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**POSTTEST RELAP4 ANALYSIS
OF LOFT
EXPERIMENT L1-4**

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November 1977

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IDAHO NATIONAL ENGINEERING LABORATORY

DEPARTMENT OF ENERGY

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by

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and

Heikki L. O. Holmstrom

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PREPARED FOR THE
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ABSTRACT

Results of posttest analysis of LOFT loss-of-coolant experiment L1-4 with the RELAP4 code are presented. This analysis was based on parametric studies which have been performed in an attempt to better understand the physical phenomenon and to evaluate alternate modeling techniques. The results are compared with the pretest prediction and the test data. Differences between the RELAP4 model used for this analysis and that used for the pretest prediction are in the areas of initial conditions, nodalization, emergency core cooling system, broken loop hot leg, and steam generator secondary. In general, these changes made only minor improvement in the comparison of the analytical results to the data. Also presented are the results of a limited study of LOFT downcomer modeling which compared the performance of the conventional single downcomer model with that of the new split downcomer model. This study showed that the split downcomer model provided a much more realistic calculation of the overall behavior of the LOFT downcomer than did the single downcomer model. Finally, a RELAP4 sensitivity calculation with artificially elevated emergency core coolant temperature was performed to highlight the need for an ECC mixing model in RELAP4.

ACRONYMS

ECC	Emergency Core Coolant
ECCS	Emergency Core Cooling System
EOS	Experiment Operating Specification
ESF	Engineered Safety Features
HPIS	High-Pressure Injection System
INEL	Idaho National Engineering Laboratory
LOCA	Loss-of-Coolant Accident
LOCE	Loss-of-Coolant Experiment
LOFT	Loss of Fluid Test
LPIS	Low-Pressure Injection System
LPWR	Large Pressurized Water Reactor
PCS	Primary Coolant System
PPS	Plant Protection System

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POSTTEST RELAP4 ANALYSIS OF LOFT EXPERIMENT L1-4

1.0 INTRODUCTION

A posttest RELAP4 analysis was completed for nonnuclear loss-of-coolant experiment (LOCE) L1-4. LOCE L1-4 was the fourth in a series of five nonnuclear LOCEs planned for performance in the Loss-of-Fluid Test (LOFT) Facility at the Idaho National Engineering Laboratory (INEL). The LOFT Experimental Program is part of the Water Reactor Safety Research Program sponsored by the Nuclear Regulatory Commission and is administered by the Department of Energy. The objectives of the LOFT Experimental Program are:

- (1) To provide data required to evaluate the adequacy and improve the analytical methods currently used to predict the loss-of-coolant accident (LOCA) response of large pressurized water reactors (LPWRs). The performance of engineered safety features (ESF) with particular emphasis on emergency core cooling systems (ECCS) and the quantitative margins of safety inherent in the performance of ESF is of primary interest.
- (2) To identify and investigate any unexpected event(s) or threshold(s) in the response of either the plant or the ESF, and develop analytical techniques that adequately describe and account for such unexpected behavior.

In order to meet these objectives, the LOFT Integral Test Facility^[a] has been designed to simulate the major components of a LPWR, and several series of experiments have been planned to produce data on the combined thermal, hydraulic, nuclear, and structural processes expected to occur during a LOCA.

The first LOFT test series (designated L1) is a nonnuclear test series which consists of five isothermal blowdown tests. This test series has been designed to make available large scale isothermal blowdown system data as a first phase of the LOFT Experimental Program. Varied parameters include break size, break location, break opening time, primary coolant system (PCS) flow resistance, emergency core coolant (ECC) injection location, and PCS pressure. Experiments completed prior to LOCE L1-4 consist of LOCEs L1-1^[1], L1-2^[2], L1-3^[3], and L1-3A^[4] (a repeat of LOCE L1-3). For these experiments an unheated core hydraulic simulator was installed to provide a flow resistance in the reactor vessel the same as expected from the nuclear core. A detailed description of the LOFT Facility and the L1 test series can be found in Reference 5.

LOCE L1-4 was conducted from initial conditions of 279°C and 15.65 MPa (gauge pressure) and simulated a 200% (100% of the break area in each leg) double-ended offset shear in the cold leg of a four-loop LPWR. ECC was injected into the intact loop cold leg from the high-pressure injection system (HPIS), low-pressure injection system (LPIS), and accumulator. The experimental parameters for LOCE L1-4 were as specified in Reference 6, with minor exceptions. The specific purposes for performing the experiment were to:

[a] The term "integral" is used to describe an experiment combining the nuclear, thermal, hydraulic, and structural processes occurring during a LOCA and differentiates it from the separate effects, nonnuclear, small scale, thermal-hydraulic experiments conducted for loss-of-coolant analysis.

- (1) Provide comparison of the delayed HPIS and LPIS injection to the cold leg and the lower plenum
- (2) Provide data reproducibility information by comparing with other related tests
- (3) Obtain data for evaluating downcomer bypass and mixing of the ECC with the primary coolant
- (4) Determine the effects of PCS operation and rapid depressurization with boric acid coolant
- (5) Test system performance with plant protection system (PPS) backup under operating procedures as similar as possible to those planned for nuclear operation
- (6) Provide system thermal-hydraulic data to compare with predictions and other experimental data for code verification purposes.

Prior to performing LOCE L1-4, an experiment prediction analysis^[7] was performed using the WHAM and RELAP4 computer codes. This analysis provided comprehensive pretest predictions for each measurement transducer recorded during L1-4 with the exception of strain gages and accelerometers. Following LOCE L1-4, selected pretest prediction results were compared to the test data in a quick-look report^[8]. Selected pertinent thermal-hydraulic data from LOCE L1-4 were then presented in graphical form in an experiment data report^[9].

Since completion of LOCE L1-4, the experimental data have been compared extensively to the prediction data. Parametric studies have been performed in an attempt to better understand the physical phenomenon and to evaluate alternate modeling techniques. Based on these studies, a posttest RELAP4 analysis was performed and is documented in this report with a discussion of modeling changes and the

effect the changes have on the calculated results. Also, the LOFT modeling experience will be related to the modeling of a LPWR.

Both the pretest and posttest RELAP4 analysis of LOCE LI-4 used a nonstandard modeling scheme in the inlet annulus-downcomer region. Since this is an area of considerable interest in the analysis community, Section 2.0 of this report has been devoted to that subject. Section 3.0 presents the changes which have been made to the pretest RELAP4 model prior to the posttest analysis. The results of the posttest analysis and comparison with the pretest prediction and the test data are presented in Section 4.0. Section 5.0 presents several conclusions drawn from the analysis. Appendices document the RELAP4 model input and the engineering units conversion of the RELAP4 data.

A review of the LOFT transducer nomenclature and their locations is provided in Table I and Figures 1 through 3. Reference 5 contains a detailed discussion of LOFT instrumentation; however, certain new transducers were added prior to LOCE LI-4. These instruments and their locations are described in Table II and Figures 4 and 5 in this report and in Reference 9.

TABLE I

NOMENCLATURE FOR LOFT INSTRUMENTATION

Designations for the different types of transducers.

1. CV	- Control Valve
2. DE	- Densitometer
3. FE	- Flow
4. FT	- Flow
5. LE	- Level
6. LIT	- Level
7. LT	- Level
8. ME	- Momentum Flux
9. PdE	- Differential Pressure
10. PdT	- Differential Pressure
11. PE	- Pressure
12. PT	- Pressure
13. RPE	- Pump Speed
14. TE	- Temperature
15. TT	- Temperature
16. VPE	- QOBV 17% Position Switch

Designations for the different systems, except for the nuclear core which has not been installed.

1. BL	- Broken Loop
2. CS	- Core Simulator
3. PC	- Intact Loop
4. RV	- Reactor Vessel
5. SG	- Steam Generator
6. ST	- Downcomer Instrument Stalk
7. SV	- Blowdown Suppression Tank

Fig. 1 LOFT thermo-fluid measurements instrumentation.

Fig. 2 LOFT reactor vessel instrumentation.

Fig. 3 LOFT ECCS instrumentation -- left side.

TABLE II

NEW INSTRUMENTATION FOR NONNUCLEAR TEST L1-4

<u>Measurement Identification</u>	<u>Description</u>
PdE-PC-8	Differential pressure across the pressurizer surge line
PdE-PC-9	Differential pressure across intact loop pump 1
PdE-PC-10	Differential pressure across intact loop pump 2
PdE-BL-9	Broken loop cold leg differential pressure from end of 14-to-5-in. contraction to middle of 5-in.-diameter pipe
PdE-BL-10	Broken loop cold leg differential pressure from end of 14-to-5-in. contraction to break plane
FE-BL-1A ME-BL-1A TE-BL-1A	Broken loop cold leg fluid velocity, momentum flux, and fluid temperature at DTT flange on bottom DTT
FE-BL-1B ME-BL-1B TE-BL-1B	Broken loop cold leg fluid velocity, momentum flux, and fluid temperature at DTT flange on middle DTT
FE-BL-1C ME-BL-1C TE-BL-1C	Broken loop cold leg fluid velocity, momentum flux, and fluid temperature at DTT flange on top DTT
PE-SV-75	Pressure at broken loop cold leg expansion joint
PCP-1-P	Pump power, intact loop pump 1
PCP-2-P	Pump power, intact loop pump 2

Fig. 4 New instrumentation in intact loop.

Fig. 5 New instrumentation in broken loop.

2.0 DOWNCOMER MODELING

The modeling of the reactor vessel downcomer region has been an area of major interest in LOCA accident analysis. The conventional nodalization scheme for the upper annulus and downcomer is a series of two or more vertically stacked volumes. However, the ability of this one-dimensional model to calculate the behavior of the fluid flow in the downcomer, which is basically two or three dimensional, was questioned early in the LOCE L1-4 pretest analysis effort. Indeed, azimuthal differences in downcomer behavior had been evident in data from the first LOFT experiment.

The azimuthal difference can be seen very clearly in data from LOCE L1-1^[1], a 100% hot leg break with cold leg ECC injection. Figures 6 and 7 show the momentum flux in the reactor vessel downcomer instrument stalks located on opposite sides of the downcomer. Note that the data show very little difference between the stalks until approximately 34 seconds after rupture. At that time, ECC flow, which was initiated at 29 seconds after rupture, began to penetrate the intact loop side of the downcomer, causing the positive flow spikes at ME-2ST-1, while negative flow (upflow) dominated at ME-1ST-1 on the broken loop side for another 15 seconds. Similarly the downcomer temperatures at these locations, Figure 8, show penetration of subcooled ECC water at TE-2ST-14 on the intact loop side, while TE-1ST-14 more nearly follows the saturation temperature curve. From these data it is evident that azimuthal variations in downcomer behavior can be expected for LOCEs which involve cold leg ECC injection. Downcomer momentum flux and temperature data from LOCE L1-4 between 20 and 50 seconds after rupture confirm this expectation, as can be seen in Figures 9, 10, and 11.

Fig. 6 Momentum flux in reactor vessel downcomer instrument stalk under broken loop cold leg from LOCE L1-1 (ME-1ST-1).

Fig. 7 Momentum flux in reactor vessel downcomer instrument stalk under intact loop cold leg from LOCE L1-1 (ME-2ST-1).

Fig. 8 Temperature in reactor vessel downcomer near lower plenum from LOCE L1-1 (TE-1ST-14 and TE-2ST-14).

Fig. 9 Momentum flux in reactor vessel downcomer instrument stalk under broken loop cold leg from LOCE L1-4 (ME-1ST-1).

Fig. 10 Momentum flux in reactor vessel downcomer instrument stalk under intact loop cold leg from LOCE L1-4 (ME-2ST-1).

Fig. 11 Temperature in reactor vessel downcomer near lower plenum from LOCE L1-4 (TE-1ST-14 and TE-2ST-14).

A RELAP4^[10][a] calculation was performed which demonstrates the inability of the code to adequately calculate downcomer performance using the conventional "single downcomer" nodalization. Figure 12 compares the measured broken loop cold leg density for LOCE L1-4 with the single downcomer RELAP4 calculation. Note the extreme overprediction of ECC bypass by the single downcomer model. The failure to adequately model downcomer performance is also evident in Figure 13 which gives the reactor vessel liquid mass from the test data (calculated from LE-1ST-1 and -2 and LE-2ST-1 and -2) and from a single downcomer RELAP4 calculation. While the test data show significant ECC accumulation in the reactor vessel, the single downcomer calculation shows very little accumulation. In this calculation the RELAP4 vertical slip option was used to simulate counter-current flow between the inlet annulus and downcomer. Two similar calculations with enhanced vertical slip correlations also showed similar results. The vertical slip option acts directly on the energy transfer between volumes. If this energy transfer is sufficient to alter the volume pressures significantly, then the mass flow between the volumes would be affected through the momentum equation. In the case of modeling LOFT LOCE L1-4, blowdown and condensation effects apparently dominate the pressure calculations so that vertical slip does not significantly affect the mass flows. Use of the flooding models available in RELAP4 with the single downcomer nodalization was not attempted. These models are used in conjunction with the vertical slip model and serve to limit the magnitude of the slip velocity under counter-current flow conditions. In the single downcomer calculation, sustained counter-current flow between the inlet annulus and the downcomer did not develop. Therefore, use of these models with the single downcomer nodalization would not induce ECC penetration of the downcomer. Although the single downcomer results are conservative, i.e., exaggerated bypass and no ECC penetration, a more

[a] RELAP4/MOD5, Update 2 with natural circulation steam generator secondary model.

Fig. 12 Density in broken loop cold leg, LOCE L1-4 data and RELAP4 single downcomer calculation.

Fig. 13 Reactor vessel liquid mass, LOCE L1-4 data and RELAP4 single downcomer calculation.

realistic approach to downcomer modeling was considered necessary for a best-estimate calculation of LOCE L1-4.

The "split downcomer" nodalization, used in both the pretest and posttest L1-4 models, was devised as a means of allowing the code to more directly approximate the azimuthal asymmetry observed in downcomer performance. In this nodalization the upper annulus and downcomer have been divided circumferentially into two sections. One section represents 1/3 of the total annular volume located on the intact loop side and the other represents the remaining 2/3 on the broken loop side of the reactor vessel (see Figure 14). The 1/3 - 2/3 split ratio was chosen with the smaller volumes located on the intact loop side to minimize the time during which condensation effects dominate the pressure calculation. Note that cross-flow junctions are provided in the annulus and downcomer regions. The input data for the modeling changes were based solely on the physical geometry of the region. The success of this modeling scheme in calculating overall downcomer performance can be seen in Figures 15 and 16 which show L1-4 test data overlaid with the pretest and posttest RELAP4 calculations of the broken loop cold leg density and reactor vessel liquid mass, respectively. Note that the calculated bypass of ECC water compares reasonably well with the data, as evidenced by the low broken loop cold leg density after ECC injection. The filling of the reactor vessel also corresponds well with the trend of the test data through 60 seconds. At the end of the posttest calculation, the mass inventory is overpredicted by the split downcomer model. Further investigation will be required to determine whether this overprediction is characteristic of the split downcomer model or the result of calculational instability experienced late in the posttest analysis calculation.

Several RELAP4 calculations have been performed to investigate the sensitivity of split downcomer model calculations to changes in the nodalization. In one case the split ratio was reversed from 1/3 - 2/3 to 2/3 - 1/3. The results showed no significant change in overall performance. Two additional calculations using a 1/10 - 9/10 split ratio and a 6% - 16% - 78% triple split also showed similar performance

a. Reactor vessel section at nozzle centerline showing 1/3 section under intact loop cold leg

b. L1-4 RELAP4 downcomer nodalization

INEL-A-5079

Fig. 14 Split downcomer model.

Fig. 15 Density in broken loop cold leg, LOCE L1-4 data and RELAP4 split downcomer calculations.

Fig. 16 Reactor vessel liquid mass, LOCE L1-4 data and RELAP4 split downcomer calculations.

except for a bypass period of about 8 - 10 seconds immediately after the ECC water entered the vessel. Subsequent investigation has traced the cause of this bypassing to the water packing routine applied to the inlet annulus. The RELAP4 water packing routine is used to prevent unrealistic pressure spikes from occurring when a volume fills. To accomplish this, the code determines how much "excess" water has entered the volume in one time step and then redistributes the flow through the connecting junctions to remove this excess. Since this flow redistribution is performed between normal time steps, it ignores the momentum equation and distributes the flows according to the product of junction area and specific volume of the fluid in the downstream volume. Therefore, if the specific volume is nearly the same in two downstream volumes, the flows will be redistributed according to the ratio of the junction flow areas. This was the case in the runs which exhibited the bypass period. The cross-flow junction area was much larger than the down-flow junction area, therefore, the water packing calculation artificially forced the ECC water across the annulus rather than down into the downcomer. This hazard can be avoided either by ensuring that the ratio of cross-flow junction area to downflow junction area is less than 10 or by not using the water-packing option.

Before discussing the detailed behavior within the reactor vessel, it is important to understand the effects on the RELAP4 calculation of subcooled ECC water flowing into a volume containing a high quality steam mixture. With RELAP4, when subcooled ECC water first enters a vapor or mixture filled volume, it immediately mixes in thermodynamic equilibrium with all of the fluid in that volume. The result of this mixing is condensation of the vapor and rapid depressurization of the volume. Usually the pressure in the volume drops below that of adjacent mixture filled volumes and the flows in the connecting junctions reverse (or accelerate) toward the filling volume. This period of simultaneous flow into the volume of subcooled ECC water and saturated mixture continues until the volume is completely filled with saturated water. As soon as the volume fills, the fluid conditions in the volume become subcooled. The upstream and downstream junction flows then may reverse allowing subcooled water to enter the adjacent volumes, and the process

repeats for successively filling volumes. Figures 17 and 18 illustrate the process for the intact loop cold leg volume immediately outside the reactor vessel. At approximately 23.2 seconds when the volume begins to fill, the flow in the downstream junction reverses and remains negative until the volume fills. Note that prior to 23.2 seconds, the flows in both junctions were primarily negative due to condensation effects while the upstream volume was filling. Thus, in a RELAP4 calculation, refilling of the plant with subcooled ECC water usually proceeds volume-by-volume with each volume in succession being filled with subcooled water. When condensation effects severely depress the volume pressure, the ECC water cannot flow beyond the filling volume until the volume is completely filled.

To further illustrate the effects of condensation by subcooled ECC water, two additional RELAP4 split downcomer calculations were performed with elevated ECC water temperatures. For these calculations the temperature was raised from 33 to 132°C (slightly subcooled) and to 177°C (saturated), respectively. Figures 19 through 22 show the change in condensation effects at the intact loop cold leg. The initial flows in Figures 20 and 22 differ from those in Figure 18 because ECC flow began entering upstream volumes prior to 22 seconds after rupture. For the 132°C ECC case in Figures 19 and 20, the flow reversal in the downstream junction occurred later, and the magnitude of the negative flow was less than in the subcooled ECC case. Note that the flow oscillations were also reduced indicating a more stable calculation. Figures 21 and 22 show that with saturated ECC the volume took approximately five times longer to fill than in the subcooled case. The downstream junction flow never reversed, indicating that condensation did not dominate the calculation. This allowed ECC water to flow through the volume while the volume was filling.

The condensation effects of subcooled ECC, particularly the complete filling of volumes with subcooled water, have a significant impact on the detailed behavior inside the reactor vessel during the refill period. Figure 23 shows the calculated flows as a function of time in the downcomer junctions for the time interval between 30 and

Fig. 17 Calculated average density in a cold leg volume filling with subcooled (33°C) ECC water.

Fig. 18 Calculated upstream and downstream junction flows while an intact loop cold leg volume is filling with subcooled (33°C) ECC water.

Fig. 19 Calculated average density in a cold leg volume filling with slightly subcooled (132°C) ECC water.

Fig. 20 Calculated upstream and downstream junction flows while an intact loop cold leg volume is filling with slightly subcooled (132°C) ECC water.

Fig. 21 Calculated average density in a cold leg volume filling with saturated (177°C) ECC water.

Fig. 22 Calculated upstream and downstream junction flows while an intact loop cold leg volume is filling with saturated (177°C) ECC water.

Fig. 23 Calculated loop flows with subcooled (33°C) ECC water (LOCE L1-4 posttest analysis).

50 seconds after rupture initiation for the posttest analysis. Figure 24 shows the calculated pressures, temperature, densities, flows and elevation pressures in the downcomer lower plenum region at 40 seconds after rupture. These figures along with Figure 25 illustrate that large fairly stable "flow loops" have formed. These flow loops are driven by the unequal gravity heads that exist in the vessel. A column of water is indicated in Figure 24 on the intact loop side of the downcomer which completely fills all the corresponding volumes; whereas, on the broken loop side the fluid is considerably less dense. Consequently, the elevation pressures (as shown) on the intact loop side are much larger than on the other side. The condensation of vapor by subcooled liquid predicted by RELAP4 maximizes these effects, as discussed earlier, because it causes every volume entered by ECC water to become liquid full before the water can flow into other volumes.

The elevated ECC temperature calculations, mentioned earlier, confirm these hypotheses. The calculation with 177°C ECC water temperature did not indicate the same kind of water column, as discussed above, and the density differences were much smaller, e.g., at 40 seconds after rupture the densities on the intact and broken loop sides were 152 and 109 kg/m³, respectively, compared to values of 915 and 138 kg/m³ in the subcooled ECC run. Figure 26 shows the calculated flows in this case (compare with Figure 23). Figure 27, in turn, shows the corresponding flows in the calculation with 132°C ECC temperature (slightly subcooled). The flow loops are there, but reduced in magnitude compared to Figure 23 (subcooled ECC). Additional confirmation was obtained through a calculation which was identical to the subcooled ECC case except that the elevations of both cross-flow junctions were changed. The flow loop time history and especially the magnitudes of the flows were drastically changed. This confirms the theory that the flow loops were driven by unbalanced elevation pressure heads; because for homogeneous volumes, a change in the junction elevations affects only the gravity force term in the momentum equation.

Clearly then, condensation effects force complete filling of the downcomer volumes on the intact loop side of the vessel giving rise to

Fig. 24 Downcomer lower plenum region pressures (MPa), temperatures ($^{\circ}\text{C}$), flows (kg/s), densities (kg/m^3), and elevation pressures (MPa) at 40 seconds into the transient (LOCE L1-4 posttest analysis).

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Fig. 25 Flow loops and net flows (kg/s) at 40 seconds into the transient (LOCE LI-4 posttest analysis).

Fig. 26 Calculated loop flows with saturated (177°C) ECC water.

Fig. 27 Calculated loop flows with slightly subcooled (132°C) ECC water.

significant elevation heads at the connecting junctions which, in turn, force the flow loops. Fortunately, these loops appear to have no significant effect on conditions outside the reactor vessel. This is evident from Figures 28, 29, and 30, which show the flow into the downcomer from the intact loop, the flow out of the downcomer into the broken loop, and the flow from the lower plenum into the core region, respectively, for both the subcooled and saturated ECC calculations. These flows compare very well between 24 and 50 seconds after rupture in spite of the large flow loops present only in the subcooled case. The difference in the mass flows in Figures 28 and 29 is due to the lower mass flow rate of the saturated ECC. The circulation within the downcomer due to the flow loops tends to homogenize the fluid within those volumes, apparently without serious consequences. Comparison of the calculated to measured downcomer momentum fluxes in Figures 31 and 32 indicates that the mixing may be physically realistic.

It may be possible to eliminate the flow loops either by arbitrarily assigning a very high reverse flow form-loss coefficient to the inlet annulus cross-flow junction or by modifying the RELAP4 treatment of elevation heads at the downcomer junctions. Although these changes may eliminate the symptom, a more viable approach is to eliminate the cause, i.e., the RELAP4 calculated excess condensation by subcooled ECC water.

In general, the split downcomer model provided a much more realistic calculation of overall downcomer behavior for LOFT LOCE LI-4 than did the conventional single downcomer model. Figures 33 and 34 provide a direct comparison of LI-4 data, split downcomer calculations, and single downcomer calculations of broken loop cold leg density and reactor vessel liquid mass, respectively. When the technique is applied to other plants, the analysts should ensure that the model is not susceptible to the water packing induced bypass problem described earlier and that downcomer flow loops (if present) do not significantly affect overall behavior.

Fig. 28 Calculated flow from the intact loop into the downcomer with subcooled (33°C) and saturated (177°C) ECC water.

Fig. 29 Calculated flow from the downcomer into the broken loop with subcooled (33°C) and saturated (177°C) ECC water.

Fig. 30 Calculated flow from the lower plenum into the core region with subcooled (33°C) and saturated (177°C) ECC water.

Fig. 31 Momentum flux in reactor vessel downcomer instrument stalk under broken loop cold leg, LOCE L1-4 data and RELAP4 calculations (ME-1ST-1).

Fig. 32 Momentum flux in reactor vessel downcomer instrument stalk under intact loop cold leg, LOCE L1-4 data and RELAP4 calculations (ME-2ST-1).

Fig. 33 Density in broken loop cold leg, LOCE L1-4 data and RELAP4 split and single downcomer calculations.

Fig. 34 Reactor vessel liquid mass, LOCE L1-4 data and RELAP4 split and single downcomer calculations.

3.0 RELAP4 POSTTEST ANALYSIS MODEL

The RELAP4 model used for the posttest analysis is basically an extension of the L1-4 experiment prediction RELAP4 model^[7]. For that reason only the changes in the pretest model will be discussed in this section. The interested reader should consult Appendix A for the input data listing and time zero edit of the RELAP4 output and Reference 7 for a detailed presentation of the L1-4 experiment prediction model. Both the L1-4 experiment prediction and posttest analyses used the same version of the RELAP4 code, designated as RELAP4/MOD5 (LOFTSV02(73))^[10].

3.1 Initial Conditions

The most obvious change for any posttest analysis concerns the initial plant conditions. Since the experiment operating specification (EOS)^[6] normally specifies a range of acceptable values for plant operating parameters, it is nearly impossible for all the nominal values used in the pretest analysis to coincide with the actual conditions within the system at the time the experiment was initiated. Therefore, the following parameters were changed to reflect the experimental conditions for the LOCE L1-4 posttest analysis:

- (1) PCS temperature, mass flow rate, and pump speed for both pumps
- (2) Pressurizer and accumulator pressures, temperature, and water volumes
- (3) Broken loop hot and cold legs temperature distribution
- (4) Steam generator secondary side liquid level.

3.2 Nodalization

Three nodalization changes were incorporated into the posttest analysis model. The purpose of these changes was to improve the calculation stability and running time. The effects of these changes on the calculated results were minimal, as they were intended to be. The first nodalization change was in the lower plenum region. For the pretest analysis (see Figure 35) this region had been modeled with three volumes. Evaluation of the pretest results indicated that these volumes behaved almost identically. Since the additional volumes and junctions are a computational liability, they were deleted for the posttest analysis. The posttest nodalization schematic in Figure 36 shows the single lower plenum volume. Although directly comparable sensitivity calculations have not been performed, no differences in the downcomer-lower plenum behavior between the pretest and posttest analyses are considered to have been caused by this nodalization change.

An evaluation of the pressurizer surge line volume performance in the pretest analysis indicated that this volume was also unnecessary. Therefore, for the posttest model, the volume of the surge line was included in the pressurizer volume and the two-phase form-loss coefficients of the junction pair combined into a single junction. Comparison of the pressurizer pressure and level response between the pretest and posttest calculations will show nearly identical behavior.

The final nodalization change concerns the pressure suppression system. For the pretest analysis this system was modeled as a single, time-dependent volume. The pressure history for the volume was taken from the EOS^[6] requirements for the system. The pretest analysis calculation was terminated due to steam flow from the suppression system when the calculated PCS pressure dropped below the specified pressure suppression system pressure. The unrealistic PCS depressurization was a direct consequence of the exaggerated ECC condensation calculated by RELAP4. In order to permit the posttest analysis calculation to continue beyond this point, the pressure suppression system volume was deleted and the connecting junctions on the broken loop were specified

Fig. 35 RELAP4 model schematic for LOFT LOCE L1-4 experiment prediction.

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Fig. 36 RELAP4 model schematic for LOFT LOCE L1-4 posttest analysis.

as "leak junctions" with a constant sink pressure. In this analysis, when the calculated PCS pressure fell below the sink pressure (at approximately 50 seconds after rupture), flow through the leak junctions stopped. The calculation continued for an additional 26 seconds; however, calculational instabilities, apparently due to a "ringing" effect in the then dead-end broken legs, were almost immediately apparent.

3.3 Emergency Core Cooling System

As discussed in Section 2.0, "Downcomer Modeling", the ECC water temperature can significantly affect the calculated local behavior when ECC enters a volume. In order to further illustrate the condensation effects of subcooled ECC, results of a hot ECC sensitivity calculation are presented in this report for comparison with the posttest analysis calculation results. The input data for these calculations were identical except for the ECC water temperature. The posttest analysis calculation used the accumulator water temperature (33°C) specified in the EOS^[6]. An ECC water temperature of 132°C, slightly below saturation temperature for the leak junction sink pressure, was chosen for the hot ECC sensitivity calculation. The condensation effects are significantly reduced in this calculation as will be discussed in Section 4.0.

During the interval between LOCEs L1-3A and L1-4, the discharge standpipe in accumulator A was modified and a smaller scaling orifice installed in the discharge pipe as discussed in Reference 6. This modification increased the resistance of the accumulator discharge pipe by 30%. This increase, however, was not incorporated into the pretest RELAP4 model. Consequently, the accumulator flow rate was over-predicted in the pretest calculation. Figure 37 illustrates the change in volumetric flow rate from the accumulator due to the resistance increase. Comparison of posttest analysis results with those of the 132°C ECC calculation indicates that the RELAP4 calculated condensation effects of the 33°C ECC water contribute to the overprediction of accumulator flow in that calculation.

Fig. 37 Flow rate in ECCS accumulator A discharge, LOCE L1-4 data and RELAP4 calculations (FT-P120-36-1).

Data from LOCE L1-4 indicated that the LPIS pump did not perform according to the flow-versus-injection-point pressure curve used in the pretest analysis, see Figure 38. The cause of this discrepancy is twofold: the injection point pressure was below 1.3 MPa when LPIS flow was initiated, and the effect on the injection point pressure of the accumulator discharge through common piping was not taken into account for the pretest pump curve. Consequently, the LPIS flow rate was also overpredicted in the pretest calculation. For the posttest analysis, the pump curve was adjusted, as indicated in Figure 38, to more closely approximate the pump performance. Although the initiation of LPIS flow was somewhat early for the posttest analysis calculation compared to the test data, Figure 39 shows that the agreement is quite good until the liquid surge at the end of the accumulator blowdown perturbed the LPIS flow. In the 132°C ECC calculation, the LPIS flow was initiated later and was underpredicted until the accumulator discharge ended. This is due to the calculated pressure in the injection line volume (No. 46 on Figure 36) being held high by the near saturated accumulator flow.

3.4 Broken Loop Hot Leg

In the pretest analysis, single-phase form-loss coefficients were used for the pump simulator junctions. Since the RELAP4/MOD5 two-phase friction calculation applies only to the laminar friction losses, the pretest calculation underpredicted the pump simulator differential pressure. The results of sensitivity studies have indicated that a two-phase factor on the order of 1.5 would be appropriate. (The performance of the LOFT pump simulator in two-phase flow conditions is currently being studied.) The form-loss coefficients used in the pretest analysis for the two pump simulator junctions were, therefore, increased by 50% for the posttest analysis calculations. The improvement in the comparison between the calculated and measured pump simulator differential pressures can be seen in Figure 40.

In conjunction with the pump simulator resistance increase, the contraction coefficient at the break plane junction was removed. The 0.75 coefficient, applied to the critical flow model at the hot leg

Fig. 38 LPIS pump characteristics for LOCE L1-4.

Fig. 39 Flow rate in ECCS LPIS pump A discharge, LOCE L1-4 data and RELAP4 calculations (FT-P120-85).

Fig. 40 Differential pressure in broken loop hot leg across pump simulator, LOCE L1-4 data and RELAP4 calculations (PdE-BL-5).

break plane in the pretest prediction, was intended to account for vena contracta effects associated with the elbow just upstream of the break plane. Since the pretest prediction analysis, it has been learned that this approach may have been erroneous, as was evidenced by the experimental work of Zaloudek^[11], who found that an elbow at the end of a test section had an insignificant influence on the critical flow rate as compared to a straight section of pipe. RELAP4 sensitivity studies have indicated that changes in the contraction coefficient have a very small effect on the mass flow, but rather, influence the broken loop hot leg pressure drop distribution, particularly between the pump simulator and the break plane.

The pressure differential across the hot leg break plane is shown in Figure 41. The overprediction by the RELAP4 calculations may be due to a combination of effects: the blowdown jet impinging on the downstream tap of the differential pressure transducer; RELAP4 not fully accounting for all of the pressure losses in the broken loop hot leg to the break plane; RELAP4 predicting too low a backpressure just downstream of the break plane; and RELAP4 overpredicting the mass flow rate.

3.5 Steam Generator Secondary

The RELAP4/MOD5 update used for the LL-4 pretest and posttest analysis calculations included a natural circulation steam generator secondary heat transfer model. Figures 42 and 43 show the steam generator secondary temperature and pressure, respectively, for the test data and RELAP4 calculations. The difference in the measured and calculated temperatures at time zero is due to the fact that the LOFT steam generator is removing primary coolant pump heat while the RELAP4 steam generator is initialized with no heat removal. It is evident from the figures that the natural circulation model overpredicted the secondary-to-primary heat transfer. The effect on the overall calculation of this overprediction is considered to be small. This overprediction has been traced to an apparent misapplication of the heat transfer model. Consequently, the RELAP4 standard conductor heat

exchanger model was used for the posttest calculations. Modeling of the LOFT steam generator secondary is currently being reviewed.

Fig. 41 Differential pressure in broken loop hot leg across break plane, LOCE L1-4 data and RELAP4 calculations (PdE-BL-4).

Fig. 42 Temperature in steam generator secondary side, LOCE L1-4 data and RELAP4 calculations (TE-SG-3).

Fig. 43 Pressure in 10-inch line from steam generator, LOCE L1-4 data and RELAP4 calculations (PT-P4-10A).

4.0 DISCUSSION OF RESULTS

The effects on the overall calculations of the RELAP4 modeling changes discussed in Section 3.0 are presented here. Each figure in this section provides the LL-4 test data overlaid with the experiment prediction (pretest) RELAP4 calculation^[7], the posttest RELAP4 calculation, and the hot ECC sensitivity calculation which used 132°C ECC water. The differences in the calculated results are generally very small. As expected, the 132°C ECC sensitivity calculation produced higher pressures and temperatures after ECC injection than did the subcooled ECC calculations.

The calculated densities in Figures 44 through 48 show nearly identical results for the three calculations. The broken loop cold leg density, Figure 44, is overpredicted by as much as 100% during blowdown between time after rupture initiation (t_0) + 5 and t_0 + 25 seconds. The intact loop cold leg density was similarly overpredicted as shown in Figure 45. Among the possible causes of this overprediction are: underprediction of broken loop cold leg mass flow, underprediction of slip effects, and steam flow from the pressurizer through the spray line and into the intact loop cold leg. Figure 46 shows that the broken loop hot leg density was somewhat underpredicted during blowdown. Examination of Figure 47 indicates that the intact loop hot leg density was generally underpredicted and that the calculated flow reversal at t_0 + 4 seconds occurred approximately 2 seconds earlier than in the test data. The increase in the density at t_0 + 20 and t_0 + 17 seconds, respectively, in Figures 46 and 47 has been attributed to fluid, which has been held in the steam generator inlet plenum during pressurizer blowdown, flowing through the intact loop hot leg to the reactor vessel outlet plenum and out the broken loop hot leg. The RELAP4 calculations track this rather subtle effect reasonably well. The density at the steam generator outlet, Figure 48, is somewhat overpredicted for approximately 10 seconds during blowdown.

After blowdown both the pretest and posttest density calculations compare reasonably well with the test data, except for the intact loop cold leg density. The data show apparent slugs of ECC water in the piping between the injection point and the primary coolant pumps during the interval between $t_0 + 30$ and $t_0 + 60$ seconds. The calculations did not show this result. The 132°C ECC broken loop density calculations beyond $t_0 + 40$ seconds generally overpredicted the data. This was expected because the higher temperature ECC calculation also overpredicts the system pressure late in the transient.

Fig. 44 Average density in broken loop cold leg, LOCE L1-4 data and RELAP4 calculations (DE-BL-102).

Fig. 45 Average density in intact loop cold leg, LOCE L1-4 data and RELAP4 calculations (DE-PC-102).

Fig. 46 Average density in broken loop hot leg, LOCE L1-4 data and RELAP4 calculations (DE-BL-202).

Fig. 47 Average density in intact loop hot leg, LOCE L1-4 data and RELAP4 calculations (DE-PC-202).

Fig. 48 Average density in intact loop steam generator outlet, LOCE L1-4 data and RELAP4 calculations (DE-PC-302).

Figures 49 and 50 compare the pressurizer liquid level and pressure calculations with the test data. Note that all three calculations predicted pressurizer blowdown very well and that the pretest and posttest calculations overlay in spite of the nodalization change. It is interesting to note that although the pressurizer level calculations overlay almost exactly with the data, the pressurizer pressure is overpredicted until after ECC initiation. This is the type of response expected if the pressurizer pressure was being relieved through a flow path not included in the RELAP4 model. Such a flow path is the pressurizer spray line which allows steam to flow from the pressurizer to the intact loop cold leg. As mentioned earlier, this steam flow may also contribute to the overprediction of the cold leg densities during blowdown. Further investigation is underway to determine whether this effect is significant for large break analysis.

Fig. 49 Pressurizer liquid level, LOCE L1-4 data and RELAP4 calculations (LT-P139-6).

Fig. 50 Pressurizer pressure, LOCE L1-4 data and RELAP4 calculations (PE-PC-4).

The calculations of PCS pressure response are quite good, as shown on an expanded scale in Figure 51. The three calculations overlay with the data within the instrument error bands^[9] for the first 25 seconds after rupture. At that time the condensation effects of the subcooled ECC cause the pretest and posttest calculated pressures to fall below the data. In contrast, the 132°C ECC pressure calculation follows the data until nearly $t_0 + 50$ seconds. Thereafter, it overpredicts the pressure slightly.

Fig. 51 Core simulator pressure, LOCE L1-4 data and RELAP4 calculations (PE-CS-1A).

The next set of figures (Figures 52 through 58) indicate that the comparison of calculated and measured temperature response is very much as expected, i.e., agreement within the instrument error bands until the time of ECC injection when the subcooled ECC calculations begin underpredicting the temperatures because of condensation effects. The temperatures from the 132°C ECC calculation generally follow the data for 20 seconds beyond ECC injection and then overpredict the data. Figure 52 exemplifies this general behavior. Note that the broken loop temperatures were initialized at the saturation temperatures corresponding to the pressure at the end of the subcooled blowdown, causing the small offset in the initial conditions.

In the intact loop cold leg, Figure 53, even the 132°C ECC calculation fell below the measured temperature because of the thermal-equilibrium assumption of RELAP4. The data between $t_0 + 25$ and $t_0 + 40$ seconds indicate that the instrument is seeing intermittent slugs of subcooled ECC in a steam environment. Between $t_0 + 40$ and $t_0 + 70$ seconds, subcooled fluid gradually begins to dominate. At $t_0 + 75$ seconds, the measured temperature in the cold leg has approached that calculated in the posttest case.

Fig. 52 Average temperature in broken loop cold leg, LOCE L1-4 data and RELAP4 calculations (TE-BL-101).

Fig. 53 Temperature in intact loop cold leg, LOCE L1-4 data and RELAP4 calculations (TE-PC-1).

The test data in Figure 54 and 55 suggest that superheated steam began flowing through the intact loop hot leg at $t_0 + 32$ seconds and reached the broken loop hot leg at approximately $t_0 + 45$ seconds. The calculations did not exhibit this behavior as strongly as did the data. At the steam generator outlet, Figure 56, all three calculations indicated superheating; however, none agreed well with the data. The early temperature rise in the pretest calculation was probably due to the overprediction of secondary-to-primary heat transfer discussed earlier. For the posttest calculation, the temperature rose briefly at $t_0 + 27$ seconds and then generally followed the system saturation temperature curve. The absence of condensation effects in the cold leg for the 132°C ECC calculation caused the flow in the steam generator outlet to nearly stagnate. The resultant lack of heat removal in the region caused the severe superheating exhibited in this calculation.

It should be noted that the temperature data may rise above the system saturation temperature due to thermocouple dry-out and heating by stem conduction and radiative heat transfer. When, this occurs the temperature rise is typically very rapid as compared to the more gradual rise experienced under actual superheated conditions. It is possible that this effect, rather than actual superheating, is the cause of the temperature rises in the data, especially at the steam generator outlet.

Fig. 54 Temperature in broken loop hot leg, LOCE L1-4 data and RELAP4 calculations (TE-BL-2).

Fig. 55 Temperature in intact loop hot leg, LOCE L1-4 data and RELAP4 calculations (TE-PC-2).

Fig. 56 Temperature in intact loop steam generator outlet, LOCE L1-4 data and RELAP4 calculations (TE-PC-3).

Temperatures on the broken and intact loop sides of the downcomer are shown in Figures 57 and 58, respectively. The subcooled ECC calculations begin underpredicting the temperature (because they underpredicted pressure) almost immediately after ECC injection. On the other hand, the 132°C ECC calculation followed the temperature data very well until the subcooled ECC water penetrated to the instrument locations. The data then exhibited a series of negative temperature spikes which indicate intermittent contact with subcooled ECC. Notice that as the instruments were cooled, the average temperatures gradually approached those of the subcooled ECC calculations. This indicates that conditions in the downcomer were slowly approaching the thermal equilibrium conditions calculated by RELAP4.

Fig. 57 Temperature in reactor vessel downcomer instrument stalk 1, LOCE L1-4 data and RELAP4 calculations (TE-1ST-14).

Fig. 58 Temperature in reactor vessel downcomer instrument stalk 2, LOCE L1-4 data and RELAP4 calculations (TE-2ST-14).

Figures 59 and 60 show that the pretest and posttest calculations exhibited the general characteristics of the primary coolant pump speeds reasonably well. The apparent initialization error of nearly 100 rpm for pump 1 contributed to the 230 rpm overprediction at $t_0 + 30$ seconds for that pump. The posttest calculation showed a discontinuity in the pump deceleration, which was not evident in the data, when the motor-generator set field breakers opened at 750 rpm. The increase in pump speed due to steam flowing into the cold leg and condensing with the subcooled ECC is shown clearly in the data and to a lesser extent in the posttest calculation. Since the 132°C ECC calculation severely reduced condensation effects, no pump acceleration was calculated. The pretest calculated pump speed did not drop below the motor-generator set field breaker setpoint until $t_0 + 50$ seconds because the overprediction of ECC flow caused more condensation in the cold leg. Consequently, higher steam flow through the pumps maintained their speeds slightly higher than those in the posttest calculation. Figure 61 shows that the differences in pump speed had very little effect on the differential pressure because the pump head is severely degraded in the high-quality range.

Fig. 59 Pump speed for primary coolant pump 1, LOCE L1-4 data and RELAP4 calculations (RPE-PC-1).

Fig. 60 Pump speed for primary coolant pump 2, LOCE L1-4 data and RELAP4 calculations (RPE-PC-2).

Fig. 61 Primary coolant pump differential pressure, LOCE L1-4 data and RELAP4 calculations (PdE-PC-1).

The velocities in the intact loop are shown on Figures 62 through 64. Note that the turbine meters are unidirectional, i.e., they have a positive output regardless of the actual flow direction. The calculated velocities in the cold leg (Figure 62), and between the steam generator and primary coolant pump (Figure 63), are overpredicted, particularly beyond $t_0 + 25$ seconds. The 132°C ECC calculation is much closer to the data in this region which indicates that excess condensation by the subcooled ECC water is a major factor. Figure 64 shows that after the flow reversal at $t_0 + 6$ seconds, the hot leg velocity instrument was either stuck or underranged. It did show the slug of water from the steam generator inlet plenum at $t_0 + 20$ seconds.

Fig. 62 Velocity in intact loop cold leg, LOCE L1-4 data and RELAP4 calculations (FE-PC-1).

Fig. 63 Velocity in intact loop steam generator outlet, LOCE L1-4 data and RELAP4 calculations (FE-PC-3).

Fig. 64 Velocity in intact loop hot leg, LOCE L1-4 data and RELAP4 calculations (FE-PC-2).

The momentum flux in the intact loop cold leg and in the core simulator are shown in Figures 65 and 66, respectively. The RELAP4 calculations predict the trend of the data within the instrument error bands^[9]. Note that the core simulator instrument was underrated for almost the entire transient.

Fig. 65 Momentum flux in intact loop cold leg, LOCE L1-4 data and RELAP4 calculations (ME-PC-1).

Fig. 66 Momentum flux in core simulator, LOCE L1-4 data and RELAP4 calculations (ME-CS-1).

The intact loop cold leg mass flow per system volume is shown in Figure 67. There is reasonably good agreement for the first 5 seconds of blowdown followed by 20 seconds of overpredictions. The data oscillations during refill are underpredicted by the calculations.

Fig. 67 Mass flow per system volume in intact loop cold leg, LOCE L1-4 data and RELAP4 calculations (FR-PC-111).

The fluid behavior in the broken loop cold leg is presented in Figures 68 through 70. The velocity calculations are in excellent agreement with the test data until just before ECC is injected. The calculations then generally overpredict the data until $t_0 + 45$ seconds. The subcooled ECC calculations then begin decreasing to zero, however, the 132°C ECC calculation continues to overpredict the velocity. The momentum flux calculations, Figure 69, are overpredicted during blowdown but become quite good after ECC injection. As suspected from the density comparisons, the cold leg mass flow per system volume was underpredicted slightly during blowdown, as shown on Figure 70. Data consistency checks have indicated that a factor of 0.72 should be applied to the experimental data. The zero offset in the data at zero seconds after rupture indicates a problem in the data initialization.

Fig. 68 Average velocity in broken loop cold leg, LOCE L1-4 data and RELAP4 calculations (VE-BL-101).

Fig. 69 Average mementum flux in broken loop cold leg, LOCE L1-4 data and RELAP4 calculations (ME-BL-101).

Fig. 70 Mass flow per system volume in broken loop cold leg, LOCE L1-4 data and RELAP4 calculations (FR-BL-116).

Figures 71 and 72 are presented for comparisons of the pretest and posttest calculated broken loop hot leg performance because both the turbine meter in Figure 71 and the drag disc in Figure 72 were under-ranged for nearly the entire test. Note that the differences in the broken loop hot leg modeling between the pretest and posttest calculations had little effect on the overall performance. Figure 73 shows that the calculations followed the trend of the mass flow per system volume data very well in spite of the overprediction early in blowdown. The 0.72 factor from data consistency checks also applies to this experimental data.

Fig. 71 Velocity in broken loop hot leg, LOCE L1-4 data and RELAP4 calculations (FE-BL-2).

Fig. 72 Momentum flux in broken loop hot leg, LOCE L1-4 data and RELAP4 calculations (ME-BL-2).

Fig. 73 Mass flow per system volume in broken loop hot leg, LOCE L1-4 data and RELAP4 calculations (FR-BL-216).

5.0 CONCLUSIONS

Several conclusions can be drawn from the data and calculations presented. The calculation with the ECC water temperature artificially raised to 132°C was an attempt to overcome the excessive steam condensation problems in RELAP4. Results of this calculation compared quite well with the experimental data for up to 25 seconds after ECC injection, but experienced problems late in the transient. The comparison between the posttest analysis and 132°C ECC sensitivity calculation results emphasizes the need for an ECC mixing model in RELAP4. Use of such a model would not only improve the pressure and temperature calculations beyond ECC injection but also would reduce the downcomer flow loops.

Comparisons between single and split downcomer calculation results have shown that the split downcomer model approximates the overall downcomer performance much better than did the single downcomer model. Sensitivity studies have demonstrated that the split downcomer model is reasonably insensitive to nodalization changes and that the downcomer flow loops have little effect on behavior outside of the downcomer.

The detailed modeling of the pressurizer surge line was shown to be unnecessary provided the form losses are properly modeled. Similarly, detailed nodalization in the reactor vessel lower plenum was shown to be unnecessary for cold leg ECC injection experiments. Elimination of the pressure suppression system as a RELAP4 control volume had very little effect on the calculated results and allowed the calculation to continue beyond the end of the calculated accumulator blowdown. Adjustment of the RELAP4 initial conditions to conform to those of the actual test had little effect on the overall results.

Examination of the primary coolant pump response has shown that precise prediction of the pump speed is not essential to predicting the pump differential pressure. Use of a two-phase friction multiplier for the pump simulator form-loss coefficients has shown that two-phase

effects in the pump simulator are important in modeling the broken loop hot leg. Removal of the contraction coefficient at the broken loop hot leg break plane had little effect on the break flow.

Much of the experience from the LOCE L1-4 pretest and posttest analyses may relate directly to LPWR LOCA analysis. Without an ECC mixing model, the injection of subcooled ECC will have substantial effects on local behavior. Use of the split downcomer nodalization may provide a more realistic representation of overall downcomer performance than the conventional nodalization. Detailed modeling of the pressurizer surge line is probably not necessary provided that the two-phase resistance of the line is taken into account.

Areas where future development of the LOFT RELAP4 model is anticipated include proper application of the steam generator secondary natural circulation model to the LOFT steam generator, development of an appropriate two-phase multiplier for the LOFT pump simulator, and evaluation of the LOFT pressurizer spray line effect on the large break transient. With these exceptions, it is felt that the LOFT analyses presented are approaching the limitations of the RELAP4 code in describing nonnuclear thermal-hydraulics for large break LOCEs in LOFT.

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APPENDIX A

LISTING OF RELAP4 COMPUTER CODE INPUT
AND ZERO TIME OUTPUT FOR POSTTEST
ANALYSIS OF EXPERIMENT L1-4

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LISTING OF INPUT DATA FOR CASE 1

```

1  =LOFT L145-A20 L1-4 POSTEST ANALYSIS
2  *
3  *      CHANGES FROM L145-A20 AT END OF INPUT DECK
4  *
5  010001 -2 9 9 6 49 3 0 55 2 1 1 2 47 14 1 0 0 0
6  010002 0.0 1.0
7  020000 AP 2 JW 52 JW 53 JW 50 JW 51 JW 41 JW 23 JW 31 ML 41
8  030010 50 2 2 0 0.0002 0.00001 0.1 2500.
9  030020 20 10 1 0 0.0005 0.00005 0.8
10 030030 10 20 1 0 0.001 0.0001 2.0
11 030040 5 10 4 0 0.01 0.0005 7.0
12 030050 5 20 4 0 0.01 0.0005 22.0
13 030060 5 40 4 0 0.010 0.00005 32.0
14 030070 5 40 4 0 0.01 0.0005 48.0
15 030080 10 40 4 0 0.005 0.0001 60.0
16 030090 5 80 2 0 0.01 0.0001 100.0
17 040010 1 1 0 0 100. 0. * END TRIP
18 040020 2 1 0 0 0.0 0 * BREAK OPENING TRIP
19 040030 3 1 0 0 1.0 0.0 * PUMP TRIP
20 040040 4 1 0 0 22.0 0.0 * HPIS TRIP
21 040050 5 -5 43 0 0.01 0. * ACCUMULATOR
22 040060 6 1 0 0 35.5 0.0 * LPIS
23 *
24 *      W1      W2      W3      W4      W5      W6
      IBUB  IREAD  PRESSURE  TEMP  QUAL  VOLUME
25 050011 0 0 2287.0893903 539. -1. 16.28172
26 050021 0 0 2290.8703204 539. -1. 4.196
27 050031 0 0 2284.7873689 539. -1. 7.95125
28 050041 0 0 2284.5601464 539.0 -1. 4.550411903
29 050051 0 0 2284.3368529 539.0 -1. 3.189863350
30 050061 0 0 2283.6356309 539. -1. 2.878222427
31 050071 1 0 2280.3779429 539.0 -1. 11.18238868
32 050081 0 0 2277.9960765 539.0 -1. 10.97689826
33 050091 0 0 2275.8634709 539.0 -1. 5.447793949
34 050101 0 0 2276.607564 539.0 -1. 10.97689826
35 050111 0 0 2277.7756209 539.0 -1. 11.18238868
36 050121 0 0 2273.5323937 539.0 -1. 2.057298380
37 050131 0 0 2273.449827 539.0 -1. 4.437981240
38 050141 0 0 2271.7515356 539. -1. 4.493459374
39 050151 0 0 2285.5603017 539. -1. 3.785608924
40 050161 0 0 2287.0355787 539. -1. 3.785608924
41 050171 0 0 2298.2609390 539. -1. 1.895801523
42 050181 0 0 2301.1219761 539. -1. 0.6933519742
43 050191 0 0 2295.6228389 539. -1. 6.288527277
44 050201 0 0 2295.1690166 539. -1. 1.61431
45 050211 0 0 2292.2723472 539. -1. 4.9664
46 050221 0 0 2294.6558132 539. -1. 11.37773334
47 050231 0 0 2296.6091197 539. -1. 16.75
48 050241 0 0 2293.5107650 539. -1. 30.249
49 050251 0 0 2292.05916 536.0 -1. 3.569594146

```

50	050261	0	0	2292.05916	533.	-1.	1.5304
51	050271	0	0	2292.05916	502.0	-1.	0.8175129257
52	050281	0	0	2288.25691	539.	-1.	7.54979
53	050291	0	0	2288.25691	538.5	-1.	2.304445
54	050301	0	0	2287.90915	538.0	-1.	0.2896469032
55	050311	0	0	2286.74707	538.0	-1.	4.582558229
56	050321	0	0	2285.31910	538.0	-1.	10.03573817
57	050331	0	0	2286.74755	537.5	-1.	4.582558229
58	050341	0	0	2288.25382	537.0	-1.	0.4089130585
59	050351	0	0	2289.37337	533.0	-1.	1.709604034
60	050361	0	0	2288.91448	529.0	-1.	0.5786674095
61	050371	0	0	2292.7987766	539.	-1.	2.4832
62	050381	0	0	2291.56007	533.0	-1.	8.170455642
63	050391	0	0	2287.89861	538.5	-1.	5.875465929
64	050401	0	0	2294.7631940	539.	-1.	1.61431
65	050411	3	0	2283.874999	-1.0	0.0	35.11452
66	050421	1	0	0.0	539.	0.0	291.6
67	050431	1	0	613.6	92.	0.0	134.8734
68	050441	0	0	2292.05226	502.0	-1.	3.276254839
69	050451	0	0	2288.24207	529.0	-1.	3.276254839
70	050461	0	0	2297.9428436	210.	-1.	5.37
71	050471	0	0	2292.05916	525.0	-1.	0.7741
72	050481	0	0	2294.8800125	539.	-1.	5.68886567
73	050491	0	0	2295.5542644	589.	-1.	6.392
74	*						
75	*	W7		W8	W9	W10	W11
76	050012	7.5		7.5	FRIC	FLOW AREA	EQ DIAM
77	050022	1.865		1.865	0	2.512	1.783
78	050032	0.9323333333		0.9323333333	0	2.491	1.314
79	050042	0.9323333333		0.9323333333	0	0.6827037757	0.932333
80	050052	0.9323333333		0.9323333333	0	0.6827037757	0.932333
81	050062	2.421562792		2.421562792	0	0.8955644145	1.067833
82	050072	2.500000000		2.500000000	0	7.941248101	1.461496
83	050082	6.750000000		6.750000000	0	1.626207149	0.0335
84	050092	2.005208333		2.005208333	0	1.626207149	0.0335
85	050102	6.750000000		6.750000000	0	1.626207149	0.0335
86	050112	2.500000000		2.500000000	0	7.941248101	1.461496
87	050122	2.375082991		2.375082991	0	0.8955644145	1.067833
88	050132	3.808666667		3.808666667	0	0.6827037757	0.932333
89	050142	2.174500000		2.174500000	0	0.6827037757	0.932333
90	050152	2.475770200		2.475770200	0	0.3940626203	0.39406
91	050162	2.475770200		2.475770200	0	0.3940626203	0.39406
92	050172	0.7083333333		0.7083333333	0	0.3940626203	0.708333
93	050182	0.7083333333		0.7083333333	0	0.3940626203	0.708333
94	050192	0.9323333333		0.9323333333	0	0.6827037757	0.932333
95	050202	0.9323333333		0.9323333333	0	0.6827038	0.932333
96	050212	3.435		3.435	0	1.30748	0.583333
97	050222	11.61191567		11.61191567	0	1.018108	0.33333
98	050232	2.4474		2.4474	0	5.58	1.518
99	050242	9.422		9.422	0	3.265	2.313
100	050252	0.9323333333		0.9323333333	0	0.6827037757	0.932333

101	050262	0.932333333	0.932333333	0	0.6827038	0.932333
102	050272	0.5677500000	0.5677500000	0	0.2531652931	0.56775
103	050282	0.9323333333	0.9323333333	0	0.6827037757	0.932333
104	050292	0.932333333	0.932333333	0	0.6827038	0.932333
105	050302	2.440125000	2.440125000	0	0.93037003700-01	0.33858
106	050312	4.582500000	4.582500000	0	1.060795302	1.215833
107	050322	4.047083333	4.047083333	0	1.161015380	1.215833
108	050332	4.582500000	4.582500000	0	1.060795302	1.215833
109	050342	4.541666667	4.541666667	0	0.90037003700-01	0.33858
110	050352	2.174500000	2.174500000	0	0.6827037757	0.932333
111	050362	4.317750000	4.317750000	0	0.90037003700-01	0.33858
112	050372	3.435	3.435	0	0.653740	0.583333
113	050382	2.065083333	2.065083333	0	0.4175836592	1.25
114	050392	2.895833333	2.895833333	0	0.4175836592	1.25
115	050402	0.932333333	0.932333333	0	0.6827038	0.932333
116	050412	6.78354	4.3272	0	6.007260513	2.7656
117	050422	27.45	9.908	0	17.1	4.67
118	050432	7.29207	5.0271724	0	13.57001	4.15667
119	050442	0.8411458333	0.8411458333	0	0.55925	0.843833
120	050452	0.8411458333	0.8411458333	0	0.55925	0.843833
121	050462	3.66185	3.66185	0	0.06447	10000.
122	050472	0.932333	0.932333	0	0.682704	0.2000
123	050482	11.61191667	11.61191667	0	0.509054	0.33333
124	050492	1.7036	1.7036	0	3.743294584	2.183142
125	*	W12	W13			
126	*	ELEVATION	IAMBLO			
127	050013	-0.973	*			
128	050023	-2.838	*			
129	050033	-0.4661666670	*			
130	050043	-0.4661666670	*			
131	050053	-0.4661666670	*			
132	050063	-0.5339166650	*			
133	050073	0.3121933630	*			
134	050083	2.812193363	*			
135	050093	9.562193363	*			
136	050103	2.812193363	*			
137	050113	0.3121933630	*			
138	050123	-0.4874368660	*			
139	050133	-0.296103530	*			
140	050143	-0.296103530	*			
141	050153	-2.121603530	*			
142	050163	-2.121603530	*			
143	050173	-0.3541666670	*			
144	050183	-0.3541666670	*			
145	050193	-0.4661666670	*			
146	050203	-0.466166667	*			
147	050213	-2.35166667	*			
148	050223	-13.96358334	*			
149	050233	-16.4	*			
150	050243	-12.266000001	*			

151	050253	-0.4661666670	*
152	050263	-0.4661666667	*
153	050273	-0.2838750000	*
154	050283	-0.4661666670	*
155	050293	-0.4661666667	*
156	050303	-0.1692916670	*
157	050313	2.270833333	*
158	050323	6.853333333	*
159	050333	2.270833334	*
160	050343	-2.270833330	*
161	050353	-4.445333330	*
162	050363	-4.148458330	*
163	050373	-2.351666667	*
164	050383	0.4661666667	*
165	050393	-0.3645833330	*
166	050403	-0.4661666667	*
167	050413	.261167	
168	050423	1.99	*
169	050433	3.37797	-1
170	050443	-0.4005729170	*
171	050453	-0.4005729170	*
172	050463	-0.28388	*
173	050473	-0.466167	*
174	050483	-13.96358334	*
175	050493	-13.9636	*
176	060011	0.8 3.0 *	
177	060021	0.8 1000000.0	
178	060031	0.8 2.0	
179	*	W1 W2 W3 W4 W5	W6 W7
180	*	IN OUT PUMP VALVE FLOW	FLOW AREA ELEVATION
181	080011	2 1 0 0 591.667	0.480 -0.973
182	080021	1 3 0 0 591.667	0.6827 0.0
183	080031	1 28 0 0 0.0	0.6827 0.0
184	080041	3 4 0 0 591.667	0.6608871601 0.0
185	080051	4 5 0 0 591.667	0.3588196284 0.0
186	080061	5 6 0 0 591.667	0.682704 0.0
187	080071	6 7 0 0 591.667	0.556 1.510110030
188	080081	7 8 0 0 591.667	1.626207149 2.812193363
189	080091	8 9 0 0 591.667	1.626207149 9.552193363
190	080101	9 10 0 0 591.667	1.626207149 9.552193363
191	080111	10 11 0 0 591.667	1.626207149 2.812193363
192	080121	11 12 0 0 591.667	0.556 1.510110030
193	080131	12 13 0 0 591.667	0.6827037757 -0.4874368670
194	080141	13 14 0 0 591.667	0.6827037757 -3.329936870
195	080151	14 15 -1 0 297.8604	0.3940626203 -2.121633530
196	080161	14 16 -2 0 293.8065	0.3940626203 -2.121633530
197	080171	15 17 1 0 297.8604	0.3940626203 0.0
198	080181	16 18 2 0 293.8065	0.3940626203 0.0
199	080191	17 19 0 0 297.8604	0.3940626203 0.0
200	080201	18 19 0 0 293.8065	0.3940626203 0.0

201	080211	19	20	0	0	591.667	0.660887	0.0
202	080221	40	37	0	0	591.667	0.682704	0.0
203	080231	21	22	0	0	284.5505	0.86996	-2.35166667
204	080241	22	23	0	0	368.7599	0.86996	-13.9635833
205	080251	49	24	0	0	591.667	1.056	-12.26
206	080261	24	2	0	0	591.667	0.7854	-2.838
207	080271	21	25	0	0	0.0	0.682704	0.0
208	080281	25	26	0	0	0.0	0.6827037757	0.0
209	080291	26	47	0	0	0.0	0.5814228	0.0
210	080301	27	44	0	0	0.0	0.25316	0.0
211	080311	37	21	0	0	284.5505	0.7	-0.5341667
212	080321	28	29	0	0	0.0	0.6827037757	0.0
213	080331	29	30	0	0	0.0	0.090037	0.0
214	080341	30	31	0	0	0.0	0.90037003700-01	2.270833333
215	080351	31	32	0	0	0.0	0.2060339789	6.853333333
216	080361	32	33	0	0	0.0	0.2060339789	6.853333333
217	080371	33	34	0	0	0.0	0.90037003700-01	2.270833333
218	080381	34	35	0	0	0.0	0.90037003700-01	-2.270833330
219	080391	35	36	0	0	0.0	0.90037003700-01	-3.979166670
220	080401	36	45	0	0	0.0	0.090037	0.0
221	080411	48	22	0	0	84.2094	3.0	-8.15762
222	080421	29	39	0	0	0.0	0.4175	0.0
223	080431	26	38	0	0	0.0	0.4175836592	0.4661666667
224	080441	43	46	0	1	0.0	0.06447	3.37797
225	080451	41	4	0	0	0.0	0.15559179000-01	0.456166666
226	080461	48	23	0	0	222.9071	0.43498	-13.9635833
227	080471	46	20	0	0	0.0	0.06447	0.0
228	080481	47	27	0	0	0.0	0.090037	0.0
229	080491	20	40	0	0	591.667	0.66087	0.0
230	080501	23	49	0	0	591.667	1.05597	-13.9536
231	080511	37	48	0	0	307.1165	0.43498	-2.35166667
232	080521	44	0	1	0	0.0	0.55925	0.0
233	080531	45	0	1	0	0.0	0.55925	0.0
234	080541	0	46	1	0	0.0	1.0	0.0
235	080551	0	46	2	0	0.0	1.0	0.0
236	*	W8				W9	W10	W11 W12 W13 W14
237	*	INERTA				FJUNF	FJUNR	INDX J CAL MV MIX
238	080012	0.0				0.6481	0.6481	0 5 2 0
239	080022	5.173				0.9134	0.9134	1 5 0 0
240	080032	4.741				0.3095	0.4732	1 5 0 0
241	080042	8.744846992				0.0514	0.0514	1 5 0 0
242	080052	8.303511660				0.02278	0.0912	1 5 0 0
243	080062	5.216303368				0.6722	0.6722	1 5 0 0
244	080072	1.862983179				1.53061	1.7764	1 5 0 0
245	080082	2.164041222				0.3584	0.6312	0 5 0 0
246	080092	3.105385439				0.0013	0.6013	0 5 0 0
247	080102	3.105385439				0.0572	0.0572	0 5 0 0
248	080112	2.164041222				0.6325	0.357	0 5 0 0
249	080122	1.371201641				1.3794	1.6017	1 5 0 0
250	080132	6.043461482				0.19658	0.2065	0 5 0 0

251	080142	9.581354524	1.0994	1.25	1	5	0	0
252	080152	17.00953568	0.21566	0.21566	0	5	0	0
253	080162	17.00953568	0.2315	0.2315	0	5	0	0
254	080172	18.29345297	0.152237	0.152237	0	5	0	0
255	080182	14.42171118	0.21838	0.21838	0	5	0	0
256	080192	12.85037549	0.66128	0.69	1	5	0	0
257	080202	8.978633589	2.93093	1.20	1	5	0	0
258	080212	5.10484	0.20375	0.20375	1	5	0	0
259	080222	3.947755	1.23785	0.8049	1	5	0	3
260	080232	0.0	0.260828	0.3	0	5	2	3
261	080242	0.0	0.774149	0.569814	0	5	2	3
262	080252	0.0	0.26046	0.26046	0	5	2	0
263	080262	0.0	0.5591795	0.55918	0	5	2	0
264	080272	3.916834	0.804	1.895	1	5	0	3
265	080282	5.4708	0.1005	0.1005	1	5	0	0
266	080292	11.11	6.545	14.05	1	5	0	0
267	080302	11.61547	0.29956	0.24629	1	5	0	0
268	080312	4.0	1.265	1.265	0	5	0	3
269	080322	5.0742	0.1005	0.1005	1	5	0	0
270	080332	20.3298	0.39605	0.75363	1	5	0	0
271	080342	19.90104223	0.93596	0.93596	0	5	0	0
272	080352	5.758748039	5.81834	5.81834	0	5	0	0
273	080362	5.758748039	5.81834	5.81834	0	5	0	0
274	080372	27.25728546	0.23025	0.23025	0	5	0	0
275	080382	27.65511851	6.351	6.351	0	5	0	0
276	080392	37.52486243	12.702	12.702	1	5	0	0
277	080402	40.91397	0.94883	0.43834	1	5	0	0
278	080412	1.1	24.18	24.18	0	5	0	3
279	080422	19.338	1.247	0.4576	0	5	0	3
280	080432	24.22295744	1.247	0.4576	0	5	0	3
281	080442	0.0	28.65	28.65	0	5	2	0
282	080452	150.2198	31.266	31.266	1	5	0	3
283	080462	0.0	0.774336	0.57	0	5	2	3
284	080472	0.0	12.25	12.25	0	5	2	0
285	080482	15.18	0.415	0.290	1	5	0	0
286	080492	5.10484	0.20375	0.20375	1	5	0	0
287	080502	0.0	0.52259	0.6	0	5	2	3
288	080512	0.0	0.2009	0.3	0	5	2	3
289	080522	25.25554003	1.037	0.537	1	5	0	0
290	080532	25.25554003	1.037	0.537	1	5	0	0
291	080542	0.0	1.0	1.0	0	5	2	3
292	080552	0.0	1.0	1.0	0	5	2	3
293	*	W15	W16	W17	W18	W19	W20	
294	*	JUN. DIAM.	CONCO	ICHOKE	ENTH	SRCOS	IADJUN	
295	080013	0.901	1.0	0	0	1.0	0	
296	080023	0.9323	1.0	0	0			
297	080033	0.9323	1.0	0	0			
298	080043	0.9323333333	1.0	0	0			
299	080053	0.6759166667	1.0	0	0			
300	080063	0.9323333333	1.0	0	0	1.0	0	

301	080073	0.90167	1.0	0	0		
302	080083	1.438941017	1.0	0	2		
303	080093	1.438941017	1.0	0	3	1.0	0
304	080103	1.438941017	1.0	0	3	1.0	0
305	080113	1.438941017	1.0	0	1		
306	080123	0.90167	1.0	0	0		
307	080133	0.9323333333	1.0	0	0	1.0	0
308	080143	0.9323333333	1.0	0	0		
309	080153	0.7083333333	1.0	0	0		
310	080163	0.7083333333	1.0	0	0		
311	080173	0.7083333333	1.0	0	0		
312	080183	0.7083333333	1.0	0	0		
313	080193	0.7083333333	1.0	0	0		
314	080203	0.7083333333	1.0	0	0		
315	080213	0.932333	1.0	0	0		
316	080223	0.932333	1.0	0	0		
317	080233	0.91145	1.0	0	0	1.0	0
318	080243	1.2889	1.0	0	0	1.0	0
319	080253	2.038	1.0	0	0	1.0	0
320	080263	1.0	1.0	0	0	1.0	0
321	080273	0.932333	1.0	0	0		
322	080283	0.9323333333	1.0	0	0		
323	080293	0.3386	1.0	0	0		
324	080303	0.56775	1.0	0	0		
325	080313	0.0	1.0	0	0		
326	080323	0.9323333333	1.0	0	0		
327	080333	0.0	1.0	0	0		
328	080343	0.3594166667	1.0	0	0	1.0	0
329	080353	0.5278189198	1.0	0	0	1.0	0
330	080363	0.5278189198	1.0	0	0	1.0	0
331	080373	0.3594166667	1.0	0	0	1.0	0
332	080383	0.3594166667	1.0	0	0	1.0	0
333	080393	0.3594166667	1.0	0	0		
334	080403	0.33858	1.00	0	0		
335	080413	0.0	1.0	0	0		
336	080423	0.7083	1.0	0	0		
337	080433	0.7083333333	1.0	0	0	1.0	0
338	080443	0.2865	1.0	0	0		
339	080453	0.1407500000	0.75	0	0		
340	080463	1.2889	1.0	0	0	1.0	0
341	080473	0.29167	1.0	0	0		
342	080483	0.3386	0.848	0	0		
343	080493	0.932333	1.0	0	0		
344	080503	1.26557	1.0	0	0	1.0	0
345	080513	0.091145	1.0	0	0	1.0	0
346	080523	0.843833	1.0	0	0		
347	080533	0.843833	1.0	0	0		
348	080543	0.2865	1.0	0	0		
349	080553	0.2865	1.0	0	0		
350	082003	1. 1. 1.	0.0025				

431	101161	2	8	4	-1.	-1.	-.25	-.9	-.08	-.8	* PUMP-TQ									
402	101162				0.	-.67					* PUMP-TQ									
403	104011	1	1	7	0.	0.	.1	.83	.2	1.09	.5	1.02	.7	1.01	.9	.94	1.	1.		
404	104021	1	2	8	0.	0.	.1	-.04	.2	0.	.3	.1	.4	.21	.8	.67	.9	.8	1.	1.
405	104031	1	3	10	-1.	-1.16	-.9	-1.24	-.8	-1.77	-.7	-2.36	-.6	-2.79	-.5	-2.91				
406	104032	-.4	-2.67	-.25	-1.69	-.1	-.65	0.	0.											
407	104041	1	4	10	-1.	-1.16	-.9	-.78	-.8	-.5	-.7	-.31	-.6	-.17	-.5	-.08	-.35	0.		
408	104042				-.2	.05	-.1	.08	0.	.11										
409	104051	1	5	6	0.	0.	.2	-.34	.4	-.65	.6	-.93	.8	-1.19	1.	-1.47				
410	104061	1	6	10	0.	.11	.1	.13	.25	.15	.4	.13	.5	.07	.6	-.04	.7	-.23	.8	-.51
411	104062	.9	-.91	1.	-1.47															
412	104071	1	7	2	-1.	0.	0.	0.												
413	104081	1	8	2	-1.	0.	0.	0.												
414	104091	2	1	6	0.	.6032	.41930	.6325	.393	.7369	* PUMP-TQ									
415	104092				.59552	.8331	.79782	.9229	1.	.9672	* PUMP-TQ									
416	104101	2	2	7	0.	-.67	.4	-.25	.5	.15	* PUMP-TQ									
417	104102				.737255	.526586	.768049	.606594	.86723	.74366	* PUMP-TQ									
418	104103				1.	.9672					* PUMP-TQ									
419	104111	2	3	6	-1.	1.9843	-.80096	1.394	-.60638	1.0975	* PUMP-TQ									
420	104112				-.40686	.822	-.19928	.6648	0.	.6032	* PUMP-TQ									
421	104121	2	4	8	-1.	1.9843	-.82234	1.6308	-.63371	1.6824	* PUMP-TQ									
422	104122				-.45853	1.557	-.267023	1.4362	-.176107	1.3879	* PUMP-TQ									
423	104123				-.08931	1.3481	0.	1.23361			* PUMP-TQ									
424	104131	2	5	4	0.	-.45	.4	-.25	.5	0.	* PUMP-TQ									
425	104132				1.	.3569					* PUMP-TQ									
426	104141	2	6	10	0.	1.23361	.609643	1.1965	.188569	1.1096	* PUMP-TQ									
427	104142				.27347	1.0416	.458669	.8958	.57448	.7807	* PUMP-TQ									
428	104143				.73816	.6134	.76852	.5849	.870057	.4877	* PUMP-TQ									
429	104144				1.	.3569					* PUMP-TQ									
430	104151	2	7	4	-1.	-1.	-.3	-.9	-.1	-.5	* PUMP-TQ									
431	104152				0.	-.45					* PUMP-TQ									
432	104161	2	8	4	-1.	-1.	-.25	-.9	-.08	-.8	* PUMP-TQ									
433	104162				0.	-.67					* PUMP-TQ									
434	120010	25	0	0	1.0	0.	0.	0.			* ACCUMULATOR									
435	120100	-3	2		43.0	0.0	0.0	0.0175	1.0	200.0	1.0									
436	130100	6	2	13	4	16AL/MIN	100.	90.			* LP1S									
437	130101	0.	172.	20.	167.	40.	160.	60.	150.	75.	135.	97.	105.							
438	130102	112.	85.	125.	74.	137.	63.	155.	40.	157.	30.									
439	130103	159.	20.	160.	0.															
440	130200	4	2	2	4	16AL/MIN	100.0	90.0												
441	130201	0.1	17.2		3000.0	17.2					* HP1S FILL									
442	150011	23	0	1	0	0	0	0	23.333	0.0	0.9093	1.744	0.0							
443	150012	1.744	0.0	5.1384	0.0	0.0	0.0													
444	150021	1	0	2	0	0	0	0	23.054	0.0	0.9829	1.788								
445	150022	0.0	0.0	0.0	0.0	4.103	0.0	0.0	0.0											
446	150031	2	0	2	0	0	0	0	10.477	0.0	0.4467	1.314	0.0							
447	150032	0.0	0.0	1.865	0.0	0.0	0.0													
448	150041	24	0	3	0	0	0	0	60.318	0.	5.236	2.313	0.							
449	150042	0.	0.	9.422	0.	0.	0.													
450	150051	36	0	11	0	0	0	0	3.42	0.0	0.2533	0.3385	0.0							

451	150052	0.3386	0.0	3.217	0.0	0.0	0.0			
452	150061	35	0	8	0	0	0	7.33	0.0	0.9674 0.932 0.0
453	150062	0.932	0.0	2.504	0.0	0.0	0.0			
454	150071	0	21	4	0	0	0	0	19.7040	2.3606 0. 0.5833
455	150072	0.0	0.0	0.0	0.0	3.435	0.0	0.0		
456	150081	21	0	5	0	0	0	23.985	0. 22.036	.5833 0.
457	150082	0.	0.	3.435	0.	0.	0.			
458	150091	0	48	4	0	0	0	0.	33.4367	6.8520 0. 0.3333
459	150092	0.	0.	0.	11.611	0.	0.			
460	150101	48	0	5	0	0	0	40.539	0.	37.2457 0.3333 0.
461	150102	0.	0.	0.	3.875	0.	0.			
462	150111	34	0	11	0	0	0	9.19	0.0	0.6807 0.3386 0.0
463	150112	0.3386	0.0	8.643	0.0	0.0	0.0			
464	150121	33	0	13	0	0	0	16.32	0.0	2.722 1.203 0.0
465	150122	1.203	0.0	4.319	0.0	0.0	0.0			
466	150131	32	0	13	0	0	0	32.67	0.0	5.447 1.203 0.0
467	150132	1.203	0.0	8.643	0.0	0.0	0.0			
468	150141	31	0	13	0	0	0	16.32	0.0	2.722 1.203 0.0
469	150142	1.203	0.0	4.319	0.0	0.0	0.0			
470	150151	30	0	11	0	0	0	6.83	0.0	0.5061 0.3386 0.0
471	150152	0.3386	0.0	6.427	0.0	0.0	0.0			
472	150161	23	0	5	0	0	0	14.4713	0.	13.2957 2.892 0.
473	150162	2.892	0.	4.145	0.	0.	0.			
474	150171	8	42	6	0	0	0	1121.92	1395.42	5.139 0.0335 4.667
475	150172	0.0335	4.667	5.79	5.79	0.83	7.57			
476	150181	9	42	6	0	0	0	649.38	807.68	2.975 0.0335 4.667
477	150182	0.0335	4.667	3.35	3.35	7.573	9.573			
478	150191	10	42	6	0	0	0	1121.92	1395.42	5.139 0.0335 4.667
479	150192	0.0335	4.667	5.79	5.79	0.83	7.57			
480	150201	44	0	7	0	0	0	13.063	0.0	1.391 0.932 0.0
481	150202	0.932	0.0	5.895	0.0	0.0	0.0			
482	150211	45	0	7	0	0	0	13.063	0.0	1.391 0.932 0.0
483	150212	0.932	0.0	5.895	0.0	0.0	0.0			
484	150221	25	0	8	0	0	0	15.31	0.0	2.02 0.932 0.0
485	150222	0.932	0.0	5.228	0.0	0.0	0.0			
486	150231	26	0	8	0	0	0	9.88	0.0	1.304 0.932 0.0
487	150232	0.932	0.0	3.375	0.0	0.0	0.0			
488	150241	3	0	8	0	0	0	15.45	0.0	2.038 0.932 0.0
489	150242	0.932	0.0	5.275	0.0	0.0	0.0			
490	150251	4	0	8	0	0	0	19.52	0.0	2.575 0.932 0.0
491	150252	0.932	0.0	6.665	0.0	0.0	0.0			
492	150261	5	0	8	0	0	0	13.68	0.0	1.805 0.932 0.0
493	150262	0.932	0.0	4.672	0.0	0.0	0.0			
494	150271	6	0	9	0	0	0	10.78	0.0	1.6092 1.0678 0.0
495	150272	1.0678	0.0	3.213	0.0	0.0	0.0			
496	150281	7	0	10	0	0	0	15.	0.0	5.267 1.4615 0.0
497	150282	1.4615	0.0	2.500	0.0	0.0	0.0			
498	150291	11	0	10	0	0	0	15.9	0.0	5.267 1.4615 0.0
499	150292	1.4615	0.0	2.500	0.0	0.0	0.0			
500	150301	12	0	9	0	0	0	7.70	0.0	1.1502 1.0678 0.0

501	150302	1.0678	0.0	2.297	0.0	0.0	0.0			
502	150311	13	0	8	0	0	0	0	19.94	0.0 2.511 0.932 0.0
503	150312	0.932	0.0	6.500	0.0	0.0	0.0			
504	150321	14	0	8	0	0	0	0	19.27	0.0 2.543 0.932 0.0
505	150322	0.932	0.0	6.581	0.0	0.0	0.0			
506	150331	19	0	8	0	0	0	0	26.97	0.0 3.558 0.932 0.0
507	150332	0.932	0.0	9.211	0.0	0.0	0.0			
508	150341	20	0	8	0	0	0	0	6.925	0. .914 .932 0.
509	150342	.932	0.	4.729	0.	0.	0.			
510	150351	28	0	8	0	0	0	0	13.72	0.0 1.811 0.932 0.0
511	150352	0.932	0.0	4.686	0.0	0.0	0.0			
512	150361	29	0	8	0	0	0	0	9.88	0.0 1.304 0.932 0.0
513	150362	0.932	0.0	3.375	0.0	0.0	0.0			
514	150371	27	0	12	0	0	0	0	5.75	0.0 0.4927 0.5678 0.0
515	150372	0.5678	0.0	3.229	0.0	0.0	0.0			
516	150381	46	0	14	0	0	0	0	16.4	47.54 8.69 0.83333 0.0 0.0 0.8 18.16
517	150382	16.16	0.0	0.0						
518	150391	40	0	8	0	0	0	0	6.925	0. .914 .932 0.
519	150392	.932	0.	4.729	0.	0.	0.			
520	150401	0	22	4	0	0	0	0	66.8733	13.7940 0. 0.3333
521	150402	0.	0.	0.	11.611	0.	0.			
522	150411	22	0	5	0	0	0	0	81.0787	0. 74.4913 0.3333 0.
523	150412	0.	0.	0.	3.8750	0.	0.			
524	150421	23	0	1	0	0	0	0	46.6667	0. 1.8187 1.744 0.
525	150422	1.744	0.	5.1384	0.	0.	0.			
526	150431	23	0	5	0	0	0	0	28.9427	0. 26.5913 2.892 0.
527	150432	2.892	0.	4.145	0.	0.	0.			
528	150441	49	0	1	0	0	0	0	28.735	0.0 1.1198 1.744 0.0
529	150442	1.744	0.0	7.158	0.0	0.0	0.0			
530	150451	49	0	5	0	0	0	0	17.821	0.0 16.374 2.892 0.0
531	150452	2.892	0.0	1.702	0.0	0.0	0.0			
532	150461	0	37	4	0	0	0	0	9.8920	1.1803 0. 0.5833
533	150462	0.	0.	0.	3.435	0.	0.			
534	150471	37	0	5	0	0	0	0	11.9927	0. 11.018 0.5833 0.
535	150472	0.	0.	0.	3.435	0.	0.			
536	170101	1	2	1	4	0.0	0.01299			
537	170102	0	1	4	0.02597	0.0				
538	170201	2	2	1	4	0.894	0.0208			
539	170202	0	1	4	0.0208	0.0				
540	170301	2	2	1	4	1.019	0.0417			
541	170302	0	1	4	0.0417	0.0				
542	170401	2	2	1	4	1.25	0.0625			
543	170402	0	1	4	0.0625	0.0				
544	170501	2	2	1	4	1.667	0.25			
545	170502	0	1	4	0.5	0.0				
546	170601	2	2	1	4	0.01675	0.00204			
547	170602	0	1	4	0.00204	0.0				
548	170701	2	2	1	4	0.354	0.031			
549	170702	0	1	4	0.063	0.0				
550	170801	2	2	1	4	0.466	0.039			

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551 170802 0 1 4 0.078 0.0
552 170901 2 2 1 4 0.5339 0.0443 0.0
553 170902 0 1 4 0.0885 0.0
554 171001 2 2 1 4 2.25 0.0208 0.0
555 171002 0 1 4 0.2709 0.0
556 171101 2 2 1 4 0.1693 0.0208 0.0
557 171102 0 1 4 0.0417 0.0
558 171201 2 2 1 4 0.2839 0.0252 0.0
559 171202 0 1 4 0.0503 0.0
560 171301 2 2 1 4 0.6016 0.0495 0.0
561 171302 0 1 4 0.0989 0.0
562 171401 2 3 1 3 0.14583 0.08333 0.0
563 171402 0 1 5 0.08333 0.0
564 171403 0 1 3 0.10417 0.0
565 180101 -2 * SS104 THERMAL CONDUCTIVITY
566 180102 212. 9.574 2372. 19.294
567 190101 -13 * SS304 HEAT CAPACITY
568 190102 170. 44.46081 250. 44.32964 400. 44.48722
569 190103 600. 45.39201 800. 46.90938 1000. 48.84151
570 190104 1200. 50.99056 1400. 53.15869 1600. 55.14808
571 190105 1800. 56.76090 2000. 57.79932 2200. 58.06550
572 190106 2400. 57.36161
573 * CHANGES FROM L145-A2G - L1-4 POSTTEST ANALYSIS
574 340010 1 1 0 0.0 0.0 * END TRIP FOR INPUT LISTING AND TIME ZERO EDIT
575 CARD ABOVE IS REPLACEMENT CARD.

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MISCELLANEOUS PROBLEM CONTROL DATA.

TAPE	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	NUM	PRO-
DUMP	EDIT	TIME	TRIP	VOL	BUB	TIME	JUN	PUMP	CHK	LEAK	FILL	HEAT	SLAB	SLAB	CORE	HEAT	GRAM	
0=NO	VAR	SETS	SGNL		SETS	VOL		SETS	VALV	CURV	CURV	SLAB	GEOM	MAT	SECT	EXCH	FLAG	
-2	9	9	6	49	3	0	55	2	1	1	2	47	14	1	0	0	0	

EXP0P4/C E 0LOFTSV02(73)

EXPERIMENTAL RELAP4 TYPE PROGRAM CONFIGURATION CONTROL:YES

INITIAL POWER (MEGAWATTS)	IMPLICIT- EXPLICIT FACTOR	LOW PRESSURE LIMIT (PSI)	HIGH PRESSURE LIMIT (PSI)	LOW TEMPERATURE LIMIT (F)	HIGH TEMPERATURE LIMIT (F)
0.	1.000000E+03	8.860000E-02	3.626000E+03	3.210000E+01	8.540312E+03

EDIT IDENTIFICATION NUMBERS

1	2	3	4	5	6	7	8	9
AP 2	JW 52	JW 53	JW 50	JW 51	JW 41	JW 23	JW 31	ML 41

DATA FOR 9 TIME STEP SETS.

SET NUM	T S PER BRF	BRF PER LRG	LRG PER RST	T S CNT OPT	TIME STEP SIZE	MIN T S SIZE	END OF INTERVAL
1	50	2	2	0	.200000E-03	.100000E-04	.100000E+00
2	20	10	1	0	.500000E-03	.500000E-04	.800000E+00
3	10	20	1	0	.100000E-02	.100000E-03	.200000E+01
4	5	10	4	0	.100000E-01	.500000E-03	.700000E+01
5	5	20	4	0	.100000E-01	.500000E-03	.220000E+02
6	5	40	4	0	.100000E-01	.500000E-04	.320000E+02
7	5	40	4	0	.100000E-01	.500000E-03	.480000E+02
8	10	40	4	0	.500000E-02	.100000E-03	.600000E+02
9	5	60	2	0	.100000E-01	.100000E-03	.100000E+03

ENDCPU = 2.50000E+03

GENERALIZED TRIP PARAMETERS FOR 6 SIGNALS.

TRIP NO.	TRIP ID	SIG ID	INDX 1	ENDX 2	ACTION	TRIP SIGNAL	SET POINT	DELAY TIME
1	1	1	0	0	END	ELAPSED TIME	0.	0.
2	2	1	0	0	GEN TRIP	ELAPSED TIME	0.	0.
3	3	1	0	0	GEN TRIP	ELAPSED TIME	.100000E+01	0.
4	4	1	0	0	GEN TRIP	ELAPSED TIME	.220000E+02	0.
5	5	5	43	0	GEN TRIP	LOW MIX LEV	.100000E-01	0.
6	6	1	0	0	GEN TRIP	ELAPSED TIME	.355000E+02	0.

INPUT DATA FOR 49 VOLUMES.

VOL NUM	BUBL INDX	TIME DEP	PRESSURE (PSIA)	TEMPERATURE (DEG F)	HUMIDITY (OR QUALITY)	VOLUME (FT**3)	HEIGHT (FT)	MIXTURE LEVEL (FT)
VOL 2-PH NUM	2-PH FRIC		FLOW AREA (FT**2)	EQUIVALENT DIAMETER (FT)	ELEVATION (FT)	VOL. BELOW		
1	0	0	.228709E+04	.539000E+03	-.100000E+01	.162817E+02	.750000E+01	.750000E+01
1	0		.251200E+01	.178800E+01	-.973000E+00	0		
2	0	0	.229087E+04	.539000E+03	-.100000E+01	.419500E+01	.186500E+01	.186500E+01
2	0		.249100E+01	.131400E+01	-.283800E+01	0		
3	0	0	.228479E+04	.539000E+03	-.100000E+01	.795126E+01	.932333E+00	.932333E+00
3	0		.682704E+00	.932333E+00	-.466167E+00	0		
4	0	0	.228456E+04	.539000E+03	-.100000E+01	.455041E+01	.932333E+00	.932333E+00
4	0		.682704E+00	.932333E+00	-.466167E+00	0		
5	0	0	.228434E+04	.539000E+03	-.100000E+01	.318986E+01	.932333E+00	.932333E+00
5	0		.682704E+00	.932333E+00	-.466167E+00	0		
6	0	0	.228364E+04	.539000E+03	-.100000E+01	.287822E+01	.242156E+01	.242156E+01
6	0		.895564E+00	.106783E+01	-.533917E+00	0		
7	1	0	.228038E+04	.539000E+03	-.100000E+01	.111824E+02	.250000E+01	.250000E+01
7	0		.794125E+01	.146150E+01	.312193E+00	0		
8	0	0	.227800E+04	.539000E+03	-.100000E+01	.109769E+02	.675000E+01	.675000E+01
8	0		.162621E+01	.335000E-01	.281219E+01	0		
9	0	0	.227586E+04	.539000E+03	-.100000E+01	.544779E+01	.200521E+01	.200521E+01
9	0		.162621E+01	.335000E-01	.956219E+01	0		
10	0	0	.227661E+04	.539000E+03	-.100000E+01	.109769E+02	.675000E+01	.675000E+01
10	0		.162621E+01	.335000E-01	.281219E+01	0		
11	0	0	.227778E+04	.539000E+03	-.100000E+01	.111824E+02	.250000E+01	.250000E+01
11	0		.794125E+01	.146150E+01	.312193E+00	0		
12	0	0	.227353E+04	.539000E+03	-.100000E+01	.205729E+01	.237508E+01	.237508E+01
12	0		.895564E+00	.106783E+01	-.487437E+00	0		
13	0	0	.227345E+04	.539000E+03	-.100000E+01	.443798E+01	.380867E+01	.380867E+01
13	0		.682704E+00	.932333E+00	-.429610E+01	0		
14	0	0	.227175E+04	.539000E+03	-.100000E+01	.449346E+01	.217450E+01	.217450E+01
14	0		.682704E+00	.932333E+00	-.429610E+01	0		
15	0	0	.228556E+04	.539000E+03	-.100000E+01	.378561E+01	.247577E+01	.247577E+01
15	0		.394063E+00	.394063E+00	-.212160E+01	0		
16	0	0	.228704E+04	.539000E+03	-.100000E+01	.378561E+01	.247577E+01	.247577E+01
16	0		.394063E+00	.394063E+00	-.212160E+01	0		
17	0	0	.229826E+04	.539000E+03	-.100000E+01	.189580E+01	.708333E+00	.708333E+00
17	0		.394063E+00	.708333E+00	-.354167E+00	0		
18	0	0	.230112E+04	.539000E+03	-.100000E+01	.693352E+00	.708333E+00	.708333E+00
18	0		.394063E+00	.708333E+00	-.354167E+00	0		
19	0	0	.229562E+04	.539000E+03	-.100000E+01	.628853E+01	.932333E+00	.932333E+00
19	0		.682704E+00	.932333E+00	-.466167E+00	0		
20	0	0	.229517E+04	.539000E+03	-.100000E+01	.161431E+01	.932333E+00	.932333E+00
20	0		.682704E+00	.932333E+00	-.466167E+00	0		

VOL NUM	BUBL INDX	TIME DEP	PRESSURE (PSIA)	TEMPERATURE (DEG F)	HUMIDITY (OR QUALITY)	VOLUME (FT**3)	HEIGHT (FT)	MIXTURE LEVEL (FT)
VOL 2-PH NUM	2-PH INDX	TIME DEP	FLJW AREA (FT**2)	EQUIVALENT DIAMETER (FT)	ELEVATION (FT)	VOL. BELOW		
21	0	0	.229227E+04	.539000E+03	-.100000E+01	.496640E+01	.343500E+01	.343500E+01
21	0		.130748E+01	.583338E+00	-.235167E+01	0		
22	0	0	.229466E+04	.539000E+03	-.100000E+01	.113777E+02	.116119E+02	.116119E+02
22	0		.101811E+01	.333330E+00	-.139636E+02	0		
23	0	0	.229661E+04	.539000E+03	-.100000E+01	.167500E+02	.244740E+01	.244740E+01
23	0		.558000E+01	.151800E+01	-.164000E+02	0		
24	0	0	.229351E+04	.539000E+03	-.100000E+01	.302499E+02	.942200E+01	.942200E+01
24	0		.326500E+01	.231300E+01	-.122600E+02	0		
25	0	0	.229206E+04	.536000E+03	-.100000E+01	.356959E+01	.932333E+00	.932333E+00
25	0		.682704E+00	.932333E+00	-.466167E+00	0		
26	0	0	.229206E+04	.533060E+03	-.100000E+01	.153040E+01	.932333E+00	.932333E+00
26	0		.682704E+00	.932333E+00	-.466167E+00	0		
27	0	0	.229206E+04	.502000E+03	-.100000E+01	.817513E+00	.567750E+00	.567750E+00
27	0		.253165E+00	.567750E+00	-.283875E+00	0		
28	0	0	.228826E+04	.539000E+03	-.100000E+01	.754979E+01	.932333E+00	.932333E+00
28	0		.682704E+00	.932333E+00	-.466167E+00	0		
29	0	0	.228826E+04	.538500E+03	-.100000E+01	.230445E+01	.932333E+00	.932333E+00
29	0		.682704E+00	.932333E+00	-.466167E+00	0		
30	0	0	.228791E+04	.538000E+03	-.100000E+01	.289649E+00	.244013E+01	.244013E+01
30	0		.900370E-01	.338580E+00	-.169292E+00	0		
31	0	0	.228675E+04	.538000E+03	-.100000E+01	.458256E+01	.458250E+01	.458250E+01
31	0		.176080E+01	.121583E+01	-.227083E+01	0		
32	0	0	.228532E+04	.538000E+03	-.100000E+01	.100357E+02	.404708E+01	.404708E+01
32	0		.116102E+01	.121583E+01	-.685333E+01	0		
33	0	0	.228675E+04	.537500E+03	-.100000E+01	.458256E-01	.458250E+01	.458250E+01
33	0		.106080E+01	.121583E+01	-.227083E+01	0		
34	0	0	.228826E+04	.537000E+03	-.100000E+01	.408918E-00	.454167E+01	.454167E+01
34	0		.900370E-01	.338580E+00	-.227083E+01	0		
35	0	0	.228937E+04	.535000E+03	-.100000E+01	.170960E-01	.217450E+01	.217450E+01
35	0		.682704E+00	.932333E+00	-.444533E+01	0		
36	0	0	.228891E+04	.529000E+03	-.100000E+01	.578667E+00	.431775E+01	.431775E+01
36	0		.900370E-01	.333580E+00	-.414845E+01	0		
37	0	0	.229280E+04	.539000E+03	-.100000E+01	.248320E+01	.343500E+01	.343500E+01
37	0		.653740E+00	.583338E+00	-.235167E+01	0		
38	0	0	.229156E+04	.533000E+03	-.100000E+01	.817046E+01	.206508E+01	.206508E+01
38	0		.417584E+00	.125000E+01	-.466167E+00	0		
39	0	0	.228790E+04	.538500E+03	-.100000E+01	.587547E+01	.289583E+01	.289583E+01
39	0		.417584E+00	.125000E+01	-.364583E+00	0		
40	0	0	.229476E+04	.539000E+03	-.100000E+01	.161431E+01	.932333E+00	.932333E+00
40	0		.682704E+00	.932333E+00	-.466167E+00	0		

VOL NUM	BUBL INDX	TIME DEP	PRESSURE (PSIA)	TEMPERATURE (DEG F)	HUMIDITY (OR QUALITY)	VOLUME (FT**3)	HEIGHT (FT)	MIXTURE LEVEL (FT)
VOL NUM	2-PH FRIC		FLOW AREA (FT**2)	EQUIVALENT DIAMETER (FT)	ELEVATION (FT)	VOL. BELOW		
41	3	0	.228387E+04	-.100000E+01	0.	.351145E+02	.678354E+01	.432720E+01
41	0		.600726E+01	.276560E+01	.261167E+00	0		
42	1	0	0.	.539000E+03	0.	.281500E+03	.274500E+02	.990800E+01
42	0		.171000E+02	.467000E+01	.199000E+01	0		
43	1	0	.613600E+03	.920000E+02	0.	.104873E+03	.729207E+01	.502717E+01
43	0		.135700E+02	.415667E+01	.337797E+01	-1		
44	0	0	.229205E+04	.502000E+03	-.100000E+01	.327625E+01	.841146E+00	.841146E+00
44	0		.559250E+00	.843838E+00	-.400573E+00	0		
45	0	0	.228824E+04	.529000E+03	-.100000E+01	.327625E+01	.841146E+00	.841146E+00
45	0		.559250E+00	.843838E+00	-.400573E+00	0		
46	0	0	.229794E+04	.210000E+03	-.100000E+01	.537000E+01	.366185E+01	.366185E+01
46	0		.644700E+01	.100000E+05	-.283880E+00	0		
47	0	0	.229206E+04	.525000E+03	-.100000E+01	.774100E+00	.932333E+00	.932333E+00
47	0		.682704E+00	.206000E+00	-.466167E+00	0		
48	0	0	.229488E+04	.539000E+03	-.100000E+01	.568387E+01	.116119E+02	.116119E+02
48	0		.509054E+00	.333330E+00	-.139636E+02	0		
49	0	0	.229555E+04	.539000E+03	-.100000E+01	.639200E+01	.170360E+01	.170360E+01
49	0		.374329E+01	.218314E+01	-.139636E+02	0		

VOLUME DATA ACTJALLY BEING USED.

VOL NUM	BUBL INDX	TIME DEP	PRESSURE (PSIA)	ENT-HALPY	VOLUME (FT**3)	HEIGHT (FT)	MIXTURE LEVEL (FT)	ELEVATION (FT)
1	0	0	.228709E+04	.533652E+03	.162817E+02	.750000E+01	.750000E+01	-.973000E+00
2	0	0	.229087E+04	.533647E+03	.419600E+01	.186500E+01	.186500E+01	-.283800E+01
3	0	0	.228479E+04	.533654E+03	.795126E+01	.932333E+00	.932333E+00	-.466167E+00
4	0	0	.228456E+04	.533655E+03	.455041E+01	.932333E+00	.932333E+00	-.466167E+00
5	0	0	.228434E+04	.533655E+03	.318986E+01	.932333E+00	.932333E+00	-.466167E+00
6	0	0	.228364E+04	.533656E+03	.287822E+01	.242156E+01	.242156E+01	-.533917E+00
7	1	0	.228038E+04	.533660E+03	.111824E+02	.250000E+01	.250000E+01	.312193E+00
8	0	0	.227800E+04	.533662E+03	.109769E+02	.675000E+01	.675000E+01	.281219E+01
9	0	0	.227586E+04	.533665E+03	.544779E+01	.200521E+01	.200521E+01	.956219E+01
10	0	0	.227661E+04	.533664E+03	.109769E+02	.675000E+01	.675000E+01	.281219E+01
11	0	0	.227778E+04	.533663E+03	.111824E+02	.250000E+01	.250000E+01	.312193E+00
12	0	0	.227353E+04	.533668E+03	.205729E+01	.237508E+01	.237508E+01	-.487437E+00
13	0	0	.227345E+04	.533668E+03	.443798E+01	.380867E+01	.380867E+01	-.429610E+01
14	0	0	.227175E+04	.533670E+03	.449346E+01	.217457E+01	.217457E+01	-.429610E+01
15	0	0	.228556E+04	.533653E+03	.378561E+01	.247577E+01	.247577E+01	-.212160E+01
16	0	0	.228704E+04	.533652E+03	.378561E+01	.247577E+01	.247577E+01	-.212160E+01
17	0	0	.229826E+04	.533639E+03	.189580E+01	.708333E+00	.708333E+00	-.354167E+00
18	0	0	.230112E+04	.533635E+03	.693352E+00	.708333E+00	.708333E+00	-.354167E+00
19	0	0	.229562E+04	.533642E+03	.628853E+01	.932333E+00	.932333E+00	-.466167E+00
20	0	0	.229517E+04	.533642E+03	.161431E+01	.932333E+00	.932333E+00	-.466167E+00
21	0	0	.229227E+04	.533646E+03	.496640E+01	.343500E+01	.343500E+01	-.235167E+01
22	0	0	.229466E+04	.533643E+03	.113777E+02	.116119E+02	.116119E+02	-.139636E+02
23	0	0	.229661E+04	.533641E+03	.167500E+02	.244740E+01	.244740E+01	-.164000E+02
24	0	0	.229351E+04	.533644E+03	.302490E+02	.942200E+01	.942200E+01	-.122600E+02
25	0	0	.229206E+04	.529994E+03	.356959E+01	.932333E+00	.932333E+00	-.466167E+00
26	0	0	.229206E+04	.526344E+03	.153040E+01	.932333E+00	.932333E+00	-.466167E+00
27	0	0	.229206E+04	.489654E+03	.817513E+00	.567750E+00	.567750E+00	-.283875E+00
28	0	0	.228826E+04	.533650E+03	.754979E+01	.932333E+00	.932333E+00	-.466167E+00
29	0	0	.228826E+04	.533042E+03	.230445E+01	.932333E+00	.932333E+00	-.466167E+00
30	0	0	.228791E+04	.532433E+03	.289649E+00	.244013E+01	.244013E+01	-.169292E+00
31	0	0	.228675E+04	.532435E+03	.458256E+01	.458250E+01	.458250E+01	.227087E+01
32	0	0	.228532E+04	.532436E+03	.100357E+02	.404708E+01	.404708E+01	.685333E+01
33	0	0	.228675E+04	.531826E+03	.458256E+01	.458250E+01	.458250E+01	.227083E+01
34	0	0	.228826E+04	.531216E+03	.468918E+00	.454167E+01	.454167E+01	-.227083E+01
35	0	0	.228937E+04	.526347E+03	.170960E+01	.217450E+01	.217450E+01	-.444533E+01
36	0	0	.228891E+04	.521524E+03	.578667E+00	.431775E+01	.431775E+01	-.414846E+01
37	0	0	.229280E+04	.533645E+03	.248320E+01	.343500E+01	.343500E+01	-.235167E+01
38	0	0	.229156E+04	.525345E+03	.817046E+01	.206508E+01	.206508E+01	.466167E+00
39	0	0	.228796E+04	.533042E+03	.587547E+01	.289583E+01	.289583E+01	-.364583E+00
40	0	0	.229476E+04	.533643E+03	.161431E+01	.932333E+00	.932333E+00	-.466167E+00

VOLUME DATA ACTUALLY BEING USED.

VOL NUM	BUBL INDX	TIME DEP	PRESSURE (PSIA)	ENTHALPY	VOLUME (FT**3)	HEIGHT (FT)	MIXTURE LEVEL (FT)	ELEVATION (FT)
41	3	0	.228367E+04	.742792E+03	.351145E+02	.678354E+01	.432720E+01	.261167E+00
42	1	0	.954809E+03	.584837E+03	.281600E+03	.274590E+02	.999800E+01	.199009E+01
43	1	0	.613600E+03	.615740E+02	.104873E+03	.729207E+01	.502717E+01	.337797E+01
44	0	0	.229205E+04	.489854E+03	.327625E+01	.841146E+00	.841146E+00	-.400573E+00
45	0	0	.228824E+04	.521525E+03	.327625E+01	.841146E+00	.841146E+00	-.400573E+00
46	0	0	.229794E+04	.183264E+03	.537000E+01	.366185E+01	.366185E+01	-.283880E+00
47	0	0	.229206E+04	.516785E+03	.774100E+00	.932333E+00	.932333E+00	-.466167E+00
48	0	0	.229488E+04	.533643E+03	.568887E+01	.116119E+02	.116119E+02	-.139636E+02
49	0	0	.229555E+04	.533642E+03	.639200E+01	.170360E+01	.170360E+01	-.139636E+02

VOLUME DATA ACTUALLY BEING USED.

	VOL 2-PH NUM FRIC	FLOW AREA (FT**2)	EQUIVALENT DIAMETER (FT)	LENGTH (FT)	L/2A (FT**1)	HORIZ. AREA (FT**2)	TEMPERATURE (F)	SATURATION TEMP. (F)	VOL. BELOW
1	0	.251200E+01	.178800E+01	.6648158E+01	.129012E+01	.217090E+01	.539000E+03	.655076E+03	0
2	0	.249100E+01	.131400E+01	.6168446E+01	.338110E+00	.224987E+01	.539000E+03	.655316E+03	0
3	0	.682704E+00	.932333E+00	.6116467E+02	.852985E+01	.852834E+01	.539000E+03	.654929E+03	0
4	0	.682704E+00	.932333E+00	.6666528E+01	.488153E+01	.488067E+01	.539000E+03	.654915E+03	0
5	0	.682704E+00	.932333E+00	.467240E+01	.342198E+01	.342138E+01	.539000E+03	.654901E+03	0
6	0	.895564E+00	.106783E+01	.321386E+01	.179432E+01	.118858E+01	.539000E+03	.654856E+03	0
7	0	.794125E+01	.146150E+01	.6140814E+01	.886599E-01	.447295E+01	.539000E+03	.654648E+03	0
8	0	.162621E+01	.335000E-01	.6675000E+01	.207538E+01	.162621E+01	.539000E+03	.654496E+03	0
9	0	.162621E+01	.335000E-01	.335000E+01	.103000E+01	.271682E+01	.539000E+03	.654369E+03	0
10	0	.162621E+01	.335000E-01	.6675000E+01	.207538E+01	.162621E+01	.539000E+03	.654408E+03	0
11	0	.794125E+01	.146150E+01	.6140814E+01	.886599E-01	.447296E+01	.539000E+03	.654482E+03	0
12	0	.895564E+00	.106783E+01	.6229720E+01	.128254E+01	.866196E+00	.539000E+03	.654211E+03	0
13	0	.682704E+00	.932333E+00	.6650060E+01	.476092E+01	.116523E+01	.539000E+03	.654206E+03	0
14	0	.682704E+00	.932333E+00	.6658186E+01	.482043E+01	.206643E+01	.539000E+03	.654097E+03	0
15	0	.394063E+00	.394060E+00	.960662E+01	.121892E+02	.152906E+01	.539000E+03	.654979E+03	0
16	0	.394063E+00	.394060E+00	.960662E+01	.121892E+02	.152906E+01	.539000E+03	.655072E+03	0
17	0	.394063E+00	.708333E+00	.6481091E+01	.610425E+01	.267643E+01	.539000E+03	.655785E+03	0
18	0	.394063E+00	.708333E+00	.6175950E+01	.223251E+01	.978850E+00	.539000E+03	.655966E+03	0
19	0	.682704E+00	.932333E+00	.6921121E+01	.674612E+01	.674493E+01	.539000E+03	.655618E+03	0
20	0	.682704E+00	.932333E+00	.6236458E+01	.173178E+01	.173147E+01	.539000E+03	.655589E+03	0
21	0	.130748E+01	.583333E+00	.6379845E+01	.145259E+01	.144582E+01	.539000E+03	.655405E+03	0
22	0	.101811E+01	.333333E+00	.6111754E+02	.548830E+01	.979832E+00	.539000E+03	.655557E+03	0
23	0	.558000E+01	.151800E+01	.6300179E+01	.268978E+00	.684400E+01	.539000E+03	.655680E+03	0
24	0	.326500E+01	.231300E+01	.926462E+01	.141878E+01	.321046E+01	.539000E+03	.655484E+03	0
25	0	.682704E+00	.932333E+00	.6522861E+01	.382934E+01	.382867E+01	.536000E+03	.655392E+03	0
26	0	.682704E+00	.932333E+00	.6224167E+01	.164176E+01	.164147E+01	.533000E+03	.655392E+03	0
27	0	.253165E+00	.567750E+00	.6322917E+01	.637759E+01	.143992E+01	.502000E+03	.655392E+03	0
28	0	.682704E+00	.932333E+00	.6110587E+02	.809917E+01	.809774E+01	.539000E+03	.655150E+03	0
29	0	.682704E+00	.932333E+00	.6337547E+01	.247213E+01	.247170E+01	.538500E+03	.655150E+03	0
30	0	.900370E-01	.338580E+00	.6321700E+01	.178649E+02	.118702E+03	.538000E+03	.655128E+03	0
31	0	.106080E+01	.121583E+01	.6431993E+01	.203617E+01	.100001E+01	.538000E+03	.655054E+03	0
32	0	.116102E+01	.121583E+01	.6864393E+01	.372257E+01	.247975E+01	.538000E+03	.654963E+03	0
33	0	.106080E+01	.121583E+01	.6431993E+01	.203617E+01	.100001E+01	.537500E+03	.655054E+03	0
34	0	.900370E-01	.338580E+00	.6454167E+01	.252211E+02	.900370E-01	.537000E+03	.655150E+03	0
35	0	.682704E+00	.932333E+00	.6250417E+01	.183401E+01	.786206E+00	.533000E+03	.655221E+03	0
36	0	.900370E-01	.338580E+00	.6642700E+01	.356909E+02	.134021E+00	.529000E+03	.655192E+03	0
37	0	.653740E+00	.583333E+00	.6379845E+01	.290517E+01	.722511E+00	.539000E+03	.655439E+03	0
38	0	.417584E+00	.125000E+01	.6195660E+02	.234277E+02	.395648E+01	.533000E+03	.655360E+03	0
39	0	.417584E+00	.125000E+01	.6140702E+02	.168471E+02	.202894E+01	.538500E+03	.655127E+03	0
40	0	.682704E+00	.932333E+00	.6236458E+01	.173178E+01	.173147E+01	.539000E+03	.655563E+03	0

VOLUME DATA ACTUALLY BEING USED.

VOL 2-PH NUM FRIC	FLOW AREA (FT**2)	EQUIVALENT DIAMETER (FT)	LENGTH (FT)	L/2A (FT**1)	HORIZ. AREA (FT**2)	TEMPERATURE (F)	SATURATION TEMP. (F)	VOL. BELOW
41	0	.600726E+01	.276560E+01	.6584535E+01	.486523E+00	.517643E+01	.654871E+03	0
42	0	.171600E+02	.467000E+01	.164678E+02	.481516E+00	.102587E+02	.539000E+03	0
43	0	.135700E+02	.415667E+01	.772832E+01	.284757E+00	.143818E+02	.920000E+02	-1
44	0	.559250E+00	.843833E+00	.585830E+01	.523764E+01	.389499E+01	.502000E+03	0
45	0	.559250E+00	.843833E+00	.585830E+01	.523764E+01	.389499E+01	.529000E+03	0
46	0	.644700E-01	.100000E+05	.6832946E+02	.645995E+03	.146647E+01	.210000E+03	0
47	0	.682704E+00	.200000E+00	.113387E+01	.830428E+00	.830283E+00	.525000E+03	0
48	0	.509054E+00	.333334E+00	.111754E+02	.109766E+02	.489916E+00	.539000E+03	0
49	0	.374329E+01	.218314E+01	.170759E+01	.228986E+00	.375205E+01	.539000E+03	0

** ADIABATIC AIR EXPANSION MODEL WILL BE USED FOR VOLUME 43 **

INPUT FOR 3 SETS OF BUBBLE CONSTANTS

SET NO.	SLOPE PARAMETER	BUBBLE VELOCITY	
0	0.	0.	(BUILT-IN DATA)
1	.800000E+00	.300000E+01	
2	.800000E+00	.100000E+07	
3	.800000E+00	.200000E+01	

DESCRIPTIONS OF 55 JUNCTIONS.

JUN NUM	FROM VOL	TO VOL	PUMP LEAK FI_L	CHKV VALV	INITIAL FLOW (LBM/SEC)	JUNCTION FLOW AREA (FT**2)	JUNCTION ELEVATION (FT)	JUNCTION INERTIA (FT*-1)	SP. ENERGY LOSS COEF. (FORWARD)	SP. ENERGY LOSS COEF. (REVERSE)
VERT JUN INDX	CHOK -ING INDX	IC CALC INDX	MDM EQ. INDX	JUNCTION DIAMETER (FT)	CONTRACTION COEFFICIENT	SUBCOCL CHCKE	ENTHALPY INDEX	COSINE	IADJUN	
1	2	1	0	0	.591667E+03	.480000E+00	-.973000E+00	0.	.648100E+00	.648100E+00
1	0	5	2	0	.901000E+00	.100000E+01	0	0	.100000E+01	0
2	1	3	0	0	.591667E+03	.682700E+00	0.	.517300E+01	.513400E+00	.913400E+00
2	1	5	0	0	.932300E+00	.100000E+01	0	0	0.	0
3	1	28	0	0	0.	.682700E+00	0.	.474100E+01	.309500E+00	.473200E+00
3	1	5	0	0	.932300E+00	.100000E+01	0	0	0.	0
4	3	4	0	0	.591667E+03	.660887E+00	0.	.874485E+01	.514000E-01	.514000E-01
4	1	5	0	0	.932333E+00	.100000E+01	0	0	0.	0
5	4	5	0	0	.591667E+03	.358820E+00	0.	.930351E+01	.227800E-01	.912000E-01
5	1	5	0	0	.675917E+00	.100000E+01	0	0	0.	0
6	5	6	0	0	.591667E+03	.682704E+00	0.	.521630E+01	.672200E+00	.672200E+00
6	1	5	0	0	.932333E+00	.100000E+01	0	0	.100000E+01	0
7	6	7	0	0	.591667E+03	.556000E+00	.151011E+01	.198298E+01	.153961E+01	.177640E+01
7	1	5	0	0	.901670E+00	.100000E+01	0	0	0.	0
8	7	8	0	0	.591667E+03	.162621E+01	.281219E+01	.216404E+01	.358400E+00	.631200E+00
8	0	5	0	0	.143894E+01	.100000E+01	0	2	0.	0
9	8	9	0	0	.591667E+03	.162621E+01	.956219E+01	.310539E+01	.130000E-02	.130000E-02
9	0	5	0	0	.143894E+01	.100000E+01	0	3	.100000E+01	0
10	9	10	0	0	.591667E+03	.162621E+01	.956219E+01	.310539E+01	.572000E-01	.572000E-01
10	0	5	0	0	.143894E+01	.100000E+01	0	3	.100000E+01	0
11	10	11	0	0	.591667E+03	.162621E+01	.281219E+01	.216404E+01	.632500E+00	.357000E+00
11	0	5	0	0	.143894E+01	.100000E+01	0	1	0.	0
12	11	12	0	0	.591667E+03	.556000E+00	.151011E+01	.137120E+01	.137940E+01	.160170E+01
12	1	5	0	0	.901670E+00	.100000E+01	0	0	0.	0
13	12	13	0	0	.591667E+03	.682704E+00	-.487437E+00	.604346E+01	.196580E+00	.206500E+00
13	0	5	0	0	.932333E+00	.100000E+01	0	0	.100000E+01	0
14	13	14	0	0	.591667E+03	.682704E+00	-.382994E+01	.958135E+01	.109940E+01	.125000E+01
14	1	5	0	0	.932333E+00	.100000E+01	0	0	0.	0
15	14	15	-1	0	.297860E+03	.394063E+00	-.212160E+01	.170096E+02	.215660E+00	.215660E+00
15	0	5	0	0	.708333E+00	.100000E+01	0	0	0.	0

JUN NUM	FROM VOL	TO VOL	PUMP LEAK	CHKV VALV	INITIAL FLOW (LBM/SEC)	JUNCTION FLOW AREA (FT**2)	JUNCTION ELEVATION (FT)	JUNCTION INERTIA (FT**1)	SP. ENERGY LOSS COEF. (FORWARD)	SP. ENERGY LOSS COEF. (REVERSE)
			FILL							
	VERT JUN INDX	CHOK -ING INDX	IC CALC INDX	MOM EQ. INDX	JUNCTION DIAMETER (FT)	CONTRACTION COEFFICIENT	SUBCOOL CHOKE	ENTHALPY INDEX	COSINE	IADJUN
16	14	16	-2	0	.293807E+03	.394063E+00	-.212160E+01	.170096E+02	.231500E+00	.231500E+00
16	0	5	0	0	.708333E+00	.100000E+01	0	0	0.	0
17	15	17	1	0	.297860E+03	.394063E+00	0.	.182935E+02	.152237E+00	.152237E+00
17	0	5	0	0	.708333E+00	.100000E+01	0	0	0.	0
18	16	18	2	0	.293807E+03	.394063E+00	0.	.144217E+02	.218380E+00	.218380E+00
18	0	5	0	0	.708333E+00	.100000E+01	0	0	0.	0
19	17	19	0	0	.297860E+03	.394063E+00	0.	.128504E+02	.661280E+00	.690000E+00
19	1	5	0	0	.708333E+00	.100000E+01	0	0	0.	0
20	18	19	0	0	.293807E+03	.394063E+00	0.	.897863E+01	.293098E+01	.120000E+01
20	1	5	0	0	.708333E+00	.100000E+01	0	0	0.	0
21	19	20	0	0	.591667E+03	.660887E+00	0.	.510484E+01	.203750E+00	.203750E+00
21	1	5	0	0	.932333E+00	.100000E+01	0	0	0.	0
22	40	37	0	0	.591667E+03	.682704E+00	0.	.394776E+01	.123785E+01	.804000E+00
22	1	5	0	3	.932333E+00	.100000E+01	0	0	0.	0
23	21	22	0	0	.284551E+03	.869960E+00	-.235167E+01	0.	.200828E+00	.300000E+00
23	0	5	2	3	.911450E+00	.100000E+01	0	0	.100000E+01	0
24	22	23	0	0	.368760E+03	.869960E+00	-.139636E+02	0.	.774149E+00	.569814E+00
24	0	5	2	3	.128890E+01	.100000E+01	0	0	.100000E+01	0
25	49	24	0	0	.591667E+03	.105600E+01	-.122600E+02	0.	.260460E+00	.260460E+00
25	0	5	2	0	.203800E+01	.100000E+01	0	0	.100000E+01	0
26	24	2	0	0	.591667E+03	.785400E+00	-.283800E+01	0.	.559180E+00	.559180E+00
26	0	5	2	0	.100000E+01	.100000E+01	0	0	.100000E+01	0
27	21	25	0	0	0.	.682704E+00	0.	.391683E+01	.804000E+00	.189500E+01
27	1	5	0	3	.932333E+00	.100000E+01	0	0	0.	0
28	25	26	0	0	0.	.682704E+00	0.	.547080E+01	.100500E+00	.100500E+00
28	1	5	0	0	.932333E+00	.100000E+01	0	0	0.	0
29	26	47	0	0	0.	.581423E+00	0.	.111100E+02	.654500E+01	.140500E+02
29	1	5	0	0	.338600E+00	.100000E+01	0	0	0.	0
30	27	44	0	0	0.	.253160E+00	0.	.116155E+02	.299560E+00	.246290E+00
30	1	5	0	0	.567750E+00	.100000E+01	0	0	0.	0

JUN NUM	FROM VOL	TO PUMP VOL	CHKV LEAK	CHKV VALV	INITIAL FLOW (LBM/SEC)	JUNCTION FLOW AREA (FT**2)	JUNCTION ELEVATION (FT)	JUNCTION INERTIA (FT*-1)	SP. ENERGY LOSS COEF. (FORWARD)	SP. ENERGY LOSS COEF. (REVERSE)
	VERT JUN INDX	CHOK -ING INOX	IC CALC INDX	MOM EQ. INDX	JUNCTION DIAMETER (FT)	CONTRACTION COEFFICIENT	SUBCOOL CHOKE	ENTHALPY INDEX	COSINE	IADJUN
31	37	21	0	0	.284551E+03	.700000E+00	-.634167E+00	.400000E+01	.126500E+01	.126500E+01
31	0	5	0	3	0.	.100000E+01	0	0	0.	0
32	28	29	0	0	0.	.682704E+00	0.	.507420E+01	.100500E+00	.100500E+00
32	1	15	0	0	.932333E+00	.100000E+01	0	0	0.	0
33	29	30	0	0	0.	.900370E-01	0.	.203298E+02	.396050E+00	.753630E+00
33	1	5	0	0	0.	.100000E+01	0	0	0.	0
34	30	31	0	0	0.	.900370E-01	.227083E+01	.199010E+02	.935960E+00	.935960E+00
34	0	5	0	0	.359417E+00	.100000E+01	0	0	.100000E+01	0
35	31	32	0	0	0.	.206034E+00	.685333E+01	.575875E+01	.581834E+01	.581834E+01
35	0	5	0	0	.527819E+00	.100000E+01	0	0	.100000E+01	0
36	32	33	0	0	0.	.206034E+00	.685333E+01	.575875E+01	.581834E+01	.581834E+01
36	0	5	0	0	.527819E+00	.100000E+01	0	0	.100000E+01	0
37	33	34	0	0	0.	.900370E-01	.227083E+01	.272573E+02	.230250E+00	.230250E+00
37	0	5	0	0	.359417E+00	.100000E+01	0	0	.100000E+01	0
38	34	35	0	0	0.	.900370E-01	-.227083E+01	.270551E+02	.635100E+01	.635100E+01
38	0	5	0	0	.359417E+00	.100000E+01	0	0	.100000E+01	0
39	35	36	0	0	0.	.900370E-01	-.397917E+01	.375249E+02	.127020E+02	.127020E+02
39	1	5	0	0	.359417E+00	.100000E+01	0	0	0.	0
40	36	40	0	0	0.	.900370E-01	0.	.409140E+02	.948830E+00	.438340E+00
40	1	5	0	0	.338580E+00	.100000E+01	0	0	0.	0
41	40	22	0	0	.842094E+02	.300000E+01	-.815762E+01	.110000E+01	.241800E+02	.241800E+02
41	0	5	0	3	0.	.100000E+01	0	0	0.	0
42	29	30	0	0	0.	.417500E+00	0.	.193380E+02	.124700E+01	.457600E+00
42	0	5	0	3	.708300E+00	.100000E+01	0	0	0.	0
43	26	30	0	0	0.	.417584E+00	.466167E+00	.242230E+02	.124700E+01	.457600E+00
43	0	5	0	3	.708333E+00	.100000E+01	0	0	.100000E+01	0
44	43	46	0	1	0.	.644700E-01	.337797E+01	0.	.286500E+02	.286500E+02
44	0	5	2	0	.236500E+00	.100000E+01	0	0	0.	0
45	41	4	0	0	0.	.155592E-01	.466167E+00	.150220E+03	.312660E+02	.312660E+02
45	1	5	0	3	.140750E+00	.750000E+00	0	0	0.	0

JUN NUM	FROM VOL	TO VOL	PUMP LEAK FILL	CHKV VALV	INITIAL FLOW (LBM/SEC)	JUNCTION FLOW AREA (FT**2)	JUNCTION ELEVATION (FT)	JUNCTION INERTIA (FT*-1)	SP. ENERGY LOSS COEF. (FORWARD)	SP. ENERGY LOSS COEF. (REVERSE)
VERT JUN INDX	CHOK -ING INDX	IC CALC INDX	MOM EG. INDX	JUNCTION DIAMETER (FT)	CONTRACTION COEFFICIENT	SUBCOOL CHOKE	ENTHALPY INDEX	COSINE	IADJUN	
46	48	23	0	0	.222907E+03	.434980E+00	-.139636E+02	0.	.774336E+00	.570000E+00
46	0	5	2	3	.128890E+01	.100000E+01	0	0	.100000E+01	0
47	46	20	0	0	0.	.644700E-01	0.	0.	.122500E+02	.122500E+02
47	0	15	2	0	.291670E+00	.100000E+01	0	0	0.	0
48	47	27	0	0	0.	.900370E-01	0.	.151800E+02	.415000E+00	.290000E+00
48	1	5	0	0	.338600E+00	.848000E+00	0	0	0.	0
49	20	40	0	0	.591667E+03	.660870E+00	0.	.510484E+01	.203750E+00	.203750E+00
49	1	5	0	0	.932333E+00	.100000E+01	0	0	0.	0
50	23	49	0	0	.591667E+03	.105597E+01	-.139536E+02	0.	.522590E+00	.600000E+00
50	0	5	2	3	.126557E+01	.100000E+01	0	0	.100000E+01	0
51	37	48	0	0	.307117E+03	.434980E+00	-.235167E+01	0.	.200900E+00	.300000E+00
51	0	5	2	3	.911450E-01	.100000E+01	0	0	.100000E+01	0
52	44	0	1	0	0.	.559250E+00	0.	.252555E+02	.103700E+01	.537000E+00
52	1	5	0	0	.843833E+00	.100000E+01	0	0	0.	0
53	45	0	1	0	0.	.559250E+00	0.	.252555E+02	.103700E+01	.537000E+00
53	1	5	0	0	.843833E+00	.100000E+01	0	0	0.	0
54	0	46	1	0	0.	.100000E+01	0.	0.	.100000E+01	.100000E+01
54	0	5	2	3	.286500E+00	.100000E+01	0	0	0.	0
55	0	46	2	0	0.	.100000E+01	0.	0.	.100000E+01	.100000E+01
55	0	5	2	3	.286500E+00	.100000E+01	0	0	0.	0

DIAL VALUES FOR FAUSKE-HEM CRITICAL FLOW MODEL

DLHEM = .1000E+01
 DLHRY = .1000E+01
 DLEHRY = .1000E+01
 DLXTFE = .2500E-02

INPUT DATA FOR 2 PUMPS.

NUMBER OF PUMP CURVES TO BE READ FOR EACH CURVE SET.

16 0 0 16

PMP NUM	CRV SET	TRP ID	REV	DEG	RATED SPEED (REV/MIN)	SPEED RATIO	RATED FLOW (GAL/MIN)	RATED HEAD (FT)	RATED TORQUE (FT-LBF)	MOM OF INERTIA (LBM-FT**2)
1	1	3	0	1	.353000E+04	.488993E+00	.500000E+04	.392700E+03	.465000E+03	.340000E+02
	0				.387500E+02	.152994E+03	0.	.303300E-02	.144550E+02	0.
					STOP PUMP AT 0.	SEC. OR IF SPEED IS GT	0.0 RPM OR LT	0.0 RPM.	(NO STOP ON OPTION IF 0.0)	
2	1	3	0	1	.353000E+04	.500000E+00	.500000E+04	.394500E+03	.465000E+03	.340000E+02
	0				.387500E+02	.152994E+03	0.	.300300E-02	.144550E+02	0.
					STOP PUMP AT 0.	SEC. OR IF SPEED IS GT	0.0 RPM OR LT	0.0 RPM.	(NO STOP ON OPTION IF 0.0)	

PUMP HEAD MULTIPLIER CURVE

-11	0.	0.	.100000E+00	0.	.150000E+00	.500000E-01
	.240000E+00	.800000E+00	.300000E+00	.960000E+00	.400000E+00	.980000E+00
	.600000E+00	.970000E+00	.800000E+00	.900000E+00	.900000E+00	.800000E+00
	.960000E+00	.500000E+00	.100000E+01	0.		

PUMP TORQUE MULTIPLIER CURVE

-7	0.	0.	.100000E+00	0.	.150000E+00	.500000E-01
	.240000E+00	.560000E+00	.800000E+00	.560000E+00	.960000E+00	.450000E+00
	.100000E+01	0.				

PUMP CURVE SET NUMBER 1 HAS 16 CURVES TO BE READ.

SET NUM	HEAD OR TORQ	TYPE	NUM DAT PTS	X	Y	X	Y	X	Y
1	1	1	6	FLOW/SPEED 0. .593950E+00	HEAD/SPEED**2 .140360E+01 .123280E+01	FLOW/SPEED .190610E+00 .790200E+00	HEAD/SPEED**2 .136360E+01 .113360E+01	FLOW/SPEED .389630E+00 .100000E+01	HEAD/SPEED**2 .131860E+01 .100780E+01
1	1	2	8	SPEED/FLOW 0. .575540E+00 .863130E+00	HEAD/FLOW**2 -.670000E+00 0. .632600E+00	SPEED/FLOW .200000E+00 .744320E+00 .100000E+01	HEAD/FLOW**2 -.500000E+00 .258300E+00 .100780E+01	SPEED/FLOW .400000E+00 .773480E+00	HEAD/FLOW**2 -.250000E+00 .377800E+00
1	1	3	6	FLOW/SPEED -.100000E+01 -.406830E+00	HEAD/SPEED**2 .247220E+01 .162400E+01	FLOW/SPEED -.805740E+00 -.200171E+00	HEAD/SPEED**2 .204740E+01 .147050E+01	FLOW/SPEED -.606900E+00 0.	HEAD/SPEED**2 .183100E+01 .140360E+01
1	1	4	8	SPEED/FLOW -.100000E+01 -.455340E+00 -.907300E-01	HEAD/FLOW**2 .247220E+01 .132790E+01 .101560E+01	SPEED/FLOW -.822970E+00 -.271090E+00 0.	HEAD/FLOW**2 .199680E+01 .119490E+01 .934279E+00	SPEED/FLOW -.633320E+00 -.177160E+00	HEAD/FLOW**2 .158970E+01 .106050E+01
1	1	5	7	FLOW/SPEED 0. .411800E+00 .100000E+01	HEAD/SPEED**2 .250000E+00 .276800E+00 .946500E+00	FLOW/SPEED .200000E+00 .597630E+00	HEAD/SPEED**2 .280000E+00 .458400E+00	FLOW/SPEED .400000E+00 .793467E+00	HEAD/SPEED**2 .340000E+00 .699200E+00
1	1	6	10	SPEED/FLOW 0. .271762E+00 .740516E+00 .100000E+01	HEAD/FLOW**2 .934279E+00 .875000E+00 .346600E+00 .946500E+00	SPEED/FLOW .910990E-01 .455872E+00 .766619E+00	HEAD/FLOW**2 .922900E+00 .943300E+00 .946900E+00	SPEED/FLOW .186500E+00 .574406E+00 .871471E+00	HEAD/FLOW**2 .896300E+00 .835500E+00 .883800E+00
1	1	7	6	FLOW/SPEED -.100000E+01 -.400000E+00	HEAD/SPEED**2 -.100000E+01 -.500000E-01	FLOW/SPEED -.800000E+00 -.200000E+00	HEAD/SPEED**2 -.630000E+00 .150000E+00	FLOW/SPEED -.600000E+00 0.	HEAD/SPEED**2 -.300000E+00 .250000E+00
1	1	8	6	SPEED/FLOW -.100000E+01 -.400000E+00	HEAD/FLOW**2 -.100000E+01 -.800000E+00	SPEED/FLOW -.800000E+00 -.200000E+00	HEAD/FLOW**2 -.370000E+00 -.800000E+00	SPEED/FLOW -.600000E+00 0.	HEAD/FLOW**2 -.950000E+00 -.670000E+00
1	2	1	6	FLOW/SPEED 0. .595520E+00	TORQ/SPEED**2 .603200E+00 .833100E+00	FLOW/SPEED .193000E+00 .797820E+00	TORQ/SPEED**2 .632500E+00 .922900E+00	FLOW/SPEED .393000E+00 .100000E+01	TORQ/SPEED**2 .736900E+00 .967200E+00

1	2	2	7	SPEED/FLOW 0. .737255E+00 .100000E+01	TORQ/FLOW**2 -.670000E+00 .526586E+00 .961200E+00	SPEED/FLOW 0.000000E+00 .768049E+00	TORQ/FLOW**2 -.250000E+00 .506594E+00	SPEED/FLOW 0.000000E+00 .867230E+00	TORQ/FLOW**2 .150000E+00 .743660E+00
1	2	3	6	FLOW/SPEED -.100000E+01 -.405860E+00	TORQ/SPEED**2 .196430E+01 .822000E+00	FLOW/SPEED -.860960E+00 -.199280E+00	TORQ/SPEED**2 .139400E+01 .664800E+00	FLOW/SPEED 0. 0.	TORQ/SPEED**2 .109750E+01 .603200E+00
1	2	4	8	SPEED/FLOW -.100000E+01 -.453530E+00 -.893190E+01	TORQ/FLOW**2 .196430E+01 .155700E+01 .134810E+01	SPEED/FLOW -.822340E+00 -.267023E+00 0.	TORQ/FLOW**2 .183280E+01 .143620E+01 .123361E+01	SPEED/FLOW -.633710E+00 -.176107E+00	TORQ/FLOW**2 .168240E+01 .138790E+01
1	2	5	4	FLOW/SPEED 0. .100000E+01	TORQ/SPEED**2 -.450000E+00 .354900E+00	FLOW/SPEED 0.000000E+00 -.250000E+00	TORQ/SPEED**2 0. 0.	FLOW/SPEED 0.000000E+00 0.	TORQ/SPEED**2 0. 0.
1	2	6	10	SPEED/FLOW 0. .273470E+00 .738160E+00 .100000E+01	TORQ/FLOW**2 .123361E+01 .104160E+01 .613400E+00 .355900E+00	SPEED/FLOW 0.000000E+01 .458669E+00 .768520E+00	TORQ/FLOW**2 .119650E+01 .995800E+00 .584900E+00	SPEED/FLOW .188569E+00 .574480E+00 .870057E+00	TORQ/FLOW**2 .110960E+01 .780780E+00 .487700E+00
1	2	7	4	FLOW/SPEED -.100000E+01 0.	TORQ/SPEED**2 -.100000E+01 -.450000E+00	FLOW/SPEED -.300000E+00 -.900000E+00	TORQ/SPEED**2 -.900000E+00 0.	FLOW/SPEED -.100000E+00 0.	TORQ/SPEED**2 -.500000E+00 0.
1	2	8	4	SPEED/FLOW -.100000E+01 0.	TORQ/FLOW**2 -.100000E+01 -.670000E+00	SPEED/FLOW -.250000E+00 0.	TORQ/FLOW**2 -.900000E+00 0.	SPEED/FLOW -.800000E+01 0.	TORQ/FLOW**2 -.800000E+00 0.

PUMP CURVE SET NUMBER 1 HEAD CURVES FOLLOW

SET NUM	HEAD OR TORQ	TYPE	NUM DAT PTS	X	Y	X	Y	X	Y	X	Y
1	1	1	6	FLOW/SPEED 0. .593960E+00	HEAD/SPEED**2 .140360E+01 .123280E+01	FLOW/SPEED .190610E+00 .790200E+00	HEAD/SPEED**2 .136360E+01 .113360E+01	FLOW/SPEED .389630E+00 .100000E+01	HEAD/SPEED**2 .131860E+01 .100780E+01		
1	1	2	8	SPEED/FLOW 0. .575540E+00 .863130E+00	HEAD/FLOW**2 -.670000E+00 0. .632600E+00	SPEED/FLOW .200000E+00 .744320E+00 .100000E+01	HEAD/FLOW**2 -.500000E+00 .258300E+00 .100780E+01	SPEED/FLOW .400000E+00 .773480E+00	HEAD/FLOW**2 -.250000E+00 .377800E+00		
1	1	3	6	FLOW/SPEED -.100000E+01 -.406830E+00	HEAD/SPEED**2 .247220E+01 .162400E+01	FLOW/SPEED -.805740E+00 -.200171E+00	HEAD/SPEED**2 .204740E+01 .147950E+01	FLOW/SPEED -.606900E+00 0.	HEAD/SPEED**2 .183100E+01 .140360E+01		
1	1	4	8	SPEED/FLOW -.100000E+01 -.455340E+00 -.907300E+01	HEAD/FLOW**2 .247220E+01 .132790E+01 .101560E+01	SPEED/FLOW -.822970E+00 -.271090E+00 0.	HEAD/FLOW**2 .199680E+01 .119490E+01 .934279E+00	SPEED/FLOW -.633320E+00 -.177160E+00	HEAD/FLOW**2 .158970E+01 .106050E+01		
1	1	5	7	FLOW/SPEED 0. .411800E+00 .100000E+01	HEAD/SPEED**2 .250000E+00 .276800E+00 .946500E+00	FLOW/SPEED .200000E+00 .597630E+00	HEAD/SPEED**2 .280000E+00 .458400E+00	FLOW/SPEED .400000E+00 .793467E+00	HEAD/SPEED**2 .340000E+00 .699200E+00		
1	1	6	10	SPEED/FLOW 0. .271762E+00 .740576E+00 .100000E+01	HEAD/FLOW**2 .934279E+00 .875000E+00 .846600E+00 .946500E+00	SPEED/FLOW .910990E+01 .455872E+00 .766619E+00	HEAD/FLOW**2 .922900E+00 .843300E+00 .846900E+00	SPEED/FLOW .186509E+00 .574406E+00 .871471E+00	HEAD/FLOW**2 .896300E+00 .835500E+00 .883800E+00		
1	1	7	6	FLOW/SPEED -.100000E+01 -.400000E+00	HEAD/SPEED**2 -.100000E+01 -.500000E+01	FLOW/SPEED -.800000E+00 -.200000E+00	HEAD/SPEED**2 -.530000E+00 .150000E+00	FLOW/SPEED -.600000E+00 0.	HEAD/SPEED**2 -.300000E+00 .250000E+00		
1	1	8	6	SPEED/FLOW -.100000E+01 -.400000E+00	HEAD/FLOW**2 -.100000E+01 -.880000E+00	SPEED/FLOW -.800000E+00 -.200000E+00	HEAD/FLOW**2 -.970000E+00 -.800000E+00	SPEED/FLOW -.600000E+00 0.	HEAD/FLOW**2 -.950000E+00 -.670000E+00		

PUMP CURVE SET NUMBER 1 TORQUE CURVES FOLLOW.

SET NUM	HEAD OR TORQ	TYPE	NUM CAT PTS	X	Y	X	Y	X	Y
1	2	1	6	FLOW/SPEED 0. .595520E+00	TORQ/SPEED**2 .603200E+00 .833100E+00	FLOW/SPEED .193000E+00 .797820E+00	TORQ/SPEED**2 .632500E+00 .922900E+00	FLOW/SPEED .393000E+00 .100000E+01	TORQ/SPEED**2 .736900E+00 .967200E+00
1	2	2	7	SPEED/FLOW 0. .737255E+00 .100000E+01	TORQ/FLOW**2 -.670000E+00 .526586E+00 .967200E+00	SPEED/FLOW .400000E+00 .768049E+00	TORQ/FLOW**2 -.250000E+00 .606594E+00	SPEED/FLOW .500000E+00 .867230E+00	TORQ/FLOW**2 .150000E+00 .743660E+00
1	2	3	6	FLOW/SPEED -.100000E+01 -.406860E+00	TORQ/SPEED**2 .198430E+01 .822000E+00	FLOW/SPEED -.300960E+00 -.199280E+00	TORQ/SPEED**2 .139400E+01 .664800E+00	FLOW/SPEED 0. 0.	TORQ/SPEED**2 .109750E+01 .603200E+00
1	2	4	8	SPEED/FLOW -.100000E+01 -.458530E+00 -.693100E+01	TORQ/FLOW**2 .198430E+01 .155700E+01 .134810E+01	SPEED/FLOW -.322340E+00 -.267023E+00 0.	TORQ/FLOW**2 .183980E+01 .143620E+01 .123361E+01	SPEED/FLOW -.633710E+00 -.176107E+00	TORQ/FLOW**2 .168240E+01 .138790E+01
1	2	5	4	FLOW/SPEED 0. .100000E+01	TORQ/SPEED**2 -.450000E+00 .356900E+00	FLOW/SPEED .400000E+00	TORQ/SPEED**2 -.250000E+00	FLOW/SPEED .500000E+00	TORQ/SPEED**2 0.
1	2	6	10	SPEED/FLOW 0. .273470E+00 .738100E+00 .100000E+01	TORQ/FLOW**2 .123361E+01 .104160E+01 .613400E+00 .356900E+00	SPEED/FLOW .906430E+01 .458669E+00 .768520E+00	TORQ/FLOW**2 .119650E+01 .995800E+00 .584900E+00	SPEED/FLOW .186569E+00 .574480E+00 .870057E+00	TORQ/FLOW**2 .110960E+01 .780700E+00 .487700E+00
1	2	7	4	FLOW/SPEED -.100000E+01 0.	TORQ/SPEED**2 -.100000E+01 -.450000E+00	FLOW/SPEED -.300000E+00	TORQ/SPEED**2 -.900000E+00	FLOW/SPEED -.100000E+00	TORQ/SPEED**2 -.500000E+00
1	2	8	4	SPEED/FLOW -.100000E+01 0.	TORQ/FLOW**2 -.100000E+01 -.670000E+00	SPEED/FLOW -.250000E+00	TORQ/FLOW**2 -.900000E+00	SPEED/FLOW -.800000E+01	TORQ/FLOW**2 -.800000E+00

PUMP CURVE SET NUMBER 4 HAS 16 CURVES TO BE READ.

SET NUM	HEAD CR TORQ	TYPE	NUM DAT PTS	X	Y	X	Y	X	Y
4	1	1	7	FLOW/SPEED 0. .500000E+00 .100000E+01	HEAD/SPEED**2 0. .102000E+01 .100000E+01	FLOW/SPEED .100000E+00 .700000E+00	HEAD/SPEED**2 .930000E+00 .101000E+01	FLOW/SPEED .200000E+00 .900000E+00	HEAD/SPEED**2 .109000E+01 .940000E+00
4	1	2	8	SPEED/FLOW 0. .300000E+00 .900000E+00	HEAD/FLOW**2 0. .100000E+00 .800000E+00	SPEED/FLOW .100000E+00 .400000E+00 .100000E+01	HEAD/FLOW**2 -.400000E-01 .210000E+00 .100000E+01	SPEED/FLOW .200000E+00 .800000E+00	HEAD/FLOW**2 0. .670000E+00
4	1	3	10	FLOW/SPEED -.100000E+01 -.700000E+00 -.400000E+00 0.	HEAD/SPEED**2 -.116000E+01 -.236000E+01 -.267000E+01 0.	FLOW/SPEED -.900000E+00 -.600000E+00 -.250000E+00	HEAD/SPEED**2 -.124000E+01 -.279000E+01 -.169000E+01	FLOW/SPEED -.800000E+00 -.500000E+00 -.100000E+00	HEAD/SPEED**2 -.177000E+01 -.291000E+01 -.500000E+00
4	1	4	10	SPEED/FLOW -.100000E+01 -.700000E+00 -.350000E+00 0.	HEAD/FLOW**2 -.116000E+01 -.310000E+00 0. .110000E+00	SPEED/FLOW -.900000E+00 -.600000E+00 -.200000E+00	HEAD/FLOW**2 -.780000E+00 -.170000E+00 .500000E-01	SPEED/FLOW -.800000E+00 -.500000E+00 -.100000E+00	HEAD/FLOW**2 -.500000E+00 -.800000E-01 .800000E-01
4	1	5	6	FLOW/SPEED 0. .600000E+00	HEAD/SPEED**2 0. -.930000E+00	FLOW/SPEED .200000E+00 .800000E+00	HEAD/SPEED**2 -.340000E+00 -.119000E+01	FLOW/SPEED .400000E+00 .100000E+01	HEAD/SPEED**2 -.650000E+00 -.147000E+01
4	1	6	10	SPEED/FLOW 0. .400000E+00 .700000E+00 .100000E+01	HEAD/FLOW**2 .110000E+00 .130000E+00 -.230000E+00 -.147000E+01	SPEED/FLOW .100000E+00 .500000E+00 .800000E+00	HEAD/FLOW**2 .130000E+00 .700000E-01 -.510000E+00	SPEED/FLOW .250000E+00 .600000E+00 .900000E+00	HEAD/FLOW**2 .150000E+00 -.400000E-01 -.910000E+00
4	1	7	2	FLOW/SPEED -.100000E+01	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED	HEAD/SPEED**2
4	1	8	2	SPEED/FLOW -.100000E+01	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW	HEAD/FLOW**2
4	2	1	6	FLOW/SPEED 0. .595520E+00	TORQ/SPEED**2 .603200E+00 .833100E+00	FLOW/SPEED .193000E+00 .797820E+00	TORQ/SPEED**2 .632500E+00 .922900E+00	FLOW/SPEED .393000E+00 .100000E+01	TORQ/SPEED**2 .736900E+00 .967200E+00

4	2	2	7	SPEED/FLOW 0. .737255E+00 .100000E+01	TORQ/FLOW**2 -.670000E-00 .526586E-00 .967200E+00	SPEED/FLOW .400000E+00 .758049E+00	TORQ/FLOW**2 -.250000E+00 .506594E+00	SPEED/FLOW .500000E+00 .867230E+00	TORQ/FLOW**2 .150000E+00 .743668E+00
4	2	3	5	FLOW/SPEED -.100000E+01 -.406860E+00	TORQ/SPEED**2 .193430E+01 .822000E+00	FLOW/SPEED -.800960E+00 -.199280E+00	TORQ/SPEED**2 .139400E+01 .664800E+00	FLOW/SPEED -.606380E+00 0.	TORQ/SPEED**2 .109758E+01 .603200E+00
4	2	4	3	SPEED/FLOW -.100000E+01 -.458530E+00 -.893100E-01	TORQ/FLOW**2 .193430E+01 .157000E+01 .134810E+01	SPEED/FLOW -.822340E+00 -.267023E+00 0.	TORQ/FLOW**2 .183080E+01 .143620E+01 .123361E+01	SPEED/FLOW -.633710E+00 -.176187E+00	TORQ/FLOW**2 .168248E+01 .138790E+01
4	2	5	4	FLOW/SPEED 0. .100000E+01	TORQ/SPEED**2 -.450000E+00 .359000E+00	FLOW/SPEED .400000E+00	TORQ/SPEED**2 -.250000E+00	FLOW/SPEED .500000E+00	TORQ/SPEED**2 0.
4	2	6	10	SPEED/FLOW 0. .273470E+00 .738160E+00 .100000E+01	TORQ/FLOW**2 .123361E+01 .104160E+01 .613400E+00 .359000E+00	SPEED/FLOW .906430E-01 .458669E+00 .768520E+00	TORQ/FLOW**2 .119650E+01 .895800E+00 .584900E+00	SPEED/FLOW .188569E+00 .574480E+00 .870057E+00	TORQ/FLOW**2 .110960E+01 .780700E+00 .487700E+00
4	2	7	4	FLOW/SPEED -.100000E+01 0.	TORQ/SPEED**2 -.104000E+01 -.450000E+00	FLOW/SPEED -.300000E+00	TORQ/SPEED**2 -.900000E+00	FLOW/SPEED -.100000E+00	TORQ/SPEED**2 -.500000E+00
4	2	8	4	SPEED/FLOW -.100000E+01 0.	TORQ/FLOW**2 -.100000E+01 -.670000E+00	SPEED/FLOW -.250000E+00	TORQ/FLOW**2 -.900000E+00	SPEED/FLOW -.800000E-01	TORQ/FLOW**2 -.800000E+00

PUMP CURVE SET NUMBER 4 HEAD CURVES FOLLOW

SET NUM	HEAD OR TORQ	TYPE	NUM DAT PTS	X	Y	X	Y	X	Y
4	1	1	7	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.
				.500000E+00	.102600E+01	.100000E+00	.830000E+00	.200000E+00	.109000E+01
				.100000E+01	.100000E+01	.700000E+00	.101000E+01	.900000E+00	.940000E+00
4	1	2	8	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.
				.300000E+00	.100000E+00	.400000E+00	.210000E+00	.200000E+00	.670000E+00
				.900000E+00	.800000E+00	.100000E+01	.100000E+01	.800000E+00	.670000E+00
4	1	3	10	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.
				-.100000E+01	-.116000E+01	-.900000E+00	-.124000E+01	-.800000E+00	-.177000E+01
				-.700000E+00	-.236000E+01	-.600000E+00	-.279000E+01	-.500000E+00	-.291000E+01
				-.400000E+00	-.267000E+01	-.250000E+00	-.169000E+01	-.100000E+00	-.500000E+00
4	1	4	10	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.
				-.100000E+01	-.116000E+01	-.900000E+00	-.780000E+00	-.800000E+00	-.500000E+00
				-.700000E+00	-.310000E+00	-.600000E+00	-.170000E+00	-.500000E+00	-.800000E+01
				-.350000E+00	.110000E+00	-.200000E+00	.500000E+01	-.100000E+00	.800000E+01
4	1	5	6	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.
				.600000E+00	-.930000E+00	.200000E+00	-.340000E+00	.400000E+00	-.650000E+00
						.800000E+00	-.119000E+01	.100000E+01	-.147000E+01
4	1	6	10	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.
				.400000E+00	.130000E+00	.100000E+00	.130000E+00	.250000E+00	.150000E+00
				.700000E+00	-.230000E+00	.500000E+00	.700000E+01	.500000E+00	-.400000E+01
				.100000E+01	-.147000E+01	.800000E+00	-.510000E+00	.900000E+00	-.910000E+00
4	1	7	2	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.	FLOW/SPEED 0.	HEAD/SPEED**2 0.
				-.100000E+01	0.	0.	0.	0.	0.
4	1	8	2	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.	SPEED/FLOW 0.	HEAD/FLOW**2 0.
				-.100000E+01	0.	0.	0.	0.	0.

PUMP CURVE SET NUMBER 4 TORQUE CURVES FOLLOW.

SET NUM	HEAD OR TORQ	TYPE	NUM DAT PTS	X	Y	X	Y	X	Y
4	2	1	6	FLOW/SPEED 0. .595520E+00	TORQ/SPEED**2 .603200E+00 .833100E+00	FLOW/SPEED .193000E+00 .797820E+00	TORQ/SPEED**2 .532500E+00 .922900E+00	FLOW/SPEED .593000E+00 .100000E+01	TORQ/SPEED**2 .736900E+00 .967200E+00
4	2	2	7	SPEED/FLOW 0. .737255E+00 .100000E+01	TORQ/FLOW**2 -.670000E+00 .526586E+00 .967200E+00	SPEED/FLOW .400000E+00 .768049E+00	TORQ/FLOW**2 -.250100E+00 .606594E+00	SPEED/FLOW .500000E+00 .867230E+00	TORQ/FLOW**2 .150000E+00 .743660E+00
4	2	3	6	FLOW/SPEED -.100000E+01 -.406860E+00	TORQ/SPEED**2 .198430E+01 .822600E+00	FLOW/SPEED -.800960E+00 -.199280E+00	TORQ/SPEED**2 .139400E+01 .564600E+00	FLOW/SPEED -.606380E+00 0.	TORQ/SPEED**2 .109750E+01 .603200E+00
4	2	4	8	SPEED/FLOW -.100000E+01 -.458530E+00 -.893100E+01	TORQ/FLOW**2 .198430E+01 .155700E+01 .134810E+01	SPEED/FLOW -.822340E+00 -.257023E+00 0.	TORQ/FLOW**2 .183080E+01 .143620E+01 .123361E+01	SPEED/FLOW -.633710E+00 -.176107E+00	TORQ/FLOW**2 .168240E+01 .138790E+01
4	2	5	9	FLOW/SPEED 0. .100000E+01	TORQ/SPEED**2 -.450000E+00 .356900E+00	FLOW/SPEED .400000E+00	TORQ/SPEED**2 -.250000E+00	FLOW/SPEED .500000E+00	TORQ/SPEED**2 0.
4	2	6	10	SPEED/FLOW 0. .273470E+00 .733160E+00 .100000E+01	TORQ/FLOW**2 .123361E+01 .104160E+01 .613400E+00 .356900E+00	SPEED/FLOW .936430E+01 .458669E+00 .758520E+00	TORQ/FLOW**2 .119650E+01 .895800E+00 .584900E+00	SPEED/FLOW .188569E+00 .574480E+00 .870057E+00	TORQ/FLOW**2 .110960E+01 .780700E+00 .487700E+00
4	2	7	4	FLOW/SPEED -.100000E+01 0.	TORQ/SPEED**2 -.100000E+01 -.450000E+00	FLOW/SPEED -.300000E+00	TORQ/SPEED**2 -.300000E+00	FLOW/SPEED -.100000E+00	TORQ/SPEED**2 -.500000E+00
4	2	8	4	SPEED/FLOW -.100000E+01 0.	TORQ/FLOW**2 -.100000E+01 -.670000E+00	SPEED/FLOW -.250000E+00	TORQ/FLOW**2 -.300000E+00	SPEED/FLOW -.800000E+01	TORQ/FLOW**2 -.900000E+00

PARAMETERS FOR 1 CHECKVALVES.

VALV NUM	TRIP ID	AREA TABL	LATCH FLAG	BACK PRESSURE FOR CLOSING	FORWARD FRIC. COEFF.	OPEN REVERSE FRIC. COEFF.	CLOSED REVERSE FRIC. COEFF.
1	25	0	0	.100000E+01	0.	0.	0.

PARAMETERS FOR 1 LEAKS.

LEAK NUM	DATA PTS	TRIP ID	SINK PRESSURE	TIME OR ANGLE	AREA	TIME OR ANGLE	AREA	TIME OR ANGLE	AREA
1	-3	2	.430000E+02	0.	0.	.175000E-01	.100000E+01	.200000E+03	.100000E+01

DATA FOR 2 FILL SYSTEMS

FILL TYPE TRIP ID FILL PRESS (PSI) FILL ENTHALPY (BTU/LB) AIR FRACTION

2 6 1.000000D+02 5.828412D+01 0.

** FILL TABLE **

N	PRESSURE (PSI)	FLOW RATE (LB/SEC-FT2)	N	PRESSURE (PSI)	FLOW RATE (LB/SEC-FT2)	N	PRESSURE (PSI)	FLOW RATE (LB/SEC-FT2)
1	0.	2.381403D+01	6	9.780000D+01	1.453763D+01	10	1.550000D+02	5.538147D+00
2	2.000000D+01	2.312176D+01	7	1.120000D+02	1.176856D+01	11	1.570000D+02	4.153610D+00
3	4.000000D+01	2.215259D+01	8	1.250000D+02	1.024557D+01	12	1.590000D+02	2.769073D+00
4	6.000000D+01	2.076805D+01	9	1.370000D+02	8.722581D+00	13	1.600000D+02	0.
5	7.500000D+01	1.869124D+01						

FILL TYPE TRIP ID FILL PRESS (PSI) FILL ENTHALPY (BTU/LB) AIR FRACTION

2 4 1.000000D+02 5.828412D+01 0.

** FILL TABLE **

N	PRESSURE (PSI)	FLOW RATE (LB/SEC-FT2)	N	PRESSURE (PSI)	FLOW RATE (LB/SEC-FT2)	N	PRESSURE (PSI)	FLOW RATE (LB/SEC-FT2)
1	1.000000D+01	2.381403D+01	2	3.000000D+03	2.381403D+00			

*** WARNING *** POSSIBLE INITIAL ENTHALPY IMBALANCE
THE JUNCTION ENTHALPY CALCULATED LIES OUTSIDE THE RANGE OF THE TWO VOLUMES IT CONNECTS.
J VOL.A VOL.B H(J) H(VOL.A) H(VOL.B)
9 8 9 5.33667E+02 5.33662E+02 5.33665E+02

*** WARNING *** POSSIBLE INITIAL ENTHALPY IMBALANCE
THE JUNCTION ENTHALPY CALCULATED LIES OUTSIDE THE RANGE OF THE TWO VOLUMES IT CONNECTS.
J VOL.A VOL.B H(J) H(VOL.A) H(VOL.B)
10 9 10 5.33663E+02 5.33655E+02 5.33664E+02

*** WARNING *** POSSIBLE INITIAL ENTHALPY IMBALANCE
THE JUNCTION ENTHALPY CALCULATED LIES OUTSIDE THE RANGE OF THE TWO VOLUMES IT CONNECTS.
J VOL.A VOL.B H(J) H(VOL.A) H(VOL.B)
11 10 11 5.33665E+02 5.33654E+02 5.33663E+02

JUNCTION DATA ACTUALLY BEING USED.

JUN NUM	FROM VOL	TO VOL	PUMP LEAK FILL	CHK VALV	INITIAL FLOW (LBM/SEC)	JUNCTION FLOW AREA (FT**2)	JUNCTION ELEVATION (FT)	JUNCTION DIAMETER (FT)	LEAK CONTRACTION COEFFICIENT
1	2	1	0	0	.591667E+03	.486000E+00	-.973093E+00	.901000E+00	.100000E+01
2	1	3	0	0	.591667E+03	.682700E+00	0.	.932300E+00	.100000E+01
3	1	28	0	0	0.	.682700E+00	0.	.932300E+00	.100000E+01
4	3	4	0	0	.591667E+03	.6660887E+00	0.	.932333E+00	.100000E+01
5	4	5	0	0	.591667E+03	.4358820E+00	0.	.675917E+00	.100000E+01
6	5	6	0	0	.591667E+03	.682704E+00	0.	.932333E+00	.100000E+01
7	6	7	0	0	.591667E+03	.556000E+00	.151011E+01	.901670E+00	.100000E+01
8	7	8	0	0	.591667E+03	.162621E+01	.281219E+01	.143894E+01	.100000E+01
9	8	9	0	0	.591667E+03	.162621E+01	.956219E+01	.143894E+01	.100000E+01
10	9	10	0	0	.591667E+03	.162621E+01	.956219E+01	.143894E+01	.100000E+01
11	10	11	0	0	.591667E+03	.162621E+01	.281219E+01	.143894E+01	.100000E+01
12	11	12	0	0	.591667E+03	.556000E+00	.151011E+01	.901670E+00	.100000E+01
13	12	13	0	0	.591667E+03	.682704E+00	-.487437E+00	.932333E+00	.100000E+01
14	13	14	0	0	.591667E+03	.682704E+00	-.382994E+01	.932333E+00	.100000E+01
15	14	15	-1	0	.297860E+03	.394063E+00	-.212160E+01	.708333E+00	.100000E+01
16	14	16	-2	0	.293807E+03	.394063E+00	-.212160E+01	.708333E+00	.100000E+01
17	15	17	1	0	.297860E+03	.394063E+00	0.	.708333E+00	.100000E+01
18	16	18	2	0	.293807E+03	.394063E+00	0.	.708333E+00	.100000E+01
19	17	19	0	0	.297860E+03	.394063E+00	0.	.708333E+00	.100000E+01
20	18	19	0	0	.293807E+03	.394063E+00	0.	.708333E+00	.100000E+01
21	19	20	0	0	.591667E+03	.6660887E+00	0.	.932333E+00	.100000E+01
22	40	37	0	0	.591667E+03	.682704E+00	0.	.932333E+00	.100000E+01
23	21	22	0	0	.284551E+03	.869960E+00	-.235167E+01	.911450E+00	.100000E+01
24	22	23	0	0	.368760E+03	.869960E+00	-.139636E+02	.128890E+01	.100000E+01
25	49	24	0	0	.591667E+03	.105600E+01	-.122600E+02	.203800E+01	.100000E+01
26	24	2	0	0	.591667E+03	.785400E+00	-.283800E+01	.100000E+01	.100000E+01
27	21	25	0	0	0.	.682704E+00	0.	.932333E+00	.100000E+01
28	25	26	0	0	0.	.682704E+00	0.	.932333E+00	.100000E+01
29	26	47	0	0	0.	.581423E+00	0.	.338600E+00	.100000E+01
30	27	44	0	0	0.	.6253160E+00	0.	.567750E+00	.100000E+01
31	37	21	0	0	.284551E+03	.708000E+00	-.634167E+00	.944070E+00	.100000E+01
32	28	29	0	0	0.	.682704E+00	0.	.932333E+00	.100000E+01
33	29	30	0	0	0.	.900370E-01	0.	.338583E+00	.100000E+01
34	30	31	0	0	0.	.900370E-01	.227083E+01	.359417E+00	.100000E+01
35	31	32	0	0	0.	.206034E+00	.685333E+01	.527819E+00	.100000E+01

JUNCTION DATA ACTUALLY BEING USED.

JUN NUM	FROM VOL	TO VOL	PUMP LEAK FILL	CHK VALV	INITIAL FLOW (LBM/SEC)	JUNCTION FLOW AREA (FT**2)	JUNCTION ELEVATION (FT)	JUNCTION DIAMETER (FT)	LEAK CONTRACTION COEFFICIENT
36	32	33	0	0	0.	.6206034E+00	.685333E+01	.527819E+00	.100000E+01
37	33	34	0	0	0.	.6900370E-01	.227083E+01	.359417E+00	.100000E+01
38	34	35	0	0	0.	.6900370E-01	.227083E+01	.359417E+00	.100000E+01
39	35	36	0	0	0.	.6900370E-01	.397917E+01	.359417E+00	.100000E+11
40	36	45	0	0	0.	.6900370E-01	0.	.239580E+00	.100000E+01
41	48	22	0	0	.842094E+02	.6300000E+01	-.815762E+01	.195441E+01	.100000E+01
42	29	39	0	0	0.	.6417500E+00	0.	.708300E+00	.100000E+01
43	26	38	0	0	0.	.6417584E+00	.466167E+00	.708333E+00	.100000E+01
44	43	46	0	1	0.	.6444700E-01	.337797E+01	.286500E+00	.100000E+01
45	41	4	0	0	0.	.6155592E-01	.466167E+00	.140750E+00	.750000E+00
46	48	23	0	0	.222907E+03	.6434980E+00	-.139636E+02	.128890E+01	.100000E+01
47	46	20	0	0	0.	.6444700E-01	0.	.291670E+00	.100000E+01
48	47	27	0	0	0.	.6900370E-01	0.	.338600E+00	.848000E+00
49	20	40	0	0	.591667E+03	.660870E+00	0.	.932333E+00	.100000E+01
50	23	49	0	0	.591667E+03	.6105597E+01	-.139536E+02	.126557E+01	.100000E+01
51	37	48	0	0	.307117E+03	.6434980E+00	-.235167E+01	.911450E-01	.100000E+01
52	44	0	1	0	0.	.6559250E+00	0.	.843833E+00	.100000E+01
53	45	0	1	0	0.	.6559250E+00	0.	.843833E+00	.100000E+01
54	0	46	1	0	0.	0.	0.	.286500E+00	.100000E+01
55	0	46	2	0	0.	0.	0.	.286500E+00	.100000E+01

JUNCTION DATA ACTUALLY BEING USED.

JUN NUM	VERT JUN	CHOK -ING	IC CALC	MOM EQ.	JUNCTION INERTIA	SP. ENERGY LOSS COEF. (FORWARD)	SP. ENERGY LOSS COEF. (REVERSE)	RESIDUAL LOSS COEF. (NON-DIR)	RESIDUAL DELTA P (PSIA)	ENTHALPY TRANS		ANGLE
										INLET	OUTLET	
1	0	5	2	0	.162823E+01	.648100E+00	.648100E+00	.458506E-09	.157951E-08	NO	NO	.190000E+01
2	1	5	0	0	.517300E+01	.913400E+00	.913400E+00	.454957E-07	.774805E-07	NO	NO	0.
3	1	5	0	0	.474100E+01	.309500E+00	.473200E+00	0.	0.	NO	NO	0.
4	1	5	0	0	.674485E+01	.514000E-01	.514000E-01	.155564E-06	.282716E-06	NO	NO	0.
5	1	5	0	0	.830351E+01	.227800E-01	.912000E-01	.472536E-07	.291326E-06	NO	NO	0.
6	1	5	0	0	.521630E+01	.672200E+00	.672200E+00	.945681E-07	.161056E-06	NO	NO	.100000E+01
7	1	5	0	0	.188298E+01	.153061E+01	.177640E+01	.195777E-06	.502704E-06	NO	NO	0.
8	0	5	0	0	.216404E+01	.358400E+00	.631200E+00	.118477E-05	.355634E-06	NO	YES	0.
9	0	5	0	0	.310539E+01	.130000E-02	.130000E-02	.282086E-05	.846770E-06	YES	YES	.100000E+01
10	0	5	0	0	.310539E+01	.572000E-01	.572000E-01	.177298E-04	.532230E-05	YES	YES	.100000E+01
11	0	5	0	0	.216404E+01	.632500E+00	.357000E+00	.146021E-04	.438337E-05	YES	NO	0.
12	1	5	0	0	.137120E+01	.137940E+01	.160170E+01	.420628E-05	.109015E-04	NO	NO	0.
13	0	5	0	0	.604346E+01	.196580E+00	.206500E+00	.440736E-05	.750712E-05	NO	NO	.100000E+01
14	1	5	0	0	.958135E+01	.109940E+01	.125000E+01	.526681E-05	.897106E-05	NO	NO	0.
15	0	5	0	0	.170096E+02	.215660E+00	.215660E+00	.165303E-03	.214188E-03	NO	NO	0.
16	0	5	0	0	.170096E+02	.231500E+00	.231500E+00	.865859E-02	.109159E-01	NO	NO	0.
17	0	5	0	0	.182935E+02	.152237E+00	.152237E+00	.172722E-03	.223759E-03	NO	NO	0.
18	0	5	0	0	.144217E+02	.218380E+00	.218380E+00	.866048E-02	.109160E-01	NO	NO	0.
19	1	5	0	0	.128504E+02	.661280E+00	.690000E+00	.415967E-07	.538786E-07	NO	NO	0.
20	1	5	0	0	.897863E+01	.293098E+01	.120000E+01	.287462E-07	.362259E-07	NO	NO	0.
21	1	5	0	0	.510484E+01	.203750E+00	.203750E+00	.319290E-07	.580181E-07	NO	NO	0.
22	1	5	0	3	.394776E+01	.123785E+01	.804000E+00	.439245E-07	.747961E-07	NO	NO	0.
23	0	5	2	3	.694089E+01	.200828E+00	.300000E+00	.378628E-06	.918395E-07	NO	NO	.100000E+01
24	0	5	2	3	.575728E+01	.774149E+00	.569814E+00	.447909E-05	.182457E-05	NO	NO	.100000E+01
25	0	5	2	0	.164686E+01	.260460E+00	.260460E+00	.833886E-07	.593487E-07	NO	NO	.100000E+01
26	0	5	2	0	.175689E+01	.559180E+00	.559180E+00	.173879E-07	.223722E-07	NO	NO	.100000E+01
27	1	5	0	3	.391683E+01	.680400E+00	.189500E+01	0.	0.	NO	NO	0.
28	1	5	0	0	.547080E+01	.100500E+00	.100500E+00	0.	0.	NO	NO	0.
29	1	5	0	0	.111100E+02	.654500E+01	.140500E+02	0.	0.	NO	NO	0.
30	1	5	0	0	.116155E+02	.299560E+00	.246290E+00	0.	0.	NO	NO	0.
31	0	5	0	3	.400000E+01	.126500E+01	.126500E+01	.642657E-04	.240768E-04	NO	NO	0.
32	1	5	0	0	.507420E+01	.100500E+00	.100500E+00	0.	0.	NO	NO	0.
33	1	5	0	0	.203298E+02	.396050E+00	.753630E+00	0.	0.	NO	NO	0.
34	0	5	0	0	.199010E+02	.935960E+00	.935960E+00	0.	0.	NO	NO	.100000E+01
35	0	5	0	0	.575875E+01	.581834E+01	.581834E+01	0.	0.	NO	NO	.100000E+01

JUNCTION DATA ACTUALLY BEING USED.

JUN NUM	VERT JUN INDX	CHOK -ING INDX	IC CALC INDX	MEM EQ. INDX	JUNCTION INERTIA	SP. ENERGY LOSS COEF. (FORWARD)	SP. ENERGY LOSS COEF. (REVERSE)	RESIDUAL LOSS COEF. (NON-DIR)	RESIDUAL DELTA P (PSIA)	ENTHALPY TRANS		ANGLE
										INLET	OUTLET	
36	0	5	0	0	.575375E+01	.581834E+01	.581834E+01	0.	0.	NO	NO	.100000E+01
37	0	5	0	0	.272573E+02	.230250E+00	.230250E+00	0.	0.	NO	NO	.100000E+01
38	0	5	0	0	.270551E+02	.635100E+01	.635100E+01	0.	0.	NO	NO	.100000E+01
39	1	5	0	0	.375249E+02	.127020E+02	.127020E+02	0.	0.	NO	NO	0.
40	1	5	0	0	.409140E+02	.494830E+00	.438340E+00	0.	0.	NO	NO	0.
41	0	5	0	3	.110000E+01	.241800E+02	.241800E+02	.219990E-02	.392975E-05	NO	NO	0.
42	0	5	0	3	.193380E+02	.124700E+01	.457600E+00	0.	0.	NO	NO	0.
43	0	5	0	3	.242230E+02	.124700E+01	.457600E+00	0.	0.	NO	NO	.190000E+01
44	0	5	2	0	.646279E+03	.286500E+02	.286500E+02	0.	0.	NO	NO	0.
45	1	5	0	3	.150220E+03	.312660E+02	.312660E+02	0.	0.	NO	NO	0.
46	0	5	2	3	.112456E+02	.774536E+00	.570000E+00	.291979E-05	.173838E-05	NO	NO	.100000E+01
47	0	5	2	0	.647726E+03	.122500E+02	.122500E+02	0.	0.	NO	NO	0.
48	1	5	0	0	.151800E+02	.441500E+00	.290000E+00	0.	0.	NO	NO	0.
49	1	5	0	0	.510484E+01	.203750E+00	.203750E+00	.103394E-07	.137888E-07	NO	NO	0.
50	0	5	2	3	.497064E+00	.522590E+00	.600000E+00	.595874E-07	.424109E-07	NO	NO	.100000E+01
51	0	5	2	3	.138818E+02	.200000E+00	.300000E+00	.481930E-07	.544688E-07	NO	NO	.100000E+01
52	1	5	0	0	.252555E+02	.103700E+01	.537000E+00	0.	0.	NO	NO	0.
53	1	5	0	0	.252555E+02	.103700E+01	.537000E+00	0.	0.	NO	NO	0.
54	0	5	2	3	.645995E+03	0.	0.	0.	0.	NO	NO	0.
55	0	5	2	3	.645995E+03	0.	0.	0.	0.	NO	NO	0.

*** WARNING *** THE FOLLOWING JUNCTIONS HAVE LARGER AREAS THAN THOSE OF ONE OF THE ASSOCIATED VOLUMES:
22 31 41

PARAMETERS IN JUNCTION MATRIX
NUMBER OF CHAINS (MS) = 6
NUMBER OF CHAIN JUNCTIONS (NTRI) = 28
NUMBER OF NON-CHAIN JUNCTIONS (N2) = 23
INDEX OF FIRST CRITICAL JUNCTION (MPP) = 52
TOTAL NUMBER OF JUNCTIONS (NTOT1) = 55

DATA FOR 47 HEAT CONDUCTING SLABS.

SLAB NUM	L VOL	R VOL	GEOM NUM	S ^T K IND	LEFT SURFACE AREA, FT**2	RIGHT SURFACE AREA, FT**2	VOLUME FT**3	LEFT HYDRAULIC DIAMETER, FT	RIGHT HYDRAULIC DIAMETER, FT	MAJOR JUNCTIONS			
										L IN	L OUT	R IN	R OUT
					LOC X L C R C LFT HEATED EQ IND END IND DIAMETER, FT	RHT HEATED EQ DIAMETER, FT	LEFT CHANNEL LENGTH, FT	RIGHT CHANNEL LENGTH, FT	BOT HEIGHT IN R (L) VOL, FT	TOP HEIGHT IN R (L) VOL, FT			
1	23	0	1	0	.233330E+02 0	0.	.909300E+00 .513840E+01	.174400E+01 0.	0. 0.	24	50	0	0
2	1	0	2	0	.230540E+02 0	0.	.982900E+00 .410300E+01	.178800E+01 0.	0. 0.	1	2	0	0
3	2	0	2	0	.194770E+02 0	0.	.446700E+00 .186500E+01	.131400E+01 0.	0. 0.	26	1	0	0
4	24	0	3	0	.603180E+02 0	0.	.523600E+01 .942200E+01	.231300E+01 0.	0. 0.	25	26	0	0
5	36	0	11	0	.342000E+01 0	0.	.253300E+00 .321700E+01	.338600E+00 0.	0. 0.	39	40	0	0
6	35	0	8	0	.733000E+01 0	0.	.967400E+00 .250400E+01	.932000E+00 0.	0. 0.	38	39	0	0
7	0	21	4	0	0. 0	.197840E+02 0.	.236060E+01 0.	0. .343500E+01	.583300E+00 0.	0	0	31	23
8	21	0	5	0	.239850E+02 0	0.	.220360E+02 .343500E+01	.583300E+00 0.	0. 0.	31	23	0	0
9	0	48	4	0	0. 0	.334367E+02 0.	.685200E+01 0.	0. .116110E+02	.333300E+00 0.	0	0	51	46
10	48	0	5	0	.405390E+02 0	0.	.372457E+02 0.	.333300E+00 .387500E+01	0. 0.	51	46	0	0
11	34	0	11	0	.919000E+01 0	0.	.680700E+00 .864300E+01	.339600E+00 0.	0. 0.	37	38	0	0
12	33	0	13	0	.163200E+02 0	0.	.272200E+01 .431900E+01	.120300E+01 0.	0. 0.	36	37	0	0
13	32	0	13	0	.326700E+02 0	0.	.544700E+01 .864300E+01	.120300E+01 0.	0. 0.	35	36	0	0
14	31	0	13	0	.163200E+02 0	0.	.272200E+01 .431900E+01	.120300E+01 0.	0. 0.	34	35	0	0

15	30	0	11	0	.683000E+01	0.	.506100E+00	.338600E+00	0.	33	34	0	0
		0	0	0	.338600E+01	0.	.642700E+01	0.	0.				
15	23	0	5	0	.144713E+02	0.	.132957E+02	.289200E+01	0.	24	50	0	0
		0	0	0	.289200E+01	0.	.414500E+01	0.	0.				
17	8	42	6	0	.112192E+04	.139542E+04	.513900E+01	.335000E-01	.466700E+01	6	9	0	0
		0	0	0	.335000E-01	.466700E+01	.579000E+01	.579000E+01	.830000E+00	.757000E+01			
19	9	42	6	0	.649380E+03	.807680E+03	.297500E+01	.335000E-01	.466700E+01	9	10	0	0
		0	0	0	.335000E-01	.466700E+01	.335000E+01	.335000E+01	.757300E+01	.957300E+01			
19	10	42	6	0	.112192E+04	.139542E+04	.513900E+01	.335000E-01	.466700E+01	10	11	0	0
		0	0	0	.335000E-01	.466700E+01	.579000E+01	.579000E+01	.830000E+00	.757000E+01			
20	44	0	7	0	.130630E+02	0.	.139100E+01	.932000E+00	0.	30	52	0	0
		0	0	0	.932000E+00	0.	.589500E+01	0.	0.				
21	45	0	7	0	.130630E+02	0.	.139100E+01	.932000E+00	0.	40	53	0	0
		0	0	0	.932000E+00	0.	.589500E+01	0.	0.				
22	25	0	8	0	.153100E+02	0.	.202000E+01	.932000E+00	0.	27	28	0	0
		0	0	0	.932000E+00	0.	.522800E+01	0.	0.				
23	26	0	8	0	.988000E+01	0.	.130400E+01	.932000E+00	0.	28	29	0	0
		0	0	0	.932000E+00	0.	.337500E+01	0.	0.				
24	3	0	8	0	.154500E+02	0.	.203800E+01	.932000E+00	0.	2	4	0	0
		0	0	0	.932000E+00	0.	.527500E+01	0.	0.				
25	4	0	8	0	.195200E+02	0.	.257500E+01	.932000E+00	0.	4	5	0	0
		0	0	0	.932000E+00	0.	.666500E+01	0.	0.				
26	5	0	8	0	.136800E+02	0.	.180500E+01	.932000E+00	0.	5	6	0	0
		0	0	0	.932000E+00	0.	.467200E+01	0.	0.				
27	6	0	9	0	.107800E+02	0.	.160920E+01	.106780E+01	0.	6	7	0	0
		0	0	0	.106780E+01	0.	.321300E+01	0.	0.				
29	7	0	10	0	.150000E+02	0.	.526700E+01	.146150E+01	0.	7	8	0	0
		0	0	0	.146150E+01	0.	.250000E+01	0.	0.				
29	11	0	10	0	.159000E+02	0.	.526700E+01	.146150E+01	0.	11	12	0	0
		0	0	0	.146150E+01	0.	.250000E+01	0.	0.				
30	12	0	9	0	.770000E+01	0.	.115020E+01	.106780E+01	0.	12	13	0	0
		0	0	0	.106780E+01	0.	.229700E+01	0.	0.				

31	13	0	8	0	.190400E+02	0.	.251100E+01	.932000E+00	0.	13	14	0	0
		0	0	0	.932000E+00	0.	.650000E+01	0.	0.				
32	14	0	8	0	.192700E+02	0.	.254300E+01	.932000E+00	0.	14	15	0	0
		0	0	0	.932000E+00	0.	.658100E+01	0.	0.				
33	19	0	8	0	.269700E+02	0.	.355800E+01	.932000E+00	0.	19	21	0	0
		0	0	0	.932000E+00	0.	.921100E+01	0.	0.				
34	20	0	8	0	.692500E+01	0.	.914000E+00	.932000E+00	0.	21	49	0	0
		0	0	0	.932000E+00	0.	.472900E+01	0.	0.				
35	28	0	8	0	.137200E+02	0.	.181100E+01	.932000E+00	0.	3	32	0	0
		0	0	0	.932000E+00	0.	.468600E+01	0.	0.				
36	29	0	8	0	.988000E+01	0.	.130400E+01	.932000E+00	0.	32	33	0	0
		0	0	0	.932000E+00	0.	.337500E+01	0.	0.				
37	27	0	12	0	.575000E+01	0.	.492700E+00	.567800E+00	0.	48	30	0	0
		0	0	0	.567800E+00	0.	.322900E+01	0.	0.				
38	46	0	14	0	.164000E+02	.475400E+02	.869000E+01	.933300E+00	0.	44	47	0	0
		0	0	0	0.	.900600E+00	.181600E+02	.181600E+02	0.				
39	40	0	8	0	.692500E+01	0.	.914000E+00	.932000E+00	0.	49	22	0	0
		0	0	0	.932000E+00	0.	.472900E+01	0.	0.				
40	0	22	4	0	0.	.668733E+02	.137040E+02	0.	.333300E+00	0	23	24	
		0	0	0	0.	0.	0.	.116110E+02	0.				
41	22	0	5	0	.810787E+02	0.	.744913E+02	.333300E+00	0.	23	24	0	0
		0	0	0	0.	0.	0.	.387500E+01	0.				
42	23	0	1	0	.466667E+02	0.	.181870E+01	.174400E+01	0.	24	50	0	0
		0	0	0	.174400E+01	0.	.513840E+01	0.	0.				
43	23	0	5	0	.289427E+02	0.	.265913E+02	.289200E+01	0.	24	50	0	0
		0	0	0	.289200E+01	0.	.414500E+01	0.	0.				
44	49	0	1	0	.287350E+02	0.	.111980E+01	.174400E+01	0.	50	25	0	0
		0	0	0	.174400E+01	0.	.715800E+01	0.	0.				
45	49	0	5	0	.178210E+02	0.	.163740E+02	.289200E+01	0.	50	25	0	0
		0	0	0	.289200E+01	0.	.170200E+01	0.	0.				
46	0	37	4	0	0.	.989200E+01	.118030E+01	0.	.583300E+00	0	0	22	51
		0	0	0	0.	0.	0.	.343500E+01	0.				
47	37	0	5	0	.119927E+02	0.	.110180E+02	.583300E+00	0.	22	51	0	0
		0	0	0	0.	0.	.343500E+01	0.	0.				

AXIAL STACKS OF HEAT SLABS -

1 THROUGH	1	1 DIMENSIONAL HEAT TRANSFER
2 THROUGH	2	1 DIMENSIONAL HEAT TRANSFER
3 THROUGH	3	1 DIMENSIONAL HEAT TRANSFER
4 THROUGH	4	1 DIMENSIONAL HEAT TRANSFER
5 THROUGH	5	1 DIMENSIONAL HEAT TRANSFER
6 THROUGH	6	1 DIMENSIONAL HEAT TRANSFER
7 THROUGH	7	1 DIMENSIONAL HEAT TRANSFER
8 THROUGH	8	1 DIMENSIONAL HEAT TRANSFER
9 THROUGH	9	1 DIMENSIONAL HEAT TRANSFER
10 THROUGH	10	1 DIMENSIONAL HEAT TRANSFER
11 THROUGH	11	1 DIMENSIONAL HEAT TRANSFER
12 THROUGH	12	1 DIMENSIONAL HEAT TRANSFER
13 THROUGH	13	1 DIMENSIONAL HEAT TRANSFER
14 THROUGH	14	1 DIMENSIONAL HEAT TRANSFER
15 THROUGH	15	1 DIMENSIONAL HEAT TRANSFER
16 THROUGH	16	1 DIMENSIONAL HEAT TRANSFER
17 THROUGH	17	1 DIMENSIONAL HEAT TRANSFER
18 THROUGH	18	1 DIMENSIONAL HEAT TRANSFER
19 THROUGH	19	1 DIMENSIONAL HEAT TRANSFER
20 THROUGH	20	1 DIMENSIONAL HEAT TRANSFER
21 THROUGH	21	1 DIMENSIONAL HEAT TRANSFER
22 THROUGH	22	1 DIMENSIONAL HEAT TRANSFER
23 THROUGH	23	1 DIMENSIONAL HEAT TRANSFER
24 THROUGH	24	1 DIMENSIONAL HEAT TRANSFER
25 THROUGH	25	1 DIMENSIONAL HEAT TRANSFER
26 THROUGH	26	1 DIMENSIONAL HEAT TRANSFER
27 THROUGH	27	1 DIMENSIONAL HEAT TRANSFER
28 THROUGH	28	1 DIMENSIONAL HEAT TRANSFER
29 THROUGH	29	1 DIMENSIONAL HEAT TRANSFER
30 THROUGH	30	1 DIMENSIONAL HEAT TRANSFER
31 THROUGH	31	1 DIMENSIONAL HEAT TRANSFER
32 THROUGH	32	1 DIMENSIONAL HEAT TRANSFER
33 THROUGH	33	1 DIMENSIONAL HEAT TRANSFER
34 THROUGH	34	1 DIMENSIONAL HEAT TRANSFER
35 THROUGH	35	1 DIMENSIONAL HEAT TRANSFER
36 THROUGH	36	1 DIMENSIONAL HEAT TRANSFER
37 THROUGH	37	1 DIMENSIONAL HEAT TRANSFER
38 THROUGH	38	1 DIMENSIONAL HEAT TRANSFER
39 THROUGH	39	1 DIMENSIONAL HEAT TRANSFER
40 THROUGH	40	1 DIMENSIONAL HEAT TRANSFER
41 THROUGH	41	1 DIMENSIONAL HEAT TRANSFER
42 THROUGH	42	1 DIMENSIONAL HEAT TRANSFER
43 THROUGH	43	1 DIMENSIONAL HEAT TRANSFER
44 THROUGH	44	1 DIMENSIONAL HEAT TRANSFER
45 THROUGH	45	1 DIMENSIONAL HEAT TRANSFER
46 THROUGH	46	1 DIMENSIONAL HEAT TRANSFER
47 THROUGH	47	1 DIMENSIONAL HEAT TRANSFER

DATA FOR 14 HEAT SLAB GEOMETRIES

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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1	1		1	4	0.	.129900E-01	0.
	2	0	1	4		.259700E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.894000E+00	.208000E-01	0.
	2	0	1	4		.208000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.101900E+01	.417000E-01	0.
	2	0	1	4		.417000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.125000E+01	.625000E-01	0.
	2	0	1	4		.625000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.166700E+01	.250000E+00	0.
	2	0	1	4		.500000E+00	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.167500E-01	.204000E-02	0.
	2	0	1	4		.204000E-02	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.354000E+00	.310000E-01	0.
	2	0	1	4		.630000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.466000E+00	.390000E-01	0.
	2	0	1	4		.780000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.533900E+00	.443000E-01	0.
	2	0	1	4		.885000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.225000E+01	.208000E-01	0.
	2	0	1	4		.270900E+00	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.159300E+00	.208000E-01	0.
	2	0	1	4		.417000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
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2	1		1	4	.283900E+00	.252000E-01	0.
	2	0	1	4		.503000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
2	1		1	4	.601600E+00	.495000E-01	0.
	2	0	1	4		.989000E-01	0.

SUM OF POWER FRACTIONS IS 0.

GEOM TYPE	REG NO	GAP IND	MAT NO	NO DX	X0 TO N=1	REGION WIDTH	POWER FRAC
2	1		1	8	.145830E+00	.833300E-01	0.
	2	0	1	5		.833300E-01	0.
	3	0	1	3		.104170E+00	0.

SUM OF POWER FRACTIONS IS 0.

PROPERTIES FOR HEAT CONDUCTING MATERIAL NUMBER 1

	THERMAL CONDUCTIVITY (BTU/FT-HR-F) VS TEMPERATURE (T(1),K(1),----			
-2 POINTS	.212000E+03	.957400E+01	.237200E+04	.192940E+02

	VOL HEAT CAPACITY (BTU/FT**3-F) VS TEMPERATURE (T(1),C(1),----					
-13 POINTS	.170000E+03	.444608E+02	.250000E+03	.443296E+02	.400000E+03	.444872E+02
	.600000E+03	.453920E+02	.800000E+03	.469094E+02	.100000E+04	.488415E+02
	.120000E+04	.509906E+02	.140000E+04	.531587E+02	.160000E+04	.551481E+02
	.180000E+04	.567609E+02	.200000E+04	.577993E+02	.220000E+04	.580655E+02
	.240000E+04	.573616E+02				

EXP0P4/C E GLOFTSV02(73)
LOFT L145-A20 L1-4 POSTEST ANALYSIS

EXPERIMENTAL RELAP4 TYPE PROGRAM CONFIGURATION CONTROL: YES
10/20/77

CPU TIME = 1.39

STANDARD TIME STEP NUMBER 0. ACTUAL TIME STEP NUMBER 0. TIME = 0. SEC. LAST DT = -R SEC.

TOTAL SYSTEM QUANTITIES	NORM POWR 1.00000E+00	POWR (MW) 0.	HEAT REM (BTU/HR) 0.	ENGY LEAK (BTU) 0.	MASS LEAK (LB) 0.	ENGY BAL. (BTU) 1.72624E+07	MASS BAL. (LB) 2.30866E+04	TOT. REAC (%) 0.	REAC T SEC. 0.
VOLUME NUMBER	AVG. PRES PSIA	TOT. MASS (LB) H2O	AVG. ENTH (BTU/LB)	AVG. DENS (LB/FT3)	AVG. TEMP (F)	AVG. QUAL	BUBB MASS (LB)	MIXT LEVL (FT)	LIQ. MASS (LB)
1	2.28709E+03	7.74954E+02	5.33652E+02	4.75966E+01	5.39000E+02	0.	0.	7.50000E+00	7.74954E+02
2	2.29087E+03	1.99725E+02	5.33647E+02	4.75990E+01	5.39000E+02	0.	0.	1.86500E+00	1.99725E+02
3	2.28479E+03	3.78441E+02	5.33654E+02	4.75951E+01	5.39000E+02	0.	0.	9.32333E-01	3.78441E+02
4	2.28456E+03	2.16577E+02	5.33655E+02	4.75950E+01	5.39000E+02	0.	0.	9.32333E-01	2.16577E+02
5	2.28434E+03	1.51821E+02	5.33655E+02	4.75948E+01	5.39000E+02	0.	0.	9.32333E-01	1.51821E+02
6	2.28364E+03	1.36987E+02	5.33656E+02	4.75944E+01	5.39000E+02	0.	0.	2.42156E+00	1.36987E+02
7	2.28038E+03	5.32195E+02	5.33660E+02	4.75923E+01	5.39000E+02	0.	0.	2.50000E+00	5.32196E+02
8	2.27600E+03	5.22400E+02	5.33662E+02	4.75908E+01	5.39000E+02	0.	0.	6.75000E+00	5.22400E+02
9	2.27586E+03	2.59258E+02	5.33665E+02	4.75895E+01	5.39000E+02	0.	0.	2.90521E+00	2.59258E+02
10	2.27661E+03	5.22390E+02	5.33664E+02	4.75899E+01	5.39000E+02	0.	0.	6.75000E+00	5.22390E+02
11	2.27778E+03	5.32178E+02	5.33663E+02	4.75907E+01	5.39000E+02	0.	0.	2.50000E+00	5.32178E+02
12	2.27353E+03	9.79022E+01	5.33668E+02	4.75880E+01	5.39000E+02	0.	0.	2.37508E+00	9.79022E+01
13	2.27345E+03	2.11194E+02	5.33668E+02	4.75879E+01	5.39000E+02	0.	0.	3.80867E+00	2.11194E+02
14	2.27175E+03	2.13830E+02	5.33670E+02	4.75869E+01	5.39000E+02	0.	0.	2.17450E+00	2.13830E+02
15	2.28556E+03	1.80175E+02	5.33653E+02	4.75956E+01	5.39000E+02	0.	0.	2.47577E+00	1.80178E+02
16	2.28704E+03	1.80182E+02	5.33652E+02	4.75966E+01	5.39000E+02	0.	0.	2.47577E+00	1.80182E+02
17	2.29826E+03	9.02471E+01	5.33639E+02	4.76036E+01	5.39000E+02	0.	0.	7.08333E-01	9.02471E+01
18	2.30112E+03	3.30073E+01	5.33635E+02	4.76054E+01	5.39000E+02	0.	0.	7.08333E-01	3.30073E+01
19	2.29562E+03	2.99346E+02	5.33642E+02	4.76020E+01	5.39000E+02	0.	0.	9.32333E-01	2.99346E+02
20	2.29517E+03	7.68433E+01	5.33642E+02	4.76017E+01	5.39000E+02	0.	0.	9.32333E-01	7.68439E+01
21	2.29227E+03	2.35400E+02	5.33646E+02	4.75999E+01	5.39000E+02	0.	0.	3.43500E+00	2.35400E+02
22	2.29466E+03	5.41596E+02	5.33643E+02	4.76014E+01	5.39000E+02	0.	0.	1.16119E+01	5.41596E+02
23	2.29661E+03	7.97344E+02	5.33641E+02	4.76026E+01	5.39000E+02	0.	0.	2.44740E+00	7.97344E+02
24	2.29351E+03	1.43987E+03	5.33644E+02	4.76006E+01	5.39000E+02	0.	0.	9.42200E+00	1.43987E+03
25	2.29206E+03	1.70554E+02	5.29994E+02	4.77797E+01	5.36000E+02	0.	0.	9.32333E-01	1.70554E+02
26	2.29206E+03	7.33877E+01	5.26344E+02	4.79533E+01	5.33000E+02	0.	0.	9.32333E-01	7.33877E+01
27	2.29206E+03	4.06264E+01	4.89854E+02	4.96951E+01	5.02000E+02	0.	0.	5.67750E-01	4.06264E+01
28	2.28826E+03	3.59350E+02	5.33650E+02	4.75973E+01	5.39000E+02	0.	0.	9.32333E-01	3.59350E+02
29	2.28826E+03	1.09755E+02	5.33042E+02	4.76278E+01	5.38500E+02	0.	0.	9.32333E-01	1.09756E+02
30	2.28791E+03	1.38040E+01	5.32433E+02	4.76578E+01	5.38000E+02	0.	0.	2.44013E+00	1.38040E+01
31	2.28675E+03	2.18391E+02	5.32435E+02	4.76571E+01	5.38000E+02	0.	0.	4.58250E+00	2.18391E+02
32	2.28532E+03	4.78265E+02	5.32436E+02	4.76562E+01	5.38000E+02	0.	0.	4.04708E+00	4.78265E+02
33	2.28675E+03	2.18525E+02	5.31826E+02	4.76872E+01	5.37500E+02	0.	0.	4.58250E+00	2.18529E+02
34	2.28826E+03	1.95128E+01	5.63121E+02	4.77180E+01	5.37000E+02	0.	0.	4.54167E+00	1.95128E+01
35	2.28937E+03	8.19784E+01	5.26347E+02	4.79517E+01	5.33000E+02	0.	0.	2.17450E+00	8.19784E+01

36	2.28391E+03	2.78815E+01	5.621524E+02	4.81823E+01	5.29000E+02	0.	0.	4.31775E+00	2.78815E+01
37	2.29280E+03	1.18201E+02	5.33645E+02	4.76002E+01	5.39000E+02	0.	0.	3.43500E+00	1.18201E+02
38	2.29156E+03	3.91798E+02	5.26345E+02	4.79530E+01	5.33000E+02	0.	0.	2.96508E+00	3.91798E+02
39	2.28790E+03	2.79834E+02	5.33042E+02	4.76275E+01	5.38500E+02	0.	0.	2.89583E+00	2.79834E+02
40	2.29476E+03	7.68435E+01	5.33643E+02	4.76014E+01	5.39000E+02	0.	0.	9.32333E-01	7.68435E+01
41	2.28391E+03	9.07589E+02	7.64279E+02	2.58466E+01	6.54871E+02	9.15213E-02	2.21739E-03	4.32723E+00	8.24526E+02
42	9.54809E+02	5.12878E+03	5.84837E+02	1.82130E+01	5.39000E+02	7.47715E-02	3.96671E-07	9.90300E+00	4.74529E+03
43	6.13600E+02	4.43949E+03	6.00313E+01	4.37400E+01	9.20000E+01	1.64397E-05	0.	5.02717E+00	4.46941E+03
44	2.29205E+03	1.62814E+02	4.89854E+02	4.96951E+01	5.02000E+02	0.	0.	8.41146E-01	1.62814E+02
45	2.28824E+03	1.57856E+02	5.21525E+02	4.81819E+01	5.29000E+02	0.	0.	8.41146E-01	1.57856E+02
46	2.29794E+03	3.23957E+02	1.83264E+02	6.03272E+01	2.10000E+02	0.	0.	3.66185E+00	3.23957E+02
47	2.29206E+03	3.74654E+01	5.16785E+02	4.84245E+01	5.25000E+02	0.	0.	9.32333E-01	3.74654E+01
48	2.29488E+03	2.70799E+02	5.33643E+02	4.76015E+01	5.39000E+02	0.	0.	1.16119E+01	2.70799E+02
49	2.29555E+03	3.04272E+02	5.33642E+02	4.76019E+01	5.39000E+02	0.	0.	1.70360E+00	3.04272E+02

VOLUME

AIR MASS

1	0.
2	0.
3	0.
4	0.
5	0.
6	0.
7	0.
8	0.
9	0.
10	0.
11	0.
12	0.
13	0.
14	0.
15	0.
16	0.
17	0.
18	0.
19	0.
20	0.
21	0.
22	0.
23	0.
24	0.
25	0.
26	0.
27	0.
28	0.
29	0.
30	0.
31	0.
32	0.
33	0.
34	0.
35	0.
36	0.
37	0.
38	0.
39	0.
40	0.
41	0.
42	0.
43	9.76805E+01
44	0.
45	0.
46	0.
47	0.
48	0.
49	0.

VOLUME
NUMBER15
15PUMP SPEED
(RPM)1.72615E+03
1.76500E+03PUMP NORM
TORQUE2.90363E-01
3.02758E-01

HEAT SLAB NUMBER	VOL NUM	HEAT TRAN MODE	SURF FLUX (BTU/HR/FT2)	CRIT FLUX (BTU/HR/FT2)	H.T. COEF (BTU/H/FT2/F)	SURF TEMP (F)	AVG. QVAL	POWR H2O (BTU/HR)
1	LEFT 23	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
2	LEFT 1	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
3	LEFT 2	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
4	LEFT 24	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
5	LEFT 36	0	0.	9.00000E+04	5.00000E+00	5.29000E+02	0.	0.
6	LEFT 35	0	0.	9.00000E+04	5.00000E+00	5.33000E+02	0.	0.
7	RIGHT 21	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
8	LEFT 21	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
9	RIGHT 48	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
10	LEFT 48	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
11	LEFT 34	0	0.	9.00000E+04	5.00000E+00	5.37000E+02	0.	0.
12	LEFT 33	0	0.	9.00000E+04	5.00000E+00	5.37500E+02	0.	0.
13	LEFT 32	0	0.	9.00000E+04	5.00000E+00	5.38000E+02	0.	0.
14	LEFT 31	0	0.	9.00000E+04	5.00000E+00	5.38000E+02	0.	0.
15	LEFT 30	0	0.	9.00000E+04	5.00000E+00	5.38000E+02	0.	0.
16	LEFT 23	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
17	LEFT 8	0	0.	7.664868E+05	5.00000E+00	5.39000E+02	0.	0.
17	RIGHT 42	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	7.47715E-02	0.
18	LEFT 9	0	0.	7.65622E+05	5.00000E+00	5.39000E+02	0.	0.
18	RIGHT 42	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	7.47715E-02	0.
19	LEFT 10	0	0.	7.65359E+05	5.00000E+00	5.39000E+02	0.	0.
19	RIGHT 42	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	7.47715E-02	0.
20	LEFT 44	0	0.	9.00000E+04	5.00000E+00	5.02000E+02	0.	0.
21	LEFT 45	0	0.	9.00000E+04	5.00000E+00	5.29000E+02	0.	0.
22	LEFT 25	0	0.	9.00000E+04	5.00000E+00	5.36000E+02	0.	0.
23	LEFT 26	0	0.	9.00000E+04	5.00000E+00	5.33000E+02	0.	0.
24	LEFT 3	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
25	LEFT 4	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
26	LEFT 5	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
27	LEFT 6	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
28	LEFT 7	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
29	LEFT 11	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
30	LEFT 12	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
31	LEFT 13	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
32	LEFT 14	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
33	LEFT 19	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
34	LEFT 20	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
35	LEFT 28	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
36	LEFT 29	0	0.	9.00000E+04	5.00000E+00	5.38500E+02	0.	0.
37	LEFT 27	0	0.	9.00000E+04	5.00000E+00	5.02000E+02	0.	0.
38	LEFT 46	0	0.	9.00000E+04	5.00000E+00	2.10000E+02	0.	0.
39	LEFT 40	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
40	RIGHT 22	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
41	LEFT 22	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
42	LEFT 23	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
43	LEFT 23	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
44	LEFT 49	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
45	LEFT 49	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
46	RIGHT 37	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.
47	LEFT 37	0	0.	9.00000E+04	5.00000E+00	5.39000E+02	0.	0.

EXP0P4/C E 0LOFTSV02(73)
LOFT L145-A20 L1-4 POSTEST ANALYSIS

EXPERIMENTAL RELAP4 TYPE PROGRAM CONFIGURATION CONTROL: YES
11/29/77

CPU TIME = 1.46

JUNCTION NUMBER	CONNECTING VOLUMES	CHOKE	JCT. FLOW (LB/SEC)	JCT. ENTH (BTU/LB)	JCT. SPVL (FT3/LB)	P R E S STAG PSI	S U R F ELEV PSI	D I F F FRIC PSI	E R E N T ACCL PSI	I A L S PUMP PSI
1	2 TO 1	0 0	5.91667E+02	5.33645E+02	2.10089E-02	3.78305E+00	-1.54773E+00	-2.23532E+00	2.54657E-14	0.
2	1 TO 3	0 0	5.91667E+02	5.33655E+02	2.10099E-02	7.24698E-01	9.17887E-01	-1.64258E+00	1.42109E-14	0.
3	1 TO 28	0 0	0.	5.33650E+02	2.10099E-02	-9.15942E-01	9.17887E-01	-1.94111E-03	3.78780E-06	0.
4	3 TO 4	0 0	5.91667E+02	5.33654E+02	2.10106E-02	2.27212E-01	-9.36674E-16	-2.27212E-01	1.33227E-15	0.
5	4 TO 5	0 0	5.91667E+02	5.33655E+02	2.10106E-02	2.23283E-01	2.43596E-16	-2.23283E-01	8.88178E-16	0.
6	5 TO 6	0 0	5.91667E+02	5.33655E+02	2.10107E-02	1.41457E+00	-2.23715E-01	-1.19086E+00	1.42109E-14	0.
7	6 TO 7	0 0	5.91667E+02	5.33655E+02	2.10109E-02	4.23481E+00	-2.92615E-01	-3.94219E+00	6.03961E-14	0.
8	7 TO 8	0 0	5.91667E+02	5.33653E+02	2.10118E-02	2.09426E+00	-1.52854E+00	-5.65726E-01	0.	0.
9	8 TO 9	0 0	5.91667E+02	5.33667E+02	2.10126E-02	2.13259E+00	-1.44675E+00	-6.85835E-01	5.20417E-18	0.
10	9 TO 10	0 0	5.91667E+02	5.33665E+02	2.10131E-02	-7.44087E-01	1.44673E+00	-7.02645E-01	1.11022E-16	0.
11	10 TO 11	0 0	5.91667E+02	5.33665E+02	2.10130E-02	-8.80460E-01	1.52850E+00	-6.48042E-01	1.77636E-15	0.
12	11 TO 12	0 0	5.91667E+02	5.33663E+02	2.10125E-02	3.26592E+00	2.84897E-01	-3.55081E+00	3.90799E-14	0.
13	12 TO 13	0 0	5.91667E+02	5.33669E+02	2.10137E-02	-6.30910E-01	1.02178E+00	-3.90868E-01	3.55271E-15	0.
14	13 TO 14	0 0	5.91667E+02	5.33670E+02	2.10137E-02	1.69821E+00	2.70028E-01	-1.96824E+00	1.42109E-14	0.
15	14 TO 15	0 0	2.97860E+02	5.33663E+02	2.10143E-02	-1.21290E+01	-7.68449E-01	-4.69878E-01	3.55271E-15	1.33673E+11
16	14 TO 16	0 0	2.93807E+02	5.33663E+02	2.10143E-02	-1.35575E+01	-7.68458E-01	-4.89391E-01	3.55271E-15	1.48154E+01
17	15 TO 17	0 0	2.97860E+02	5.33652E+02	2.10104E-02	-1.27002E+01	-2.92091E-01	-3.75020E-01	1.77636E-15	1.33673E+01
18	16 TO 18	0 0	2.93807E+02	5.33651E+02	2.10100E-02	-1.40859E+01	-2.92097E-01	-4.37351E-01	3.55271E-15	1.48154E+01
19	17 TO 19	0 0	2.97860E+02	5.33639E+02	2.10068E-02	9.59272E-01	-3.45853E-15	-9.59272E-01	3.55271E-15	0.
20	18 TO 19	0 0	2.93807E+02	5.33635E+02	2.10060E-02	3.77356E+00	-7.94311E-15	-3.77356E+00	1.77636E-14	0.
21	19 TO 20	0 0	5.91667E+02	5.33642E+02	2.10075E-02	4.54802E-01	4.95841E-11	-4.54802E-01	5.19602E-15	0.
22	40 TO 37	0 0	5.91667E+02	5.33643E+02	2.10078E-02	1.95442E+00	2.09628E-01	-2.17415E+00	1.42109E-14	0.
23	21 TO 22	0 0	2.84551E+02	5.33643E+02	2.10085E-02	-2.38347E+00	2.48697E+00	-1.03508E-01	4.44089E-16	0.
24	22 TO 23	0 0	3.68760E+02	5.33650E+02	2.10078E-02	-1.95331E+00	2.32014E+00	-3.66833E-01	3.55271E-15	0.
25	49 TO 24	0 0	5.91667E+02	5.33641E+02	2.10075E-02	2.02569E+00	-1.83885E+00	-1.86838E-01	3.44169E-15	0.
26	24 TO 2	0 0	5.91667E+02	5.33633E+02	2.10081E-02	2.58698E+00	-1.86550E+00	-7.21475E-01	1.28786E-14	0.
27	21 TO 25	0 0	0.	5.33645E+02	2.10085E-02	2.13187E-01	-2.09627E-01	-3.56269E-03	-2.19202E-06	0.
28	25 TO 26	0 0	0.	5.29994E+02	2.09294E-02	0.	5.03730E-11	0.	5.82077E-11	0.
29	26 TO 47	0 0	0.	5.16785E+02	2.08536E-02	0.	1.67974E-07	0.	1.67973E-07	0.
30	27 TO 44	0 0	0.	4.89854E+02	2.01227E-02	6.90000E-03	-6.90209E-03	0.	-2.09242E-06	0.
31	37 TO 21	0 0	2.84551E+02	5.33645E+02	2.10085E-02	5.26429E-01	6.92764E-14	-5.26429E-01	3.55271E-15	0.
32	28 TO 29	0 0	0.	5.33650E+02	2.10096E-02	0.	4.96859E-11	0.	5.82077E-11	0.
33	29 TO 30	0 0	0.	5.33042E+02	2.09962E-02	3.47760E-01	-3.47760E-01	0.	5.04224E-08	0.
34	30 TO 31	0 0	0.	5.32433E+02	2.09829E-02	1.16208E+00	-1.16208E+00	0.	-1.79619E-06	0.
35	31 TO 32	0 0	0.	5.32439E+02	2.09832E-02	1.42797E+00	-1.42798E+00	0.	-5.98174E-06	0.
36	32 TO 33	0 0	0.	5.32439E+02	2.09836E-02	-1.42845E+00	1.42845E+00	0.	4.81926E-06	0.
37	33 TO 34	0 0	0.	5.31829E+02	2.09700E-02	-1.51127E+00	1.51127E+00	0.	3.22339E-07	0.
38	34 TO 35	0 0	0.	5.31219E+02	2.09564E-02	-1.11455E+00	1.11455E+00	0.	-3.18396E-07	0.
39	35 TO 36	0 0	0.	5.21527E+02	2.08543E-02	4.58890E-01	-4.58894E-01	0.	-4.16812E-06	0.
40	36 TO 45	0 0	0.	5.21522E+02	2.07545E-02	6.72410E-01	-6.72405E-01	0.	4.55859E-06	0.

41	48 TO	22	0	0	8.42094E+01	5.33643E+02	2.16078E-02	2.24199E-01	-4.91945E-12	-2.24199E-01	4.44089E-16	0.
42	29 TO	39	0	0	0.	5.33043E+02	2.09962E-02	3.58300E-01	-3.58309E-01	0.	-9.00147E-06	0.
43	26 TO	38	0	0	0.	5.26344E+02	2.08536E-02	4.99090E-01	-4.99081E-01	0.	8.72930E-06	0.
44	43 TO	46	0	0	0.	1.83261E+02	5.22352E+01	-1.68434E+03	1.85095E+03	0.	0.	0.
45	41 TO	4	0	0	0.	7.05341E+02	2.71673E-02	-6.85147E-01	7.34097E-01	-4.87011E-02	2.48182E-04	0.
46	48 TO	23	0	0	2.22907E+02	5.33650E+02	2.10078E-02	-1.72911E+00	2.32014E+00	-5.91038E-01	5.32907E-15	0.
47	46 TO	20	0	0	0.	1.83266E+02	1.65763E-02	-6.30824E-01	6.48117E-01	-1.72748E-02	1.82581E-05	0.
48	47 TO	27	0	0	0.	5.16785E+02	2.06507E-02	0.	-1.68141E-07	0.	-1.58147E-07	0.
49	20 TO	40	0	0	5.91667E+02	5.33642E+02	2.10077E-02	4.04804E-01	-8.87342E-16	-4.04804E-01	3.55271E-15	0.
50	23 TO	49	0	0	5.91667E+02	5.33639E+02	2.10073E-02	1.05486E+00	-6.82465E-01	-3.72390E-01	5.32907E-15	0.
51	37 TO	48	0	0	3.07117E+02	5.33647E+02	2.10084E-02	-2.08124E+00	2.48698E+00	-4.05748E-01	1.77635E-15	0.
52	44 TO	0	0	0	0.	4.89854E+02	1.00000E-02	0.	0.	0.	0.	0.
53	45 TO	0	0	0	0.	5.21525E+02	1.00000E-02	0.	0.	0.	0.	0.
54	0 TO	46	0	0	0.	1.83266E+02	0.	0.	0.	0.	0.	0.
55	0 TO	46	0	0	0.	1.83266E+02	0.	0.	0.	0.	0.	0.

JUNCTION NUMBER	SLIP VEL. (FT/SEC)	LIQUID VEL. (FT/SEC)	VAPOR VEL. (FT/SEC)	JCT. FLOW-L (LBM/SEC)	JCT. FLOW-G (LBM/SEC)	SAT. H-L (BTU/LBM)	SAT. H-G (BTU/LBM)	FLOW-WEIGHTED H (BTU/LBM)
1	0.	2.59963E+01	2.58963E+01	5.91667E+02	0.	5.33648E+02	0.	5.33648E+02
2	0.	1.82084E+01	1.82084E+01	5.91667E+02	0.	5.33652E+02	0.	5.33652E+02
3	0.	0.	0.	0.	0.	0.	0.	0.
4	0.	1.88099E+01	1.88099E+01	5.91667E+02	0.	5.33661E+02	0.	5.33661E+02
5	0.	3.46450E+01	3.46450E+01	5.91667E+02	0.	5.33661E+02	0.	5.33661E+02
6	0.	1.62090E+01	1.62090E+01	5.91667E+02	0.	5.33661E+02	0.	5.33661E+02
7	0.	2.23587E+01	2.23587E+01	5.91667E+02	0.	5.33660E+02	0.	5.33660E+02
8	0.	7.64477E+00	7.64477E+00	5.91667E+02	0.	5.33660E+02	0.	5.33660E+02
9	0.	7.64501E+00	7.64501E+00	5.91667E+02	0.	5.33672E+02	0.	5.33672E+02
10	0.	7.64523E+00	7.64523E+00	5.91667E+02	0.	5.33663E+02	0.	5.33663E+02
11	0.	7.64515E+00	7.64515E+00	5.91667E+02	0.	5.33662E+02	0.	5.33662E+02
12	0.	2.23605E+01	2.23605E+01	5.91667E+02	0.	5.33663E+02	0.	5.33663E+02
13	0.	1.82116E+01	1.82116E+01	5.91667E+02	0.	5.33671E+02	0.	5.33671E+02
14	0.	1.82116E+01	1.82116E+01	5.91667E+02	0.	5.33674E+02	0.	5.33674E+02
15	0.	1.58840E+01	1.58840E+01	2.97860E+02	0.	5.33676E+02	0.	5.33676E+02
16	0.	1.56678E+01	1.56678E+01	2.93807E+02	0.	5.33676E+02	0.	5.33676E+02
17	0.	1.58811E+01	1.58811E+01	2.97860E+02	0.	5.33658E+02	0.	5.33658E+02
18	0.	1.56647E+01	1.56647E+01	2.93807E+02	0.	5.33657E+02	0.	5.33657E+02
19	0.	1.58784E+01	1.58784E+01	2.97860E+02	0.	5.33644E+02	0.	5.33644E+02
20	0.	1.56617E+01	1.56617E+01	2.93807E+02	0.	5.33640E+02	0.	5.33640E+02
21	0.	1.88072E+01	1.88072E+01	5.91667E+02	0.	5.33648E+02	0.	5.33648E+02
22	0.	1.82064E+01	1.82064E+01	5.91667E+02	0.	5.33649E+02	0.	5.33649E+02
23	0.	6.87154E+00	6.87154E+00	2.84551E+02	0.	5.33646E+02	0.	5.33646E+02
24	0.	8.90482E+00	8.90482E+00	3.68760E+02	0.	5.33644E+02	0.	5.33644E+02
25	0.	1.17703E+01	1.17703E+01	5.91667E+02	0.	5.33642E+02	0.	5.33642E+02
26	0.	1.58261E+01	1.58261E+01	5.91667E+02	0.	5.33644E+02	0.	5.33644E+02
27	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.	0.	0.
31	0.	8.53990E+00	8.53990E+00	2.84551E+02	0.	5.33652E+02	0.	5.33652E+02
32	0.	0.	0.	0.	0.	0.	0.	0.
33	0.	0.	0.	0.	0.	0.	0.	0.
34	0.	0.	0.	0.	0.	0.	0.	0.
35	0.	0.	0.	0.	0.	0.	0.	0.
36	0.	0.	0.	0.	0.	0.	0.	0.
37	0.	0.	0.	0.	0.	0.	0.	0.
38	0.	0.	0.	0.	0.	0.	0.	0.
39	0.	0.	0.	0.	0.	0.	0.	0.
40	0.	0.	0.	0.	0.	0.	0.	0.
41	0.	5.89683E-01	5.89683E-01	8.42094E+01	0.	5.33646E+02	0.	5.33646E+02
42	0.	0.	0.	0.	0.	0.	0.	0.
43	0.	0.	0.	0.	0.	0.	0.	0.
44	0.	0.	0.	0.	0.	0.	0.	0.
45	0.	0.	0.	0.	0.	0.	0.	0.
46	0.	1.07655E+01	1.07655E+01	2.22907E+02	0.	5.33646E+02	0.	5.33646E+02
47	0.	0.	0.	0.	0.	0.	0.	0.
48	0.	0.	0.	0.	0.	0.	0.	0.
49	0.	1.83678E+01	1.83678E+01	5.91667E+02	0.	5.33649E+02	0.	5.33649E+02

EXPOP4/C E 0LOFTSV02(73)
LOFT L145-A20 L1-4 POSTEST ANALYSIS

EXPERIMENTAL RELAP4 TYPE PROGRAM CONFIGURATION CONTROL: YES
10/20/77

CPU TIME = 1.51

JUNCTION NUMBER	SLIP VEL. (FT/SEC)	LIQUID VEL. (FT/SEC)	VAPOR VEL. (FT/SEC)	JCT. FLOW-L (LBM/SEC)	JCT. FLOW-G (LBM/SEC)	SAT. H-L (BTU/LBM)	SAT. H-G (BTU/LBM)	FLOW-WEIGHTED H (BTU/LBM)
50	0.	1.17705E+01	1.17705E+01	5.91667E+02	0.	5.33641E+02	0.	5.33641E+02
51	0.	1.48329E+01	1.48329E+01	3.07117E+02	0.	5.33652E+02	0.	5.33652E+02
52	0.	0.	0.	0.	0.	0.	0.	0.
53	0.	0.	0.	0.	0.	0.	0.	0.
54	0.	0.	0.	0.	0.	0.	0.	0.
55	0.	0.	0.	0.	0.	0.	0.	0.

EXPOP4/C E 0LOFTSV02(73)
LOFT L145-A20 L1-4 POSTEST ANALYSIS

EXPERIMENTAL RELAP4 TYPE PROGRAM CONFIGURATION CONTROL: YES
10/20/77

CPU TIME = 1.52

END TRIP SIGNAL.

LISTING OF INPUT DATA FOR CASE 1.

```

1  =LOFT L145-A21 L1-4 POSTTEST ANALYSIS
2  *          132 DEGREE C ECC WATER
3  050431  1  0  613.6      270.0  0.0      104.8734
4  050461  0  0  2297.9428436  270.  -1.      5.37
5  130100  6  2  13  4  ?GAL/MIN? 100. 270.0 *LP1S
6  130200  4  2  2  4  ?GAL/MIN? 100% 270.0

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APPENDIX B

UNITS CONVERSION

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TABLE B-I

ENGINEERING UNITS CONVERSION OF THE RELAP4 DATA

Transducer Identification	Calculation Method	Engineering Units
DE-BL-1A, -1B, and -1C	$1.0 \div JV29$	lbm/ft ³
DE-BL-2A, -2B, and -2C	$1.0 \div JV33$	lbm/ft ³
DE-PC-1A, -1B, and -1C	$1.0 \div JV21$	lbm/ft ³
DE-PC-2A, -2B, and -2C	$1.0 \div JV4$	lbm/ft ³
DE-PC-3A, -3B, and -3C	$1.0 \div JV13$	lbm/ft ³
FE-BL-1A, -1B, and -1C	$FV29 \times 0.896566$	ft/sec
FE-BL-2	$FV33 \times 0.138839$	ft/sec
FE-CS-1	$FV1 \times 0.269663$	ft/sec
FE-PC-1	$FV21 \times 1.0191$	ft/sec
FE-PC-2	$FV4 \times 1.0191$	ft/sec
FE-PC-3	$FV13 \times 1.05274$	ft/sec
FE-1ST-1	$FV24 \times 0.569718$	ft/sec
FE-2ST-1	$FV52 \times 0.284859$	ft/sec
FT-P120-36-1 and -5	$JF44 \times 448.8312$	gpm
FT-P120-85	$JW54 \times 7.48052$	gpm
FT-P128-104	$JW55 \times 7.48052$	gpm
FT-P139-27-1 and -3	$JW5 \times 0.0036$	mlbm/hr

TABLE B-I (continued)

Transducer Identification	Calculation Method	Engineering Units
LE-1ST-1	$(1.7534 \times WM23 \times VF23) +$ $(11.6916 \times WM22 \times VF22) +$ $(7.9210 \times WM21 \times VF21)$	inches
LE-2ST-1	$(1.7534 \times WM23 \times VF23) +$ $(23.3832 \times WM48 \times VF48) +$ $(15.8421 \times WM37 \times VF37)$	inches
LIT-P120-44	$12.0 \times ML43$	inches
LT-P139-6, -7, and -8	$10.2835 \times ML41$	inches
LT-P4-8B	$9.91453 \times ML42 - 116.0$	inches
ME-BL-1A, -1B, and -1C	$(0.001 \div JV29) \times$ (absolute value of FV29) x $FV29 \times 0.803831$	klbm/ft-sec ²
ME-BL-2	$(0.001 \div JV33) \times$ (absolute value of FV33) x $FV33 \times 0.0192763$	klbm/ft-sec ²
ME-CS-1	$(0.001 \div JV1) \times$ (absolute value of FV1) x $FV1 \times 0.0727181$	klbm/ft-sec ²
ME-PC-1	$(0.001 \div JV21) \times$ (absolute value of FV21) x $FV21 \times 1.03857$	klbm/ft-sec ²
ME-PC-2	$(0.001 \div JV4) \times$ (absolute value of FV4) x $FV4 \times 1.03857$	klbm/ft-sec ²
ME-PC-3	$(0.001 \div JV13) \times$ (absolute value of FV13) x $FV13 \times 1.10826$	klbm/ft-sec ²
ME-1ST-1	$(0.001 \div JV24) \times$ (absolute value of FV24) x $FV24 \times 0.324579$	klbm/ft-sec ²
ME-2ST-1	$(0.001 \div JV52) \times$ (absolute value of FV52) x $FV52 \times 0.0811447$	klbm/ft-sec ²

TABLE B-I (continued)

<u>Transducer Identification</u>	<u>Calculation Method</u>	<u>Engineering Units</u>
PCP-1-F	PR15 x 0.016667	Hz
PCP-2-F	PR16 x 0.016667	Hz
PdE-BL-4	AP36 - AP45	psid
PdE-BL-5	AP34 - AP36	psid
PdE-BL-6	AP33 - AP34	psid
PdE-BL-7	AP31 - AP33	psid
PdE-BL-8	AP30 - AP31	psid
PdE-CS-1	AP23 - AP2	psid
PdE-PC-1	AP19 - AP13	psid
PdE-PC-2	AP6 - AP12	psid
PdE-PC-3	AP3 - AP4	psid
PdE-PC-4	AP4 - AP6	psid
PdE-PC-5	AP19 - AP20	psid
PdE-PC-7	AP20 - AP25	psid
PdE-PC-8	(AP41 - AP4) x 0.89458	psid
PdE-PC-9	AP17 - AP14	psid
PdE-PC-10	AP18 - AP14	psid
PdE-RV-1	AP23 - 43.0	psid
PdE-RV-3	AP20 - AP48	psid
PdE-RV-4	AP1 - AP3	psid
PdE-2ST-2	AP37 - AP48	psid
PdT-P139-30	AP20 - AP3	psid
PE-BL-1	AP25 - 12.3	psig
PE-BL-2	AP28 - 12.3	psig

TABLE B-I (continued)

<u>Transducer Identification</u>	<u>Calculation Method</u>	<u>Engineering Units</u>
PE-BL-6	AP34 - 12.3	psig
PE-CS-1A, -1B, -1FF, and -2FF	AP2 - 12.3	psig
PE-PC-1	AP19 - 12.3	psig
PE-PC-2	AP2 - 12.3	psig
PE-PC-3A and -3B	AP13 - 12.3	psig
PE-PC-4	AP41 - 12.3	psig
PE-1ST-1A, -1B, and -1FF	AP23 - 12.3	psig
PE-1ST-3A, -3B, and -3FF	AP21 - 12.3	psig
PE-2ST-1A, -1B, and -1FF	AP23 - 12.3	psig
PT-P120-43	AP43 - 12.3	psig
PT-P120-61	AP46 - 12.3	psig
PT-P139-2, -3, and -4	AP5 - 12.3	psig
PT-P139-5	AP41 - 12.3	psig
PT-P4-10A	AP42 - 12.3	psig
RPE-PC-1	PR15	rpm
RPE-PC-2	PR16	rpm
TE-BL-1A, -1B, and -1C	AT26	°F
TE-BL-2	AT29	°F
TE-BL-3	AT38	°F
TE-CS-1	AT2	°F

TABLE B-I (continued)

<u>Transducer Identification</u>	<u>Calculation Method</u>	<u>Engineering Units</u>
TE-PC-1	AT20	°F
TE-PC-2	AT3	°F
TE-PC-3	AT13	°F
TE-P120-41	AT43	°F
TE-P138-62	AT44	°F
TE-P138-63	AT27	°F
TE-P138-65	AT36	°F
TE-P138-66	AT45	°F
TE-P139-19 and -20	AT41	°F
TE-P139-29	AT20	°F
TE-SG-1	AT7	°F
TE-SG-2	AT11	°F
TE-SG-3	AT42	°F
TE-1ST-1	AT21	°F
TE-1ST-2, -3, -4, -5, -6, -7, and -8	AT22	°F
TE-1ST-9, -10, -11, -12, and -13	AT23	°F
TE-1ST-14	AT22	°F
TE-2ST-1	AT37	°F
TE-2ST-2, -3, -4, -5, -6, -7, and -8	AT48	°F
TE-2ST-9, -10, -11, -12, and -13	AT23	°F

TABLE B-I (continued)

<u>Transducer Identification</u>	<u>Calculation Method</u>	<u>Engineering Units</u>
TE-2ST-14	AT48	°F
TT-P120-62	AT46	°F
TT-P120-32, -33, and -34	AT5	°F
Enthalpy at BL-1	AH26	Btu/lbm
Enthalpy at BL-2	AH29	Btu/lbm
Enthalpy at PC-1	AH20	Btu/lbm
Enthalpy at PC-2	AH3	Btu/lbm
Enthalpy at PC-3	AH13	Btu/lbm
Void fraction at BL-1	$1.0 - (WM26 \times VF26 \times 0.653424)$	fraction
Void fraction at BL-2	$1.0 - (WM29 \times VF29 \times 0.433943)$	fraction
Void fraction at PC-1	$1.0 - (WM20 \times VF20 \times 0.61946)$	fraction
Void fraction at PC-2	$1.0 - (WM3 \times VF3 \times 0.125766)$	fraction
Void fraction at PC-3	$1.0 - (WM13 \times VF13 \times 0.225328)$	fraction
Mass flow/system volume at BL-1	$JW29 \div 273$	lbm/sec-ft ³
Mass flow/system volume at BL-2	$JW33 \div 273$	lbm/sec ft ³
Mass flow/system volume at PC-1	$JW21 \div 273$	lbm/sec-ft ³
Mass flow/system volume at PC-2	$JW4 \div 273$	lbm/sec-ft ³
Mass flow/system volume at PC-3	$JW13 \div 273$	lbm/sec-ft ³

TABLE B-I (continued)

<u>Transducer Identification</u>	<u>Calculation Method</u>	<u>Engineering Units</u>
Static quality at BL-1	AX26	fraction
Static quality at BL-2	AX29	fraction
Static quality at PC-1	AX20	fraction
Static quality at PC-2	AX3	fraction
Static quality at PC-3	AX13	fraction
Saturation tempera- ture at BL-1	TS26	°F
Saturation tempera- ture at BL-2	TS29	°F
Saturation tempera- ture at PC-1	TS20	°F
Saturation tempera- ture at PC-2	TS3	°F
Saturation tempera- ture at PC-3	TS13	°F
Saturation tempera- ture at CS-1	TS2	°F
Saturation tempera- ture at PE-1ST-1A	TS23	°F
Saturation tempera- ture at PE-2ST-1A	TS23	°F
Total mass of liquid in reactor vessel	TM37 + TM21 + TM22 + TM48 + TM23 + TM49 + TM24 + TM2 + TM1	lbm
Total ECC mass flow rate	JW44 + JW54 + JW55	lbm/sec

TABLE B-I (continued)

<u>Transducer Identification</u>	<u>Calculation Method</u>	<u>Engineering Units</u>
Integrated ECC mass flow rate	$\int_0^t (JW44 + JW54 + JW55) dt$	lbm

where

JVXX is the junction specific volume in junction XX

FVXX is the junction velocity in junction XX

JFXX is the junction volumetric flow in junction XX

JWXX is the junction mass flow in junction XX

AHXX is the junction enthalpy in junction XX

MLYY is the mixture level in volume YY

WMYY is the liquid mass in volume YY

TMYY is the total mass in volume YY

PRYY is the pump speed in volume YY

APYY is the average pressure in volume YY

ATYY is the average temperature in volume YY

AXYY is the average quality in volume YY

TSYY is the saturation temperature in volume YY

TABLE B-II

ENGLISH TO SI UNITS CONVERSION CONSTANTS

Type Measurement	English Units	SI ^[a] Units	Conversion Factor
Acceleration	g	m/s ²	9.806650E+00
Current rms	A rms	A rms	1.000000E+00
Instantaneous current	A	A	1.000000E+00
Density	lb/ft ³	mg/m ³	1.601846E-02
Average density	lb/ft ³	mg/m ³	1.601846E-02
Enthalpy	btu/lbm	kJ/kg	2.326000E+00
Extensometer	in.	m	2.540000E-02
Flow rate	klbm/hr	kg/s	1.259979E-01
Flow rate	gpm	l/s	6.309020E-02
Flow filtered	gpm	l/s	6.309020E-02
Volumetric flow rate	gpm	l/s	6.309020E-02
Water horsepower	hp	MW	7.460430E-04
Integral mass flow	lbm	kg	4.535924E-01
Flow quality			1.000000E+00
Frequency	Hz	Hz	1.000000E+00
Liquid level	in.	m	2.540000E-02
Coolant level	in.	m	2.540000E-02
Mass flow/system vol.	lbm/ft ³ -sec	kg/s-m ³	16.01846E+00
Mass flow rate	lbm/sec	kg/s	4.535924E-01
Mass flow rate	mlbm/hr	kg/s	1.259979E+02
Momentum flux	klbm/ft-sec ²	mg/m-s ²	1.488164E+00

TABLE B-II (continued)

Type Measurement	English Units	SI ^[a] Units	Conversion Factor
Momentum flux filter	klbm/ft-sec ²	mg/m-s ²	1.488164E+00
Valve position	pct	pct	1.000000E+00
Pressure	psig	MPa	6.894757E-03
Pressure	psia	MPa	6.894757E-03
Coolant pressure	psig	MPa	6.894757E-03
Delta pressure	psid	MPa	6.894757E-03
Delta pressure	in. H ₂ O	Pa	2.488400E+02
Strain	μin./in.	μm/m	1.000000E+00
Stress	lbft	N	4.448222E+00
Stress	klbft	N	4.448222E+03
Pump speed	rpm	rpm	1.000000E+00
Pump rpm	rpm	rpm	1.000000E+00
Slip			1.000000E+00
Static quality			1.000000E+00
Steam quality			1.000000E+00
Velocity	ft/sec	m/s	3.048000E-01
Velocity filtered	ft/sec	m/s	3.048000E-01
Average velocity	ft/sec	m/s	3.048000E-01
Liquid phase velocity	ft/sec	m/s	3.048000E-01
Vapor phase velocity	ft/sec	m/s	3.048000E-01
Coolant velocity	ft/sec	m/s	3.048000E-01
Volts rms	V rms	V rms	1.000000E+00

TABLE B-II (continued)

<u>Type Measurement</u>	<u>English Units</u>	<u>SI^[a] Units</u>	<u>Conversion Factor</u>
Instantaneous volts	V	V	1.000000E+00
Void fraction			1.000000E+00

[a] SI - International System of Units.

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