109.	109.	113.	107.	109.	119.
133-27	14.8	4923.	382.	5466.	7.	15.			98.9	102.	101.	102.	107.	103.	103.	103.	102.	104.	107.
133-28	14.8	4921.	237.	5281.	7.	15.			97.5	100.	99.	100.	104.	101.	100.	100.	99.	102.	104.
134- 1	14.8	7527.	12.	7577.	5.	15.			94.1	94.	94.	94.	99.	95.	94.	94.	95.	102.	94.
134- 2	14.8	7501.	205.	7911.	22.	15.			90.9	91.	91.	91.	95.	92.	91.	91.	91.	98.	91.
134- 3	14.8	7518.	291.	7897.	45.	16.			97.3	96.	96.	96.	98.	96.	96.	96.	96.	101.	96.
134- 4	14.8	7517.	386.	8063.	50.	16.			98.3	97.	97.	97.	98.	97.	97.	97.	97.	100.	97.
134- 5	14.8	7519.	479.	8126.	45.	16.			98.4	97.	97.	97.	99.	97.	97.	97.	97.	100.	97.
134- 6	14.8	7510.	531.	8363.	43.	15.			96.3	96.	95.	95.	96.	96.	95.	95.	95.	98.	95.
134- 7	14.8	7517.	573.	8273.	45.	15.			97.8	97.	97.	96.	97.	97.	96.	97.	97.	98.	97.
134- 8	14.8	7513.	620.	8292.	41.	15.			97.6	96.	96.	96.	97.	96.	96.	96.	96.	98.	96.
134- 9	14.8	7518.	671.	8198.	46.	15.			98.9	98.	97.	97.	98.	98.	97.	97.	98.	98.	97.
134-10	14.8	7523.	689.	8137.	46.	15.			96.6	95.	95.	95.	96.	95.	95.	95.	95.	96.	95.
134-11	14.8	7536.	716.	8420.	46.	15.			96.7	95.	95.	95.	95.	95.	95.	95.	95.	96.	95.
134-12	14.8	7535.	735.	8419.	45.	15.			95.2	94.	94.	94.	94.	94.	94.	94.	94.	95.	94.
134-13	14.8	7526.	759.	8250.	45.	16.			95.3	94.	94.	94.	94.	94.	94.	94.	94.	95.	94.
134-14	14.8	7508.	782.	8368.	45.	16.			98.2	97.	97.	97.	100.	97.	97.	97.	97.	102.	97.
134-15	14.8	7531.	803.	8883.	48.	17.			97.1	96.	96.	96.	106.	96.	96.	96.	97.	112.	97.
134-16	14.8	7524.	833.	8380.	58.	22.			96.3	112.	153.	105.	195.	150.	114.	158.	140.	211.	195.
134-17	14.9	7542.	849.	909.	5476.	46.	0.10	3.67	95.9	199.	208.	199.	208.	204.	198.	203.	211.	210.	210.
134-18	14.9	7579.	897.	483.	7146.	87.	0.05	3.87	99.1	208.	211.	204.	211.	209.	203.	205.	212.	213.	210.
134-19	15.2	7559.	946.	612.	6925.	143.	0.07	4.05	100.9	211.	208.	207.	208.	211.	208.	210.	214.	211.	212.
134-20	14.8	7570.	806.	1658.	5801.	33.	0.18	3.49	100.4	208.	204.	201.	203.	208.	209.	208.	212.	207.	211.
134-21	14.8	7556.	759.	1703.	4815.	32.	0.18	3.29	99.9	200.	207.	199.	207.	203.	201.	203.	211.	210.	211.
134-22	14.8	7525.	716.	1866.	4386.	29.	0.20	3.10	105.5	204.	202.	201.	202.	206.	209.	205.	209.	208.	212.
134-23	14.8	7526.	665.	1972.	4638.	27.	0.21	2.88	110.9	199.	206.	201.	207.	204.	203.	205.	209.	210.	211.

ZERO POWER LOOP CCFL DATA

RUN NO.	PRES PSIA	FLOW (LB/HR) MAIN SPRAY	INLET STEAM	LOWER DRAIN	UPPER DRAIN	STACK STEAM	KF	KG	SPRAY TEMP	TIE PLATE POCKET TEMPS (F) #1	#3	#4	#5	#8	#10	#11	#12	#13	#14
134-24	14.8	7524.	603.	2477.	4226.	23.	0.27	2.61	113.2	196.	202.	196.	202.	203.	204.	202.	207.	209.	210.
134-25	14.8	7575.	572.	7425.	578.	15.			110.6	119.	118.	118.	128.	121.	119.	119.	120.	128.	121.
134-26	14.8	7816.	526.	8504.	46.	15.			96.8	99.	99.	99.	107.	100.	99.	99.	99.	108.	99.
134-27	14.8	7753.	431.	8183.	45.	15.			93.5	95.	95.	95.	101.	96.	95.	95.	95.	104.	95.
134-28	14.8	7765.	242.	8183.	45.	17.			95.1	96.	96.	96.	100.	97.	96.	96.	96.	103.	96.
135- 1	14.8	7237.	22.	7106.	67.	14.			199.8	200.	200.	200.	200.	200.	200.	201.	201.	200.	200.
135- 2	14.9	7239.	199.	7285.	81.	83.			198.7	213.	213.	212.	213.	213.	213.	214.	214.	214.	214.
135- 3	15.3	7234.	291.	5435.	1367.	166.	0.59	1.24	199.8	214.	214.	214.	215.	215.	215.	215.	216.	215.	216.
135- 4	15.6	7210.	336.	4434.	2283.	215.	0.48	1.42	202.7	216.	216.	216.	216.	216.	216.	217.	217.	217.	217.
135- 5	16.0	7200.	381.	3561.	3097.	251.	0.39	1.59	201.8	217.	217.	217.	217.	217.	217.	217.	218.	218.	218.
135- 6	16.5	7169.	433.	2701.	3844.	298.	0.29	1.79	203.6	219.	219.	218.	219.	219.	219.	219.	220.	219.	220.
135- 7	16.6	7199.	476.	2232.	4285.	310.	0.24	1.96	197.4	219.	219.	218.	219.	219.	219.	221.	220.	220.	220.
135- 8	17.0	7206.	533.	1800.	4663.	338.	0.20	2.17	195.3	220.	220.	220.	220.	221.	220.	251.	221.	221.	221.
135- 9	17.8	7166.	573.	1416.	5015.	396.	0.15	2.29	203.5	223.	223.	223.	223.	223.	223.	224.	224.	224.	224.
135-10	18.6	7222.	619.	1210.	5226.	439.	0.13	2.42	204.6	225.	225.	224.	225.	225.	225.	225.	225.	225.	226.
135-11	18.9	7246.	670.	835.	5368.	459.	0.09	2.60	201.1	225.	225.	225.	225.	225.	225.	226.	226.	226.	226.
135-12	20.2	7195.	759.	524.	5446.	519.	0.06	2.86	202.3	229.	229.	228.	229.	229.	229.	228.	230.	229.	230.
135-13	22.7	7195.	953.	90.	6074.	626.	0.01	3.42	200.4	235.	235.	234.	235.	236.	235.	236.	236.	236.	237.