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ICSP-LP-FP-1

International Agreement Report

TRAC-PF1 Code Assessment Using OECD LOFT LP-FP-1 Experiment

Prepared by
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Office of Nuclear Regulatory Research
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Prepared as part of
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ABSTRACT

Document resumes the final calculations of the thermal-hydraulic aspects of the OECD LOFT-LP-FP-1 experiment, with emphasis in those related with the assessment of the TRAC-PF1 code.

LOFT LP-FP-1 experiment was carried out at the LOFT facility in INEL, sponsored by the OECD.

Code used for this simulation was TRAC-PF1/Mod 1 (version 11.0) running on a CDC Cyber 830 (O.S. NOS-BE).

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FOREWORD

This report represents one of the assessment/application calculations submitted in fulfilment of the bilateral agreement for cooperation in thermalhydraulic activities between the Consejo de Seguridad Nuclear of Spain (CSN) and the United States Nuclear Regulatory Commission (US-NRC) in the form of Spanish contribution to the International Code Assessment and Applications Program (ICAP) of the US-NRC whose main purpose is the validation of the TRAC and RELAP system codes.

The Consejo de Seguridad Nuclear has promoted a coordinated Spanish Nuclear Industry effort (ICAP-SPAIN) aiming to satisfy the requirements of this agreement and to improve the quality of the technical support groups at the Spanish Utilities, Spanish Research Establishments, Regulatory Staff and Engineering Companies, for safety purposes.

This ICAP-SPAIN national program includes agreements between CSN and each of the following organizations:

- Unidad Eléctrica (UNESA)
- Unión Iberoamericana de Tecnología Eléctrica (UITESA)
- Empresa Nacional del Uranio (ENUSA)
- Centro de Investigaciones Energéticas y Medioambientales (CIEMAT)
- TECNATOM
- LOFT-ESPAÑA

The program is executed by 12 working groups and a generic code review group and is coordinated by the "Comité de Coordinación". This committee has approved the distribution of this document for ICAP purposes.

1. INTRODUCTION

The fission products release test LP-FP-1 was conducted on Dec 19,1984. The first trial to conduct the test on Dec 12 had failed because of a defect in the position indicator of the hot leg QOBV (Quick Opening Blowdown Valve). The test was terminated by the PPS (Plant Protection System) action at about 10 s and the transient ended at 50 s. This test is designated as LP-FP-1A.

The thermal-hydraulic transient of the test LP-FP-1 has been initiated by the reactor scram and opening of the QOBV's with one second delay. This experiment simulates large break LOCA in the cold leg with delayed ECC injection to allow pin rupture and fission products release.

LP-FP-1 was specified to be similar to LOFT experiment L2-5 and OECD LOFT experiments LP-02-6 and LP-LB-1, except for initial primary pump operation, closure of the BLCL valve and ECCS operation for core recovery and fuel cladding quench.

From the thermal-hydraulic point of view, the following objectives were considered achievable:

- Determine system thermal-hydraulics and core thermal response for initial and boundary conditions similar to a large break design basis LOCA leading to and limited to fission product release from the fuel cladding gap region.
- Determine the fission product retention effectiveness of the ECCS operating in a mode representative of a German

PWR ECCS in nominal (best estimate) conditions for combined hot leg and cold leg injection.

During the conduct of FP-1, most of the water in the accumulator B line was unintentionally injected into the upper plenum during the blowdown. This water distorted the thermal behaviour of the core and delayed the burst of the pressurized fuel pins by more than 200 s. Also more than 60 % of the rods that were planned to burst, remained intact. the thermal-hydraulic conditions in the core at the time of fission product release are far less definite than was expected. In order to be able to analyse the test results and to carry out post-test calculations using advanced thermal hydraulic codes, one has to know the amount and the rate of water injected.

We have selected a history for this unexpected injection, based on previous studies. We have run a simulation of 400 s, covering blowdown, heat-up and reflood phases in order to compare the obtained results with the data measured along the experiment, both hydraulic and thermal variables.

A brief description of the LOFT facility, system configuration for LP-FP-1 experiment and test evolution are included in Section 2, together with initial conditions and operational set points.

Section 3 contains the input model for TRAC-PF1 code and nodalization details.

In Section 4, results obtained are checked against the measured data for a set of important parameters showing main physical phenomena that occurred during the experiment.

Run statistics in different regions of the transient are shown in Section 5.

Conclusions and recomendations arising from the study are resumed in Section 6.

Apendix A resumes the instrumentation nomenclature and location for the LOFT system, related with the assessment.

2. FACILITY AND TEST DESCRIPTION

2.1 System configuration

The LOFT facility was designed to simulate the major components and system responses of a commercial PWR during a LOCA. The experimental assembly includes five major subsystems which have been instrumented in such a way that the system variables can be measured and recorded during a LOCA simulation. The subsystems include:

- Reactor vessel
- Intact loop
- Broken loop
- Blowdown supression tank (BST)
- ECC system

Complete information on the LOFT system is provided in ref [1].

The arrangement of the major LOFT components is shown in Figs 2.1 and 2.2. The intact loop simulates three loops of a commercial four-loop PWR and contains a steam generator, two primary coolant pumps in parallel, a pressurizer, a venturi flowmeter and connecting piping.

The broken loop consists of a hot and a cold legs, each of which are connected to the reactor vessel and the BST header. Primary coolant pump and steam generator simulators were installed in the broken loop hot leg to provide the flow resistence normally represented by these components in a commercial PWR. Each broken leg contains a quick-opening blowdown valve, a recirculation line, an isolation valve, an orifice to represent the break plane, and connecting piping. The recirculation lines establish a small flow through the broken loop to maintain hot fluid conditions in these loops which otherwise are stagnant prior to initiation of the experiment.

The LOFT reactor vessel, shown in Figure 2.3 has an annular downcomer, a lower plenum, lower core support plates, a nuclear core and an upper plenum. The downcomer is connected to the cold legs of the intact and broken loops and the upper plenum is connected to the hot legs.

The core consists of 1300 enriched uranium fuel rods arranged in five square and four triangular fuel assemblies. The fuel rods were designed to commercial PWR specifications except that they are only 1.68 m long and several fuel rods have special instrumentation. Twenty-four fuel rods were enriched to 6 % (wt) U235, and twenty-two of these were pre-pressurized at cold conditions to 2.41 MPa. The other two fuel rods were unpressurized and were designed to be easily removed for PIE. All other fuel rods in the core were un-pressurized and enriched to 4 % (wt) U235. Fig 2.4 shows the fuel cladding thermocouple locations and Fig 2.5 shows all the central fuel assembly instrumentation, as well as the locations of the two fuel rods which were removed for PIE. Fig 2.6 shows the location for the thermocouples in the upper plenum. Nomenclature and location of the instruments may be seen in Apendix A.

The ECCS in FP-1 was designed to simulate the hot leg and cold leg ECC injection rates representative of the ECCS operation in a KWU 1300 Mwe reference PWR under nominal conditions. As mentioned, injection have to be delayed to allow fuel rupture and fission product release and transport in a vapour environment. Accumulator A was rooted to the intact loop cold leg (Fig 2.2) and was used to inject ECC scaled to the reference PWR best estimate cold leg accumulators and LPIS injection based on power scaling (1:100).

Accumulator B was rooted to the upper plenum (Fig 2.2) near the top of the center fuel assembly through a special piping configuration conveniant to the LOFT system and not related to the reference PWR. Accumulator B was designed to inject ECC scaled to the reference PWR.

As the injection line enters the pressure vessel, it penetrates through the central fuel module and branches in the upper structure (see Fig 2.7). At station 203.17 (3.44 m) above reactor vessel bottom and about 42 cm above the top of fuel pins, 6 reflood injection nozzles are positioned to inject inside the flow shroud in the central fuel module. At station 191.82 (about 13 cm above the top of fuel pins) another 8 reflood nozzles are positioned in such a way as to inject outside the flow shroud and towards the peripheral elements. Details may be found in reference [2].

Accumulator B is connected to the pressure vessel by three lines. Injection in the hot leg, in downcomer or in the upper plenum can be activated. Direct injection in the downcomer is only activated in case of PPS as hapenned in LP-FP-1A. The same lines are also used by the low pressure injection system (LPIS). See design of the injection line in Fig 2.8.

The upper plenum injection valve CV-P120-54 which is very near to the pressure vessel was then opened about 90 s before the test while the far valve CV-P120-33 was kept close. This means that the whole line between that valve and the nozzles in the upper plenum was subjected to the system pressure of 14.77 MPa during a period of 90 s before the test.

No accumulator blowdown and no venting of the primary system were performed after the failed experiment and no precautions were taken to prevent nitrogen injection. The injection line of accumulator B included large amount of nitrogen before system pressurization in the transient phase of FP-1. This nitrogen was then compressed to system pressure during the 90 s after opening CV-P120-54 and the gas bubble was moved towards the accumulator B, behind the flowmeter FE-P120-33.

The LOFT steam generator, located in the intact loop, is a vertical U-tube-design steam generator. Operation of the secondary coolant system approximates that of a commercial PWR.

2.2 Test description

LP-FP-1 was defined to consist of four distinct phases which were designated as: fuel preconditioning, pretransient, transient and postransient. The four phases were continous and had specific beginning and ending definitions.

The purpose of the fuel preconditioning phase, in conjunction with the pretransient phase, was to subject the 24 6 % (wt) enriched fuel rods in the new center assembly to the minimum required burnup condition of 1175 MWD/MTU prior to conducting the transient. This burnup is equivalent to power operation at a maximum linear heat generation rate of 52.2 Kw/m for 20 days on the enriched fuel rods. The preconditionning phase started at the begining of plant heatup prior to power operation and ended with termination of power operation after the calculated burnup fraction had been achieved. An additional period of preconditioning beyond that required for minimum burnup occurred after the first attempt of conducting the experiment. The delay of one week resulted in three more days of power operation, reaching 1417 MWD/MTU.

The pretransient phase consisted of a reactor shutdown interval of approximately five days, followed by a power operation interval. The final plant preparations were completed during the reactor shutdown interval. The power operation interval established the required minimum decay heat level (86 % of DH in commercial PWR fuel rods after one year of at 52 Kw/m), and the initial conditions for conducting the experiment. The requirement to build up the short lived fission product inventory of 40 Equivalent Fission Product Hours was achieved by 70 %. The pretransient phase started at the termination of power operation in the preconditioning phase and ended with initiation of the transient by a reactor scram.

The transient phase of the experiment started with reactor scram, followed by the opening of the QOBV's and ended at the initiation of the closure of the broken loop hot leg (BLHL) QOBV. The BLCL-QOBV was closed at 68 s to ensure that positive core vapour flow existed for the transport of fission products, released from the fuel rod gap, along the intended path for fission product measurements. The unplanned injection of water in the upper plenum due to the expansion of non-condensable gases in the injection line from accumulator B have caused a delay in pin rupture, core reflood and system recovery, which commenced at 344 s instead of the expected value of 100 s on a peak cladding temperature trip of 1037 K in the peripheral fuel assemblies was accomplished with cold leg and upper plenum accumulator ECC injection. The maximum cladding temperature measured in the central fuel assembly was 1210 K.

The final (postransient) phase consisted of a 12 h time from the closure of the BLHL-QOBV, for measuring the redistribution of fission product inventory in gas and liquid in the BST and PCS.

The initial conditions are specified in Table 2.1 together with the measured system conditions inmediately prior to the transient phase of LP-FP-1. The operational setpoints specified are listed in Table 3 together with the measured values. Differences between specified and operational setpoints reflect in some cases the time elapsed between operator action and system response.

As shown in Table 2.2, the break apertures was taken as the initiation time of the experiment. The reactor was scrammed one second prior to the initiation of blowdown. This was done for avoiding early departure from nucleate boiling (DNB) on the 6 % fuel rods which would lead to excessive cladding temperatures early in the transient. The blowdown was the initiated by opening the QOBVs and the pumps were turned off and decoupled from their flywheels within 1 s.

The PCS quickly depressurized to saturation pressure in the upper plenum, broken hot and cold legs by 0.1, 1.1 and 3.5 s, respectively. A bottom-up partial core quench occurred between 6 and 7 s, followed at 12 to 18 s by a total top-down quench of the central fuel assembly. The lower part of some of the peripheral fuel rods did not completely quench at this time. This total top-down quench was the 1st indication that the upper plenum injection line was leaking. This unplanned injection of water in the upper plenum doesn't influence the pressure history.

The cold leg QOBV was closed by 68 s, forcing all break flow out the cold leg and core flow from bottom to top. A sustained heatup of most (not all) of the core started at 90 s, resulting in the rupture of some of the enriched fuel rods beginning at 325 s. The ECCS was initiated at 344 s and the entire core was quenched by 365 s. A 12 h postexperiment sampling period followed and the experiment was then terminated with plant cleanup and sample removal for PIE.

TABLE 2.1. Initial conditions for experiment LP-FP-1

	Specified[(a)] Value	Measured Value	
PRIMARY COOLANT SYSTEM			
Core delta T (K)		14.4 ± 0.1	
Primary system pressure (hot leg) (MPa)	14.95 ± 0.1	14.77 ± 0.07[(b)]	(-1.2 %)
Hot leg temperatura (K)	577 ± 1.1	577.6 ± 0.8	
Cold leg temperatura (K)		563.2 ± 1.1	
Mass flow intect loop (kg/s)	479 ± 19	486.7 ± 2.5[(b)]	(+1.6 %)
Boron concentration (ppm)		612 ± 15	
Primary coolant pump injection (both pumps) (L/s)	0.127 ± 0.016	0.126 ± 0.003	
REACTOR VESSEL			
Power level (MW)	38 ± 1	37.0 ± 1.2[(b)]	(-2.6 %)
Maximum linear heat generation rate (kW/m)	~52	51.2 ± 3.6	
Control rod position (above full-in position) (m)	1.37 ± 0.01	1.38 ± 0.002	
STEAM GENERATOR			
Secondary system pressure (MPa) .		6.41 ± 0.08	
Water level (m)[(c)]	0.19 ± 0.05	0.15 ± 0.06[(b)]	(-21 %)
PRESSURIZER			
Liquid volume (m^3)		0.66 ± 0.02	
Steam volume		0.27 ± 0.02	
Water temperature (K)		616.2 ± 5.8	
Pressure (MPa)		14.73 ± 0.11	
Liquid level (m)	1.12 ± 0.1	1.23 ± 0.04[(b)]	(+9.8 %)
BROKEN LOOP			
Cold leg temperature (K)		561.4 ± 1.5	
Hot leg temperature (K)		564.8 ± 1.8	

... / ...

... / ...

	Specified Value[a]	Measured Value	
SUPRESSION TANK			
Liquid level (m)	1.27 ± 0.127	1.52 ± 0.06 ²)	(+19.6 %)
Gas volume (m^3)		47.90 ± 2.11	
Water temperature (K)		354.4 ± 3	
Pressure (gas space) (kPa)		99.5 ± 3	
Boron concentration (ppm)		3898 ± 15	
EMERGENCY CORE COOLING SYSTEM			
Borated water storage tank temperature (K)	303 ± 3	303.4 ± 7	
Accumulator A liquid level (m) ..	2.15 ± 0.03	2.11 ± 0.01 ²)	(-1.8 %)
Accumulator A standpipe position (above inside bottom of tank) (m)		0.4 ± 0.03	
Accumulator A pressure (MPa)	4.14 ± 0.17	4.30 ± 0.06 ²)	(+3.8 %)
Accumulator A liquid temperature (K)	303 ± 3	300 ± 6 ²)	(-0.99 %)
Accumulator B liquid level (m) ..	2.1 ± 0.03	2.08 ± 0.01 ²)	(-0.9 %)
Accumulator B pressure (MPa)	4.14 ± 0.17	4.26 ± 0.06 ²)	(+2.8 %)
Accumulator B liquid temperature (K)	303 ± 3	308 ± 6 ²)	(+1.6 %)

(a) If no value is listed, non was specified.

(b) These values were out of specification.

(c) Steam generator liquid level referenced to 2.95 m (116 in.) above top of tube sheet.

TABLE 2.2. Operational setpoints

Event	Specified (s)	Actual (s)
Reactor scram	1.0 ± 0.025	-0.99 ± 0.01
QOBV open	0	0
Primary pumps turned off	1.25 ± 0.25	0.91 ± 0.01
FPMS isolation valve opened	29 ± 2	29.2 ± 0.1
BLCL QOBV closed	49 ± 5	62.5 ± 0.1
FPMS incore isolation valves closed[a]	341	340.8 ± 0.05
Accumulator A & B injection started[b]	347 ± 1	344.3 ± 0.05
FPMS BLHL isolation valve closed[c]	371 ± 2	371.7 ± 0.05
Accumulator injection stopped[d]	507 ± 1	506.5 ± 0.5
HPIS injection starts[d]	507 ± 1	515.8 ± 0.5
BLHL QOBV closed[e]	<527	535 ± 1
QOBV isolation valves closed[f]	>527	695 ± 1

(a) Defined as when 3 peripheral thermocouples measured 1037 K (1408 °F).

(b) 5 to 7 s after FPMS incore isolation valves closed.

(c) 30±2 s after FPMS incore isolation valve closure.

(d) 160 s after accumulator injection initiation.

(e) Within 20 s after accumulator injection termination.

(f) After closure of BLHL QOBV.

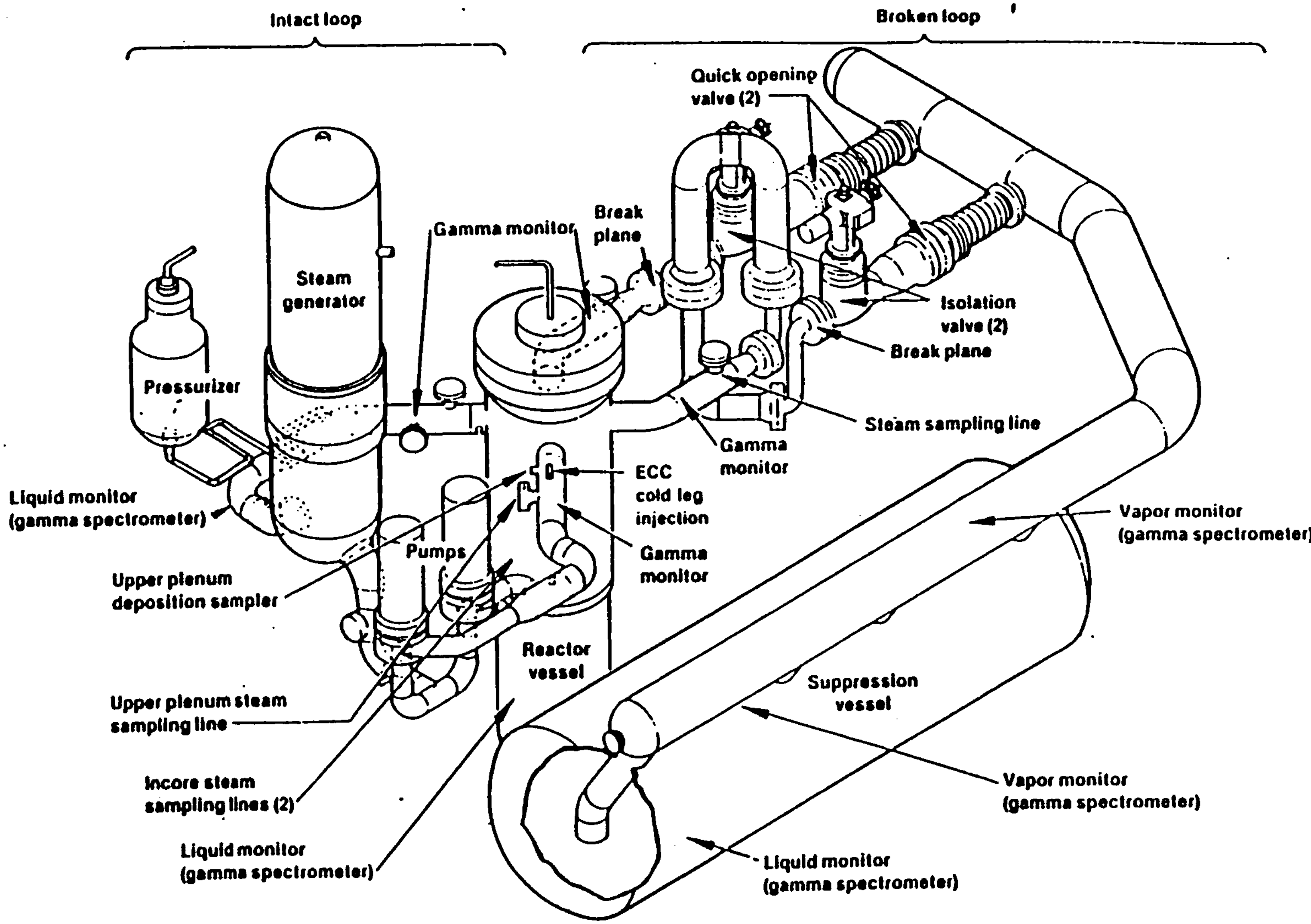


Figure 2.1. Axonometric representation of LOFT system

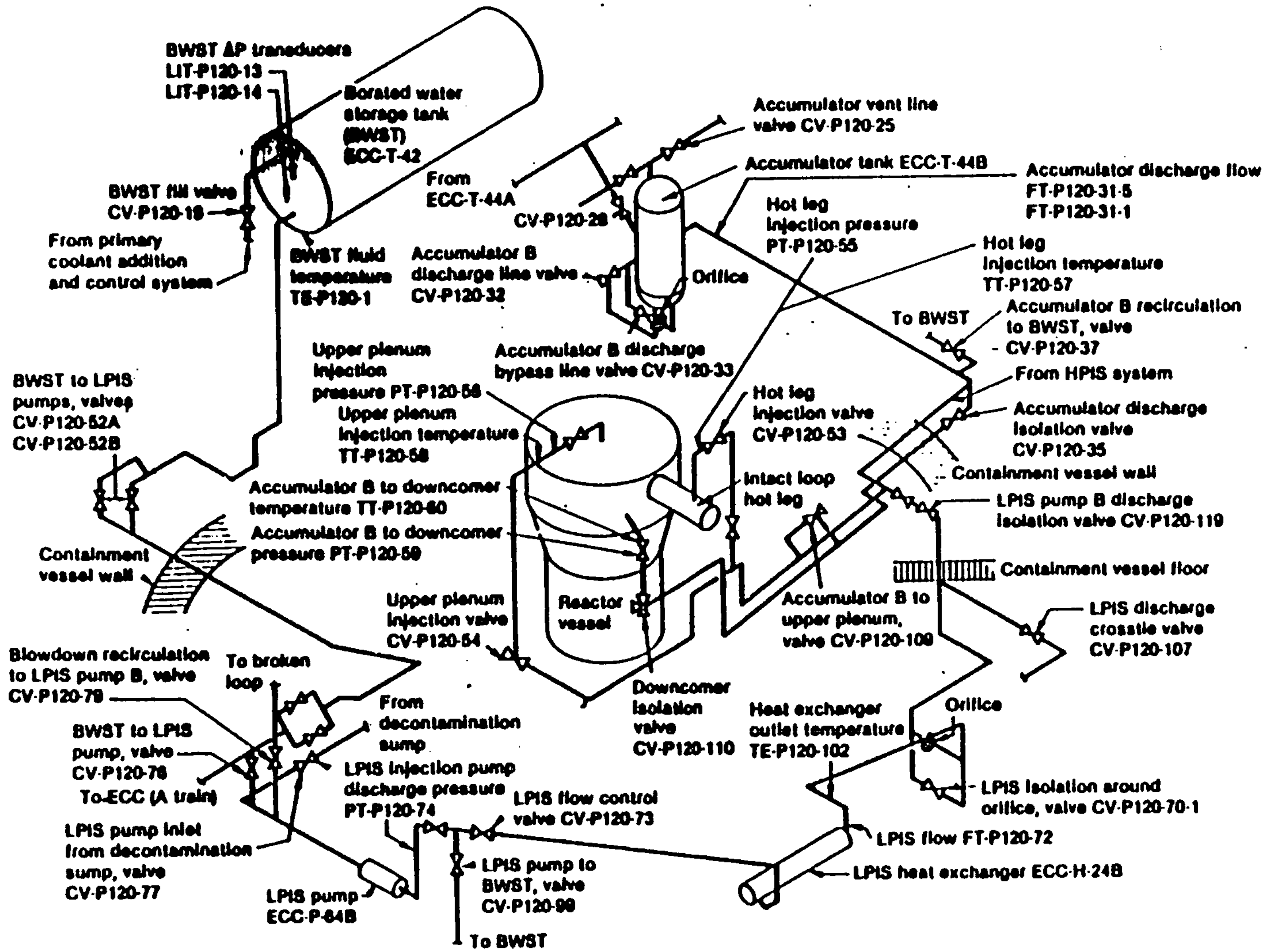


Figure 2.2. Emergency Core Cooling System

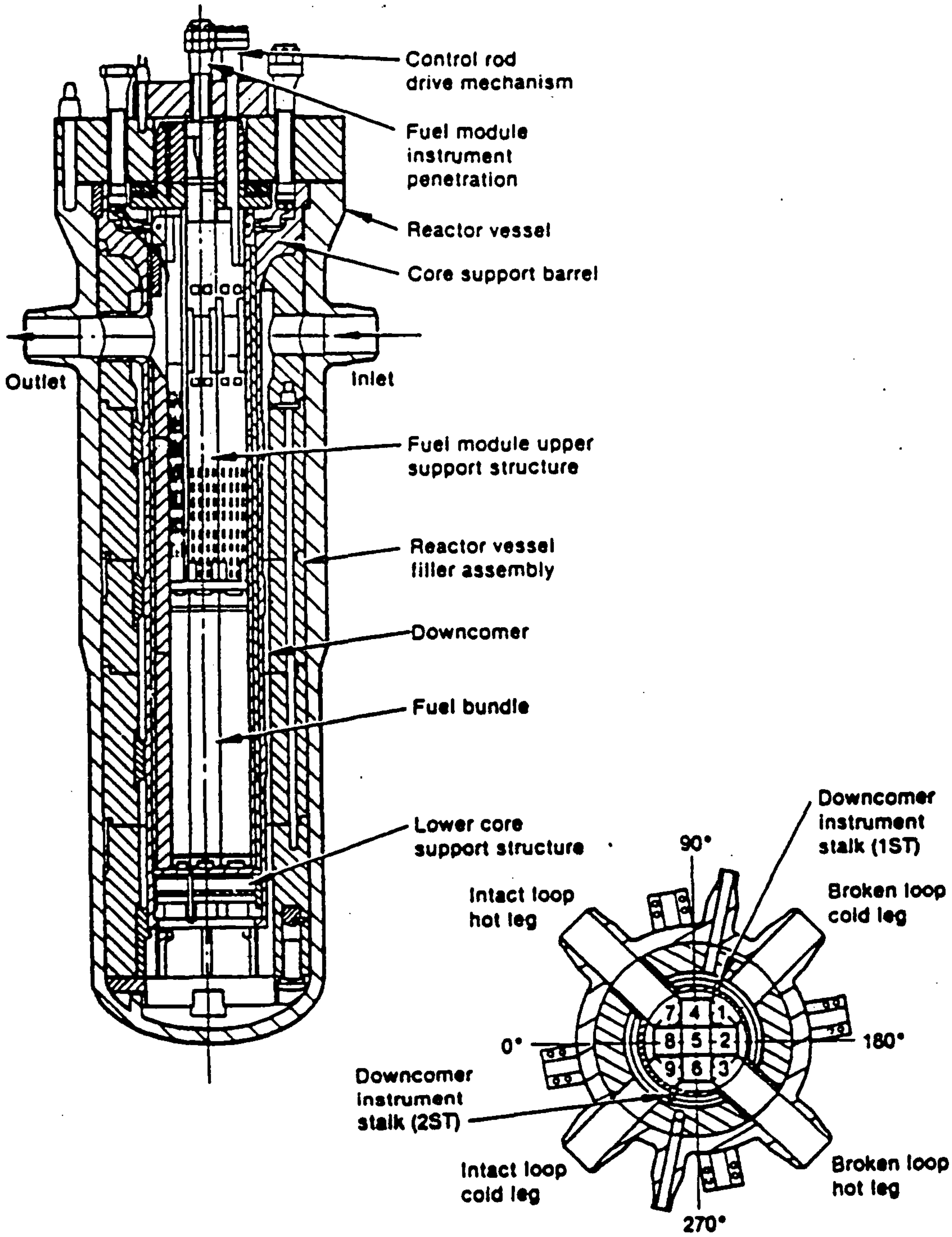


Figure 2.3. Loft rector vessel

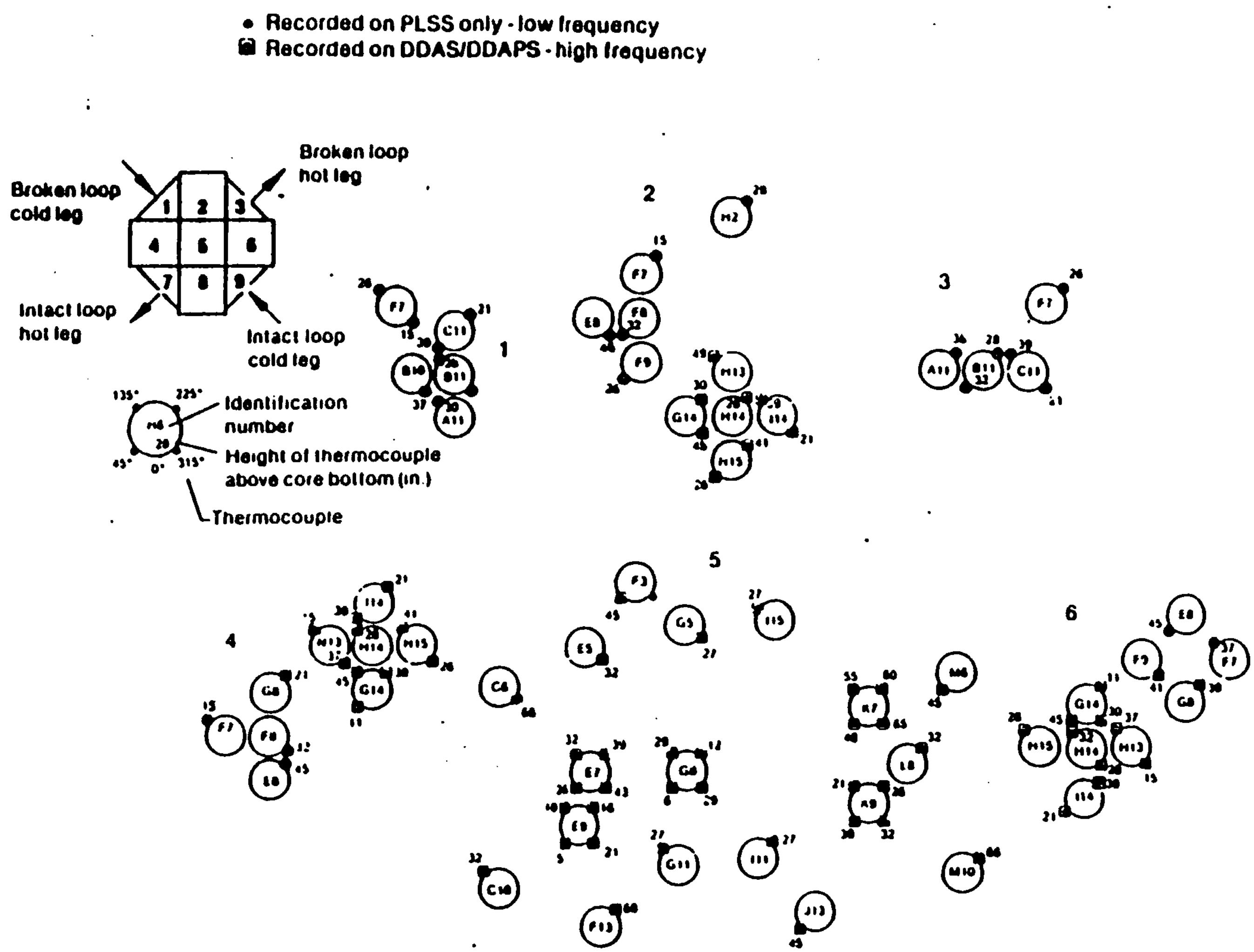


Figure 2.4. Fuel cladding thermocouples in core

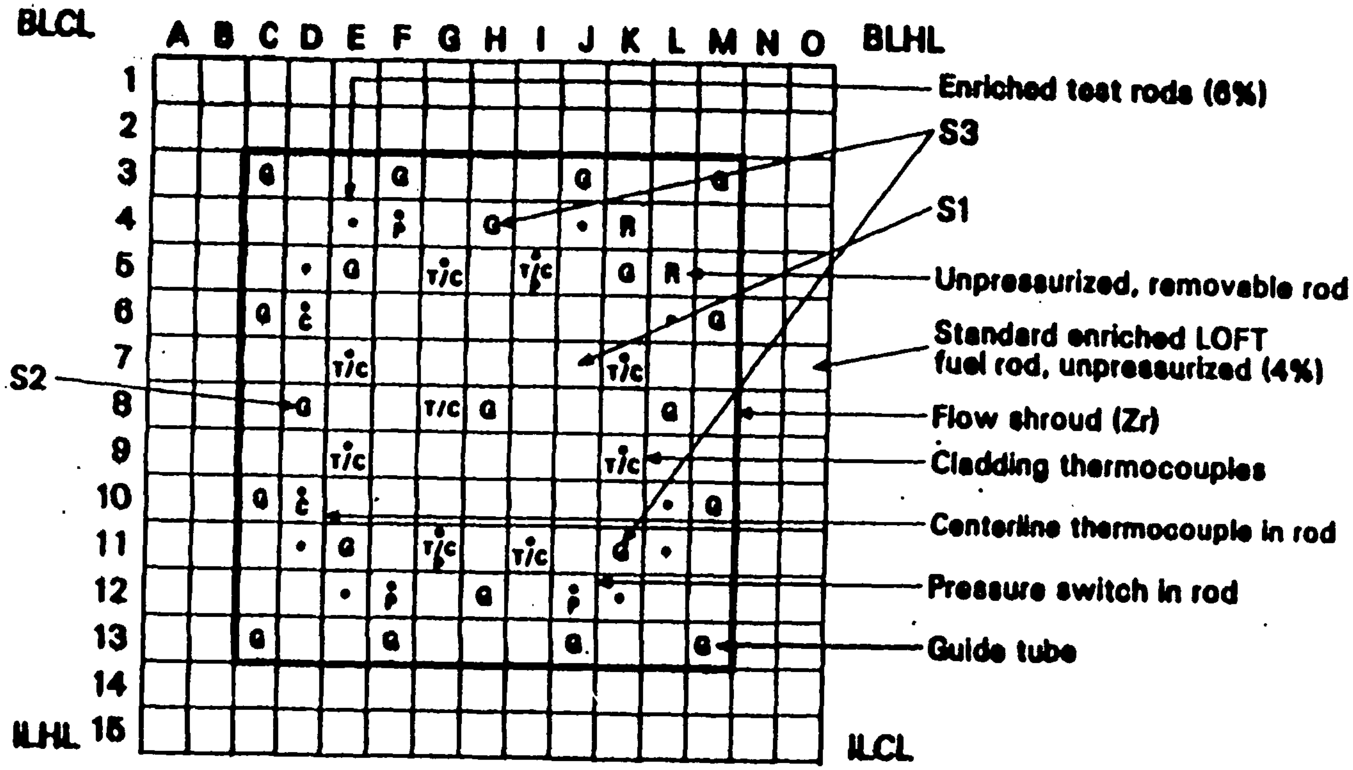
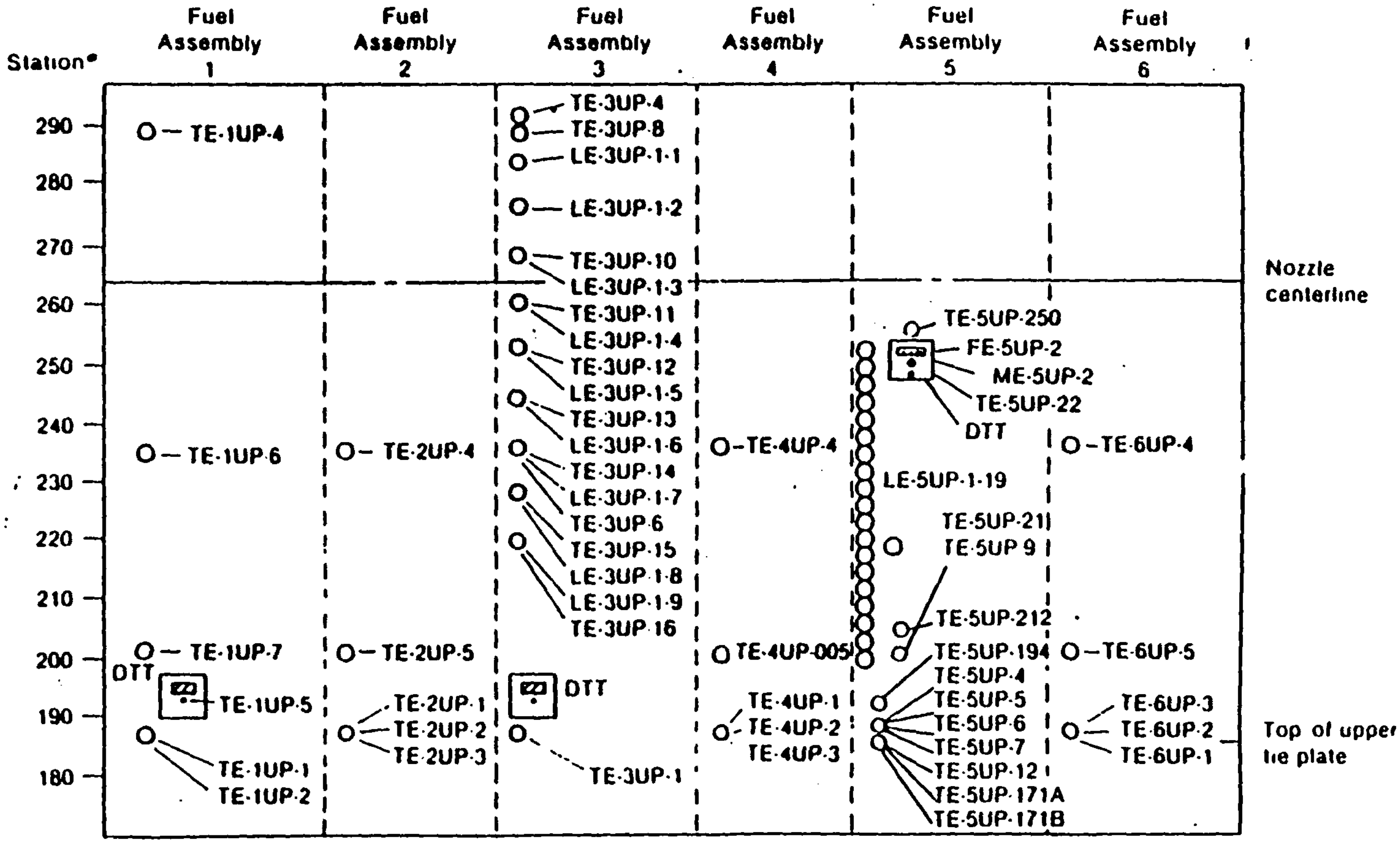


Figure 2.5. Central fuel assembly instrumentation



*Station numbers are a dimensionless measure of relative elevation within the reactor vessel. They are assigned in increments of 25.4 mm with station 300.00 defined at the core barrel support ledge inside the reactor vessel flange

Figure 2.6. Upper plenum thermocouples

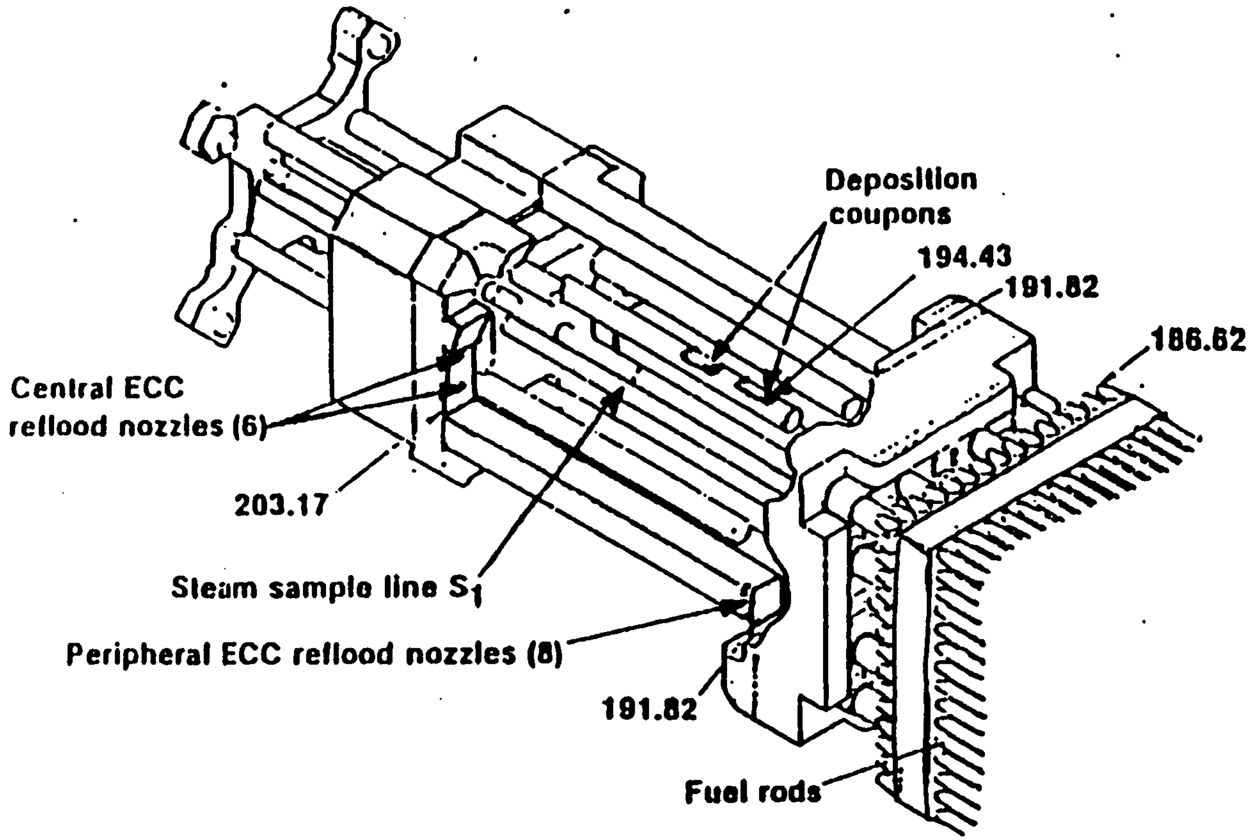


Figure 2.7. Accumulator B upper head injection

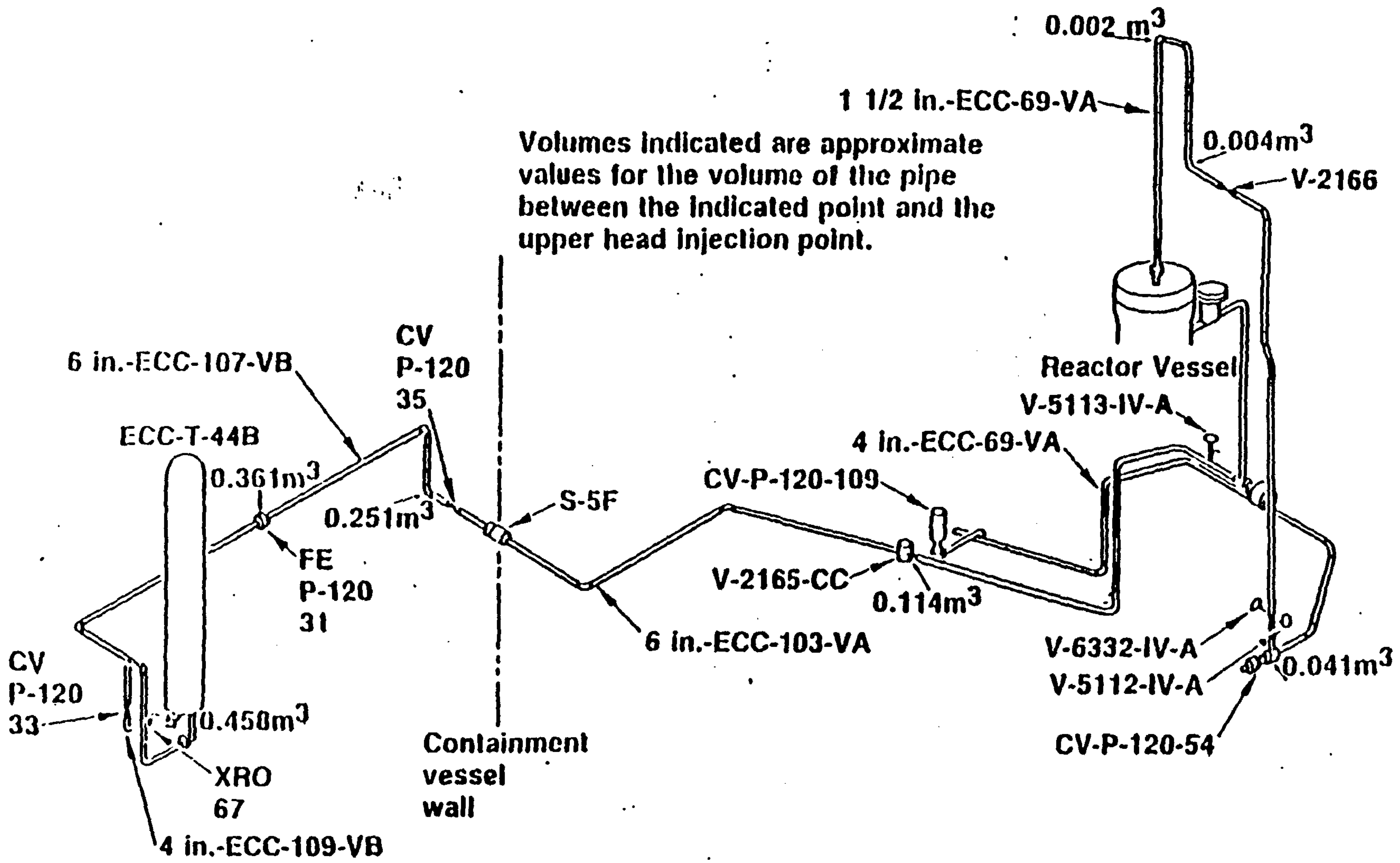


Figure 2.8. Accumulator B injection line

3. INPUT MODEL AND NODALIZATION

3.1 Code

Code used was TRAC-PF1/Mod 1 (version 11.0), installed on CDC Cyber 830.

The Transient Reactor Analysis Code (TRAC serie P) is an advanced best-estimate code for handling PWR accidents, having the capability to make a 3-D model in the reactor vessel. Code uses full two-fluid model with two-steps numerics in the one-dimensional components and may also handle a noncondensible gas field.

TRAC has the capability to treat the following physical phenomena:

1. ECC downcomer penetration and bypass, including the effects of countercurrent flow and hot walls

2. Lower plenum refill with entrainment and phase separation effects

3. Bottom-flood and falling-film reflood quench fronts

4. Multidimensional flow patterns in the core and plenum regions

5. Pool formation and countercurrent flow at the upper core support plate region

6. Pool formation in the upper plenum

7. Steam binding

8. Average rod and hot rod cladding temperature histories

9. Alternate ECC injection systems, including hot leg and upper head injection

10. Direct injection of subcooled ECC water, without artificial mixing zones

11. Critical flow (choking)

12. Liquid carryover during reflood

13. Metal-water reaction

14. Water-hammer effects

15. Wall friction losses

16. Horizontal stratified flow, including reflux cooling

Code has been used without any modification in models or components. No multiplicative factor for minimum stable film boiling temperature (MSFBT) has been introduced.

3.2 Nodalization

Nodalization of the LOFT system for the FP-1 test may be seen in Figures 3.1 to 3.6 and Table 3.1.

Input deck for determinig the plant steady state (actually a first processing by TRAC), is in Table 3.2.

Reactor vessel is modelled as three-dimensional due to the non-homogeneous phenomena registered during the experiment. 3-inner rings represent the core and the 4th downcomer,which extends from level 3 to level 11. Core covers levels 4 to 8 and loops insert at level 11.

First ring simulates the central (11 x 11) fuel assembly and around, a zircaloy shroud. Second and third rings are the internal parts of the peripheral bundles. Vessel is nodalized in 192 cells.

Bypasses have been introduced in the nodalization for getting a better calculation of core liquid fraction (underestimated in pretest calculations). Description and calculations of these bypasses may be found in reference [3]:

- 4 bypasses connecting lower and upper plena, carrying 4.7 % of the flux through the intact loop in the steady state.

- 3 bypasses from downcomer to lower plenum, carrying 4.1 % of the above mentioned flux.

The existence of 1300 rods in the core was simulated using 18 "theoretical" TRAC rods:

- 12 standard rods, representing 4 % enriched fuel rods, one per internal cell.

- 4 rods with peak factor 1.25, simulate the 24 - 6 % fuel rods, one per cell in the central ring.

- 1 rod in cell 8 with peak factor 1.094

- 1 rod in cell 12 with peak factor 1.236

Rod axial dynamic renodalization factor is fixed in a value of 11, instead the initially selected of 60, due to high running times.

Decay heat used has been obtained from the previous power and burn-up histories and may be seen in Table 3.3.

Figure 3.4 shows the intact loop nodalization, including pressurizer, primary side of SG and ECCS with the roots of LPI and HPI systems:

- Accumulator A has been simulated as a PIPE component instead an ACCUM component for avoiding calculation time. Flow rates correspond to those of a 1300 MW scaled KWU reactor.

- Cold leg is fractioned in several cells for helping follow condensation when the accumulator begins to inject.

- Pressurizer has been simulated also as a PIPE for the same reason as before. FILL connected at the upper end represents a relief valve.

Steam generator secondary side is modelled as a STGEN component, including secondary downcomer, main steam line and steam control valve (see Figure 3.5).

Broken loop is shown in Fig 3.6. where secondary sides of TEES represent Reflood Assist Bypass Valve, connecting both legs. Hot leg, which includes simulators of steam generator and pumps, is nodalized in detail but the cold leg has been defined using the minimum number of nodes, due to the TRAC ability for modelling the choked flow.

Accumulator B has been nodalized as 12 independent FILLs (one for each cell) rooted on the vessel axial node 9, where the upper head injector is located. Each FILL has the same injection history (see Fig 3.7 and Table 3.4) but different weights. History has been defined to be azimuthally symmetric but non-homogeneous from one ring to another. During the blow-down and heatup phases, these weights are:

Ring	Weight	Weight per cell
1	0.33	0.0825
2	0.67	0.1675
3	0.	0.

Planned injection from 345 s on, follows the measured data from accumulators and the corresponding weights are:

Ring	Weight	Weight per cell
1	0.20	0.05
2	0.34	0.085
3	0.46	0.115

Unexpected injection history from accumulator B line has been selected through several parametric studies from different authors and from the data registered by thermocouples such as TE-5UP-004 (see Fig 3.8), guide tubes and flowmeter FE-P120-31. Main characteristics of the selected injection were:

- Bulk of mass injection starts at 16 s, being preceeded of a slight mass flow of coolant.
- Duration of this injection expands up to 100 s.
- Mass flow doesn't cease during the heatup phase.
- A second injection peak exists al 270 s.
- Total unplanned mass water injected is 400.5 Kg.

Trips defined in TRAC to simulate the events occurred during the experiment, were:

t(s)	Event	Components
0.	SCRAM	50
1.	QOBVs aperture	32,43
2.	Pumps disconnect	4,5
63.5	QOBV (BLHL) closes	43
345.	Reflood begins	15

Accumulator B and BREAKS are inhibited during the plant steady state calculations. When this state is reached, code starts the transient using restart data and the input deck in Table 3.5.

TABLE 3.1. Nodalization elements of LOFT system

	Component Number	Description	Number of Cells	
			Primary	Secondary
Intact	1	Hot leg--TEE	8	3
Loop	2	Steam generator--STGEN	10	5
	3	Steam generator to pump piping--TEE	3	3
	4	Pump--PUMP	2	-
	5	Pump--PUMP	2	-
	6	Pump discharge--TEE	2	1
	7	Cold leg--TEE	9	1
	8	Pressurizer--PRIZER	3	-
Steam	21	Header-TEE	2	1
Generator	22	Downcomer--TEE	4	1
Secondary	23	Exit valve--VALVE	6	-
	24	Water inlet--FILL	-	-
	25	Steam exit--BREAK	-	-
Vessel	50	Vessel		
		Axial levels	12	
		Radial segments	4 192	
		Azimuthal sectors	4	
Broken	31	Hot leg--TEE[(a)]	26	3
Loop	41	Cold leg--TEE[(a)]	2	2
	32	Hot leg break-BREAK	-	-
	42	Cold leg break--BREAK	-	-
	43	Cold leg break--VALVE	4	-
Emergency	12	HPI connection and piping--TEE.	1	1
Core	13	LPI connection and piping--TEE.	1	1
Cooling	14	Accumulator check valve--VALVE.	2	-
Systems	15	Accumulator-ACCUM	3	-
	16	HPI--FILL	1	1
Upper Plenum	81-92	Upper plenum connections, Cells 1 through 12, Vessel Level 9--PIPE	1	-
ECCS	61-72	Upper plenum fills--FILL	-	-

(a) Secondary sides of hot and cold bloken loops represent reflood assist bypass lines.

TABLE 3.3. Decay heat in LP-FP-1

t(s)	DH (MW)	t(s)	DH (MW)
0.	37.	4.	1.987
0.3	32.425	6.	1.875
0.9	9.875	8.	1.792
1.28	5.514	10.	1.726
1.38	3.990	15.	1.605
1.40	3.299	20.	1.518
1.46	2.996	30.	1.396
1.52	2.648	40.	1.309
1.59	2.332	60.	1.136
1.61	2.271	100.	1.070
2.	2.155	200.	0.950
3.	2.062	300.	0.840
		10.E4	0.053

TABLE 3.4. Unplanned injection history

t(s)	Mass flow rate (Kg/s)	Integrated flow (Kg)
0.	0.	0.
0.45	13.0	2.9
1.	0.	6.5
2.	0.67	6.8
16.	0.67	16.2
38.	7.2	102.8
40.	5.9	115.9
100.	0.	292.9
175.	0.5	311.6
255.	0.5	351.7
265.	0.	354.2
271.	1.8	359.6
277.	0.5	366.5
345.	0.5	400.5

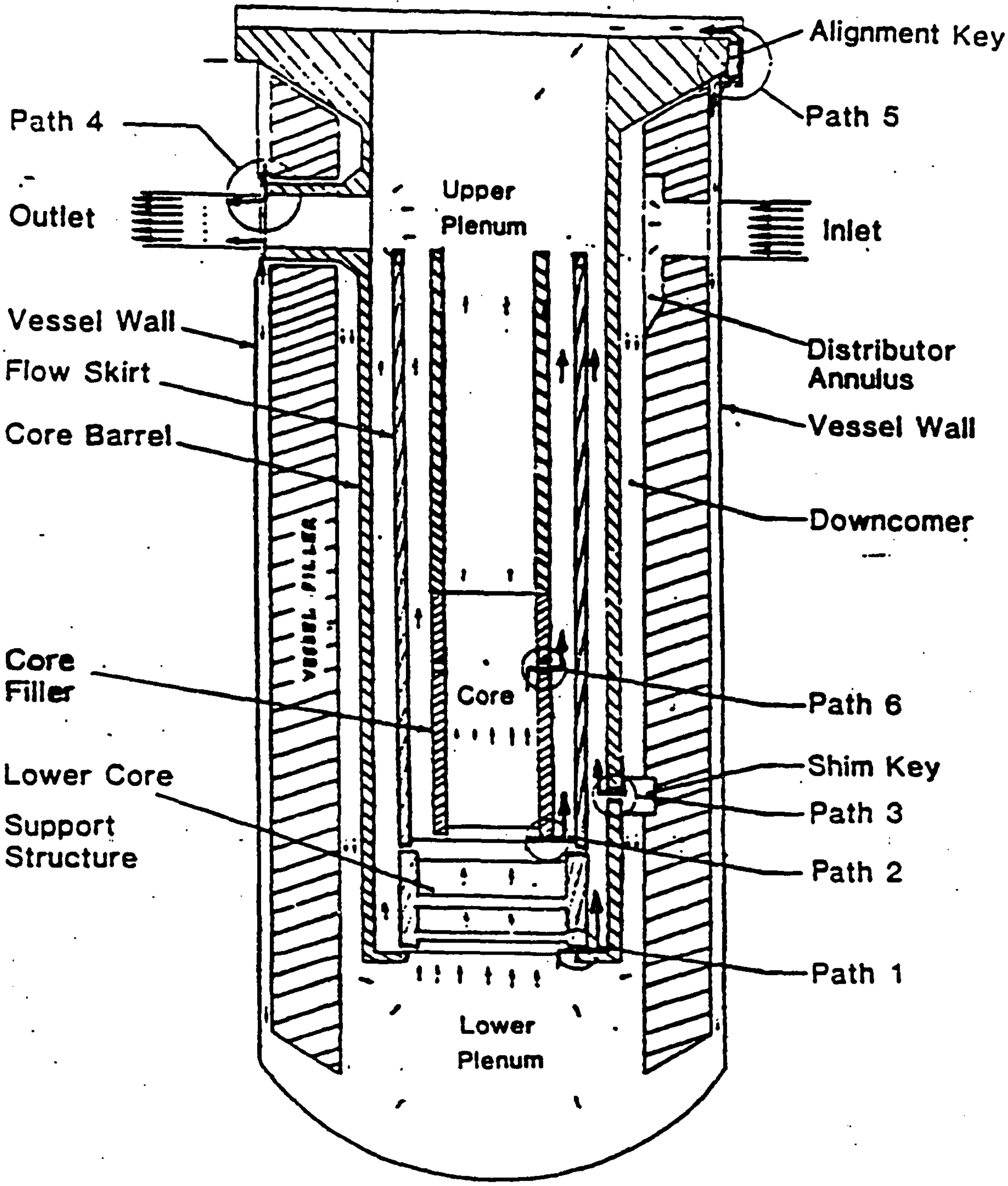


Figure 3.1. Section of LOFT reactor

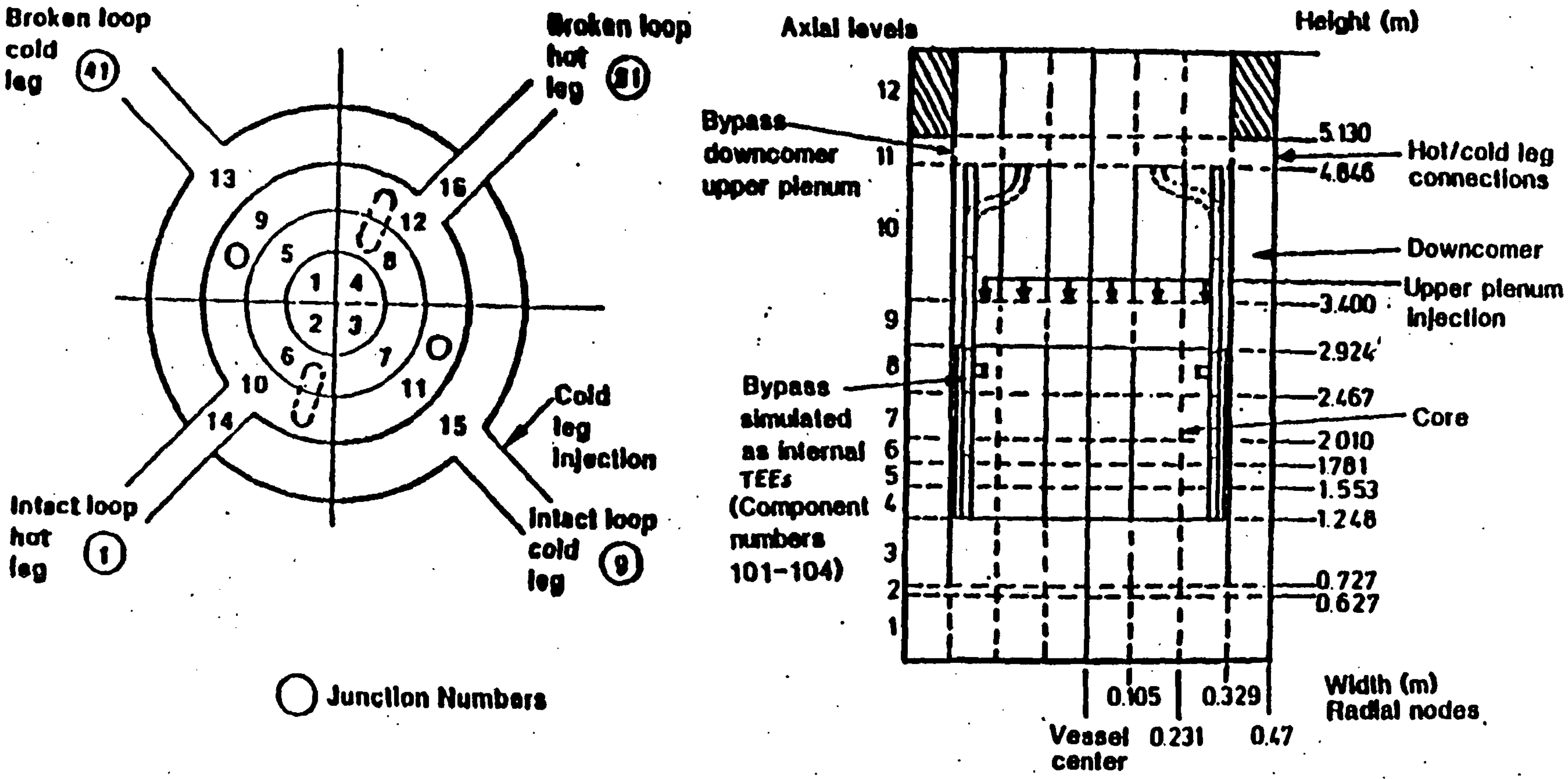


Figure 3.2. Vessel nodalization

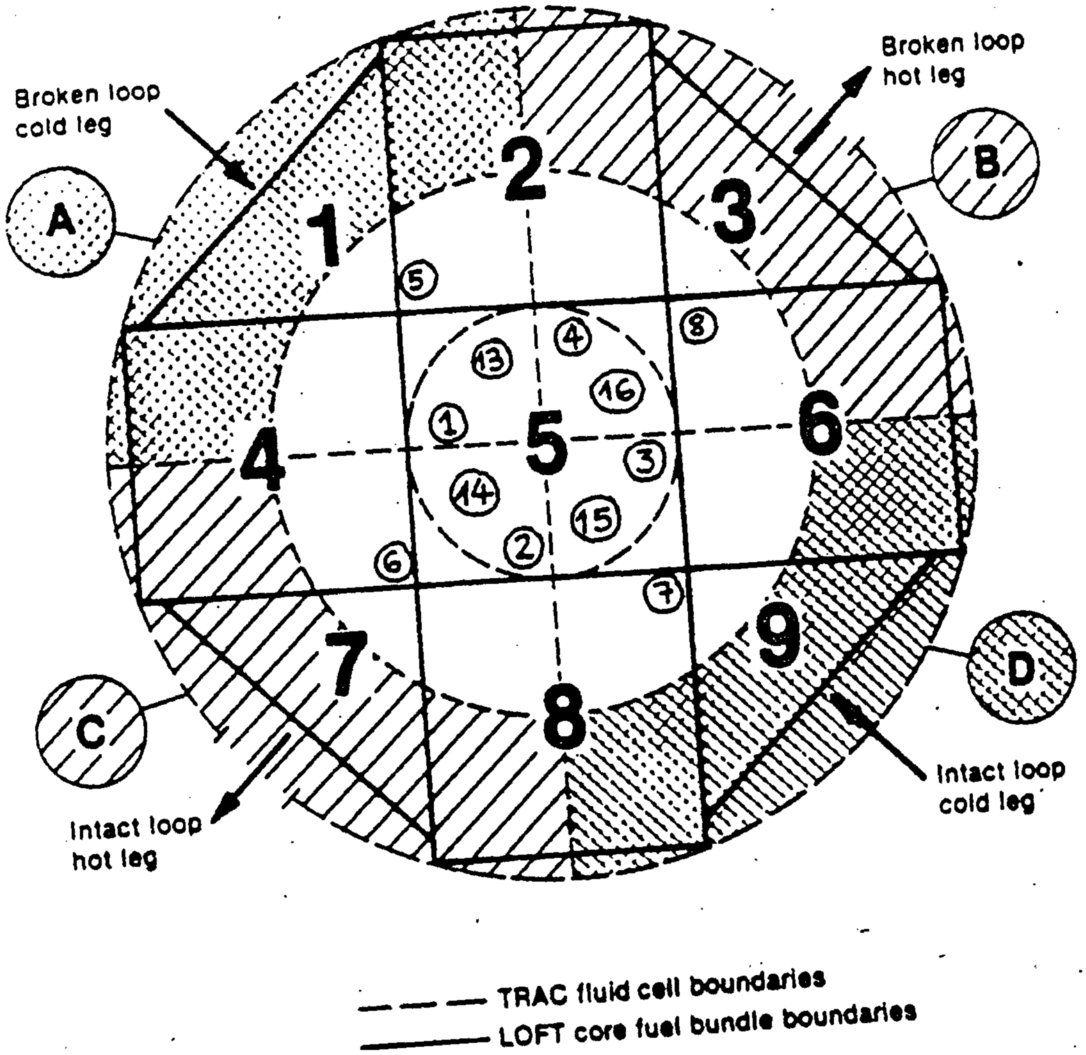


Figure 3.3. Simulated rods location

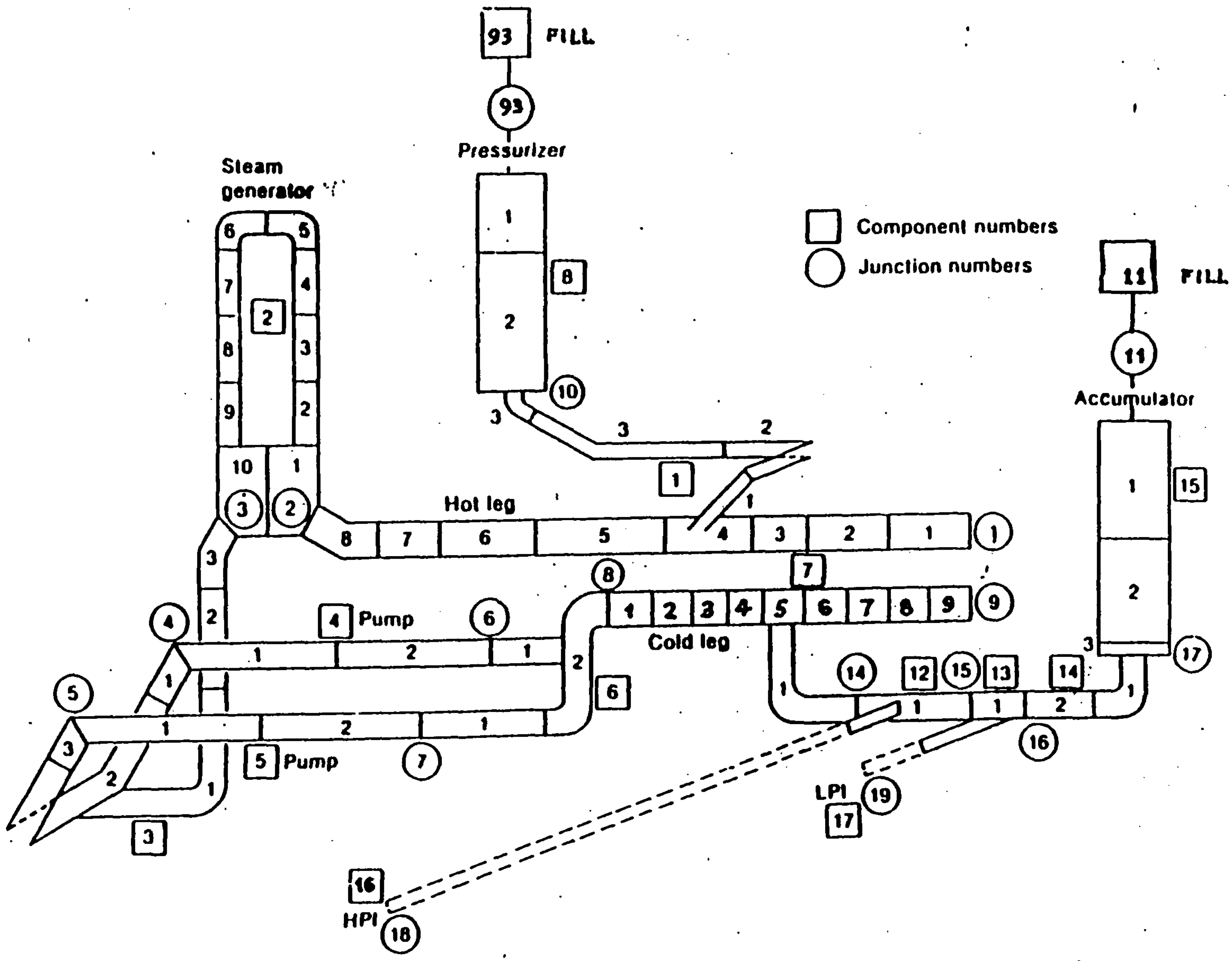


Figure 3.4. Intact loop nodalization

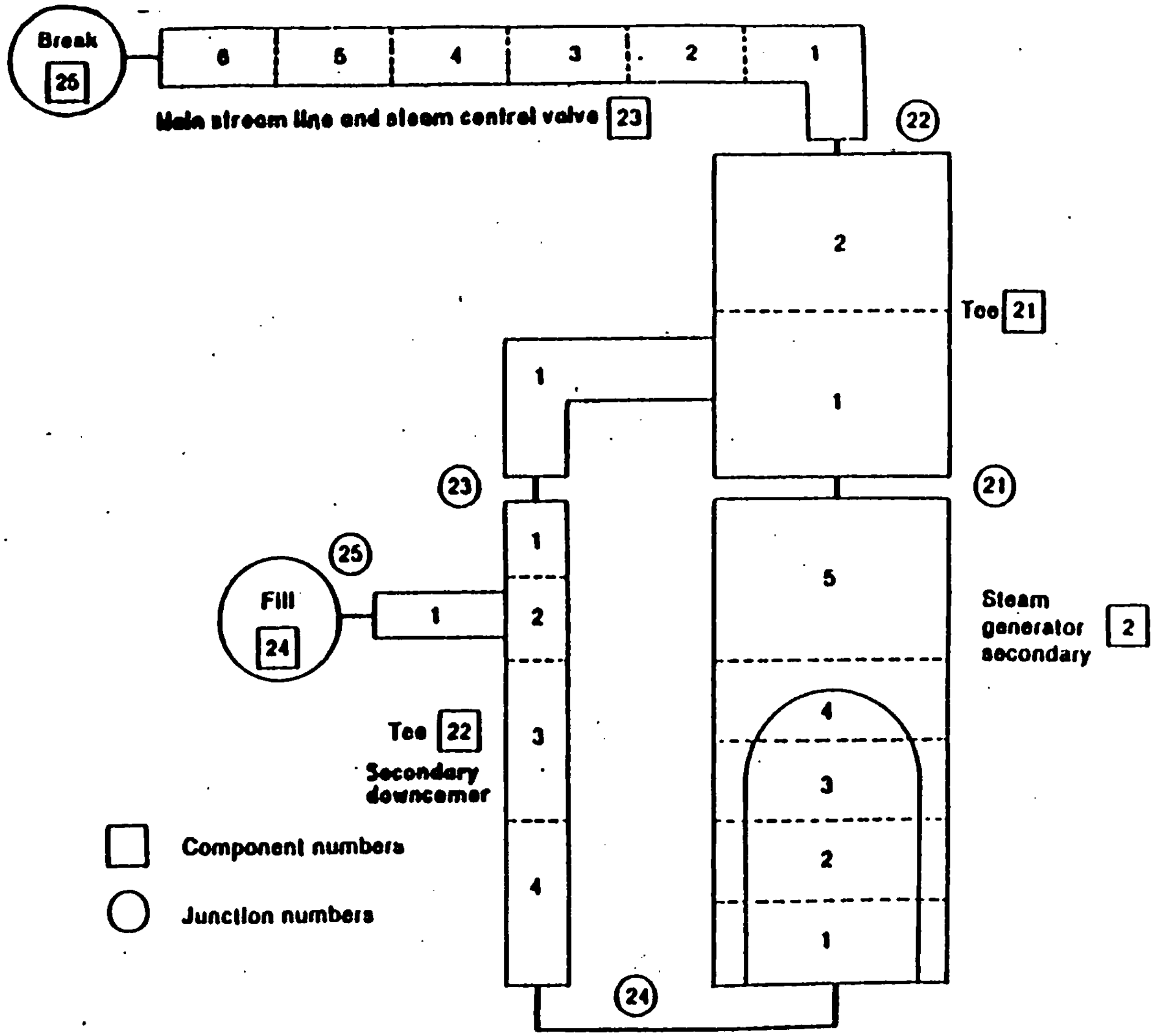


Figure 3.5. Steam generator secondary side nodalization

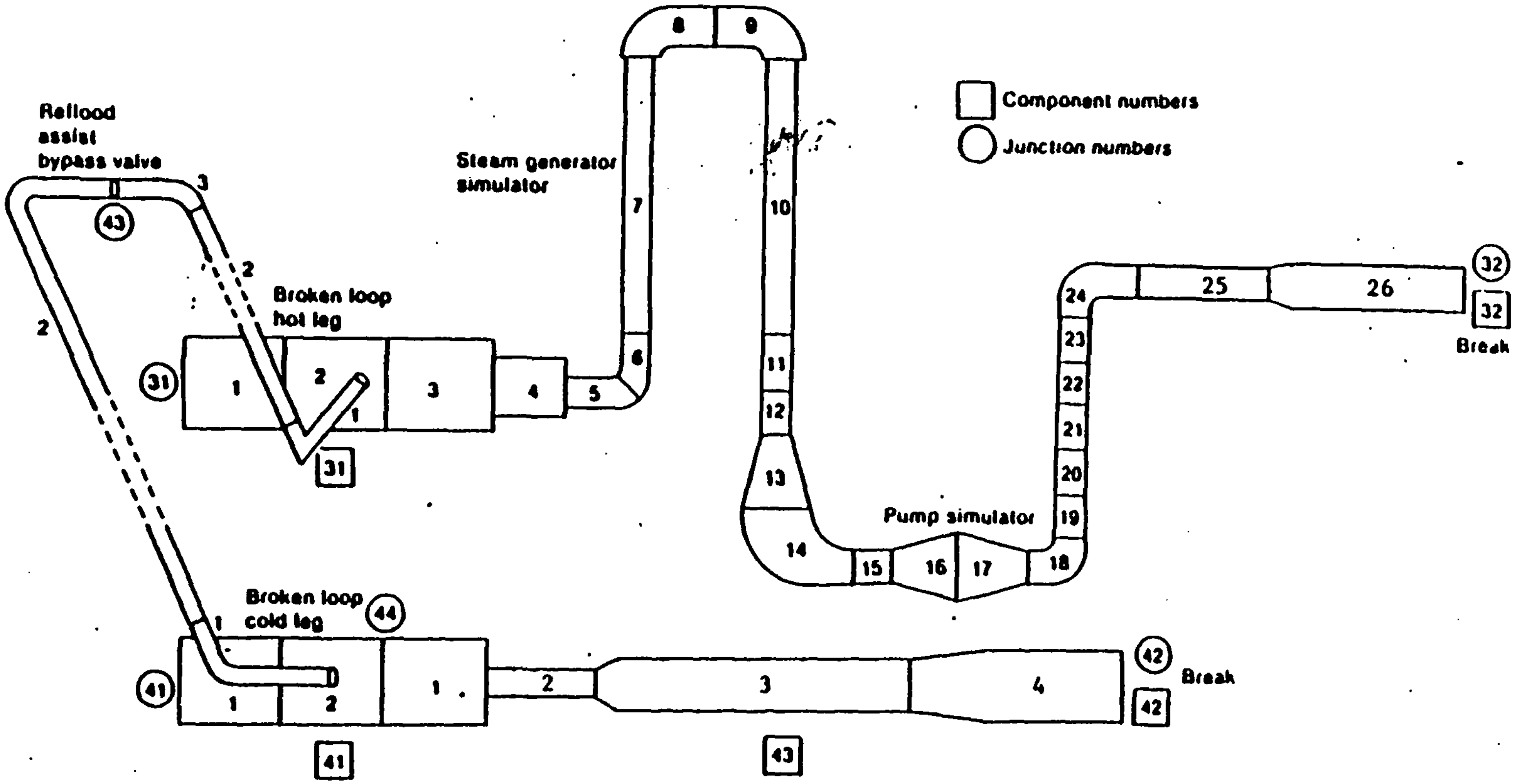


Figure 3.6. Broken loop nodalization

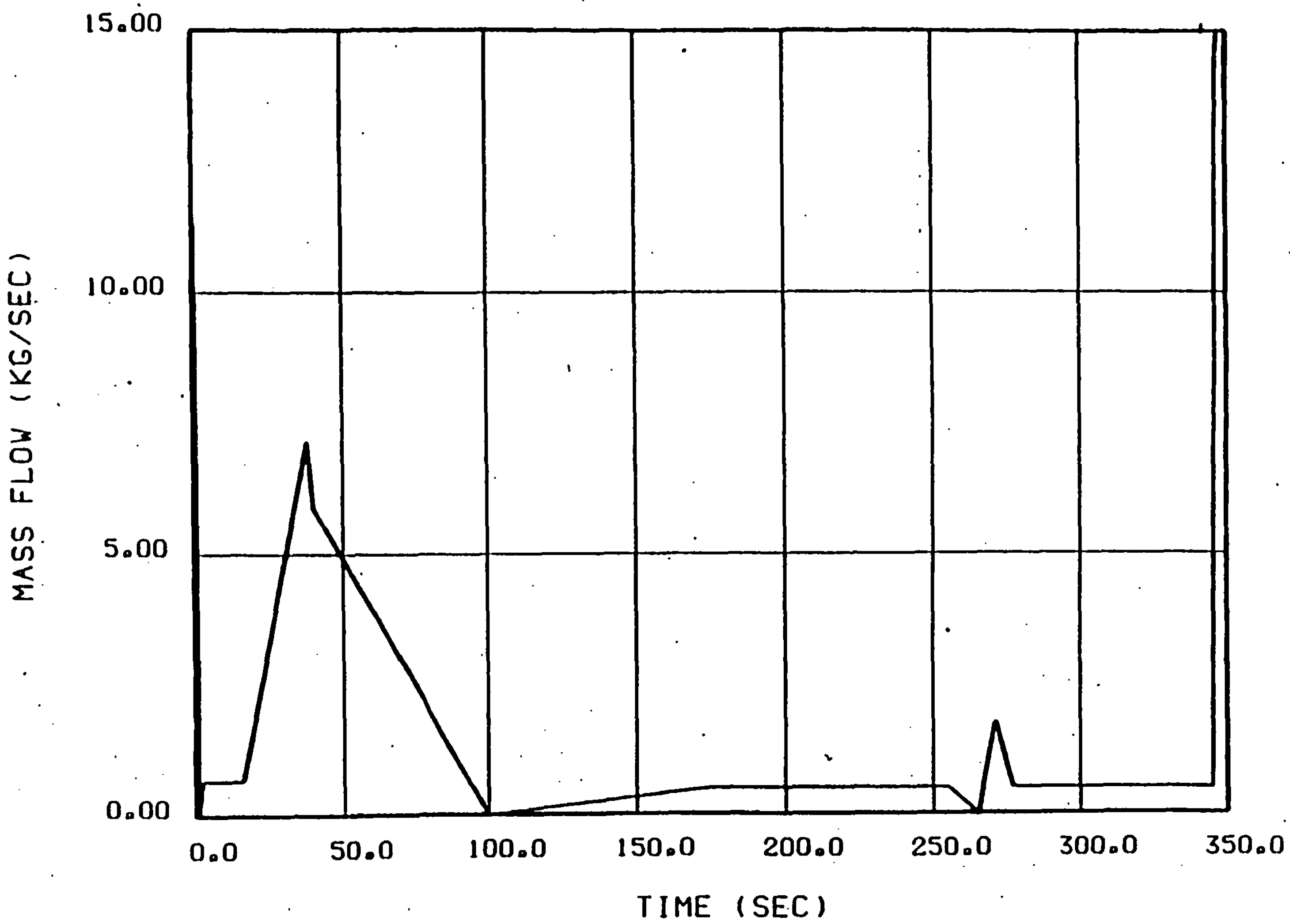
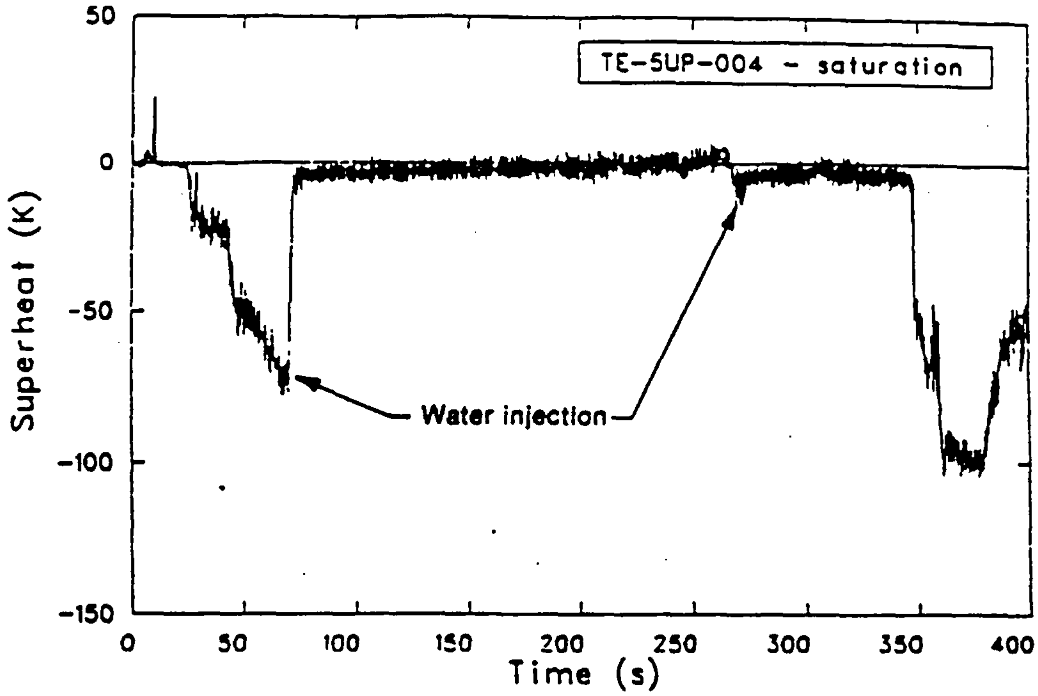


Figure 3.7. Unexpected injection history



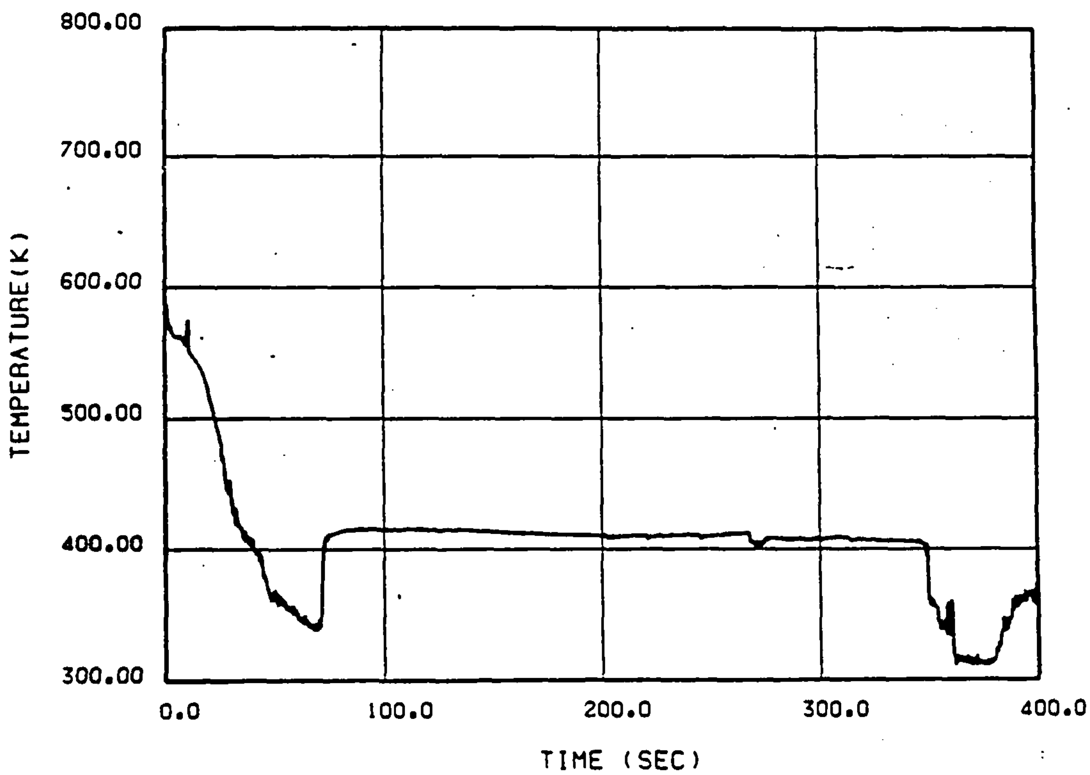


Figure 3.8. TE-5UP-004 measurements

4. RESULTS

4.1 Steady state

Plant steady state conditions have been determined after 52 s of "pseudo-transient" for starting the transient phase calculations, based on the referred input model.

Table 4.1 resumes the final values for a representative set of variables, compared with the equivalent measured ones. The agreement is good in general, except in the case of the steam generator dome pressure, which shows a minor convergence rate. The main consequence of this fact is to have a slightly higher temperature in the intact loop (mantaining differences between hot and cold legs), without influence on the transient evolution.

Convergence criteria used (also in transient) have been:

- Inner convergence : 5.0E-6
- Outer convergence : 5.0E-4
- Steady state convergence : 1.0E-5
- Maximum number of iterations in vessel : 50
- Maximum number of outer iterations : 10
- Maximum number of steady state iterations : 25

Total calculation time for this 52 s of pseudo-transient has been 89400 s of CPU.

4.2 Transient

We analize in this chapter, results obtained after simulating 400 s of transient, compared with measured data along the experiment. In the case of hydraulic variables, comparison is done between registered data and the variable calculated in the TRAC node related to the detector actual location. For cladding temperatures, code provides information at fixed rod heights; measurements for each thermocouple is compared with the calculations in two adjacent levels and, in some cases, using a cosine law interpolation.

Analysis is mainly directed to explain the asymmetry in the damaged rods distribution and to determine vessel thermal-hydraulic conditions during the fuel rod rupture period (325-345 s), in connection with fission products generation and transport.

Start time of simulation begins at scram time in order to take into account its effects on the plant thermal-hydraulic state, mainly on rod temperatures. From simulation start point through the instant of QOBV apertures, cladding temperatures decrease remarkably, while hydraulic variables remain nearly constant.

4.2.1. Exit flows

When QOBVs open, system pressure drops suddenly due to the subcooled flow through the breaks. Code slightly overestimates (~7 %) system pressure up to 16 s, when becomes lower than the observed one, partly because of the unplanned injection existence. The final pressure in the blowdown phase is well calculated (see Fig 4.1).

Figures 4.2 to 4.5 show mass flow rates through the loops, and figures 4.6 to 4.9 the corresponding densities.

Sudden aperture of QOBVs in the broken loop drives the fluid, initially subcooled, to flow out at high velocity, higher in the cold leg, a way with a lower resistence. As pressure continues decreasing, fluid in the broken loop suffer saturation conditions, reaching critical velocity and reducing the mass flow rate. Simultaneously in the intact loop, flow decreases but at lower rate so there is a net positive mass inventory in vessel, causing a bottom-up quench, starting at 4.5-5 s in simulation time (1 s less in real experiment time) (see Fig 4.10 for CORE).

Mass flow rate in the ILHL shows a good agreement with FR-PC-205 detector measurements up to 7 s, when code calculates a back flow from the pressurizer and steam generator. Total mass implied in this flow is about 500 Kg in 18 s, which causes a top-down quench. Fig 4.6 is a plot of the density in ILHL showing two peaks, one for each mentioned back flows (pressurizer and steam generator). First peak is underestimated and delayed, but the second one is simulated properly.

In the ILCL, there is no reference data, because detectors have been removed in this experiment.

Agreement of mass flow rates in BLHL with experimental data is exceptionally good, matching the peaks caused by the mentioned quenches.

Code underestimates the mass flow rate in the BLCL during the initial phase, causing a greater mass inventory and, consequently, a greater pressure as Fig 4.1 has showed (always in the range of the experimental data uncertainties).

Vessel liquid fraction for upper plenum, core and lower plenum may be seen in Fig 4.10, where all the referred initial hydraulic effects can be observed in timing and relative magnitude.

4.2.2 Initial quenches

Loss of coolant and depressurization have as a direct consequence the interruption of fission processes and a drastic fall in the capability of cooling the fuel rods, from now on producing only decay heat.

Figures 4.11 to 4.14 show the evolution of cladding temperatures for the simulated 6 % fuel rods 13, 14, 15 and 16, at heights 0., 0.305, 0.533, 0.762, 1.219 and 1.676 m, during the blowdown phase. Fig 4.15 to 4.18 show, for the same rods and heights, the evolution in the whole transient (blowdown, heatup and reflood phases).

The explanation of the behaviour in cladding temperatures, can be derived from the comparison between this TRAC calculated variables and the corresponding measurements, such as in figures 4.19 and 4.20.

Code calculates an initial rod dry-out beginning at about 3 s (depending on the level). This first heat-up brings cladding temperatures up to the minimum stable film boiling temperature (MSFBT) or beyond, for almost the whole rod surface. A first (bottom-up) quench stops the rise in temperatures in the bar, but isn't able to destroy the film, as the experiment has showed.

After this slight cooling, temperature grows again (in film boiling regime) through the second quench (top-down at 16 s), which rewets all the bar, remaining yet in the same heat transfer mode, while experimental data show a second quench dropping the cladding temperature to saturation. Code predicts a maximum temperature 2 or 3 s earlier than in the experiment.

Thermocouples remain at saturation several second, but a third dry-out occurs, irregular in timing and magnitude. An unexpected injection, actually non-homogeneous and asymmetric ends this phase. Code responds to the simulated injection only decreasing slowly cladding temperatures and, in some cases (as the 4 % fuel rods in central ring and 6 % fuel rods in cell 3) quenching the whole rod and getting the saturation temperature in the surface, when the MSFBT is reached, but in times delayed up to 40 s, compared with the measured in the experiment.

4.2.3 Heat-up

After the blowdown phase and under the effects of a decreasing unexpected injection, calculated cladding temperatures for rewetted rods begins to departure from nucleate boiling in time very near to the observed. Several thermocouples (such as 5G08 or 5I05) undergoes particular quench situations reaching the DNB point very late. Code, of course, cannot predict these special cases because simulated injection is defined to be symmetric.

DNB point is exceptionally well matched in rods 5G08, 5I11, 5E09 and 4G14, all of them starting from saturation.

Calculated mean heating rate, from DNB to reflood point, for 6 % fuel rods is about 3 K/s at peak power elevation, being 4-5 K/s a typical value for the initial rate. Calculated values are very near to measured data.

In those cases when cladding is in film boiling regime, the slope is nearly the same or lower, but starting at temperatures 200-300 K higher (see figure 26).

The effects of a second peak of injected water at 270 s, which provides about 12 Kg of coolant, are seen as a little decrease of 10-15 K in cladding temperatures. Actually, this was distributed in a very chaotic way, such as several thermocouples showed (including those in guide tubes).

Heat-up follows steadily from this point through the simultaneous injection from accumulators A and B at 345 s.

Table 4.2 resumes the maximum cladding temperatures reached in the TRAC simulated rods at peak power elevation (27 inch). Marked values correspond to those rods which remain in film boiling regime during the whole transient. Fig 4.23 to 4.25 show the behaviour of those instrumented 6 % fuel rods which ruptured, compared with the corresponding TRAC calculations. In the case of 5G11, the agreement is exceptionally good, because of heat-up starts from saturation.

For peripheral rods (Fig 4.26), when the simulated rod has descended from film boiling regime, the fitting in the final heat-up phase is sucessful.

Thermocouples cited above, show succesful fits between calculations and measured data along the final heat-up phase. In the case of 5G08 (4 % enriched fuel rod), predicted cladding temperature is lower than the registered during the final heat-up phase, so it's possible that the actual temperature in central element during the rod rupture period were slightly higher than the calculated one. This comment is derived from only one 4 % enriched rod and must be seen as an hypothesis.

4.2.4. T/H conditions during rod rupture period

Results from TRAC shows that all the hydraulic variables were nearly constant during the period in which, eight 6 % fuel rods ruptured (325-345 s).

A small quantity of water from accumulator B line was falling over the element during this phase, as some detectors showed (see Fig 3.8 for TE-5UP-004). We are feeding the system with 0.5 Kg/s of coolant in this period, which flows down among the rods, vaporizing partly.

Tables 4.3 to 4.4 resume the mean (ring averaged) vapor and liquid behaviour during the rod rupture period, when eight 6 % fuel rods failed. Fig 4.27 shows the flow patterns (also during rupture period, when 8 - 6 % fuel rods failed. Figure averaged per ring) through the vessel.

One may see two possible and alternative paths for the generated fission products, both starting at peak power elevation (where there is a stagnation point) through BLHL:

- Ascending from this point to the upper plenum
- Descending from peak power elevation to the lower plenum and then, ascending through the peripheral bundles in ring 3.

Vapor in the upper plenum has a very asymmetric behaviour (Fig 4.28 and 4.29), which may be explained by the presence of the hot legs. Those cells near to the cold legs have near identical values.

In second ring (inner parts of peripheral bundles), vapor is nearly stagnant during this period.

4.2.5. Combined injection

From 345 s on, both accumulators inject coolant for system recovery. Injection caused dramatic oscillations in all plant variables, except on cladding temperatures which drop steadily to the moment when the MSFBT is reached and the film is destroyed. Quenching is nearly instanteneous but happens with a great delay respect to the measured final quench times. Enriched fuel rods (6 %) doesn't have completed the rewetting phase at 400 s in TRAC calculations.

Some other characteristics of the reflood period are:

- Core liquid fraction rise from 0. to 0.8 at a rate of 4 Kg/s (see figure 4.30).

- Vapor temperature in the core, decreases at a rate of about 6.5 K/s near the peak power elevation.

- Cooling rates for cladding temperatures are about:

  7 K/s for 4 % enriched fuel rods in central element.
  10 K/s for 6 % enriched fuel rods in central element.
  10 K/s for 4 % enriched fuel rods in peripheral elements.

TABLE 4.1. Plant calculated steady state

	Measured	TRAC/PF1
Hot leg pressure (Mpa)	14.77 + 0.07	14.87
Hot leg temperature (K)	577.6 + 0.8	581.6
Cold leg temperature (K)	563.2 + 1.1	567.2
Mass flow in loop (Kg/s)	486.7 + 2.5	487.5
Steam generator secondary pressure (Mpa)	6.41 + 0.08	6.77
Pressurizer pressure (Mpa)	14.73 + 0.11	14.85
Pressurizer temperature (K)	616.2 + 5.8	614.3
Broken loop cold leg temperature (K)	561.4 + 1.5	562.0
Broken loop hot leg temperature (K)	564.8 + 1.8	565.0

TABLE 4.2. Maximum cladding temperatures during rod rupture phase

	4% Rod	T(K)	6% Rod	T(K)
Ring 1	1	1025	13	1254*
	2	1018	14	1238*
	3	1018	15	1167
	4	1048	16	1192
Ring 2	5	1076*		
	6	1173*		
	7	1165*		
	8	1176*		
Ring 3	10	950		
	11	933		
	12	940		
	13	952		

TABLE 4.3. Vapor axial velocity (m/s) in central ring during rod rupture phase

LEVEL	CELL			
	1	2	3	4
4	-0.75	-0.61	-0.71	-1.36
5	-0.41	-0.30	-0.39	-0.71
6	0.03	0.01	0.03	0.02
7	0.73	0.52	0.70	1.33
8	1.08	0.89	1.06	1.35

TABLE 4.4. Liquid axial velocity (m/s) in central ring during rod rupture phase

LEVEL	CELL			
	1	2	3	4
4	-3.60	-3.60	-3.60	-3.60
5	-3.51	-3.53	-3.51	-3.50
6	-3.45	-3.47	-3.45	-3.40
7	-3.35	-3.39	-3.35	-3.28
8	-3.26	-3.29	-3.26	-3.22

TABLE 4.5. Vapor temperature (K) in central ring during rod rupture phase

LEVEL	CELL			
	1	2	3	4
4	502	498	499	548
5	628	621	625	666
6	640	636	637	660
7	598	596	597	617
8	498	491	497	522

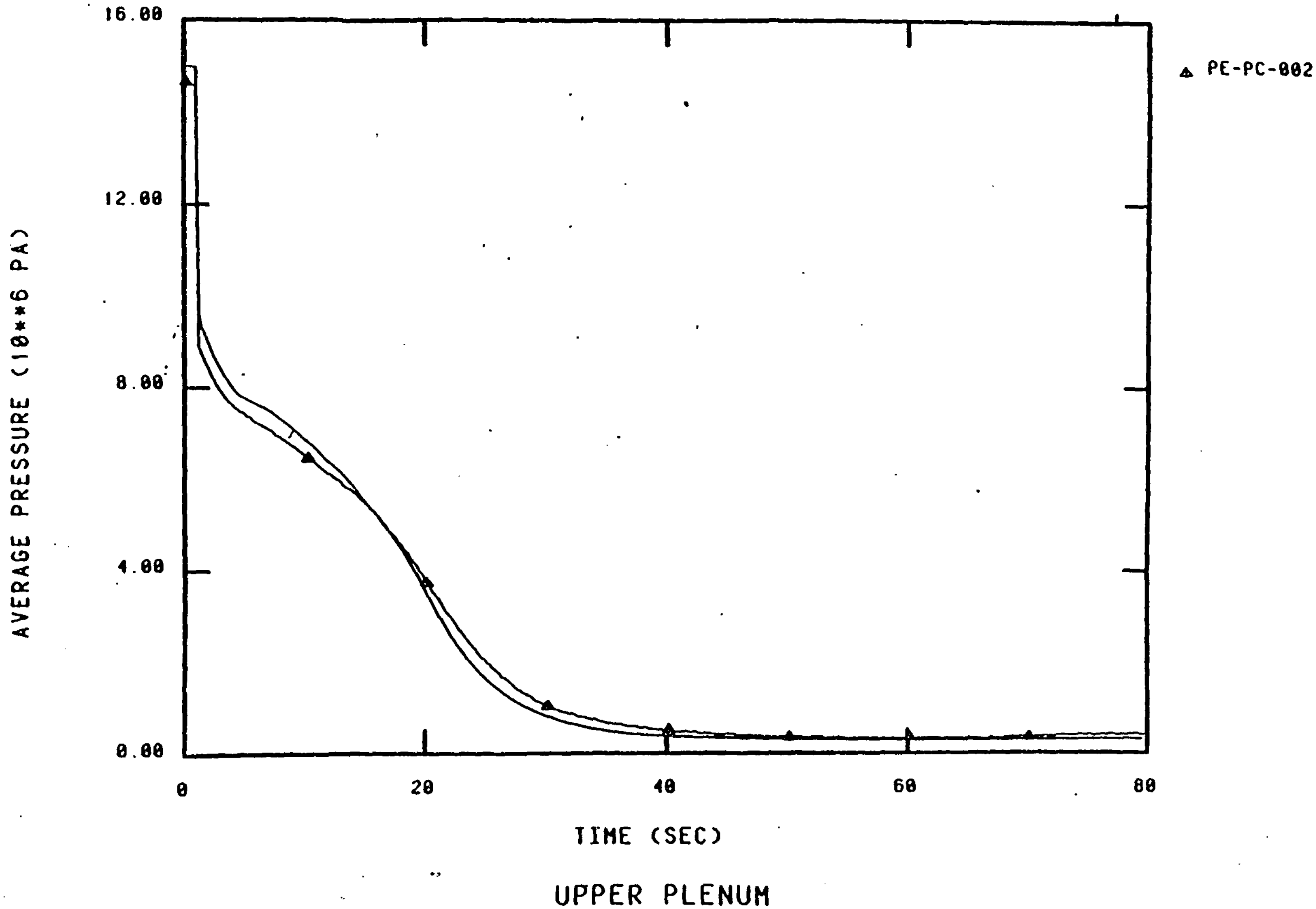


Figure 4.1. Upper plenum pressure

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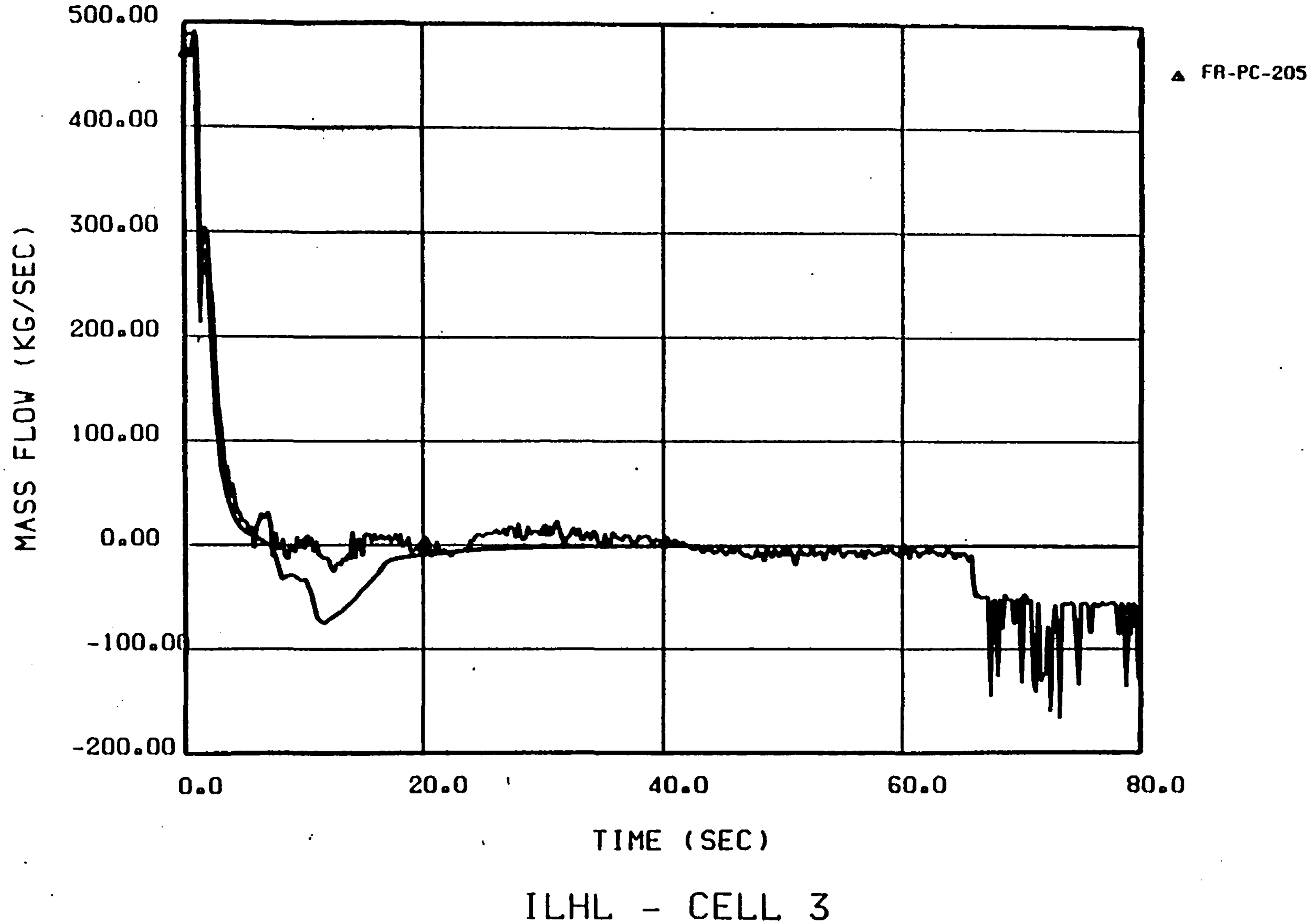


Figure 4.2. Intact loop hot leg (cell 3) mass flow

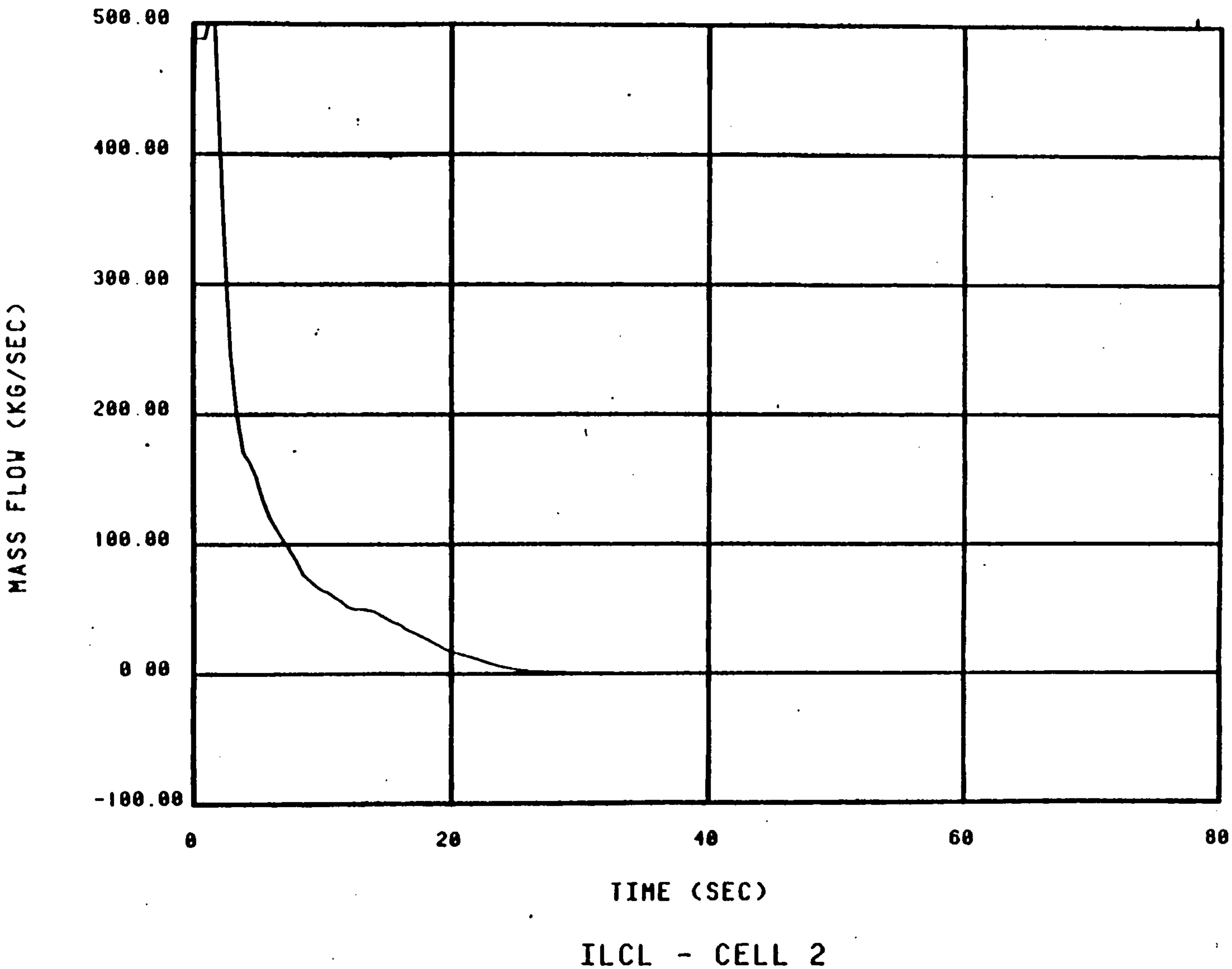
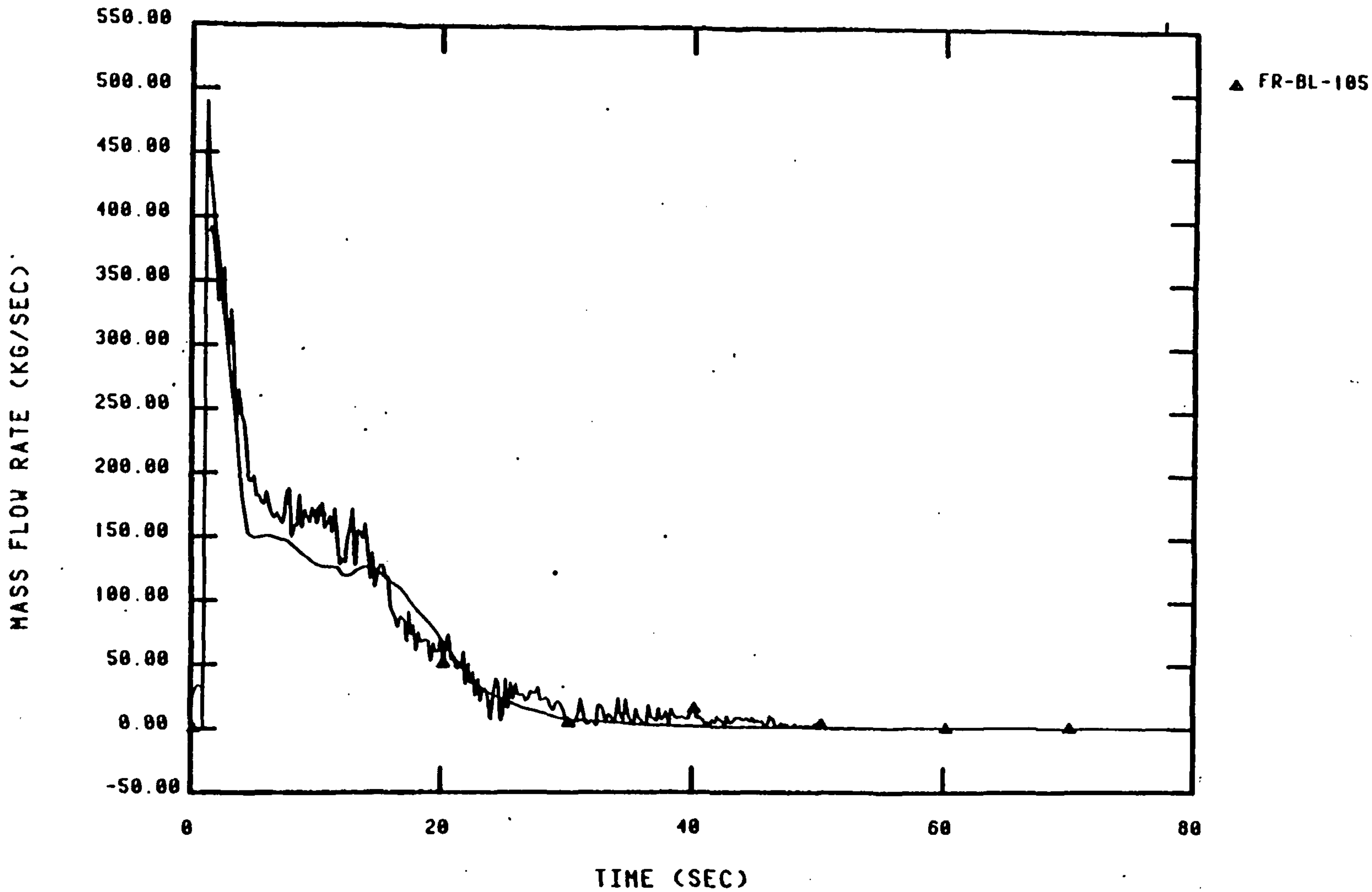
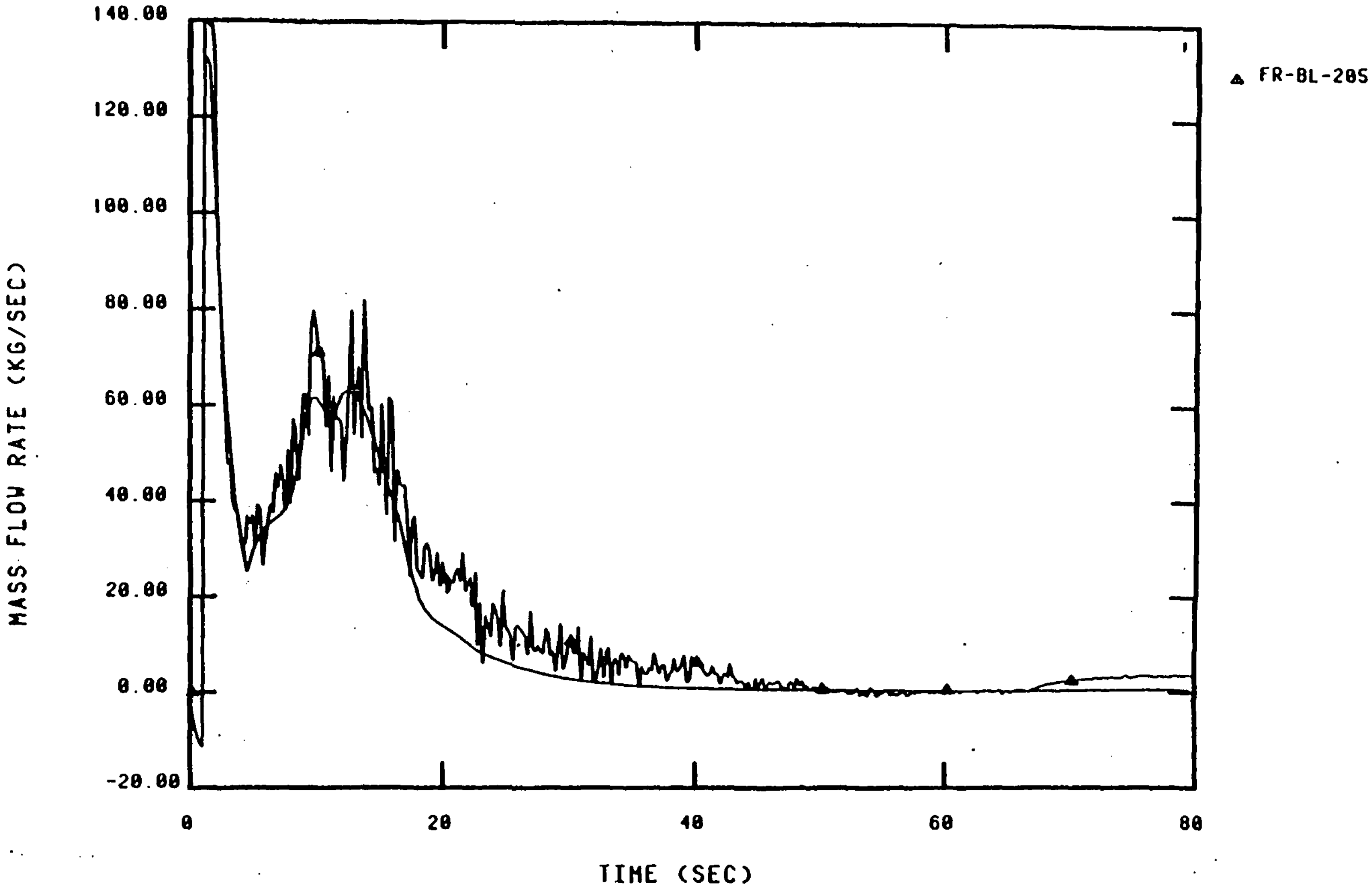


Figure 4.3. Intact loop cold leg (cell 2) mass flow



BLCL - CELL 1

Figure 4.4. Broken loop cold leg (cell 1) mass flow



BLHL - CELL 3

Figure 4.5. Broken loop hot leg (cell 3) mass flow

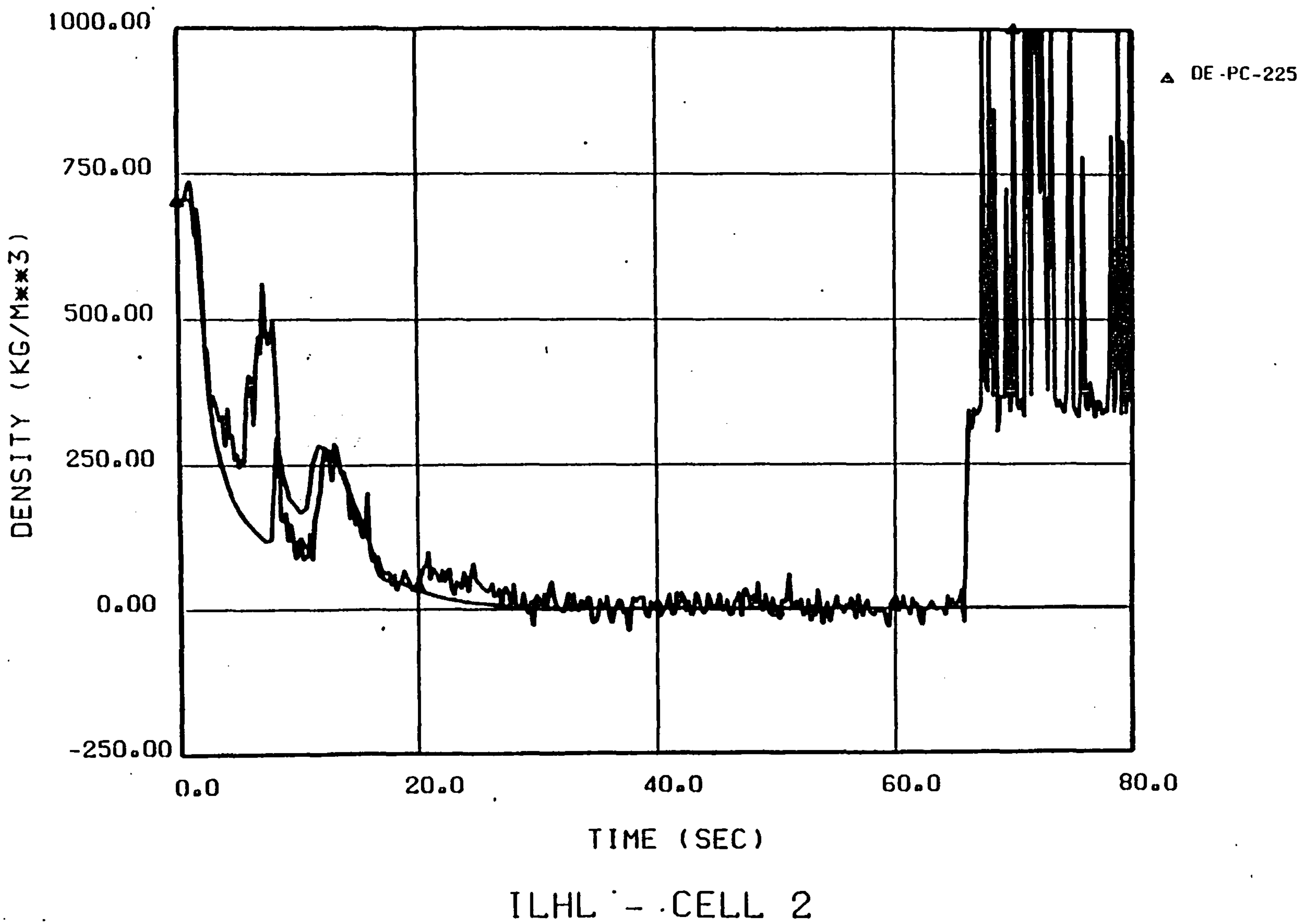
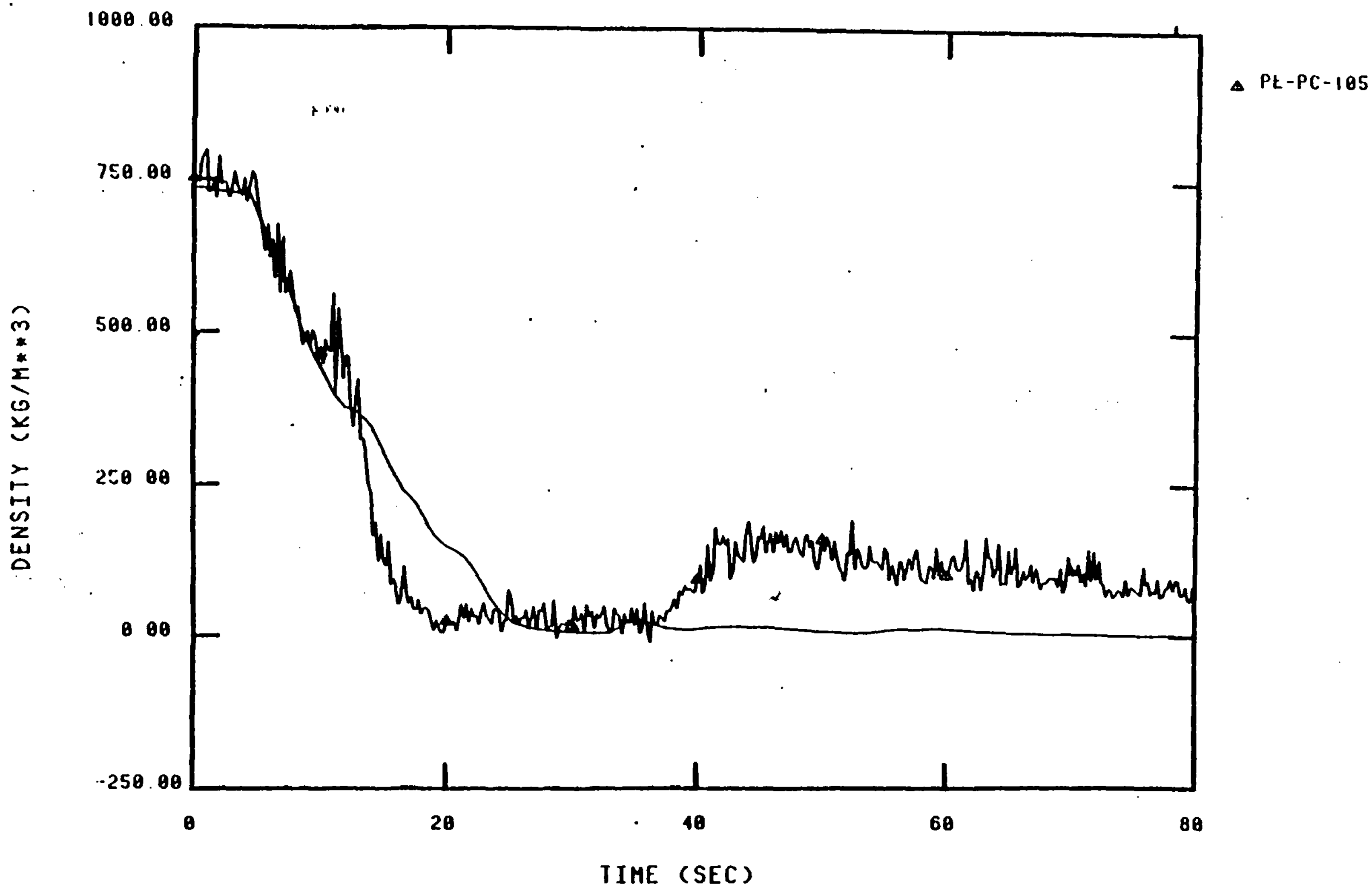
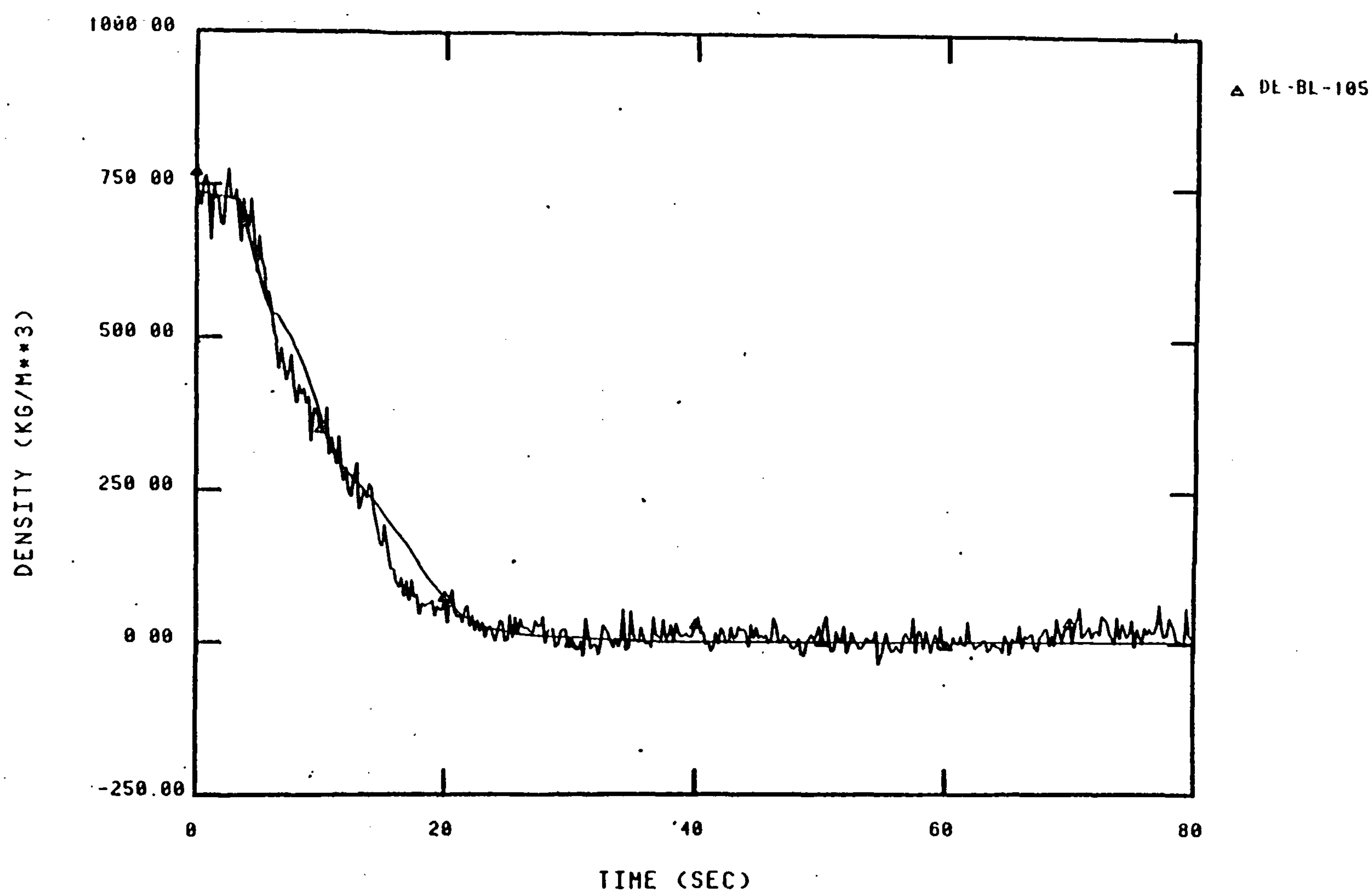


Figure 4.6. Intact loop hot leg (cell 2) density



ILCL - CELL 2

Figure 4.7. Intact loop cold leg (cell 2) density



BLCL - CELL 1

FIGURA

Figure 4.8. Broken loop cold leg (cell 1) density

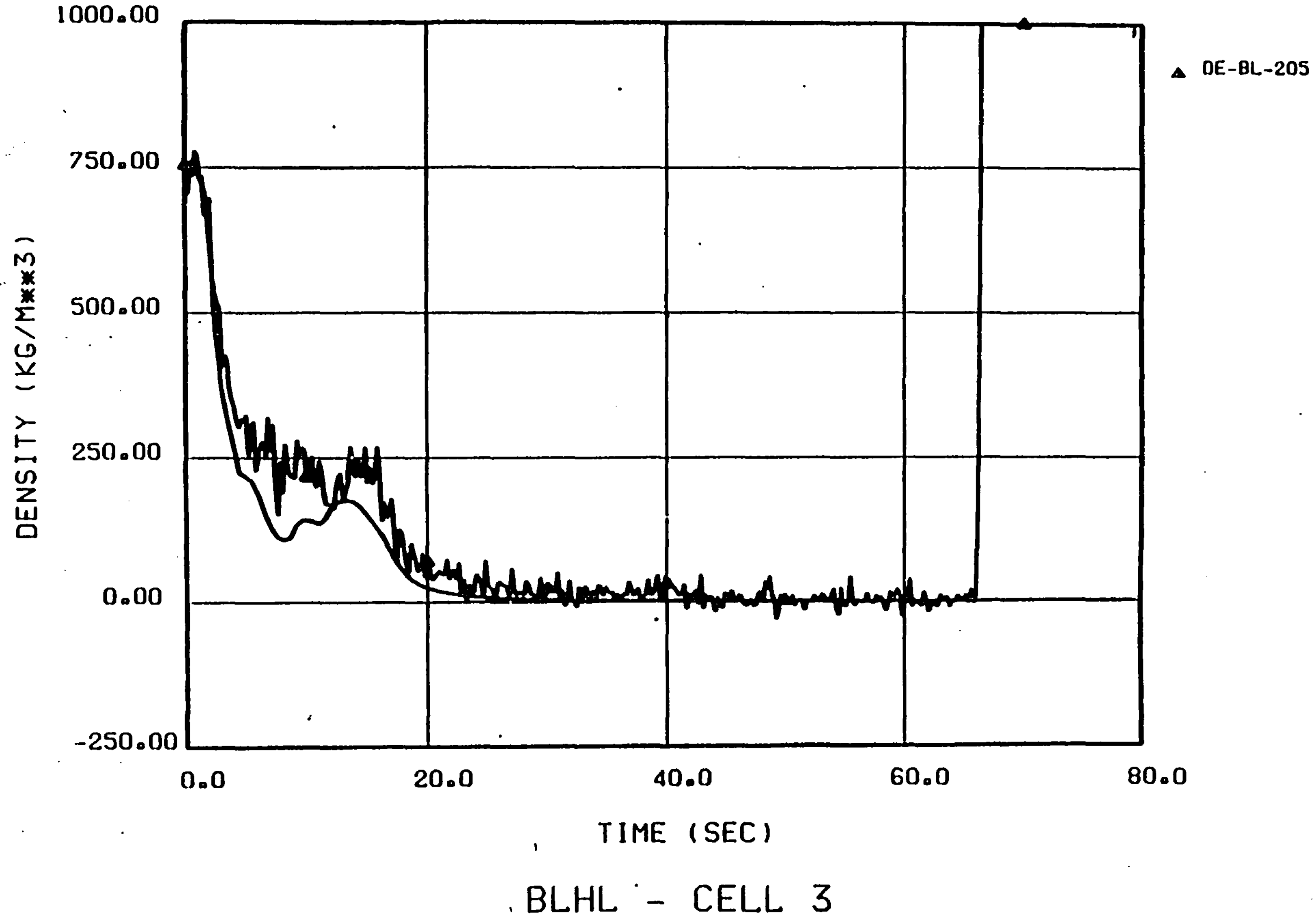


Figure 4.9. Broken loop hot leg (cell 3) density

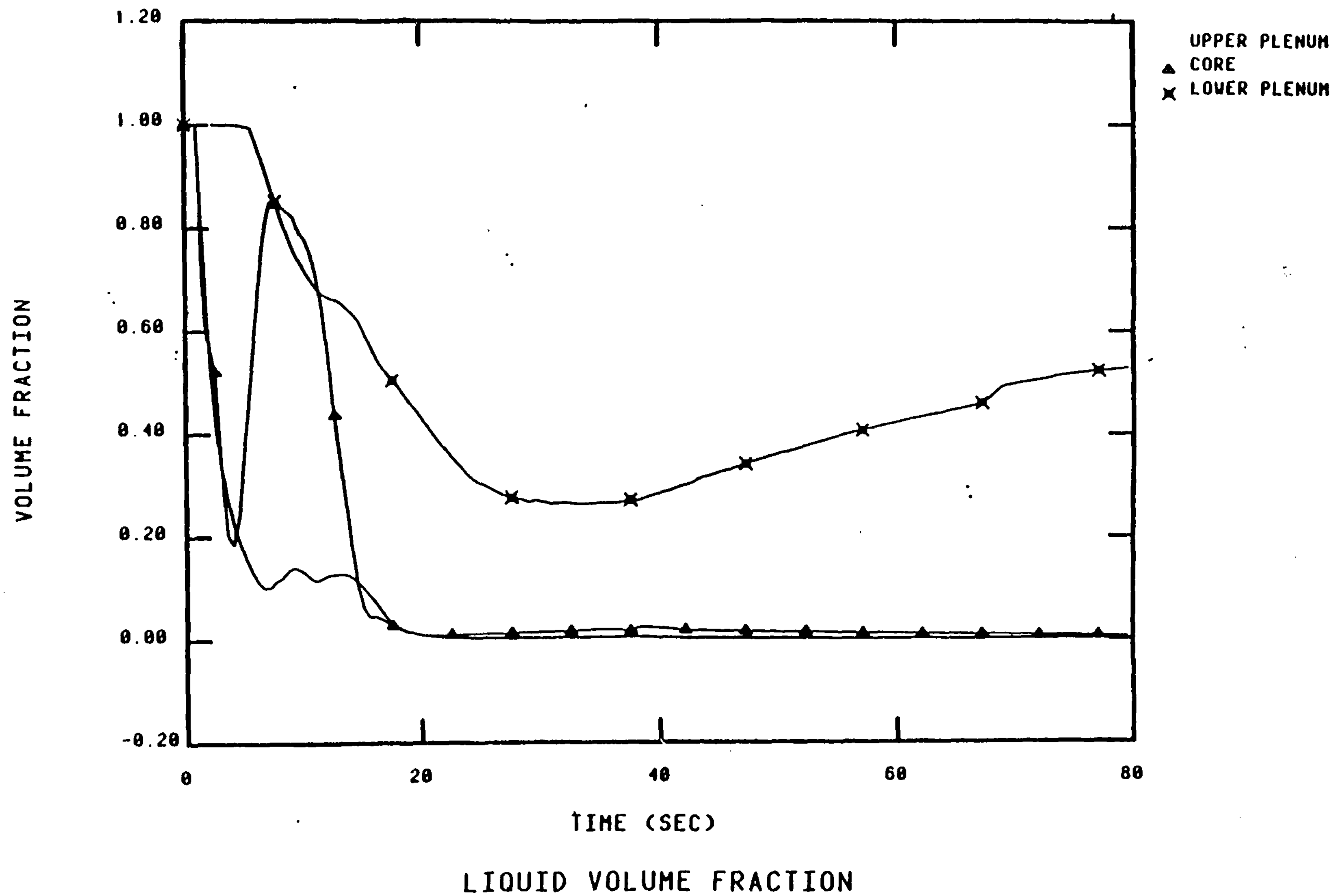


Figure 4.10. Vessel liquid fraction

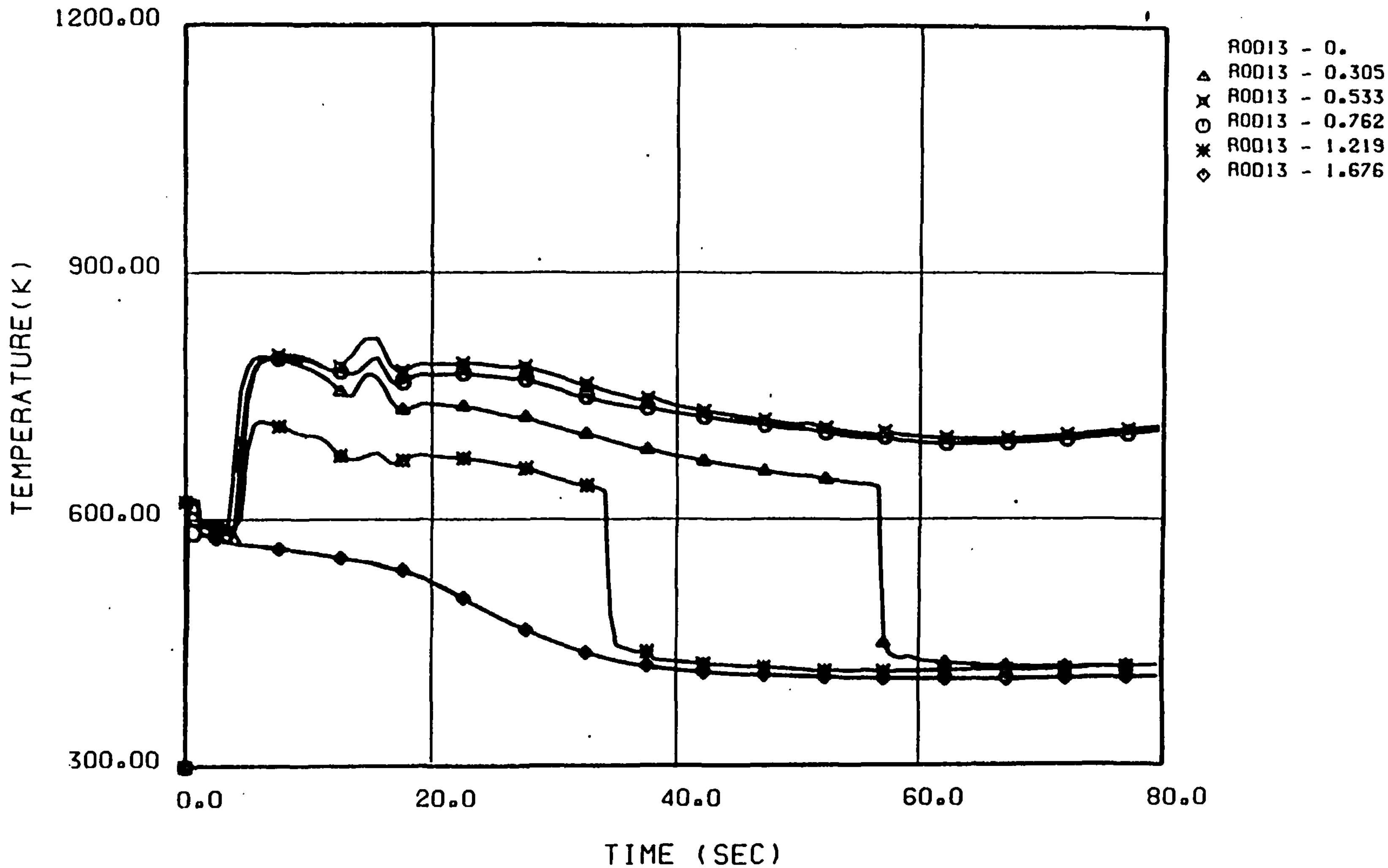


Figure 4.11. Simulated 6 % rod 13 at several heights during blowdown phase

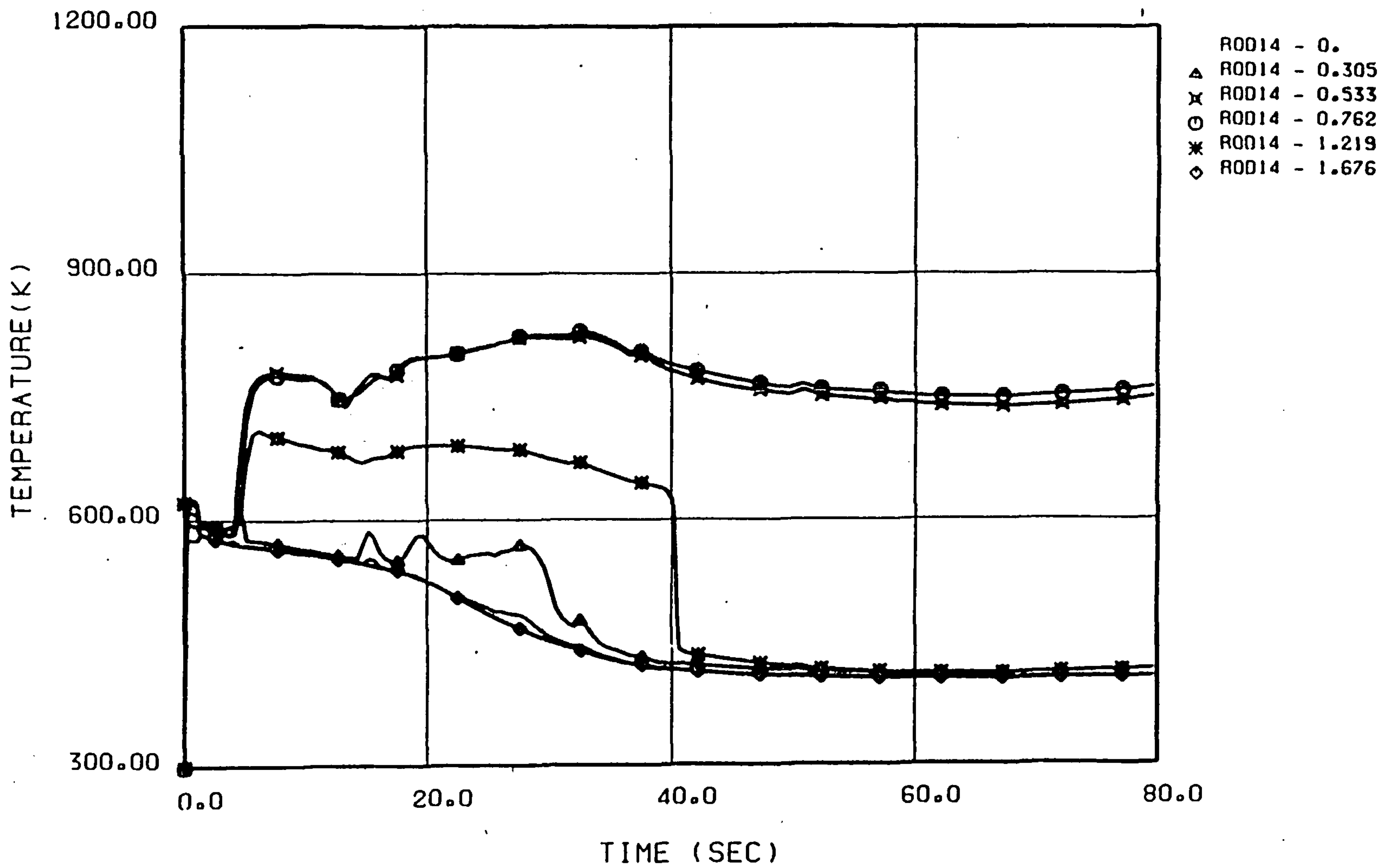


Figure 4.12. Simulated 6 % rod 14 at several heights during blowdown phase

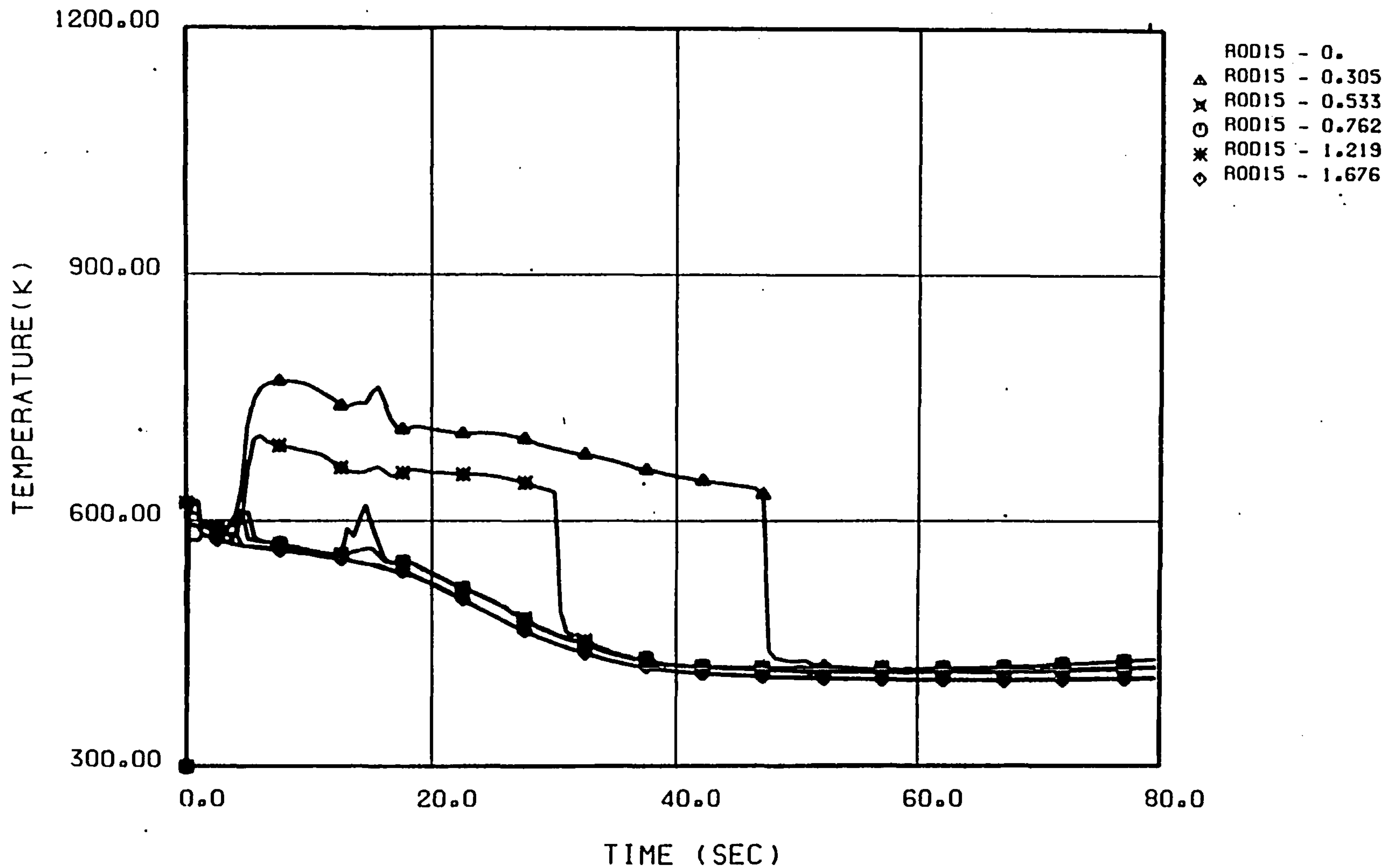


Figure 4.13. Simulated 6 % rod 15 at several heights during blowdown phase

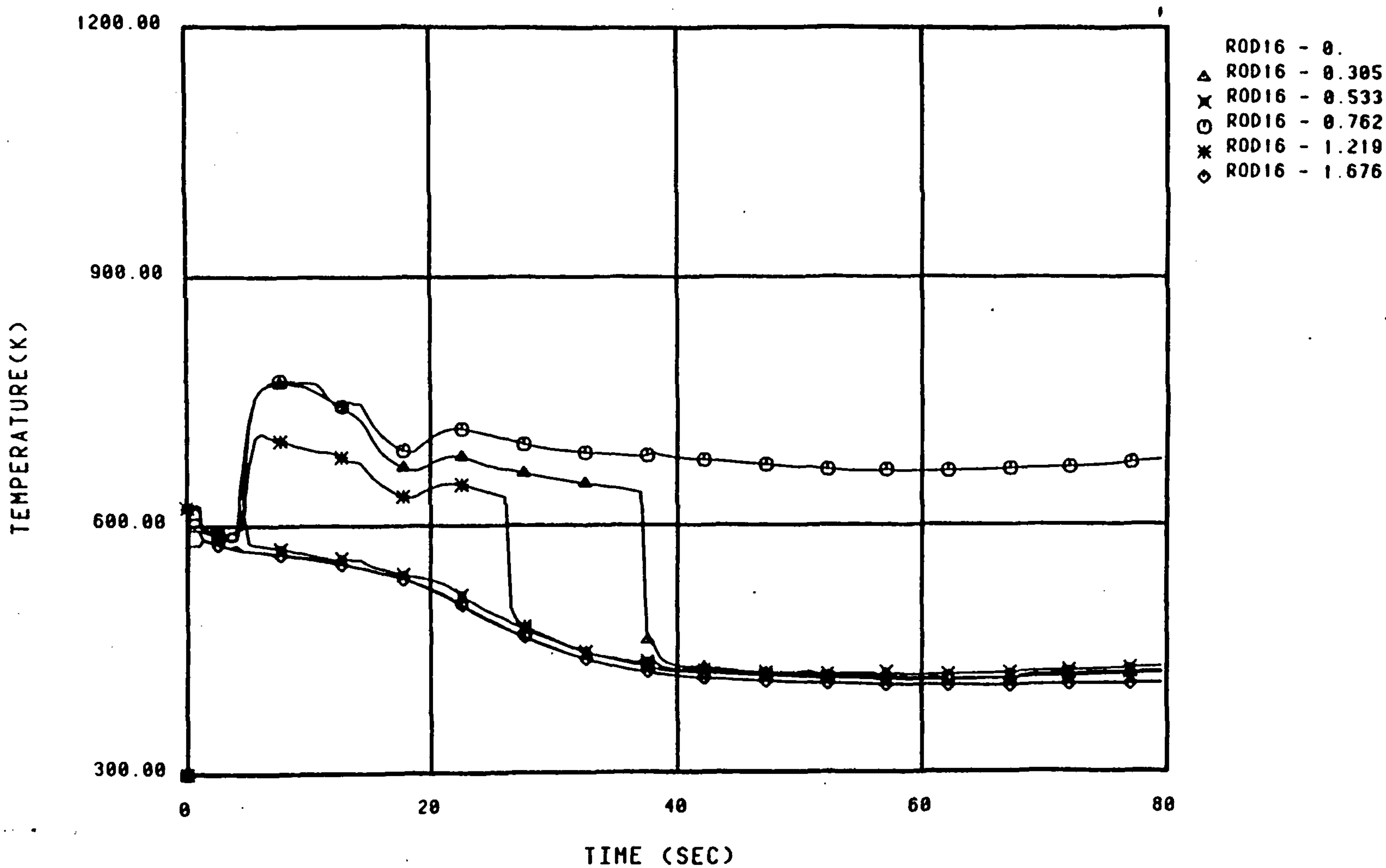


Figure 4.14. Simulated 6 % rod 16 at several heights during blowdown phase

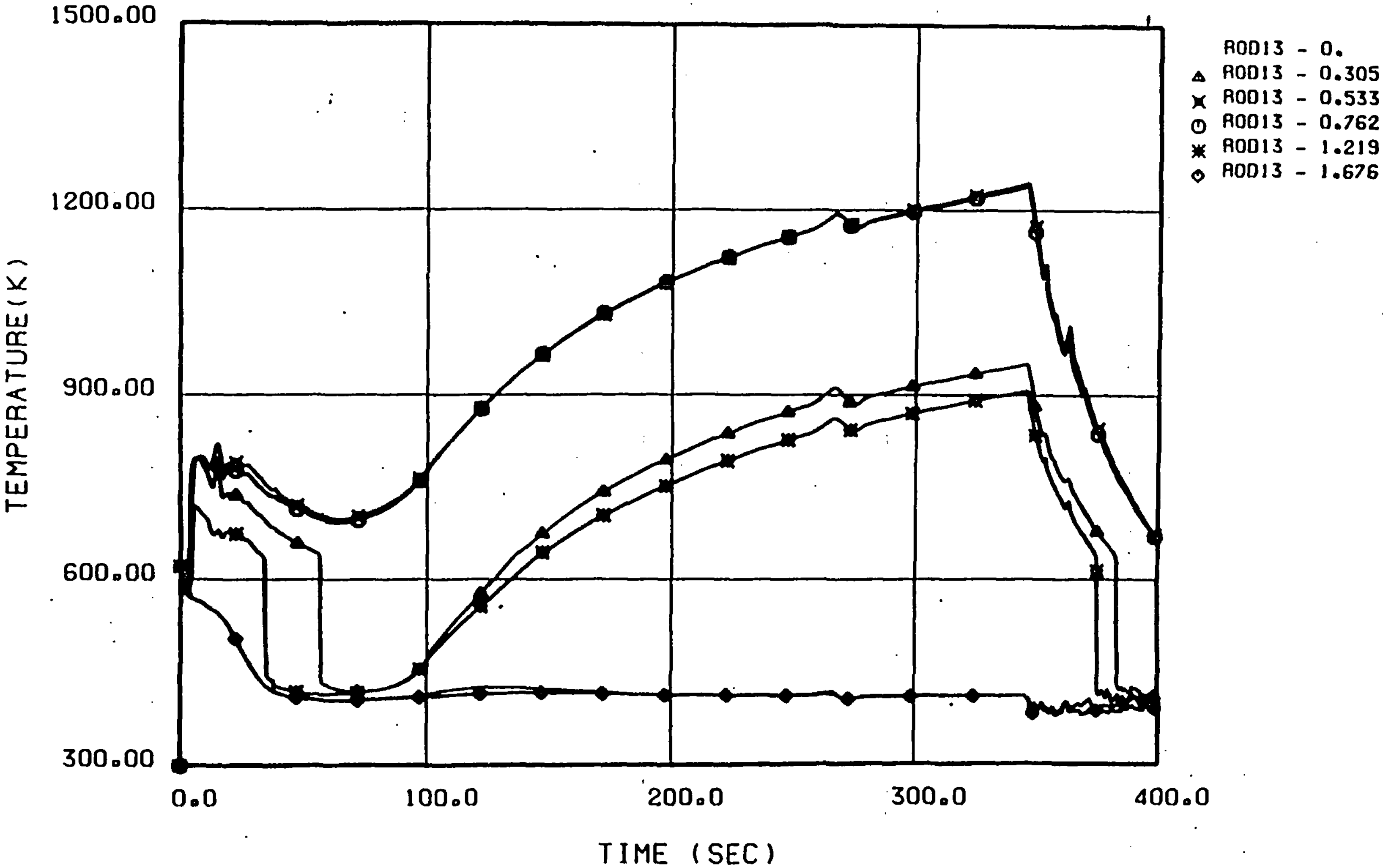


Figure 4.15. Simulated 6 % rod 13 at several heights during the whole transient

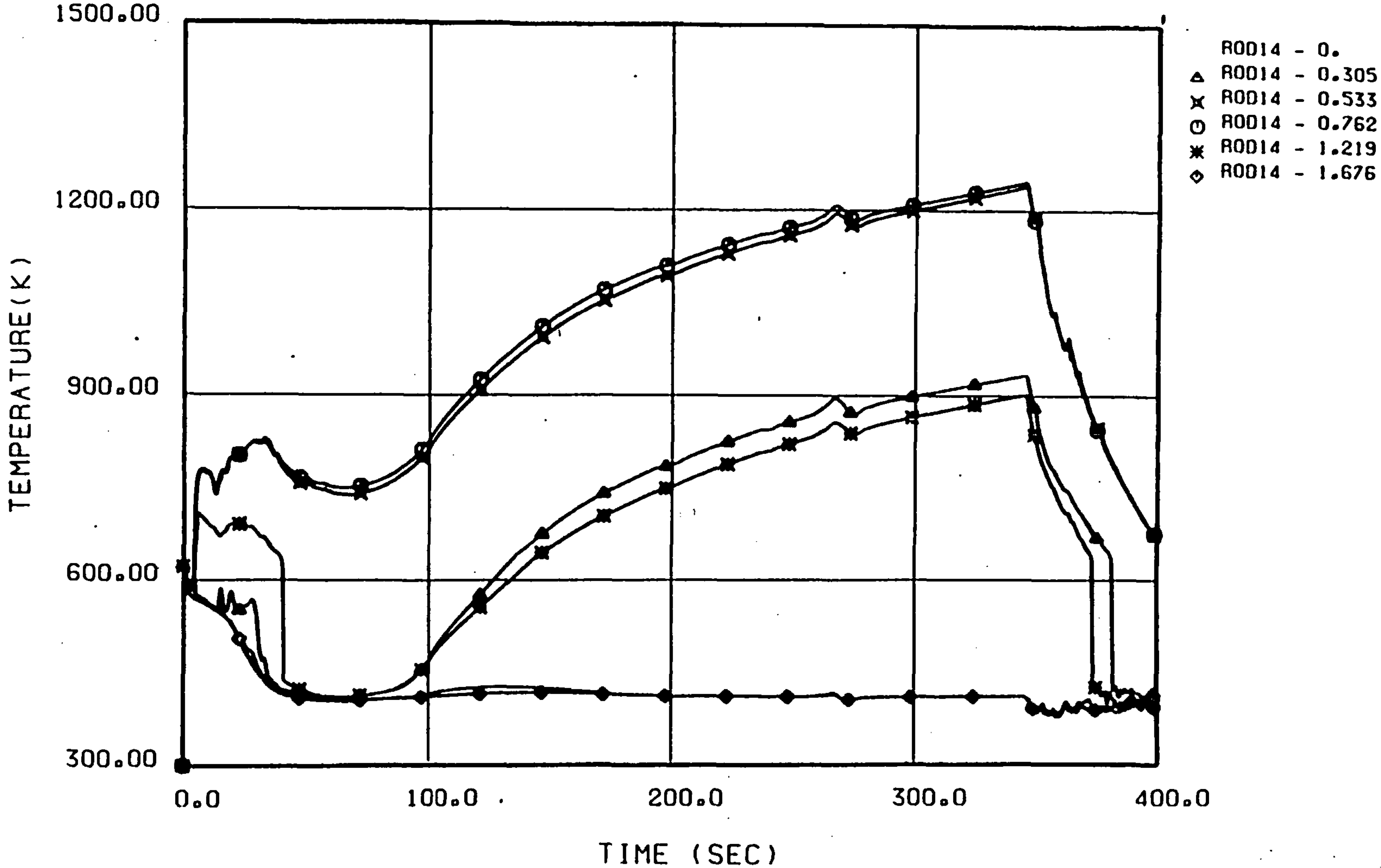


Figure 4.16. Simulated 6 % rod 14 at several heights during the whole transient

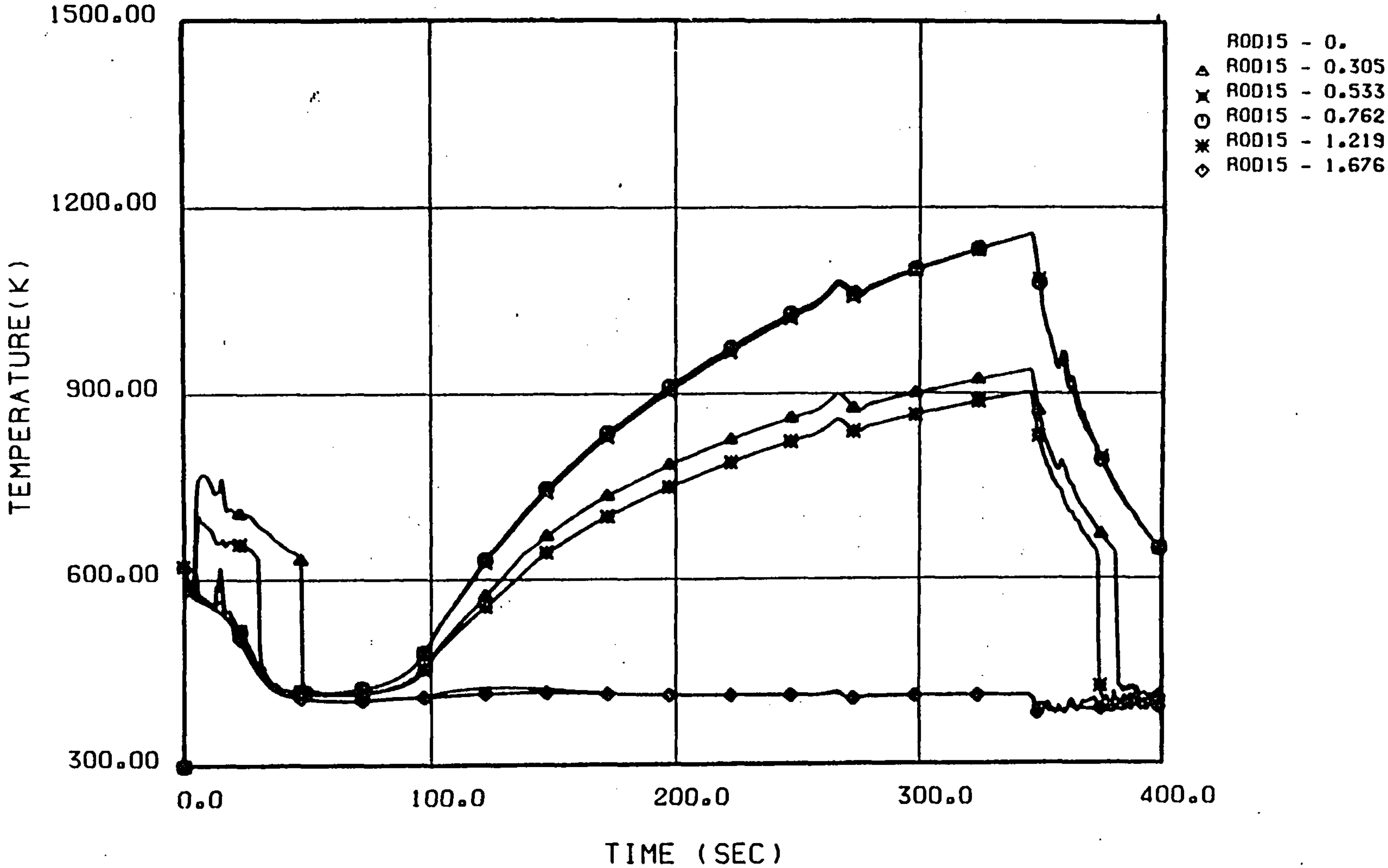


Figure 4.17. Simulated 6 % rod 15 at several heights during the whole transient

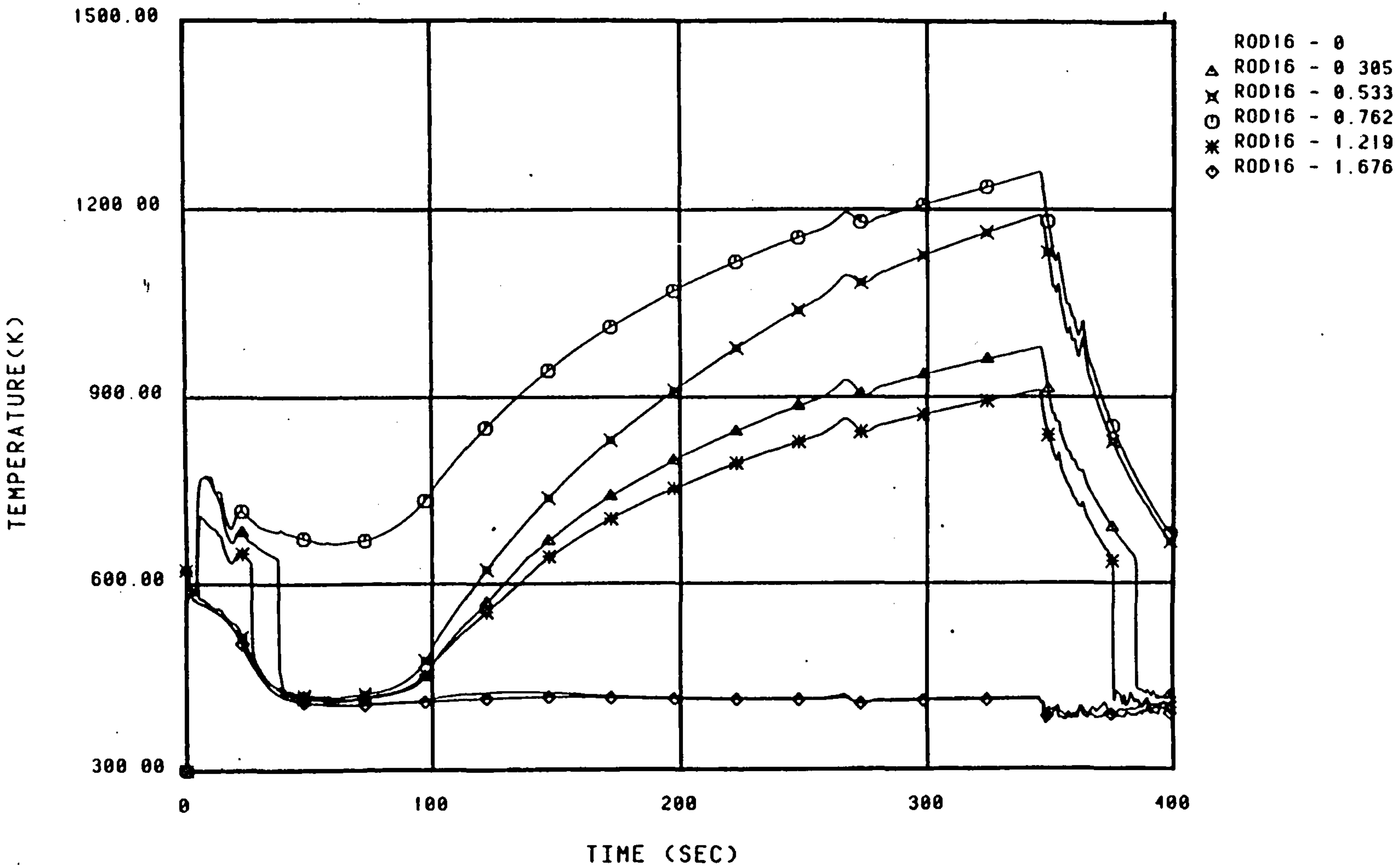


Figure 4.18. Simulated 6 % rod 16 at several heights during the whole transient

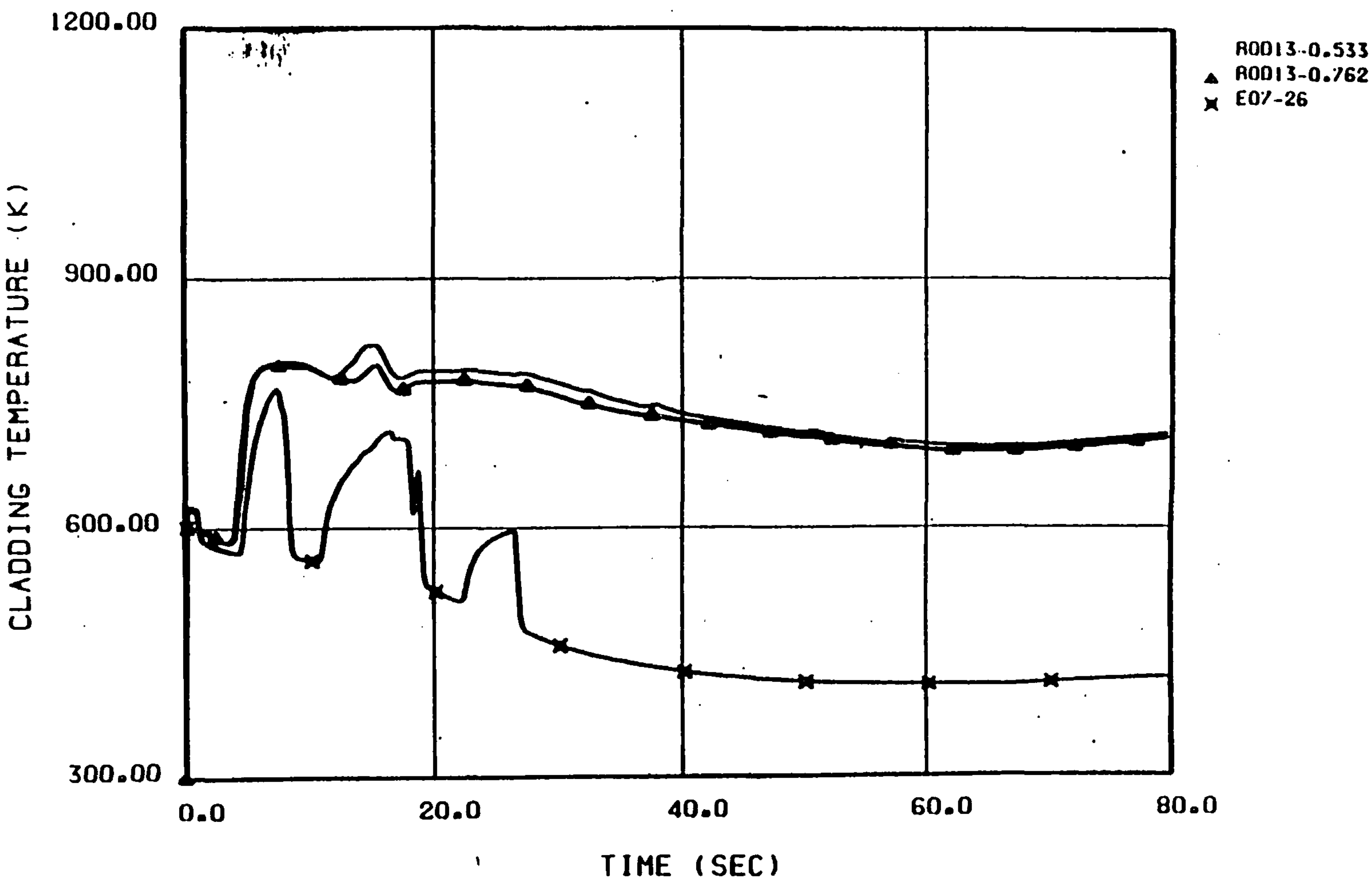


Figure 4.19. Comparison with thermocouple 5E07 (blowdown)

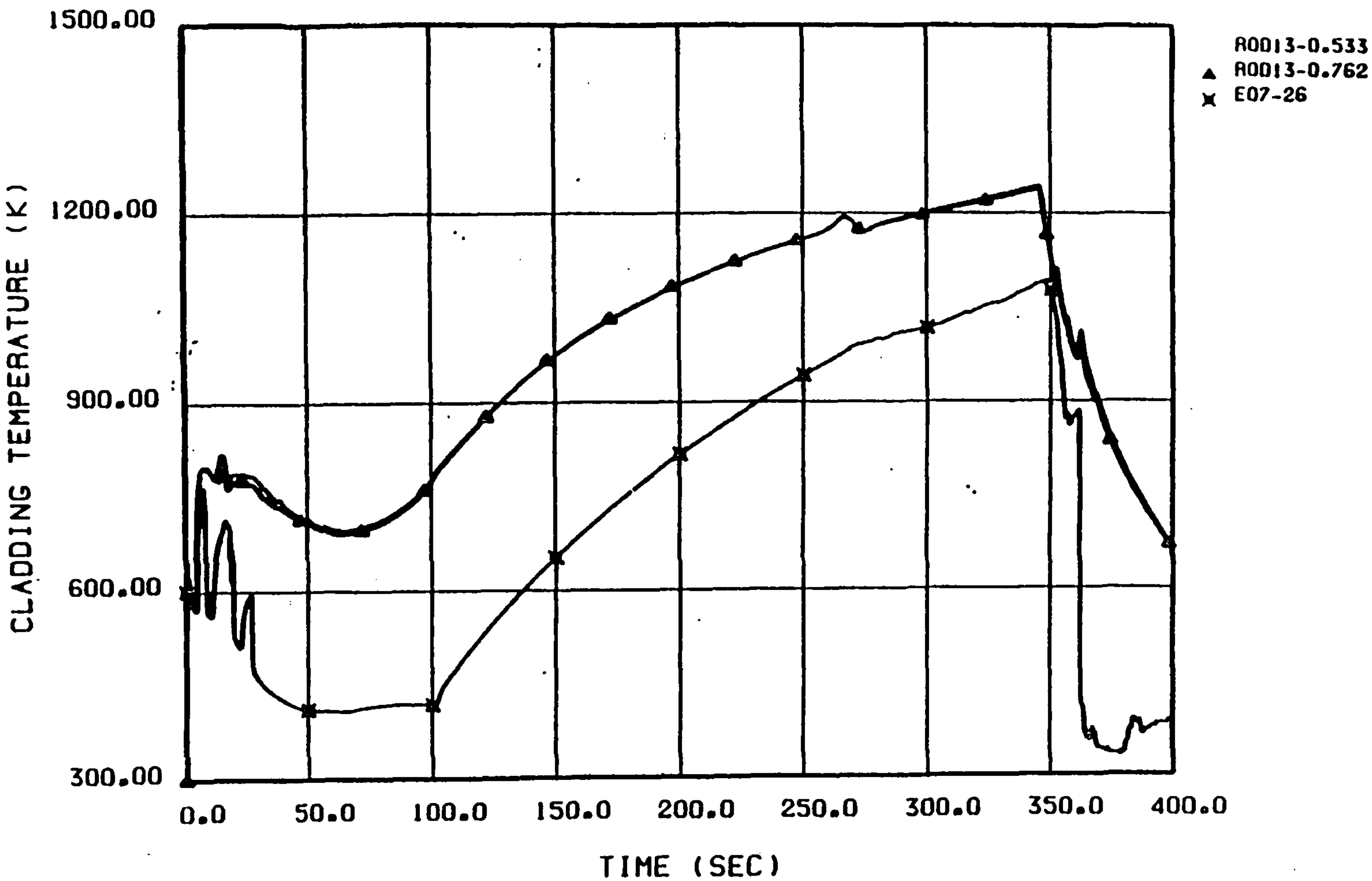


Figure 4.20. Comparison with thermocouple 5E07 (transient)

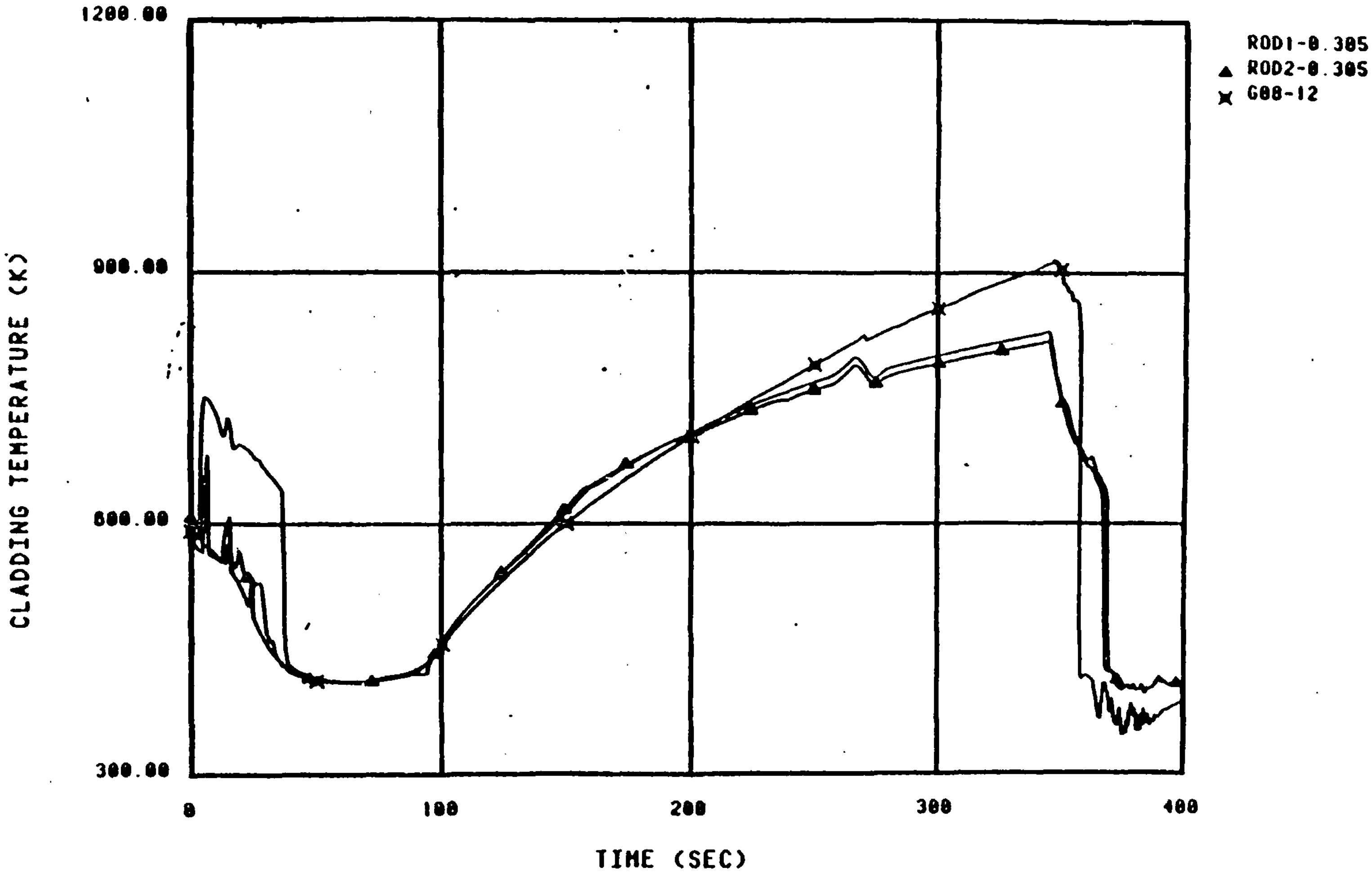


Figure 4.21. Cladding temperatures calculated for 5G08
(4 % fuel rod in central element)

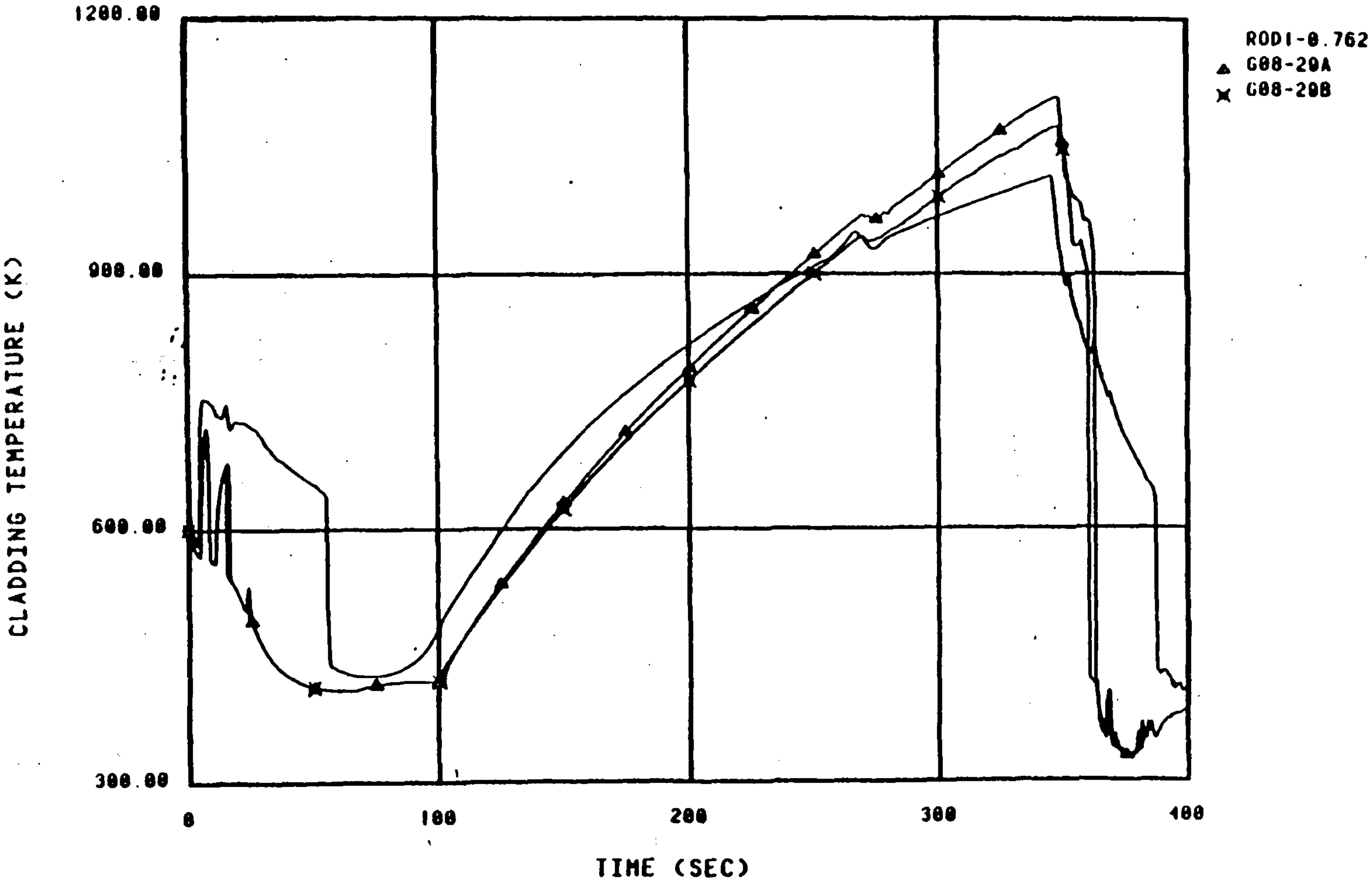


Figure 4.22. Cladding temperatures calculated for 5G08
(4 % fuel rod in central element)

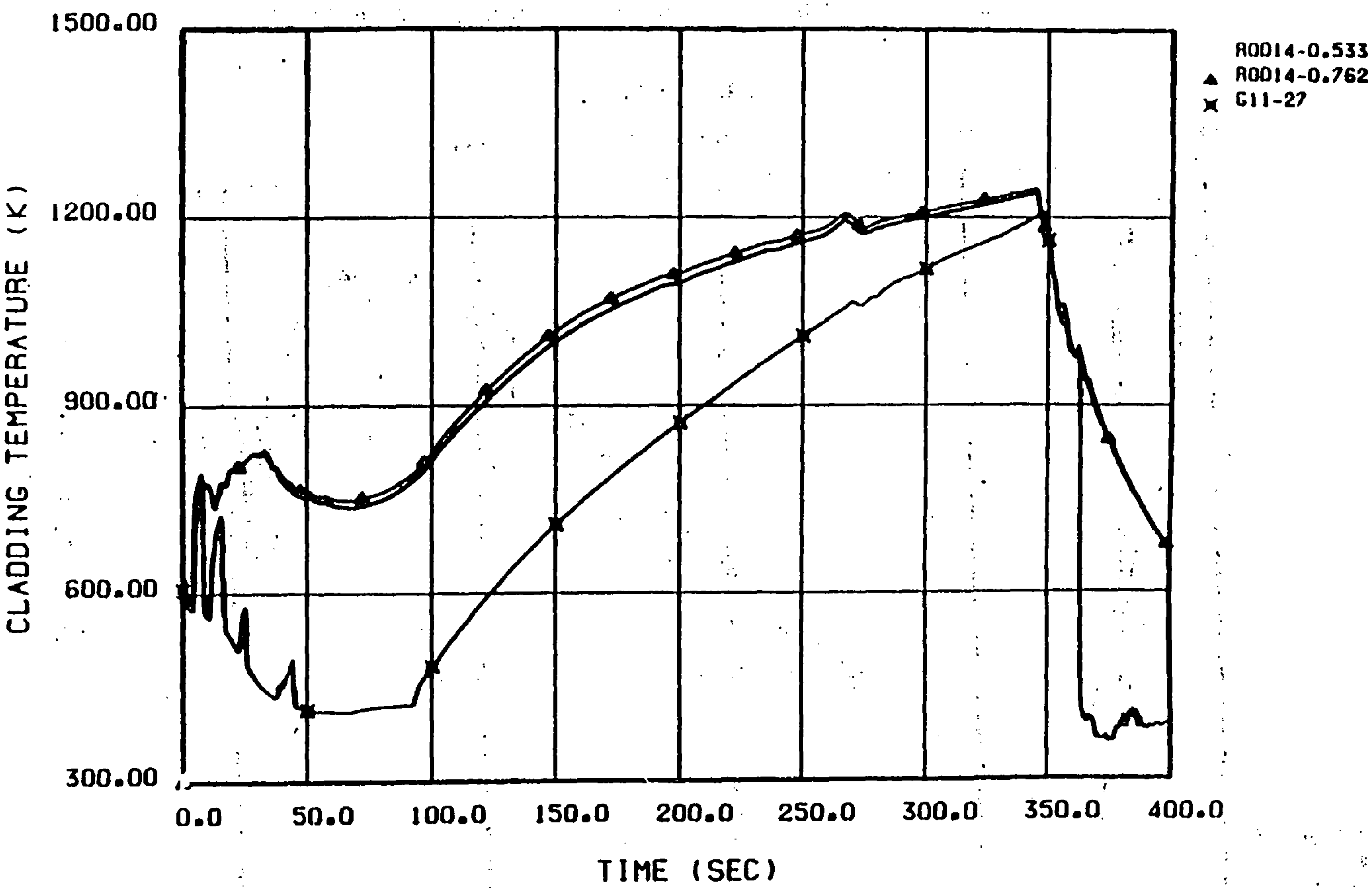


Figure 4.23. Cladding temperatures calculated for 5G11
(6 % ruptured fuel rod)

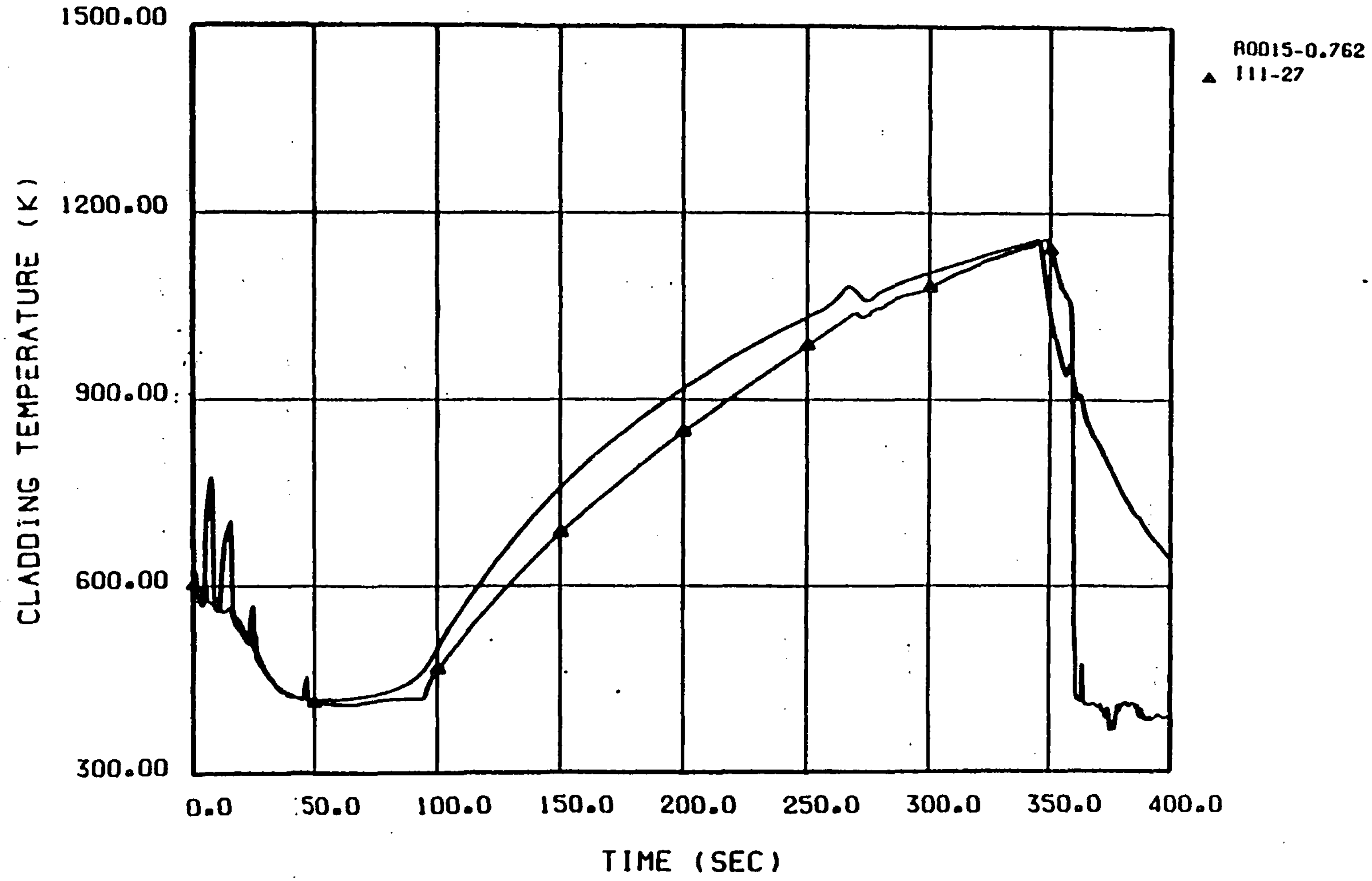


Figure 4.24. Cladding temperatures calculated for 5111
(6 % ruptured fuel rod)

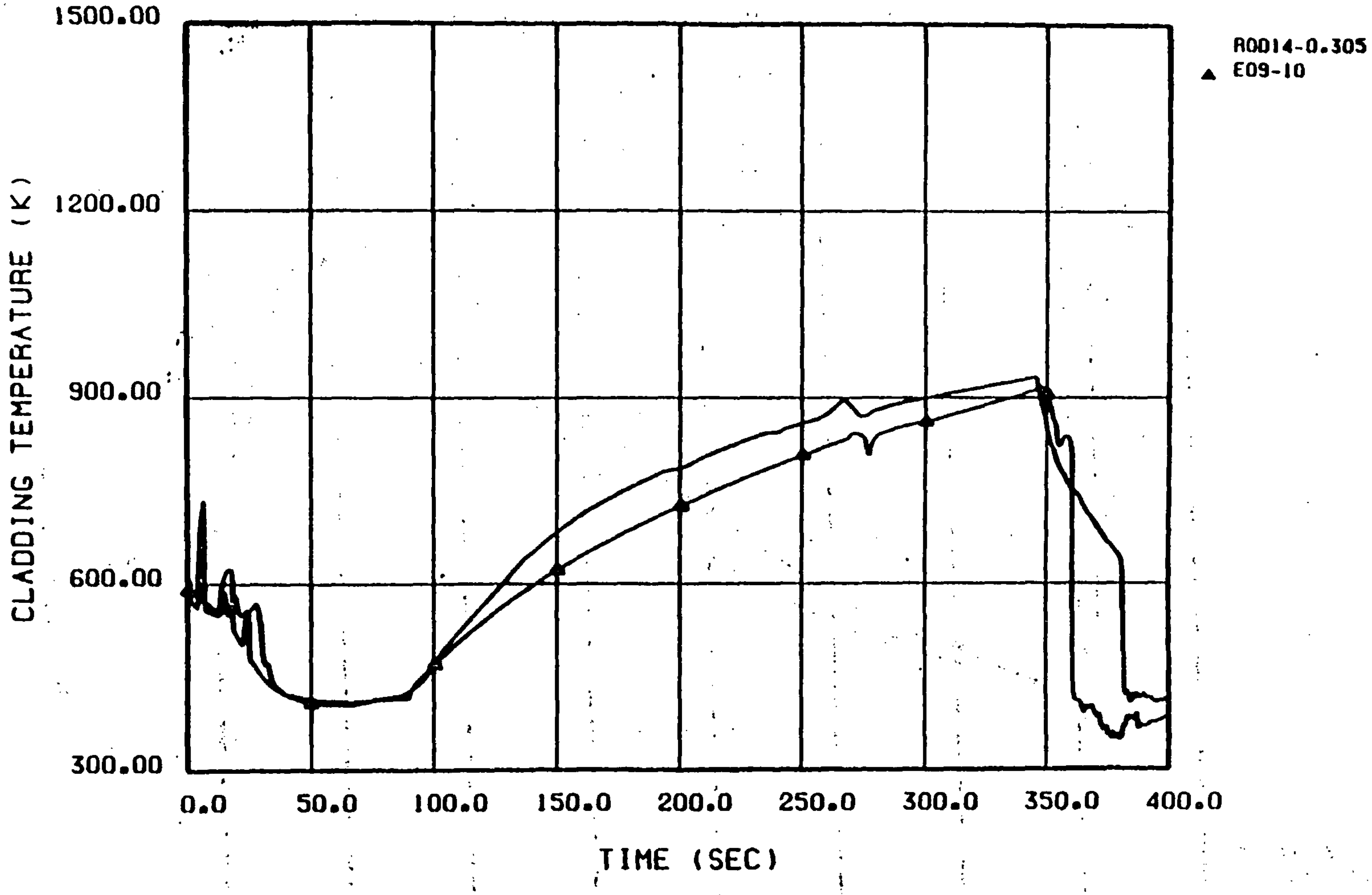


Figure 4.25. Cladding temperatures calculated for 5E09
(6 % ruptured fuel rod)

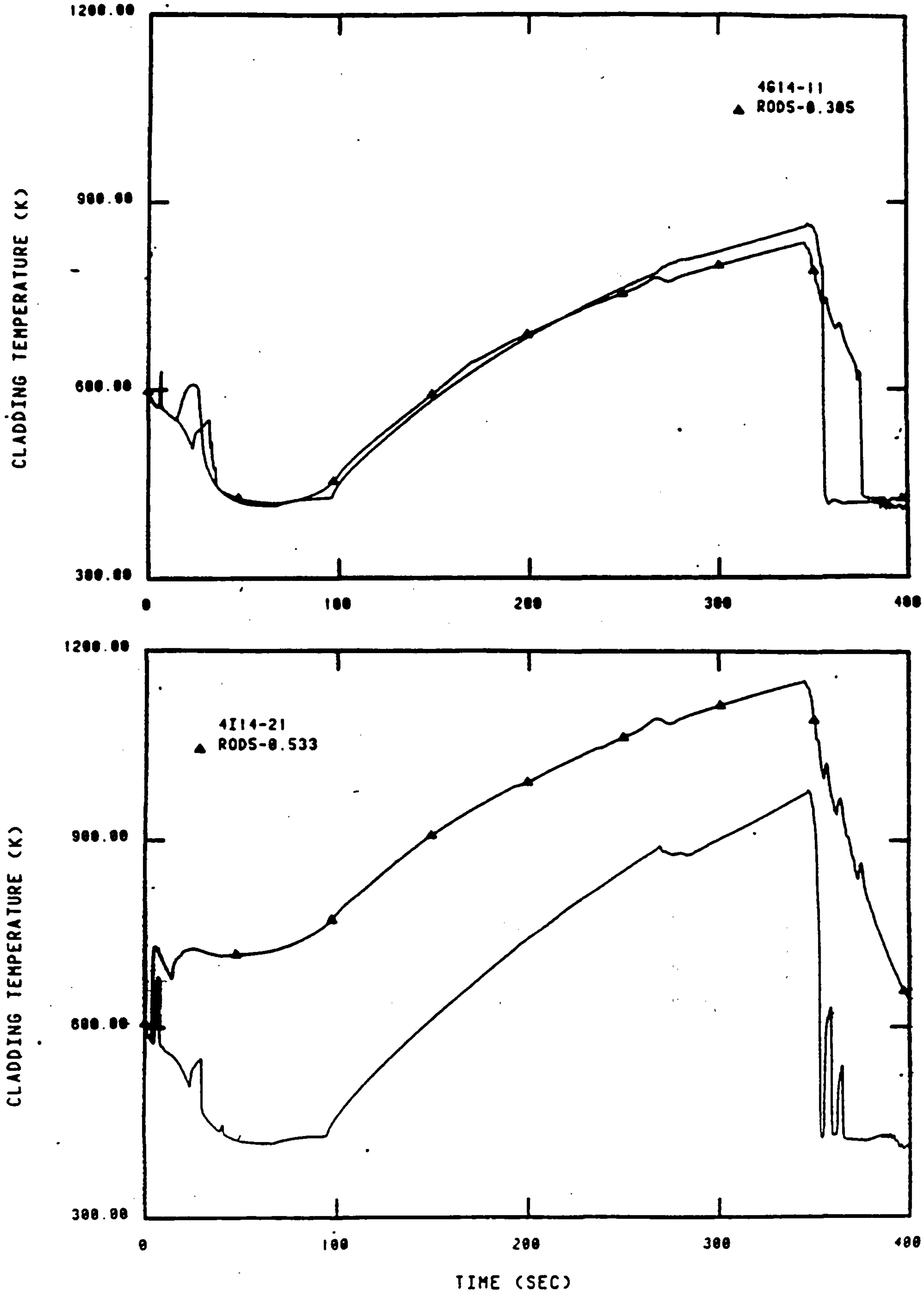


Figure 4.26. Cladding temperatures calculated for fuel rods in peripheral bundles

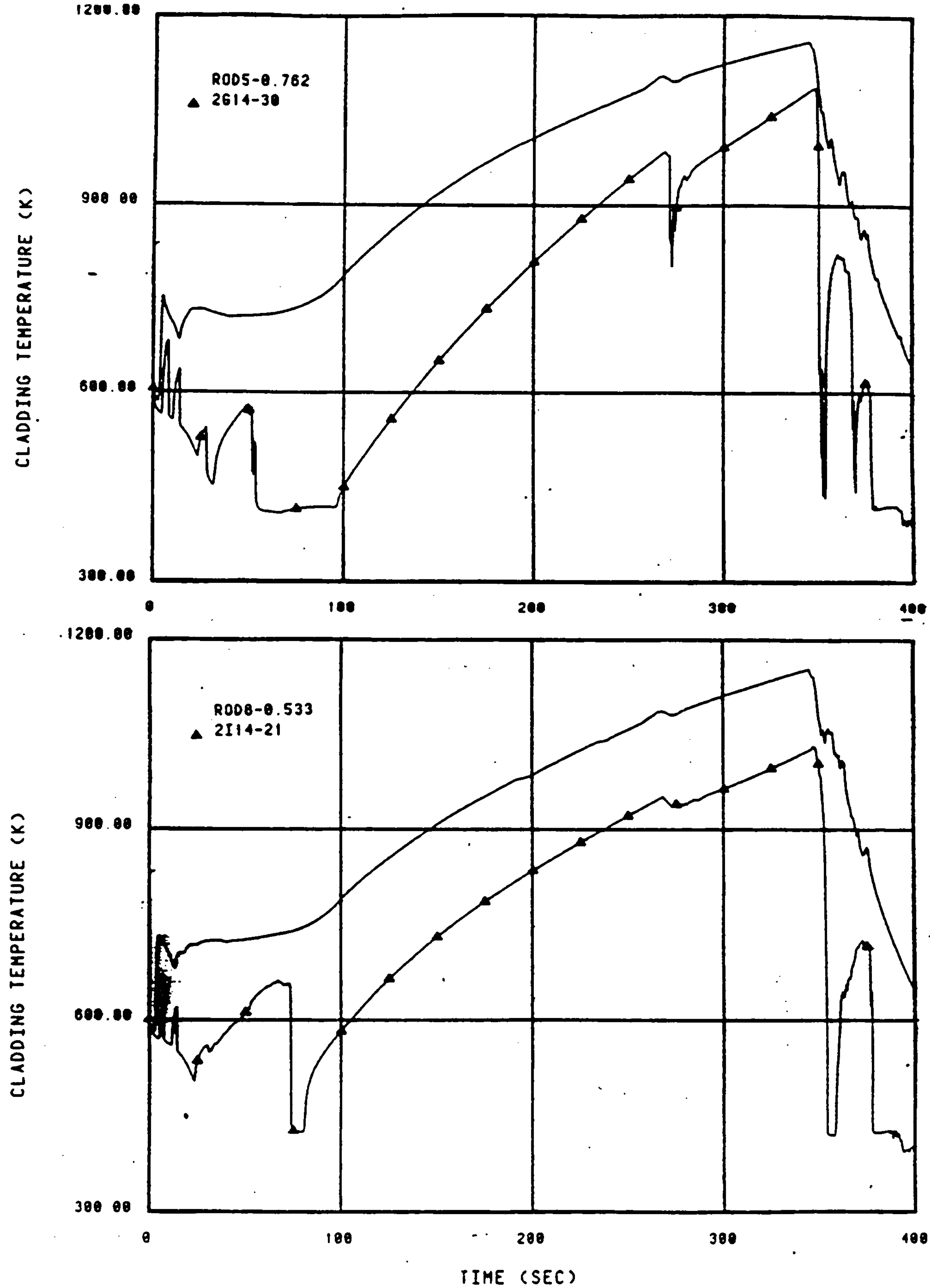


Figure 4.26. Cladding temperatures calculated for fuel rods in peripheral bundle 2

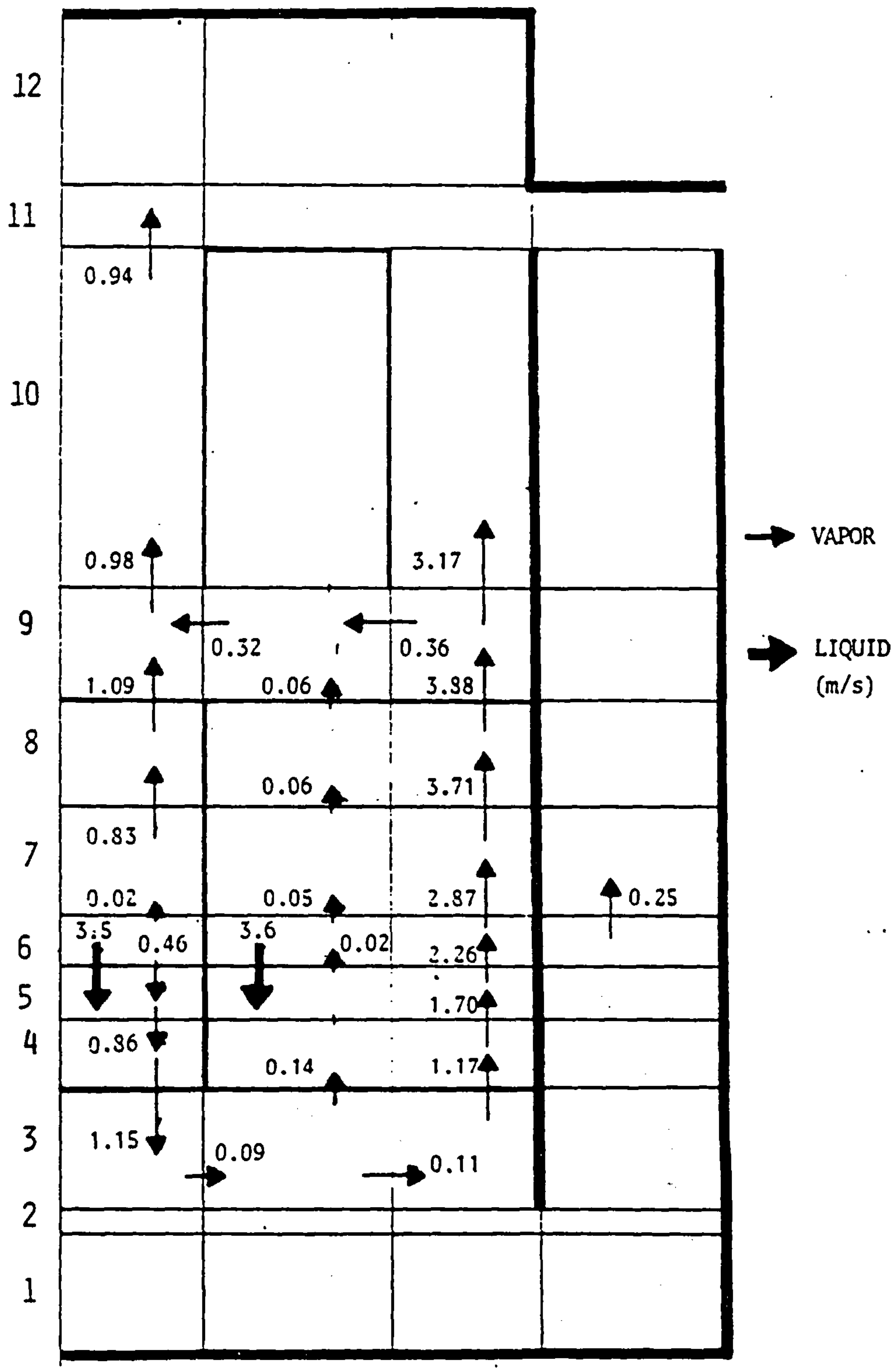


Figure 4.27. Flow patterns in vessel during rupture phase

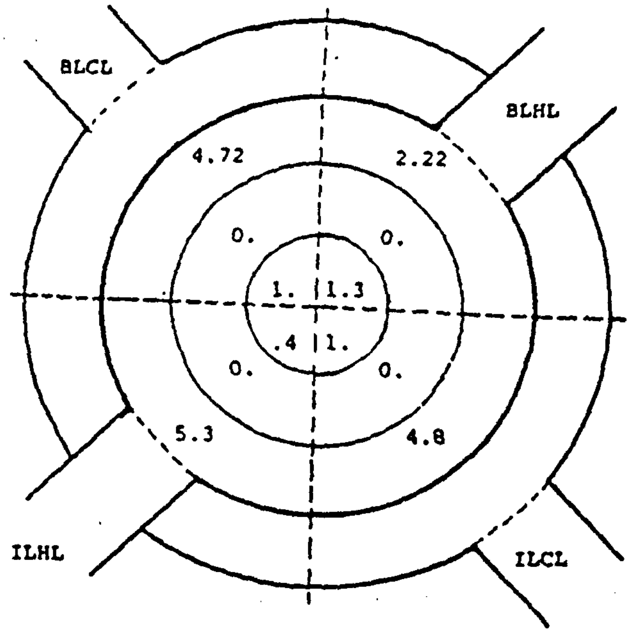


Figure 4.28. Vapor axial velocity (m/s) from level 10 to 11 during rod rupture phase

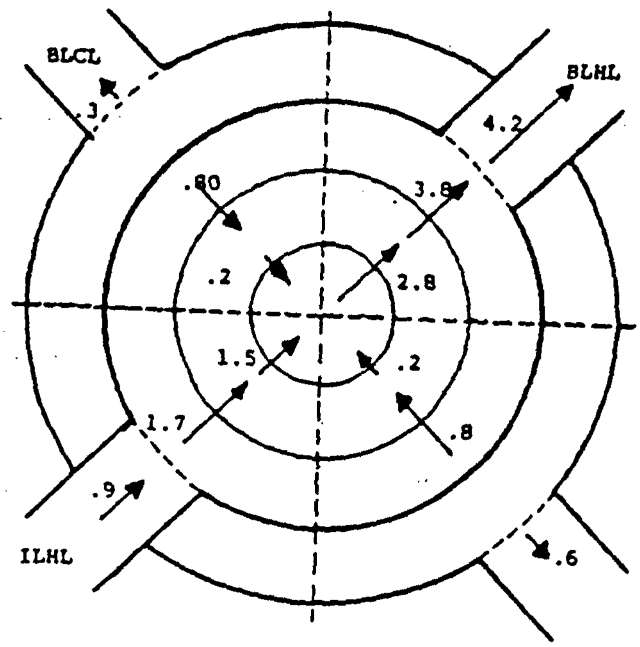


Figure 4.29. Vapor radial velocity (m/s) in level 11 during rod rupture phase

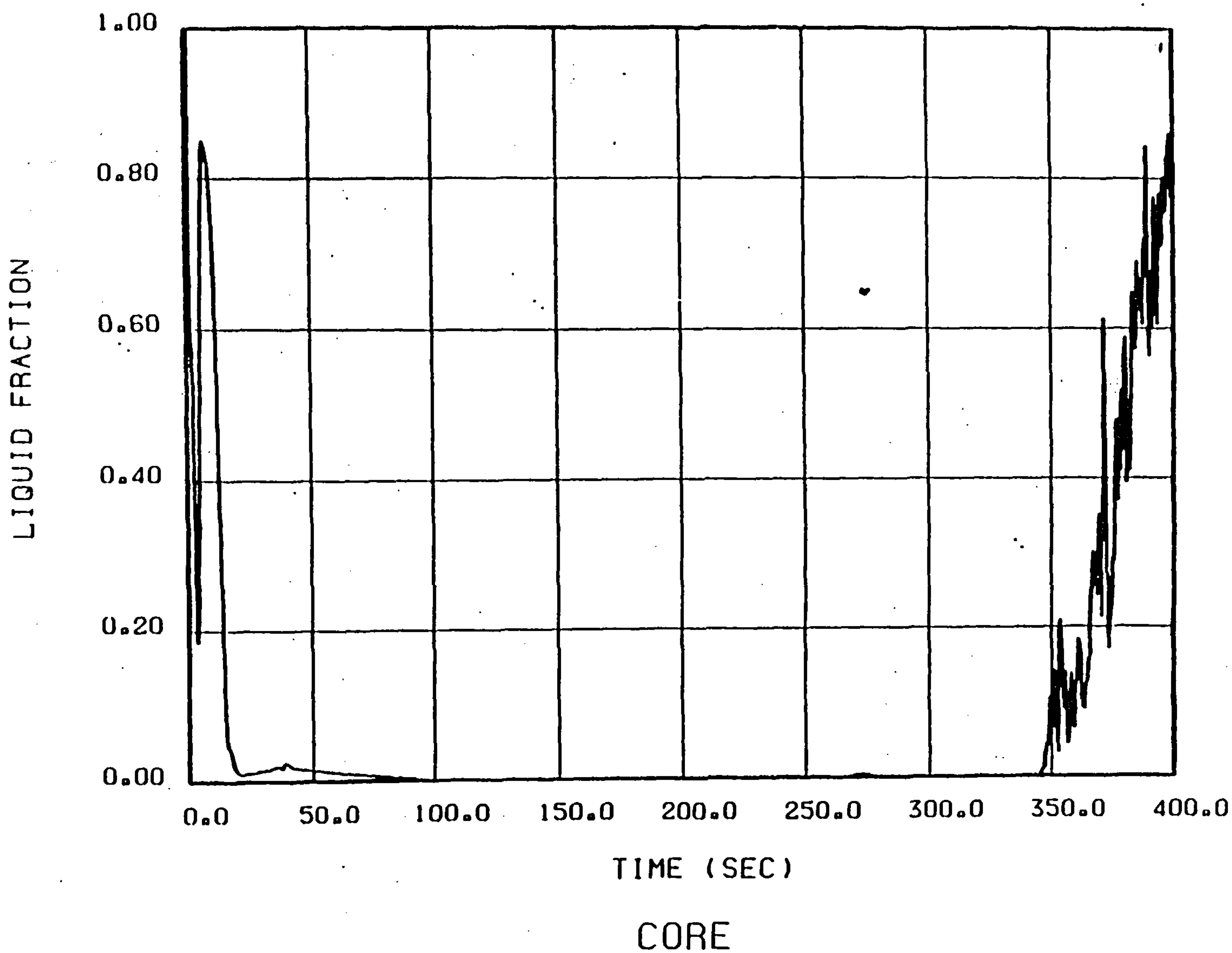


Figure 4.30. Liquid fraction in core

5. RUN STATISTICS

In the nodalization defined we have used the following number of cells:

- Vessel and core 192
- Intact loop 54
- Broken loop 37
- Steam generator (secondary side) 19

Total number of cells = 302

Minimum and maximum time steps selected were:

Range (s)	DTMIN (s)	DTMAX (s)
0 - 1	1.E-5	1.E-3
1 - 5	1.E-5	1.E-2
5 - 345	1.E-5	1.E-1

These maximum values haven't been reached in any phase as may be seen in Fig 5.1, where the time step evolution along the transient is shown.

Figure 5.2 reflects the cumulative CPU time used in calculating the transient. Clearly, we can distinguish two phases according to the time steps selected by the code:

Phase	Range (s)	Number steps	CPU time (s)	RS
Blowdown & Heat-up	0 - 345	21500	624E3	96.1
Reflood	345 - 400	16000	576E3	119.2

The last column, named RS, represents the calculated run statistics (CPU time in ms per cell and time step) in units of ms/(cell*step).

Machine used for this calculation was CDC Cyber (operating system NOS-BE) with reserved Core Memory = 376500 and Extended Memory = 500.

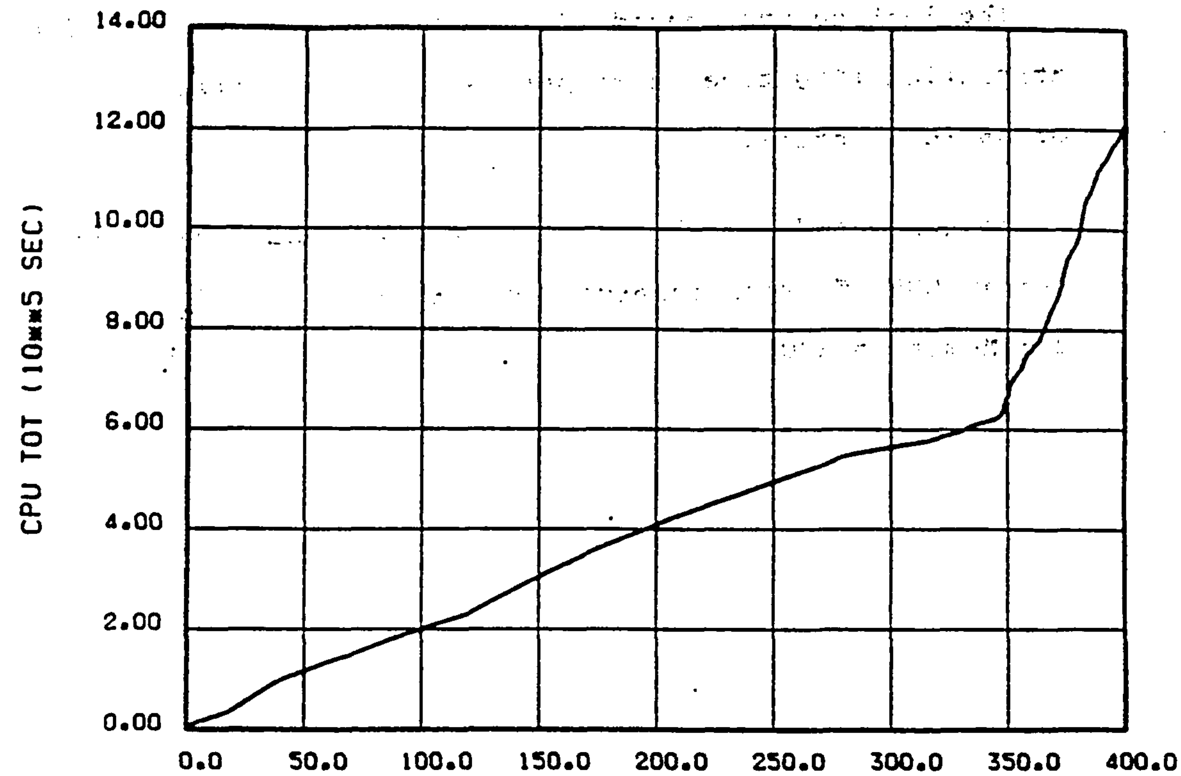


Figure 5.2. Accumulated CPU time

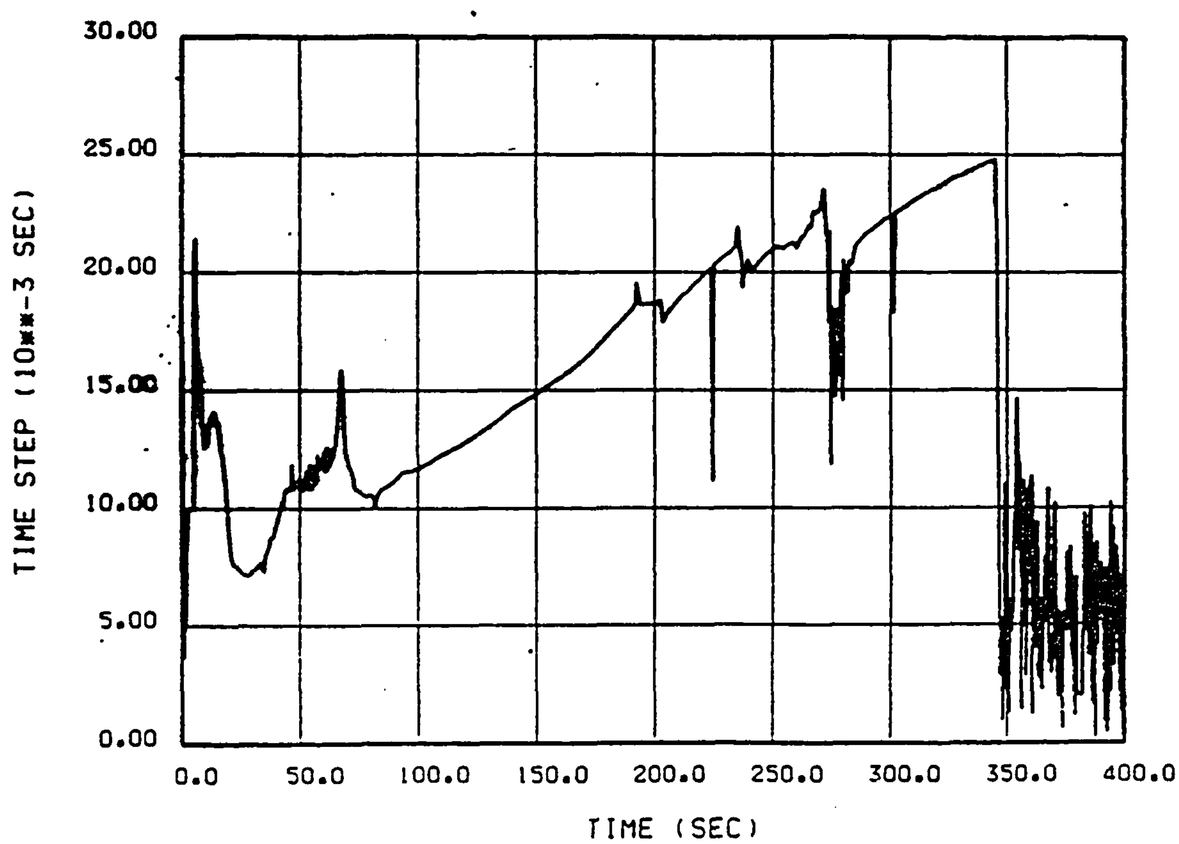


Figure 5.1. Time step evolution

6. CONCLUSIONS

1. Good agreement exists between calculated and experimental hydraulic variables during the blowdown, like pressure, mass flow rates and densities.

2. TRAC-PF1 cannot simulate observed initial quenches and final quench time. If these delays were consequence of an incorrect value of MSFBT, introducing a multiplicative correcting factor greater than 1.12 in the correlation for MSFBT (only for the FP-1 case), the experimental quench time can be reproduced.

3. Good agreement is found between calculated and measured cladding temperatures for the 4 % enriched rods in central fuel assembly.

4. Those simulated 6 % fuel rods which suffer quench during the blowdown phase (such as rod 15 in TRAC, close to ILCL), show the best fitting with thermocouple data. For the remaining 6 % and peripheral rods, higher temperatures are calculated in film boiling transfer regime.

5. Three-dimensional behaviour is calculated, although unplanned upper plenum injection was defined to be azimuthally symmetric within each ring.

6. Flow patterns during rod rupture period show two possible paths for fission products in a non-dry phase.

7. REFERENCES

1. REEDER, D.L., 1978. LOFT System and Test Description. NUREG/CR-0247, TREE-1208.

2. Upper reactor vessel and ECC tube thermal-hydraulic analysis. 1984. EG&G OECD LOFT-I-14-5093.

3. Internal LOFT reactor vessel core bypass flows. 1981. EG&G LO-17-81-044.

4. BERTA, V.T., CORYEL, E.W., 1984. OECD LOFT Proyect Experiment Specification Document Fission Product Experiment LP-FP-1. OECD-LOFT-T-3702.

5. ADAMS, J.P. et al., 1985. Quick Look Report on OECD-LOFT Experiment LP-FP-1. OECD-LOFT-T-3704. (and Experimental Data Tapes).

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7. CORYELL, E.W. and GLAESSER, H.G., 1984. Best estimate prediction for OECD LOFT Project Fission Product Experiment LP-FP-1. OECD-LOFT-T-3703.

8. CODDINGTON,P., 1987. FP-1 Accumulator Blowdown Calculations. Experts Meeting on LP-FP-1 Analysis. Garching.

9. WAHBA, A.B., 1987. The Fission Product Experiment FP-1 and Status of the Analysis. Experts Meeting on FP-1 Analysis. Garching.

LIST OF FIGURES

LIST OF TABLES

APENDIX A. LOFT system instrumentation

This section resumes the instrumentation nomenclature and location in the LOFT facility, contained in reference [5].

Figures show locations for the main instrumentation used for the FP-1 thermal-hydraulic study.

All experimental data plotted in this document are identified using the instrumentation nomenclature explained in Table A.1, which is also used for the related variables. The DIRC report resumed, shows the qualified and failed data in the experiment, recorded at 50 samples per second, except in the cases which are noted.

TABLE A.1. Nomenclature for LOFT instrumentation

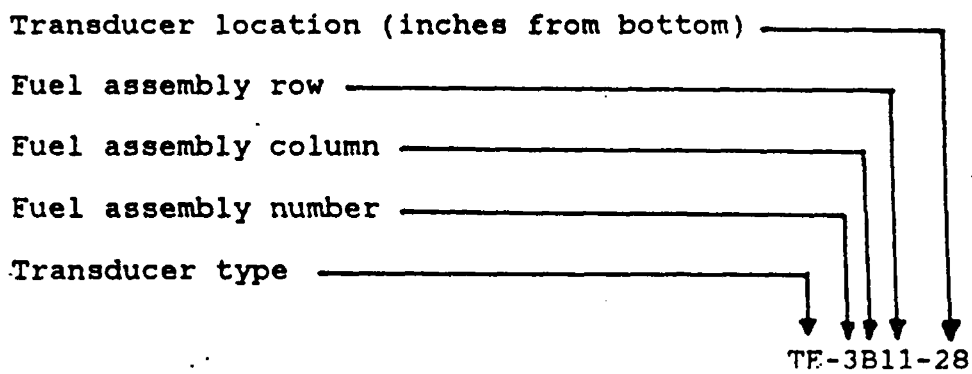
Designation for the different types of transducers

RPE - Pump speed	FE - Coolant flow
PE - Pressure transducer	DE - Densitometer
PdE - Differential pressure	ME - Momentum flux
LE - Coolant level	FT - Flow rate
PS - Pressure switch	TC - Fuel centerline
TE - Thermocouple	

Designation of systems

PC - Primary coolant intact	LP - Lower plenum
BL - Broken loop	ST - Dowcomer stalk
RV - Reactor vessel	UP - Upper plenum
P120 - Emergency core coolant system	P128 - Primary coolant addition and control

Designation for Core instrumentation



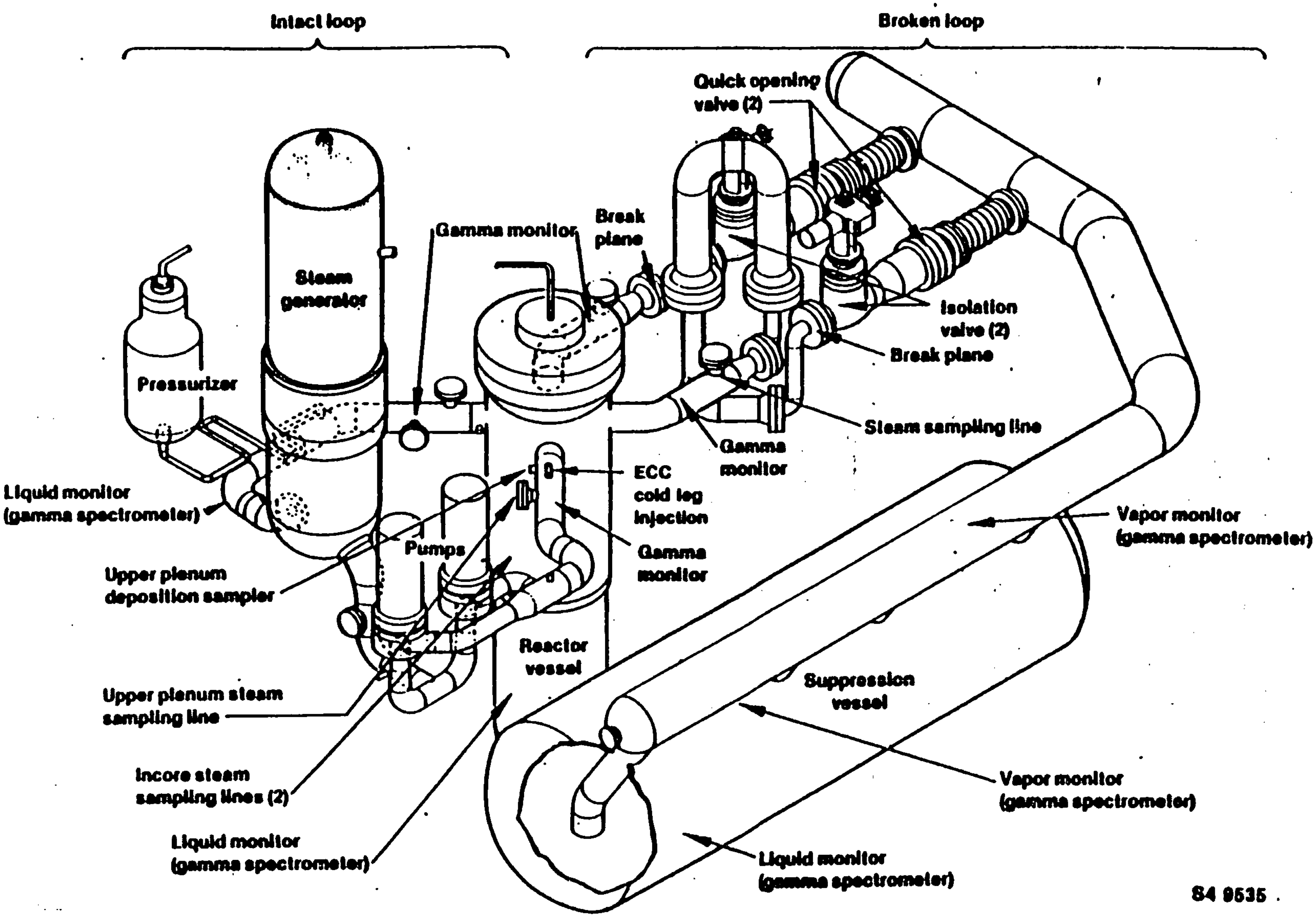


Figure A-1. LOFT Major Components

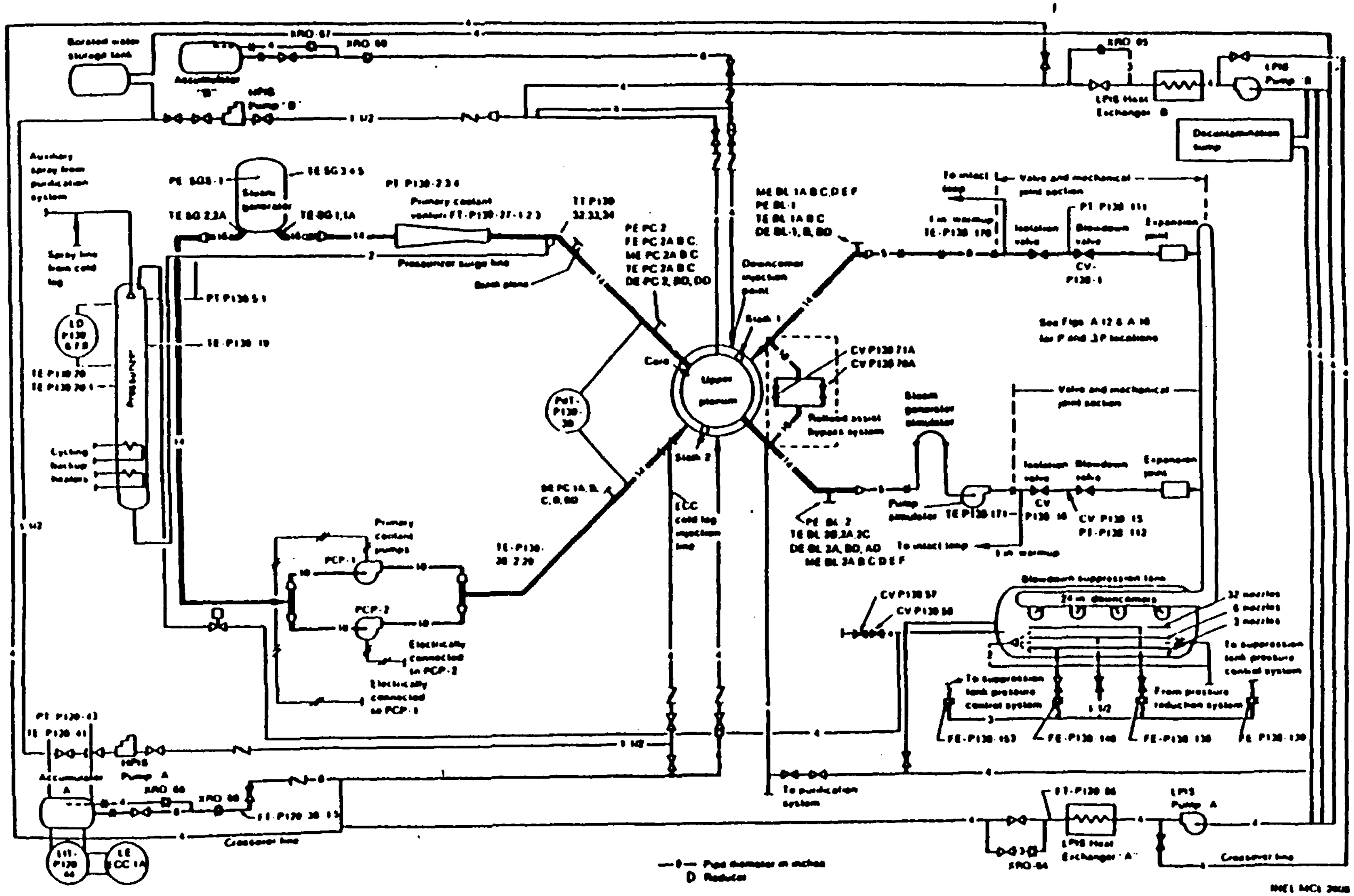


Figure A-2. LOFT Piping Schematic with Instrumentation

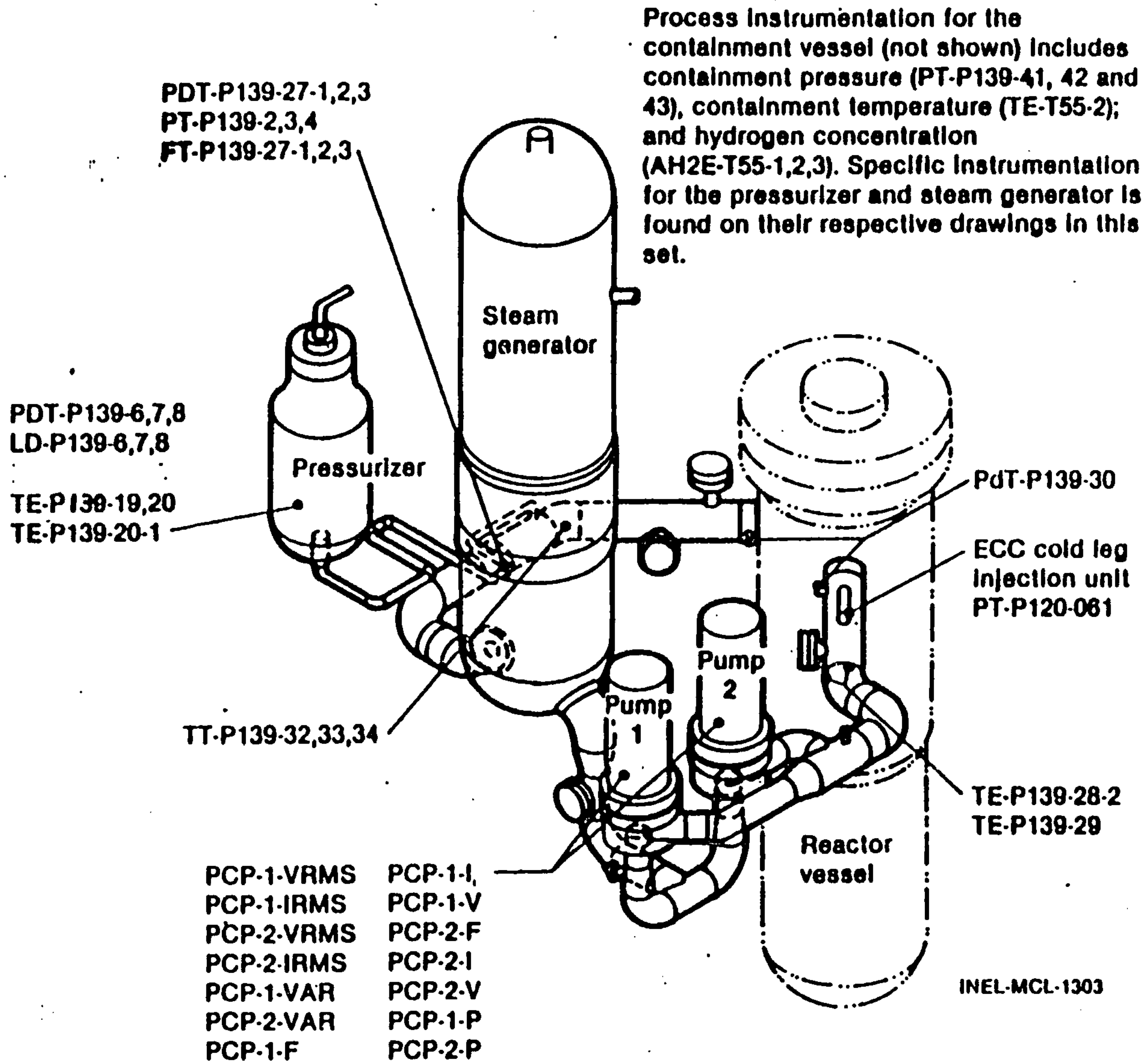


Figure A-3 LOFT Intact Loop Process Instrumentation

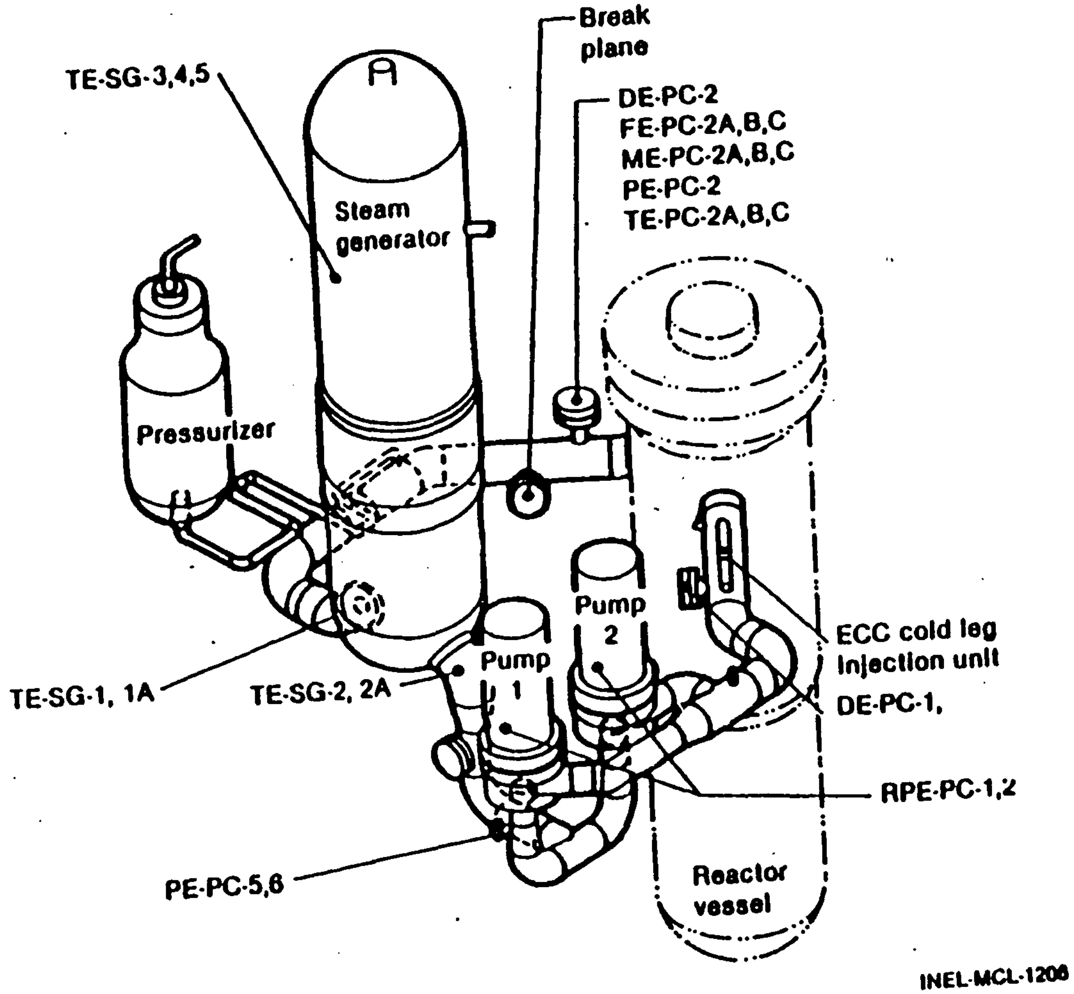


Figure A-4. LOFT Intact Loop Experimental Thermal-Hydraulic Instrumentation

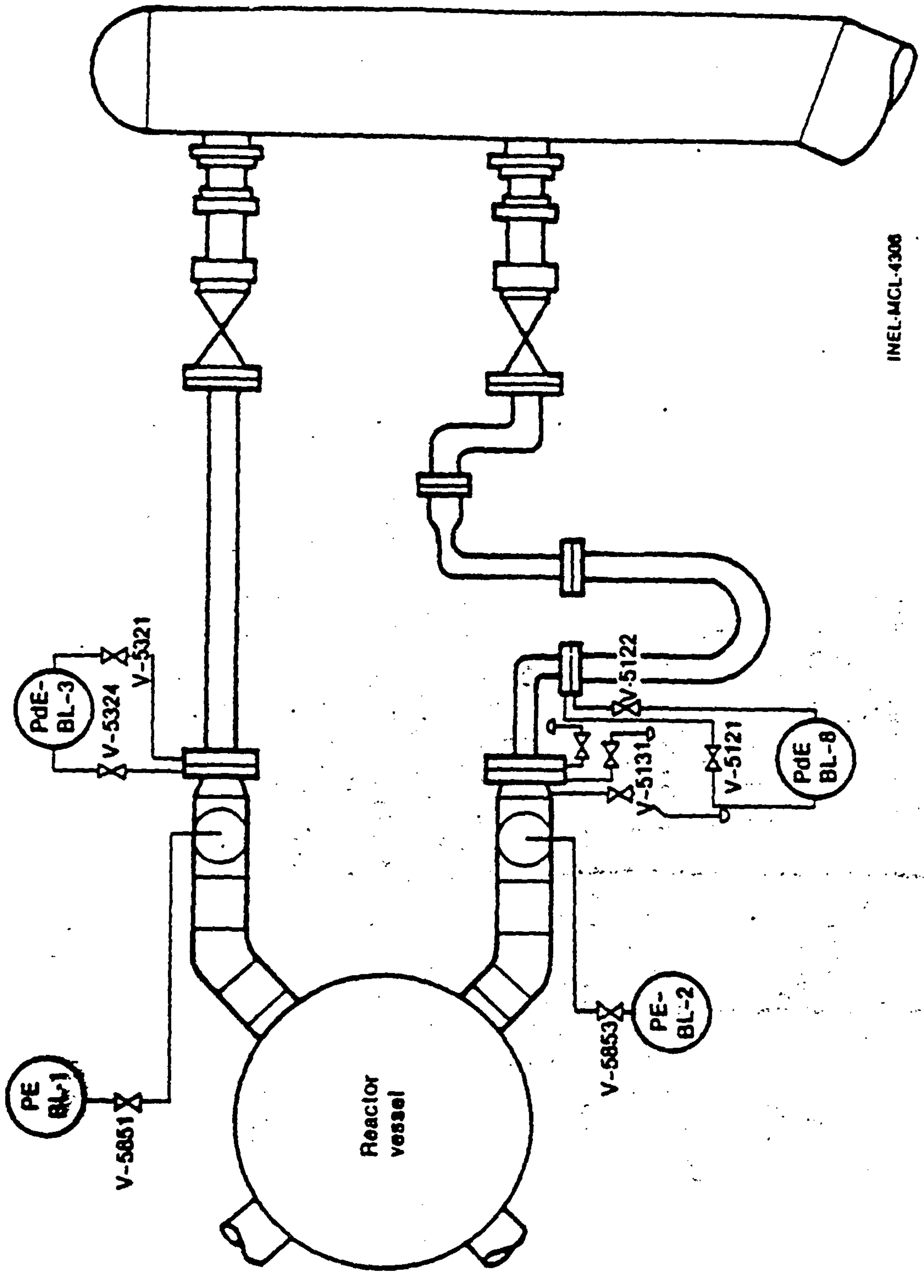


Figure A-5. Instrument Locations - Broken Loop Differential Pressure Measurements

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S):
CV-P004-008	VALVE POS-FEEDWATER FLOW CONTROL	01-03-85	QUALIFIED	
CV-P004-010	VALVE POS-SCS STEAM FLOW CONTROL	12-31-84	QUALIFIED	
CV-P004-090	MAIN STEAM BYPASS VALVE	01-03-85	QUALIFIED	
CV-P004-091	MAIN FEED BYPASS VALVE	12-31-84	QUALIFIED	
CV-P138-001	VALVE POS-BROKEN LOOP CL QOBV	01-03-85	QUALIFIED	
CV-P138-015	VALVE POS-BROKEN LOOP HL QOBV	12-31-84	QUALIFIED	
CV-P138-070A	VALVE POS-BLOWDOWN SYSTEM RABV CH A	12-31-84	QUALIFIED	
CV-P138-071A	VALVE POS-BLOWDOWN SYSTEM RABV CH B	12-31-84	QUALIFIED	
DE-BL-001A	CHORDAL DENSITY-BROKEN LOOP CL	01-08-85	QUALIFIED	
DE-BL-001B	CHORDAL DENSITY-BROKEN LOOP CL	01-03-85	QUALIFIED	
DE-BL-001C	CHORDAL DENSITY-BROKEN LOOP CL	01-08-85	QUALIFIED	TO 65 SECONDS
DE-BL-002A	CHORDAL DENSITY-BROKEN LOOP HL	01-03-[illegible]	QUALIFIED	TO 65 SECONDS
DE-BL-002B	CHORDAL DENSITY-BROKEN LOOP HL	01-03[illegible]	[illegible]UALIFIED	TO 65 SECONDS

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
DE-BL-002C	CHORDAL DENSITY-BROKEN LOOP HL	01-09-85	QUALIFIED	TO 65 SECONDS
DE-BL-002D	GROSS GAMMA BKG/BROKEN LOOP HL	01-29-85	QUALIFIED	TREND DATA ONLY, 80 SAMPLES PER SECOND DATA
DE-BL-105	AVERAGE DENSITY-BROKEN LOOP CL	01-11-85	QUALIFIED	AFTER 13 SECONDS SPURIOUS SPIKES
DE-BL-205	AVERAGE DENSITY-BROKEN LOOP HL	01-11-85	QUALIFIED	TO 65 SECONDS
DE-PC-001A	CHORDAL DENSITY-INTACT LOOP CL	01-08-85	QUALIFIED	SPURIOUS SPIKES
DE-PC-001B	CHORDAL DENSITY-INTACT LOOP CL	01-08-85	QUALIFIED	SPURIOUS SPIKES
DE-PC-001C	CHORDAL DENSITY-INTACT LOOP CL	01-08-85	QUALIFIED	SPURIOUS SPIKES
DE-PC-002A	CHORDAL DENSITY-INTACT LOOP HL	01-09-85	QUALIFIED	DE-PC-001D USED FOR BACKGROUND CORRECTION
DE-PC-002B	CHORDAL DENSITY-INTACT LOOP HL	01-03-85	QUALIFIED	TO 65 SECONDS
DE-PC-002C	CHORDAL DENSITY-INTACT LOOP HL	01-09-85	FAILED	
DE-PC-002D	GROSS GAMMA BKG/INTACT LOOP HL	01-29-85	QUALIFIED	TREND DATA ONLY
DE-PC-105	AVERAGE DENSITY - INTACT LOOP CL	01-11-85	QUALIFIED	
DE-PC-225	WEIGHTED AVG DENSITY IL HL	01-11-85	QUALIFIED	TO 65 SECONDS

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
FE-PC-002A	VELOCITY-INTACT LOOP HOT LEG BOTTOM	01-09-85	QUALIFIED	UNIDIRECTIONAL
FE-PC-002B	VELOCITY-INTACT LOOP HOT LEG MIDDLE	01-09-85	QUALIFIED	UNIDIRECTIONAL
FE-PC-002C	VELOCITY-INTACT LOOP HOT LEG TOP	01-09-85	QUALIFIED	UNIDIRECTIONAL
FE-PC-002	AVERAGE VELOCITY - INTACT LOOP HL	01-22-85	QUALIFIED	UNIDIRECTIONAL
FE-1ST-001	VELOCITY DOWNCOMER STALK 1	01-09-85	QUALIFIED	UNIDIRECTIONAL
FE-1ST-002	VELOCITY DOWNCOMER STALK 1 LOWER	01-18-85	QUALIFIED	UNIDIRECTIONAL
FE-5UP-002	VELOCITY-FA5 ABOVE UPPER END BOX	01-09-85	QUALIFIED	UNIDIRECTIONAL
FR-BL-105	AVERAGE FLOWRATE, BROKEN LOOP CL	01-18-85	QUALIFIED	TO 65 SECONDS
FR-BL-205	AVERAGE FLOWRATE, BROKEN LOOP HL	01-22-85	QUALIFIED	TO 420 SECONDS. MASS FLOW AFTER 65 SECONDS BASED ON STEAM DENSITY
FR-PC-205	MASS FLOW RATE HL DD*DENS	01-22-85	QUALIFIED	TO 22 SECONDS. B DRAG DISC SUBSTITUTED FOR C DRAG DISC IN CALCULATION
FT-P004-012	FLOWRATE-STEAM FLOW CONDENSER IN	01-03-85	QUALIFIED	INITIAL CONDITIONS ONLY
FT-P004-090	VOLUMETRIC FLOW, STEAM ULTRASONIC B	01-03-85	QUALIFIED	
FT-P004-091	VOLUMETRIC FLOW SECONDARY	01-03-85	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)'
FT-P004-72A	FLOWRATE-SCS FEEDWATER	01-09-85	QUALIFIED	INITIAL CONDITION ONLY
FT-P004-72-2	FLOWRATE-SCS FEEDWATER	01-09-85	QUALIFIED	INITIAL CONDITIONS ONLY
FT-P120-072	FLOWRATE-LPIS PUMP B DISCHARGE	01-03-85	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
FT-P120-085	FLOWRATE-LPIS PUMP A DISCHARGE	01-03-85	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
FT-P128-085	FLOWRATE-HPIS PUMP B DISCHARGE	01-09-85	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
FT-P128-104	FLOWRATE-HPIS PUMP A DISCHARGE	01-10-85	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
FT-P139-27-1	FLOWRATE-INTACT LOOP COOLANT	01-08-85	QUALIFIED	INITIAL CONDITION ONLY
FT-P139-27-2	FLOWRATE-INTACT LOOP COOLANT	01-08-85	QUALIFIED	INITIAL CONDITION ONLY
FT-P139-27-3	FLOWRATE-INTACT LOOP COOLANT	01-08-85	QUALIFIED	INITIAL CONDITION ONLY
FT-P141-022	FLOWRATE-TOTAL PCC	01-03-85	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
LD-P139-006	LIQUID LEVEL-PRESSURIZER CH A	12-31-84	QUALIFIED	INITIAL CONDITIONS ONLY
LD-P139-007	LIQUID LEVEL-PRESSURIZER CH B	12-31-84	QUALIFIED	INITIAL CONDITIONS ONLY
LD-P139-008	LIQUID LEVEL-PRESSURIZER CH C	12-31-84	FAILED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)'
LEPDE-SV-161	LIQUID LEVEL-BST	01-10-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY
LEPDE-SV-261	LIQUID LEVEL-BST	01-10-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY
LE-ECC-01A	ACCUMULATOR A LIQUID LEVEL	01-11-85	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
LE-1F10	COOLANT LEVEL-FUEL ASSY 1 LOC F10	01-03-85	QUALIFIED	FAILED STINGS - 1,4,5,6,7,8,9,11,13,16,18,19
LE-1ST-001	COOLANT LEVEL-INSTR STALK 1 LP	12-27-84	QUALIFIED	
LE-1ST-002	COOLANT LEVEL-INSTR STALK 1 DC	12-27-84	QUALIFIED	FAILED STINGS - 1,2,5
LE-3F10	COOLANT LEVEL-FUEL ASSY 3 LOC F10	12-27-84	QUALIFIED	FAILED STINGS - 2,3,4,5,7,11,16,18,19
LE-3UP-001	COOLANT LEVEL-UPPER PLENUM	01-03-85	QUALIFIED	FAILED STINGS - 1,2,3,4,5,6,9
LE-5E11	COOLANT LEVEL-FUEL ASSY 5 LOC E 11	12-27-84	QUALIFIED	FAILED STING - 17
LE-5UP-001	COOLANT LEVEL-UPPER PLENUM	12-27-84	QUALIFIED	
LIT-P120-030	LIQUID LEVEL-ACCUMULTOR B	01-11-85	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
LTD-P138-033	BST DENS CORR	01-10-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY
LTD-P138-058	BST DENS CORR	01-10-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S),
LT-P004-008A	STEAM GENERATOR LEVEL NARROW RANGE	01-14-85	QUALIFIED	
LT-P004-042	CONDENSATE RECEIVER LEVEL	12-31-84	QUALIFIED	
LT-P004-08AA	STEAM GEN LEVEL NARROW RANGE	01-14-84	QUALIFIED	
LT-P138-033	LIQUID LEVEL-BST A	01-18-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY
LT-P138-058	LIQUID LEVEL-BST B	01-18-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY
ME-BL-001A	MOM FLUX, BL-1, BOT, HIGH RANGE	01-18-85	QUALIFIED	TO 65 SECONDS
ME-BL-001B	MOM FLUX, BL-1, MIDDLE, HIGH RANGE	01-18-85	QUALIFIED	TO 65 SECONDS
ME-BL-001C	MOM FLUX, BL-1, TOP, HIGH RANGE	01-18-85	QUALIFIED	TO 65 SECONDS
ME-BL-001	AVERAGE MOM FLUX BROKEN LOOP CL	01-18-85	QUALIFIED	TO 65 SECONDS
ME-BL-002A	MOMENTUM FLUX-BROKEN LOOP HL BOTTOM	01-18-85	QUALIFIED	
ME-BL-002B	MOMENTUM FLUX-BROKEN LOOP HL MIDDLE	01-18-85	QUALIFIED	
ME-BL-002C	MOMENTUM FLUX-BROKEN LOOP HL TOP	01-18-85	QUALIFIED	
ME-BL-002	AVERAGE MOM FLUX BROKEN LOOP HL	01-18-85	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
ME-PC-002A	MOMENTUM FLUX-INTACT LOOP HL BOTTOM	01-22-85	QUALIFIED	TO 22 SECONDS
ME-PC-002B	MOMENTUM FLUX-INTACT LOOP HL MIDDLE	01-22-85	QUALIFIED	TO 22 SECONDS
ME-PC-002C	MOMENTUM FLUX-INTACT LOOP HL TOP	01-18-85	FAILED	
ME-PC-002	AVE MOMENTUM FLUX-INTACT LOOP HL	01-22-85	QUALIFIED	TO 22 SECONDS. B DRAG DISC SUBSTITUTED FOR C DRAG DISC IN CALCULATION
ME-1ST-001	MOMENTUM FLUX-INSTR STALK 1 DC	01-22-85	FAILED	
ME-1ST-002	MOMENTUM FLUX-INSTR STALK 1 DC	01-22-85	FAILED	
ME-5UP-002	MOMENTUM FLUX-FA5 AB UPPER END BOX	01-22-85	QUALIFIED	UNTIL 10 SECS AND AFTER 70 SECONDS UNCOMPENSATED TEMPERATURE SENSITIVITY BETWEEN 10 & 70 SECS.
NE-2H08-26	NEUTRON DETECTOR IN CORE FA#2	12-31-84	QUALIFIED	
NE-4H08-26	NEUTRON DETECTOR IN CORE FA#4	12-31-84	QUALIFIED	
NE-6H08-26	NEUTRON DETECTOR IN CORE FA#6	12-31-84	QUALIFIED	
PDE-BL-003	DELTA P-BL COLD LEG BRK PLANE	01-03-85	QUALIFIED	
PDE-BL-008	DELTA P-BL ACROSS SG SIM IN FLNG	01-03-85	QUALIFIED	
PDE-SV-001	SUPPRESSION VESSEL LEVEL	01-18-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
PDE-SV-002	SUPPRESSION VESSEL LEVEL	01-18-85	QUALIFIED	INITIAL AND FINAL CONDITIONS ONLY
PDTP139-27-1	INTACT LOOP MASS FLOW DELTA P	01-08-85	QUALIFIED	INITIAL CONDITION ONLY, TREND THEREAFTER
PDTP139-27-2	INTACT LOOP MASS FLOW DELTA P	01-08-85	QUALIFIED	INITIAL CONDITION ONLY, TREND THEREAFTER
PDTP139-27-3	INTACT LOOP MASS FLOW DELTA P	01-08-85	QUALIFIED	INITIAL CONDITION ONLY, TREND THEREAFTER
PDT-P004-072	DIFF PRESS FEEDWATER FLOW ORIFICE	01-09-85	QUALIFIED	INITIAL CONDITIONS ONLY
PDT-P139-030A	DELTA P-PRIMARY COOLANT PUMP	01-03-85	QUALIFIED	INITIAL CONDITIONS ONLY
PDT-P139-030B	DELTA P-INTACT LOOP SG	01-08-85	QUALIFIED	INITIAL CONDITION ONLY, TREND THEREAFTER
PDT-P139-030	DELTA P - REACTOR VESSEL	01-03-85	QUALIFIED	UNIDIRECTIONAL
PE-BL-001	PRESSURE-BROKEN LOOP COLD LEG	12-27-84	QUALIFIED	
PE-BL-002	PRESSURE-BROKEN LOOP HOT LEG	12-27-84	QUALIFIED	
PE-PC-C02	PRESSURE-INTACT LOOP HOT LEG	12-27-84	QUALIFIED	
PE-PC-005	PRESSURE-INTACT LOOP REF.	12-27-84	QUALIFIED	
PE-PC-006	PRESSURE-INTACT LOOP REF.	12-27-84	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
PS-5F04-SW	PRESSURE SWITCH, FA #5	01-11-85	QUALIFIED	SWITCH ACTIVATES AT ROD INTERNAL PRESSURE OF 450 +-20 PSI
PS-5F12-SW	PRESSURE SWITCH, FA #5	01-11-85	QUALIFIED	SWITCH ACTIVATES AT ROD INTERNAL PRESSURE OF 450 +-20 PSI
PS-5G11-SW	PRESSURE SWITCH, FA #5	01-11-85	QUALIFIED	SWITCH ACTIVATES AT ROD INTERNAL PRESSURE OF 450 +-20 PSI
PS-5I05-SW	PRESSURE SWITCH, FA #5	01-11-85	QUALIFIED	SWITCH ACTIVATES AT ROD INTERNAL PRESSURE OF 450 +-20 PSI
PS-5J12-SW	PRESSURE SWITCH, FA #5	01-11-85	QUALIFIED	SWITCH ACTIVATES AT ROD INTERNAL PRESSURE OF 450 +-20 PSI
PT-P004-010A	PRESSURE-SCS 10 INCH LINE FROM SG	12-27-84	QUALIFIED	
PT-P004-022	CONDENSATE RECEIVER PRESSURE	12-27-84	QUALIFIED	
PT-P004-034	PRESSURE-SCS FEEDWATER	12-27-84	QUALIFIED	
PT-P004-085	PRESSURE-SCS 12 INCH CONDENSOR IN	12-27-84	FAILED	
PT-P120-029	PRESSURE-ECCS ACCUMULATOR B	12-27-84	QUALIFIED	
PT-P120-043	PRESSURE-ECCS ACCUMULATOR A	01-18-85	QUALIFIED	
PT-P128-102	AC-P-4B DISCHARGE PRESS	01-09-85	FAILED	
PT-P128-103	AC-P-4A DISCHARGE PRESS	01-09-85	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
PT-P138-055	PRESSURE-BST VAPOR SPACE CH A	01-03-85	QUALIFIED	
PT-P138-056	PRESSURE-BST VAPOR SPACE CH B	01-03-84	QUALIFIED	
PT-P138-057	PRESSURE-BST VAPOR SPACE CH C	01-03-85	QUALIFIED	
PT-P139-002	PRESSURE-INTACT LOOP HOT LEG CH A	12-31-84	QUALIFIED	RESPONSE LIMITED DURING THE SUB COOLED BLOWDOWN
PT-P139-003	PRESSURE-INTACT LOOP HOT LEG CH B	12-31-84	QUALIFIED	RESPONSE LIMITED DURING THE SUB COOLED BLOWDOWN
PT-P139-004	PRESSURE-INTACT LOOP HOT LEG CH C	12-31-84	QUALIFIED	RESPONSE LIMITED DURING THE SUB COOLED BLOWDOWN
PT-P139-041	PRESSURE CONTAINMENT CHAN A	12-27-84	FAILED	
PT-P139-042	PRESSURE CONTAINMENT CHAN B	12-27-84	QUALIFIED	
PT-P139-043	PRESSURE CONTAINMENT CHAN C	12-31-84	QUALIFIED	
PT-P139-05-1	PRESSURE-PRESSURIZER	12-27-84	QUALIFIED	
RE-T-77-1A2	NIS-POWER RANGE CHANNEL A LEVEL	01-11-85	QUALIFIED	
RE-T-77-2A2	NIS-POWER RANGE CHANNEL B LEVEL	01-11-85	QUALIFIED	
RE-T-77-3A2	NIS-POWER RANGE CHANNEL C LEVEL	01-11-85	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
RPE-PC-001	PUMP SPEED-PRIMARY COOLANT PUMP 1	12-31-84	QUALIFIED	AFTER 5 SECONDS
RPE-PC-002	PUMP SPEED-PRIMARY COOLANT PUMP 2	12-31-84	QUALIFIED	
RP-CRDM2-TC	ROD POS-ROD 2 TURNS COUNTER	12-31-84	QUALIFIED	FOR SCRAM EVENT TIME ONLY
RP-CRDM4-TC	ROD POS-ROD 4 TURNS COUNTER	12-31-84	QUALIFIED	FOR SCRAM EVENT TIME ONLY
RP-CRDM6-TC	ROD POS-ROD 6 TURNS COUNTER	12-31-84	QUALIFIED	FOR SCRAM EVENT TIME ONLY
RP-CRDM8-TC	ROD POS-ROD 8 TURNS COUNTER	12-31-84	QUALIFIED	FOR SCRAM EVENT TIME ONLY
RTP165-S1-10	GROSS GAMMA S1 SAMPLE SYSTEM	01-22-85	QUALIFIED	TREND DATA ONLY
RTP165-S2-10	GROSS GAMMA S2 SAMPLE SYSTEM	01-22-85	FAILED	
RTP165-S3-10	GROSS GAMMA S3 SAMPLE SYSTEM	01-22-85	QUALIFIED	S-3 SAMPLE SYSTEM BLOCKED
RTP165-S4-10	GROSS GAMMA S4 SAMPLE SYSTEM	01-22-84	QUALIFIED	TREND DATA ONLY
SP-BL-001B	SAT PRESSURE BROKEN LOOP CL	01-08-85	QUALIFIED	
SP-BL-002B	SAT PRESSURE BROKEN LOOP HL	01-08-85	QUALIFIED	
SP-PC-002B	SATURATION PRESS-INTACT LOOP HL	01-08-85	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
SP-SG-004	SATURATION PRESSURE, STEAM GEN, MID	01-08-85	QUALIFIED	
SP-1ST-005	SATURATION PRESS-DOWNCOMER STALK 1	01-08-85	QUALIFIED	
SP-1UP-001	SATURATION PRESSURE, UPPER PLENUM	01-08-85	QUALIFIED	
ST-BL-001	SAT TEMPERATURE BROKEN LOOP CL	01-08-85	QUALIFIED	
ST-BL-002	SAT TEMPERATURE BROKEN LOOP HL	01-08-85	QUALIFIED	
ST-PC-002	SATURATION TEMP, INTACT LOOP, HL	01-08-85	QUALIFIED	
ST-PC-005	SATURATION TEMP, INTACT LOOP, CL	01-08-85	QUALIFIED	
ST-P004-010A	SATURATION TEMP - SCS SG 10 IN LINE	01-08-85	QUALIFIED	
TC-5D06-27	TEMP FUEL CENTERLINE/FA5 PIN D6 27"	12-27-84	FAILED	
TC-5D10-27	TEMP FUEL CENTERLINE/FA5 PIN D10 27	01-03-85	QUALIFIED	FAILED PRE-LOCE TEST
TE-BL-001A	COOLANT TEMP-BROKEN LOOP CL BOTTOM	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-BL-001B	COOLANT TEMP-BROKEN LOOP CL MIDDLE	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-BL-001C	COOLANT TEMP-BROKEN LOOP CL TOP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS

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MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-BL-002B	COOLANT TEMP-BROKEN LOOP HL MIDDLE	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-BL-002C	COOLANT TEMP-BROKEN LOOP HL TOP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-PC-002A	TEMP-INTACT LOOP HL BOTTOM	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-PC-002B	TEMP-INTACT LOOP HL MIDDLE	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-PC-002C	TEMP-INTACT LOOP HL TOP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-P004-054	CONDENSATE RECEIVER TEMP	12-27-84	QUALIFIED	
TE-P120-001	LIQUID TEMP-BWST	12-27-84	QUALIFIED	
TE-P120-041	LIQUID TEMP-ECCS ACCUM A	01-03-85	QUALIFIED	INITIAL CONDITIONS ONLY
TE-P120-102	LIQUID TEMP-ECCS LPIS HX B OUTLET	12-27-84	QUALIFIED	
TE-P139-019	TEMPERATURE-PRESSURIZER VAPOR	12-31-84	QUALIFIED	INITIAL CONDITIONS ONLY
TE-P139-020	TEMPERATURE-PRESSURIZER LIQUID	12-31-84	QUALIFIED	INITIAL CONDITIONS ONLY
TE-P139-029	COOLANT TEMP-INTACT LOOP COLD LEG	12-27-84	QUALIFIED	INITIAL CONDITIONS ONLY
TE-P139-28-2	TEMPERATURE-INTACT LOOP COLD LEG	12-27-84	QUALIFIED	INITIAL CONDITIONS ONLY

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-P139-32-1	PRIMARY COOLANT HOT LEG TEMP CHAN A	12-27-84	QUALIFIED	INITIAL CONDITIONS ONLY
TE-P141-094	PCCS HEAT EXCH HL TEMP	12-27-84	QUALIFIED	
TE-P141-095	WATER TEMP-COLD LEG OF PCC LOADS	12-27-84	QUALIFIED	
TE-SG-001A	COOLANT TEMP-IL SG INLET PLENUM	01-03-85	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-SG-001	COOLANT TEMP-IL SG INLET PLENUM	12-31-84	FAILED	
TE-SG-002A	COOLANT TEMP-IL SG OUTLET PLENUM	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-SG-002	COOLANT TEMP-IL SG OUTLET PLENUM	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-SG-003	LIQUID TEMP-SCS SG DOWNCOMER	12-27-84	FAILED	
TE-SG-004	LIQUID TEMP-SCS SG DOWNCOMER	12-27-84	QUALIFIED	
TE-SV-001	LIQUID TEMP-BST STALK 1-107.2	12-27-84	QUALIFIED	
TE-SV-006	LIQUID TEMP-BST STALK 1-14.7	12-27-84	QUALIFIED	
TE-SV-007	LIQUID TEMP-BST STALK 2-107.2	12-27-84	QUALIFIED	
TE-SV-011	LIQUID TEMP-BST STALK 2-39.0	12-27-84	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-SV-012	LIQUID TEMP-BST STALK 2-14.7	12-27-84	QUALIFIED	
TE-T055-002	TEMPERATURE-CONTAINMENT AMBIENT	12-27-84	QUALIFIED	NO OTHER MEASUREMENT FOR DIRECT COMPARISON
TE-1A11-030	TEMP-CLADDING/FA1 PIN A11 30 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1B10-037	TEMP-CLADDING/FA1 PIN B10 37 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1B11-028	TEMP-CLADDING/FA1 PIN B11 28 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1B11-032	TEMP-CLADDING/FA1 PIN B11 32 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1C11-021	TEMP-CLADDING/FA1 PIN C11 21 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1C11-039	TEMP-CLADDING/FA1 PIN C11 39 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1F07-015	TEMP-CLADDING/FA1 PIN F7 15 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1F07-026	TEMP-CLADDING/FA3 PIN F7 26 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-1ST-001	COOLANT TEMP-RV INSTR STALK 1 DC	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-002	COOLANT TEMP-RV INSTR STALK 1 DC	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-003	COOLANT TEMP-RV INSTR STALK 1 DC	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-1ST-004	COOLANT TEMP-RV INSTR STALK 1 DC	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-005	COOLANT TEMP-RV INSTR STALK 1 DC	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-006	COOLANT TEMP-RV INSTR STALK 1 DC	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-008	COOLANT TEMP-RV INSTR STALK 1 LP	12-27-84	FAILED	
TE-1ST-009	COOLANT TEMP-RV INSTR STALK 1 LP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-010	COOLANT TEMP-RV INSTR STALK 1 LP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-011	COOLANT TEMP-RV INSTR STALK 1 LP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-012	COOLANT TEMP-RV INSTR STALK 1 LP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-013	COOLANT TEMP-RV INSTR STALK 1 LP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-014	COOLANT TEMP-RV INSTR STALK 1 LP	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1ST-015	COOLANT TEMP-RV INSTR STALK 1 DC	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1UP-001	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1UP-002	COOLANT TEMP-UPPER END BOX	12-31-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-1UP-005	COOLANT TEMP-ON DTT FE-1UP-1	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-1UP-006	METAL TEMP-SUPPORT COLUMN FA1	12-27-84	QUALIFIED	
TE-1UP-007	METAL TEMP-SUPPORT COLUMN FA1	12-27-84	QUALIFIED	
TE-2E08-045	TEMP-CLADDING/FA2 PIN E8 45 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-2F07-015	TEMP-CLADDING/FA2 PIN F7 15 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-2F08-032	TEMP-CLADDING/FA2 PIN F8 32 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-2F09-026	TEMP-CLADDING/FA2 PIN F9 26 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-2G14-011	TEMP-CLADDING/FA2 PIN G14 11 IN.	12-27-84	QUALIFIED	
TE-2G14-030	TEMP-CLADDING/FA2 PIN G14 30 IN.	12-27-84	QUALIFIED	
TE-2G14-045	TEMP-CLADDING/FA2 PIN G14 45 IN.	12-27-84	QUALIFIED	
TE-2H02-028	TEMP-CLADDING/FA2 PIN H2 28 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-2H13-021	TEMP-CLADDING/FA2 PIN H13 21 IN.	12-27-84	QUALIFIED	
TE-2H13-049	TEMP-CLADDING/FA2 PIN H13 49 IN.	01-03-84	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-2H14-028	TEMP-CLADDING/FA2 PIN H14 28 IN.	12-27-84	QUALIFIED	
TE-2H14-032	TEMP-CLADDING/FA2 PIN H14 32 IN.	12-27-84	QUALIFIED	
TE-2H15-026	TEMP-CLADDING/FA2 PIN H15 26 IN.	12-27-84	QUALIFIED	
TE-2H15-041	TEMP-CLADDING/FA2 PIN H15 41 IN.	12-27-84	QUALIFIED	
TE-2I14-021	TEMP-CLADDING/FA2 PIN I14 21 IN.	12-27-84	QUALIFIED	
TE-2I14-039	TEMP-CLADDING/FA2 PIN I14 39 IN.	12-27-84	QUALIFIED	
TE-2LP-001	COOLANT TEMP-LOWER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-2LP-002	COOLANT TEMP-LOWER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-2LP-003	COOLANT TEMP-LOWER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-2UP-001	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-2UP-002	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-2UP-003	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-2UP-004	METAL TEMP-SUPPORT COLUMN FA2	12-27-84	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-2UP-005	METAL TEMP-SUPPORT COLUMN FA2	12-27-84	QUALIFIED	
TE-3A11-030	TEMP-CLADDING/FA3 PIN A11 30 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-3B11-028	TEMP-CLADDING/FA3 PIN B11 28 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-3B11-032	TEMP-CLADDING/FA3 PIN B11 32 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-3C11-021	TEMP-CLADDING/FA3 PIN C11 21 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-3C11-039	TEMP-CLADDING/FA3 PIN C11 39 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-3F07-026	TEMP-CLADDING/FA3 PIN F7 26 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-3UP-001	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-3UP-006	METAL TEMP-SUPPORT COLUMN FA3	12-27-84	QUALIFIED	
TE-3UP-008	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-3UP-010	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-3UP-011	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-3UP-012	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-3UP-013	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-3UP-014	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-3UP-015	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-3UP-016	TEMP-COOLANT LLT ABOVE FA3	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-4E08-045	TEMP-CLADDING/FA4 PIN E8 45 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-4F07-015	TEMP-CLADDING/FA4 PIN F7 15 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-4F08-032	TEMP-CLADDING/FA4 PIN F8 32 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-4G08-021	TEMP-CLADDING/FA4 PIN G8 21 IN.	12-27-84	QUALIFIED	
TE-4G14-011	TEMP-CLADDING/FA4 PIN G14 11 IN.	12-27-84	QUALIFIED	
TE-4G14-030	TEMP-CLADDING/FA4 PIN G14 30 IN	12-27-84	FAILED	
TE-4G14-045	TEMP-CLADDING/FA4 PIN G14 45 IN.	12-27-84	QUALIFIED	
TE-4H13-015	TEMP-CLADDING/FA4 PIN H13 15 IN.	12-27-84	QUALIFIED	
TE-4H13-037	TEMP-CLADDING/FA4 PIN H13 37 IN.	12-27-84	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-5C10-032	TEMP-GUIDE TUBE FA5 LOC C10 32 IN	12-27-84	QUALIFIED	
TE-5E05-032	TEMP-GUIDE TUBE FA5 LOC E5 32 IN	12-27-84	QUALIFIED	
TE-5E07-026	TEMP-CLADDING/FA5 PIN E7 26 IN	12-27-84	QUALIFIED	
TE-5E07-032	TEMP-CLADDING/FA5 PIN E7 32 IN	12-27-84	QUALIFIED	
TE-5E07-039	TEMP-CLADDING/FA5 PIN E7 39 IN	12-27-84	QUALIFIED	
TE-5E07-043	TEMP-CLADDING/FA5 PIN E7 43 IN	12-27-84	QUALIFIED	
TE-5E09-005	TEMP-CLADDING/FA5 PIN E9 5 IN	12-27-84	QUALIFIED	
TE-5E09-010	TEMP-CLADDING/FA5 PIN E9 10 IN	12-27-84	QUALIFIED	
TE-5E09-016	TEMP-CLADDING/FA5 PIN E9 16 IN	12-27-84	QUALIFIED	
TE-5E09-021	TEMP-CLADDING/FA5 PIN E9 21 IN	12-27-84	QUALIFIED	
TE-5F03-045	TEMP-GUIDE TUBE FA5 LOC F3 45 IN	12-27-84	QUALIFIED	
TE-5F13-060	TEMP-GUIDE TUBE FA5 LOC F13 60 IN	12-27-84	QUALIFIED	
TE-5G05-027	TEMP-CLADDING/FA5 PIN G5 27 IN	01-03-85	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-5G08-006	TEMP-CLADDING/FA5 PIN G8 6 IN	12-27-84	QUALIFIED	
TE-5G08-012	TEMP-CLADDING/FA5 PIN G8 12 IN	12-27-84	QUALIFIED	
TE-5G08-029A	TEMP-CLADDING/FA5 PIN G8 29 IN	12-27-84	QUALIFIED	
TE-5G08-029B	TEMP-CLADDING/FA5 PIN G8 29 IN	12-27-84	QUALIFIED	
TE-5G11-027	TEMP-CLADDING/FA5 PIN G11 27 IN	12-27-84	QUALIFIED	
TE-5I05-027	TEMP-CLADDING/FA5 PIN I5 27 IN	12-27-84	QUALIFIED	
TE-5I11-027	TEMP-CLADDING/FA5 PIN I11 27 IN	12-27-84	QUALIFIED	
TE-5J13-045	TEMP-GUIDE TUBE FA5 LOC J13 45 IN	12-27-84	QUALIFIED	
TE-5K07-048	TEMP-CLADDING/FA5 PIN K7 48 IN	12-27-84	FAILED	
TE-5K07-055	TEMP-CLADDING/FA5 PIN K7 55 IN	12-27-84	QUALIFIED	
TE-5K07-060	TEMP-CLADDING/FA5 PIN K7 60 IN	12-27-84	QUALIFIED	
TE-5K07-065	TEMP-CLADDING/FA5 PIN K7 65 IN	12-27-84	QUALIFIED	
TE-5K09-021	TEMP-CLADDING/FA5 PIN K9 21 IN	12-27-84	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S):
TE-5K09-026	TEMP-CLADDING/FA5 PIN K9 26 IN	12-27-84	QUALIFIED	
TE-5K09-032	TEMP-CLADDING/FA5 PIN K9 32 IN	12-27-84	QUALIFIED	
TE-5K09-039	TEMP-CLADDING/FA5 PIN K9 39 IN	12-27-84	QUALIFIED	
TE-5L08-032	TEMP-GUIDE TUBE FA5 LOC L8 32 IN	12-27-84	QUALIFIED	
TE-5M06-045	TEMP-GUIDE TUBE FA5 LOC M6 45 IN	12-27-84	QUALIFIED	
TE-5M10-066	TEMP-GUIDE TUBE FA5 LOC M10 66 IN	12-27-84	QUALIFIED	
TE-5UP-004	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-005	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-006	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-007	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-009	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-011	COOLANT TEMP-UPPER END BOX	12-31-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-012	COOLANT TEMP-UPPER END BOX	12-31-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-5UP-021	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-022	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-5UP-171A	METAL SURFACE TEMPERATURE UPPER END	12-27-84	QUALIFIED	
TE-5UP-171B	METAL SURFACE TEMPERATURE UPPER END	12-27-84	QUALIFIED	
TE-5UP-194	METAL SURFACE TEMPERATURE UPPER END	12-27-84	QUALIFIED	
TE-5UP-212	METAL SURFACE TEMPERATURE UPPER END	12-31-84	QUALIFIED	
TE-5UP-250	METAL SURFACE TEMPERATURE UPPER END	12-27-84	QUALIFIED	
TE-6E08-045	TEMP-CLADDING/FA6 PIN E8 45 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-6F07-037	TEMP-CLADDING/FA6 PIN F7 37 IN.	01-22-85	QUALIFIED	SAMPLE RATE IS 2.5 SAMPLES PER SECOND
TE-6F09-041	TEMP-CLADDING/FA6 PIN F9 41 IN.	01-03-84	QUALIFIED	
TE-6G08-039	TEMP-CLADDING/FA6 PIN G8 39 IN.	12-27-84	QUALIFIED	
TE-6G14-011	TEMP-CLADDING/FA6 PIN G14 11 IN.	12-27-84	QUALIFIED	
TE-6G14-030	TEMP-CLADDING/FA6 PIN G14 30 IN.	12-27-84	QUALIFIED	

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-6G14-045	TEMP-CLADDING/FA6 PIN G14 45 IN.	01-03-85	QUALIFIED	
TE-6H13-015	TEMP-CLADDING/FA6 PIN H13 15 IN.	12-27-84	QUALIFIED	
TE-6H13-037	TEMP-CLADDING/FA6 PIN H13 37 IN.	12-27-84	QUALIFIED	
TE-6H14-028	TEMP-CLADDING/FA6 PIN H14 28 IN.	12-27-84	QUALIFIED	
TE-6H14-032	TEMP-CLADDING/FA6 PIN H14 32 IN.	12-27-84	QUALIFIED	
TE-6H15-026	TEMP-CLADDING/FA6 PIN H15 26 IN.	01-03-85	QUALIFIED	
TE-6I14-021	TEMP-CLADDING/FA6 PIN I14 21 IN.	12-27-84	QUALIFIED	
TE-6I14-039	TEMP-CLADDING/FA6 PIN I14 39 IN.	12-27-84	QUALIFIED	
TE-6LP-001	COOLANT TEMP-LOWER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-6LP-002	COOLANT TEMP-LOWER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-6LP-003	COOLANT TEMP-LOWER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-6UP-001	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-6UP-002	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS

MEASUREMENT IDENTIFICATION	MEASUREMENT DESCRIPTION	QUAL DATE	QUAL STATUS	QUALIFYING STATEMENT(S)
TE-6UP-003	COOLANT TEMP-UPPER END BOX	12-27-84	QUALIFIED	POSSIBLE HOT WALL EFFECTS
TE-6UP-004	METAL TEMP-SUPPORT COLUMN FA5	12-27-84	QUALIFIED	
TE-6UP-005	METAL TEMP-SUPPORT COLUMN FA5	12-27-84	QUALIFIED	
TT-P004-004	LIQUID TEMP-SCS FEEDWATER	12-27-84	QUALIFIED	
TT-P120-062	LIQUID TEMP-ECCS CL INJECT POINT	01-03-84	QUALIFIED	RESPONSE LIMITED
TT-P139-032	COOLANT TEMP-INTACT LOOP HOT LEG	12-27-84	QUALIFIED	INITIAL CONDITIONS ONLY
TT-P139-033	COOLANT TEMP-INTACT LOOP HOT LEG	12-27-84	QUALIFIED	INITIAL CONDITIONS ONLY
TT-P139-034	COOLANT TEMP-INTACT LOOP HOT LEG	12-27-84	QUALIFIED	INITIAL CONDITIONS ONLY

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TABLE 3.2. Input deck listing for plant steady state

```
         25                0                1                0
*
*************************************************************************
LOFT POST-TEST LP-FP-1 STEADY STATE DECK FOR TRAC-PF1/MOD1
* DATA BASED ON L2-3 DECK FROM LANL FOR TRAC-PF1/MOD1 AND ON
* LP-1 DECK FROM AEE-WINFRITH, CHANGED TO FP-1,  AUGUST 85
* CHANGES ALREADY IN TRAC-PD2-DECK: UPPER PLENUM ECCS, INNER CORE
* RING FA-P=0.0 (FLOW SHROUD), BLCL VALVE
* ADDITIONAL CHANGES: CORE 131 MM LOWER
* HOT RODS IN CELL 1,2,3,4,8,12
* BYPASS LOWER PLENUM - UPPER PLENUM => 4 TEES (PATH 1,2,6+GUIDE TUBES),
* BYPASS UPPER PLENUM - DOWNCOMER => FA-R IN LEVEL 11 (PATH 3,4,5),
* BYPASS HAGV (INCREASED),
* CPOWR, RDX => RING AREAS,
* ENVIRONMENTAL HEAT LOSSES, HTC OUT: PCS PIPING    =  6.0 W/M**2 K
*                                     PRESSURIZER   =  2.0 W/M**2 K
*                                     SG SEC. SIDE =  1.6 W/M**2 K
* CHANGES INCORPORATED 19.9.86:
* PCS FLOW RESISTANCE REDUCED, RESISTANCE ADDED FOR LP-CORE,CORE,CORE-UP
* TWO-WAY FRICTION FACTORS USED FOR PCS, FRICKO NOT ALLOWED
* CHANGES TO VESSEL FLUID VOLUME AND FLOW AREA FRACTIONS
* CHANGES IN VESSEL HEAT SLABS
* NFF RESET TO 1
*
*************************************************************************
*
*********************NAMELIST DATA***************************************
 $INOPTS ICFLOW=2, CHM12=1.0, CHM22=0.84, NOAIR=0, IGEOM3=1, NLT=18,
         IMFR=3, NFRC1=2,
 $END
*********************MAIN CONTROL CARDS**********************************
        0          0.0                                              *MCC 01
        1            0   *NCOMP*   53   *NJUN*     63            1  *MCC 02
   5.0E-4       5.0E-6       1.0E-5           1.0E-1                *MCC 03
       10           50            25                                *MCC 04
*NTSV*  3    *NTCB*  0   *NTCF*      0   *NTRP*     10   *NTCP*     1 *MCC 05
*
        1            2             3            4             5S *COMP
        5            7             8          93S                *COMP
       23           24           25S                             *COMP
       11           12           13S                             *COMP
       14           15            16           17            31S *COMP
       32           41            42           50            43S *COMP
       81           82            83           84            85S *COMP
       95           87            88           89            90S *COMP
       91           92            61           62            63S *COMP
       64           65            66           67            68S *COMP
       69           70            71           72           101S *COMP
      102          103          104E                             *COMP
*******************************SIGNAL VARIABLE DATA******************************
* IDSV       ISVN      ILCN    ILCN1     ILCN2
    1          0         0        0         0     * PROBLEM TIME        SV01
    2         25        50     1005      4006     * ROD TEMPERATURE     SV02
    3         21        12        2         0     * HPIS PRESSURE       SV03
*******************************CONTROL BLOCK DATA********************************
*************************************TRIP DATA***********************************
* NTSE            NTCT            NTSF            NTDP            NTSD
    0               0               0               0               0  *TRIP DI
*
*   TRIP 2   -   ECC HPIS (16)
*
* IDTP            ISRT            ISET            ITST            IDSG
    2               2               0               1               1  *TRIP02
                  0.0           517.0                                  *TRIP02
                  0.0             0.0                                  *TRIP02
                    0               0                                  *TRIP02
*
*   TRIP 3   -   ECC LPIS (17) (COLD LEG ACCUMULATOR)
*
```

```
      3              2              0              1              1  *TRIP03
                   0.0          346.0                                *TRIP03
                   0.0            0.0                                *TRIP03
                     0              0                                *TRIP03
*
*  TRIP 4   -  PUMPS  (4 & 5)
*
      4              2              0              1              1  *TRIP04
                   0.0           2.00                                *TRIP04
                   0.0            0.0                                *TRIP04
                     0              0                                *TRIP04
*
*  TRIP 5   -  STEAM GENERATOR FEEDWATER (24)
*
      5              2              0              1              1  *TRIP05
                   0.0         1.0E-5                                *TRIP05
                   0.0            0.0                                *TRIP05
                     0              0                                *TRIP05
*
*  TRIP 6   -  ECC LINE VALVE  (14)
*
      6              2              0              1              1  *TRIP06
                   0.0        10000.0                                *TRIP06
                   0.0            0.0                                *TRIP06
                     0              0                                *TRIP06
*
*  TRIP 7   -  STEAM LINE VALVE (23)
*
      7              2              0              1              1  *TRIP07
                   0.0            0.0                                *TRIP07
                   0.0            0.0                                *TRIP07
                     0              0                                *TRIP07
*
*  TRIP 1010 - J. PLENUM INJECTION SYSTEM (61 BIS 72)
*
   1010              2              0              1              1 *TRIP1010
                   0.0         1.0E-5                                *TRIP1010
                   0.0            0.0                                *TRIP1010
                     0              0                                *TRIP1010
*
*  TRIP 100 - REACTOR SCRAM        VESSEL (50)
*
   100               2              0              1              1  *TRIP100
                   0.0         1.0E-5                                *TRIP100
                   0.0            0.0                                *TRIP100
                     0              0                                *TRIP100
*
*  TRIP 101 - REFLOOD FINE-MESH TRIP FOR VESSEL (50)
*
   101               2              0              1              1  *TRIP101
                   0.0         1.0E-5                                *TRIP101
                   0.0            0.0                                *TRIP101
                     0              0                                *TRIP101
*
*  TRIP 200 - BROKEN LOOP COLD LEG VALVE (43)
*
   200               2              0              1              1 *TRIP200
                   0.0           63.5                                *TRIP200
                   0.0            0.0                                *TRIP200
                     0              0                                *TRIP200
*********************************COMPONENT DATA***********************************
*
*   NOTE THAT COMPONENT , JUNCTION AND TRIP NUMBERS ARE GIVEN.
*
*   1.   TEE      1   1,2,10                      INTACT-LOOP HOT LEG
*
*   2.   STGEN    2   2,3        - P              STEAM GENERATOR
*                     22,25      - S EXTERNAL
*                     21,23,24 - S INTERNAL
*   3.   VALVE   23   22,26        7              STEAM-LINE VALVE
```

```
*    4.  FILL     24  25           5                STEAM-GENERATOR FEEDWATER
*    5.  BREAK    25  26                            STEAM-GENERATOR VENT
*
*    6.  TEE       3  4,5,3                         PUMP SUCTION
*    7.  PUMP      4  4,6          4                PUMP NO. 2
*    8.  PUMP      5  5,7          4                PUMP NO. 1
*    9.  TEE       5  7,8,6                         PUMP DISCHARGE
*
*   10.  TEE       7  8,9,14                        INTACT-LOOP COLD LEG
*
*   11.  PRIZER    6  10,93                         PRESSURIZER
*   12.  FILL     93  93                            PRESSURISER OUTLET
*
*   13.  FILL     11  11                            ACCUMULATOR OUTLET
*   14.  TEE      12  15,14,18                      ECC LINE - HPIS
*   15.  TEE      13  16,15,19                      ECC LINE - LPIS
*   16.  VALVE    14  17,16        6                ECC LINE - CHECK VALVE
*   17.  PIPE     15  17,11                         ACCUMULATOR
*   18.  FILL     16  18           2                HPIS INJECTION
*   19.  FILL     17  19           3                LPIS INJECTION
*
*   20.  TEE      31  31,32,43                      BROKEN-LOOP HOT LEG
*   21.  FILL     32  32                            BROKEN-HOT-LEG TERMINAL
*   22.  TEE      41  41,44,43                      BROKEN-LOOP COLD LEG
*   23.  FILL     42  42                            BROKEN-COLD-LEG TERMINAL
*
*   24.  VESSEL   50  1,9,31,41,81,82,   100,101 VESSEL
*                     83,84,85,86,87,
*                     88,89,90,91,92,
*                     101-112
*
*   25.  VALVE    43  44,42         200             BROKEN-LOOP COLD LEG VALVE
*
*   26.  PIPE     81  81,61                         U.PLENUM INJECTION SYSTEM
*   27.  FILL     61  61           1010             U.PLENUM INJECTION SYSTEM
*   28.  PIPE     82  82,62                         U.PLENUM INJECTION SYSTEM
*   29.  FILL     62  62           1010             U.PLENUM INJECTION SYSTEM
*   30.  PIPE     83  83,63                         U.PLENUM INJECTION SYSTEM
*   31.  FILL     63  63           1010             U.PLENUM INJECTION SYSTEM
*   32.  PIPE     84  84,64                         U.PLENUM INJECTION SYSTEM
*   33.  FILL     64  64           1010             U.PLENUM INJECTION SYSTEM
*   34.  PIPE     85  85,65                         U.PLENUM INJECTION SYSTEM
*   35.  FILL     65  65           1010             U.PLENUM INJECTION SYSTEM
*   36.  PIPE     86  86,66                         U.PLENUM INJECTION SYSTEM
*   37.  FILL     66  66           1010             U.PLENUM INJECTION SYSTEM
*   38.  PIPE     87  87,67                         U.PLENUM INJECTION SYSTEM
*   39.  FILL     67  67           1010             U.PLENUM INJECTION SYSTEM
*   40.  PIPE     88  88,68                         U.PLENUM INJECTION SYSTEM
*   41   FILL     68  68           1010             U.PLENUM INJECTION SYSTEM
*   42.  PIPE     89  89,69                         U.PLENUM INJECTION SYSTEM
*   43.  FILL     69  69           1010             U.PLENUM INJECTION SYSTEM
*   44.  PIPE     90  90,70                         U.PLENUM INJECTION SYSTEM
*   45.  FILL     70  70           1010             U.PLENUM INJECTION SYSTEM
*   46.  PIPE     91  91,71                         U.PLENUM INJECTION SYSTEM
*   47.  FILL     71  71           1010             U.PLENUM INJECTION SYSTEM
*   48.  PIPE     92  92,72                         U.PLENUM INJECTION SYSTEM
*   49.  FILL     72  72           1010             U.PLENUM INJECTION SYSTEM
*
*   50.  TEE     101 101,105,109                    CORE BYPASS
*   51.  TEE     102 102,106,110                    CORE BYPASS
*   52.  TEE     103 103,107,111                    CORE BYPASS
*   53.  TEE     104 104,108,112                    CORE BYPASS
*
*********************************COMPONENT DATA*********************************
*===============================================================================
TEE                        1                  1 INTACT-LOOP HOT LEG
        4          4          7          0.0 *ICHF* 1                  *CN02
 *
 * MAIN TUBE
 *
```

```
         0           3           1             2          0                 *CNU3
                                                                            *CN04
         0           0           0             0          0                 *CN05
   0.14203     0.03571         6.0           5.0      300.0                 *CN06
     300.0         0.0         0.0        1.0E20        1.0                 *CN07
       0.0         0.0      1.0E20           1.0                            *CN08
*
* SIDE TUBE
*
         0           3          10             0                            *CN09
                                                                            *CN10
         0           0           0             0          0                 *CN11
0.0233005   0.0056958          6.0           5.0      300.0                 *CN12
     300.0        0.0~         0.0        1.0E20        1.0                 *CN13
       0.0         0.0      1.0E20           1.0                            *CN14
*
* MAIN TUBE
*
R 2 7.83555E-1     4.92563E-1     7.75839E-1S      *DX
    1.19414E+0     8.65752E-1     4.17949E-1S
    5.25924E-1F
R 2 5.07932E-2     3.20625E-2     5.04812E-2S      *VOL
    5.95917E-2     5.52799E-2     3.13808E-2S
    5.71381E-2F
R 5 6.34253E-2     6.34253E-2     6.34253E-2S      *FA
    6.34253E-2     5.15000E-2E
          0.0R 5          0.0     7.52500E-2S      *FRIC VSL-HL FF=-0.28
          0.0     1.70400E-1E                      *FRIC HL-SG FF=0.1704
       0.0310R 5          0.0     7.52500E-2S      *FRIC REV
          0.0     1.70400E-1E                      *FRIC REV
R 8       0.0     5.89737E-1E                      *GRAV
R 7 2.84000E-1    2.84000E-1      2.56300E-1E      *HD
F          0E                                      *ICFLG
F          1E                                      *NFF
F        0.0F                                      *ALP
F        0.0E                                      *VL
F        0.0F                                      *VV
F      578.4E                                      *TL
F      515.0E                                      *TV
F   148.4E+5E                                      *P
F        0.0F                                      *PA
F        0.0F                                      *QPPP
F          7E                                      *MATID
F      593.0F                                      *TW
                                                   *CONC
                                                   *S
                                                   *POWTB1
                                                   *POWRF1
                                                   *QP3TB1
                                                   *QP3RF1
*
* SIDE TUBE
*
    2.14985E+0    2.64277E+0      2.22169E+0E      *DX
    3.11487E-3    3.69537E-3      5.70588E-3E      *VOL
F 3 1.44929E-3    5.73212E-3E                      *FA
    1.65298E-1    5.50315E-3R 2   4.66877E-3E      *FRIC
    1.65298E-1    5.50315E-3R 2   4.66877E-3E      *FRIC REV
    5.45100E-1R 2        0.0      6.04100E-1E      *GRAV
R 3 4.29568E-2    8.54304E-2E                      *HD
F          0E                                      *ICFLG
F          1E                                      *NFF
F        0.0F                                      *ALP
F        0.0F                                      *VL
F        0.0E                                      *VV
F      578.4F                                      *TL
F      515.0F                                      *TV
F   148.4E+5E                                      *P
F        0.0F                                      *PA
F        0.0F                                      *QPPP
```

```
F              7F                                           *MATID
F          593.0F                                           *TW
                                                            *CONC
                                                            *S
                                                            *POWTB1
                                                            *POWRF1
                                                            *QP3TB1
                                                            *QP3RF1
*----------------------------------------------------------------------------------------
*   TO MAKE THIS DATA CONSISTENT AT JUNCTION 2
*   THE FOLLOWING CHANGES HAVE BEEN MADE
*    FRIC : CHANGED FROM 0.1183   TO 0.19258
*    GRAV : CHANGED FROM 0.4237   TO 0.589737
*   THE NEW VALUES ARE GIVEN IN COMPONENT 1 FROM TRAC-PD2 L31 DECK
*
STGEN                         2               2 STEAM GENERATOR
     -        10              6               4          3          9  *CN    02
               0              1               2          3             *CN    03
               0              1              25         22             *CN    04
               0              0               0   0.000000             *CN    05
               0              0               5                        *CN    06
              17              4                                        *CN    07
     5.10540E-3     1.24460E-3                                         *CN    08
PIPE                          5               0          *SECONDARY PIPE 20
TEE                           4               1          *DOWNCOMER TEE22
TEE                           2               1          *STEAM DOME TEE 21
*--------------------PRIMARY SIDE
     9.63500E-1R08 5.58950E-1     9.63600E-1E                          *DX
     3.79500E-1R08 9.59500E-2     3.79500E-1E                          *VOL
     5.15000E-2R09 1.51100E-1     5.16000E-2F                          *FA
      0.17040  R09    0.000000      0.186100E                          *FRIC
      0.17040  R09    0.000000      0.186100E                        *FRIC P KE
      0.589737 R04    1.000000      0.000000R04  -1.000000     -0.711600E *GRAV
     2.55300E-1R09 1.02110E-2     2.56000E-1E                          *HD
F             0F                                                       *ICFLG
            1R09           1               1E                          *NFF
F      0.000000E                                                       *ALP
F      0.000000F                                                       *VL
F      0.000000F                                                       *VV
I09 567.500000     552.800000E                                         *TL
I08 567.500000     552.800000E                                         *TV
F    14.9400E+6F                                                       *P
F      0.000000F                                                       *PA
*--------------------SECONDARY SIDE
              24             21               0             20 *PIPE 20
R04 5.68950E-1     1.11150E+0E                                         *DX
R04 4.43562E-1     9.97863E-1E                                         *VOL
    2.18898E-1R03 7.79615E-1R02 8.97762E-1E                            *FA
      2.000000R05    0.000000E                                         *FRICF
      2.000000R05    0.000000E                                         *FRICR
      0.000000R05 1.00000E+0E                                          *GRAV
R05 6.35000E-3     1.06910E+0E                                         *HD
F             0E                                                       *ICFLG
F             1E                                                       *NFF
R04    0.000000        0.258500E                                       *ALP
F      0.000000E                                                       *VL
F      0.000000E                                                       *VV
F    549.000000F                                                       *TL
F    549.000000F                                                       *TV
F     6.4100E+6E                                                       *P
F      0.000000F                                                       *PA
*-----
              23             24              25             22 *TEE 22
R02 7.41000E-1     1.70685E+0     5.68950E-1E                          *DX
R02 3.82966E-1     3.73532E-1     1.24544E-1E                          *VOL
R02 5.15342E-1R03 2.18898E-1E                                          *FA
R04    0.000000       2.000000E                                        *FRICF
R04    0.000000       2.000000F                                        *FRICR
   -3.37524E-1R03  -1.000000        0.000000E                          *GRAV
R02 2.54000E-1R02 1.01600E-1     6.35000E-3E                           *HD
```

```
F              0F                                                          *ICFLG P
F              1F                                                          *NFF   P
        1.000000     0.796734R02   0.000000F                               *ALP   P
F       0.000000F                                                          *VL    P
F       0.000000F                                                          *VV
F     541.571343F                                                          *TL
F     541.571343F                                                          *TV    P
F       6.4100E+6E                                                         *P     P
F       0.000000F                                                          *PA    P
        0.000000          2
        2.000000F                                                          *DX    S
     1.62146E-2E                                                           *VOL   S
F       8.10732E-3E                                                        *FA    S
F       0.000000E                                                          *FRICF S
F       0.000000F                                                          *FRICR S
F       0.000000E                                                          *GRAV  S
F    1.01500E-1F                                                           *HD    S
F              0F                                                          *ICFLG S
F              1F                                                          *NFF   S
        0.000000F                                                          *ALP   S
F       0.000000E                                                          *VL    S
F       0.000000F                                                          *VV    S
      525.000000E                                                          *TL    S
      525.000000F                                                          *TV    S
        6.4100F+6E                                                         *P     S
F       0.000000F                                                          *PA    S
*-----
            21             22             23             21 *TEE 21
F    1.11150E+0F                                                           *DX    P
     9.97863E-1      1.23695E+0E                                           *VOL   P
     9.97762E-1      1.56904E+0     4.63292E-2E                            *FA    P
     0.000000        1.0000E+30     2.44600E-1E                            *FRICF P
     0.000000        1.0000E+30     2.44600E-1E                            *FRICR P
F      1.000000F                                                           *GRAV  P
R02  1.05910E+0      2.42900E-1E                                           *HD    P
F              0E                                                          *ICFLG P
F              1F                                                          *NFF   P
F      1.000000F                                                           *ALP   P
F      0.000000E                                                           *VL    P
F      0.000000F                                                           *VV    P
F    541.571343F                                                           *TL    P
F    541.571343E                                                           *TV    P
F      6.4100E+6F                                                          *P     P
F      0.000000E                                                           *PA    P
       0.000000          1
     7.41000E-1E                                                           *DX
     3.82966E-1E                                                           *VOL   S
F    5.15347E-1F                                                           *FA
F      0.000000E                                                           *FRICF S
F      0.000000F                                                           *FRICR S
F   -3.37525E-1E                                                           *GRAV  S
F    2.54000E-1E                                                           *HD    S
F              0E                                                          *ICFLG S
F              1E                                                          *NFF   S
       1.000000F                                                           *ALP   S
F      0.000000F                                                           *VL    S
F      0.000000E                                                           *VV    S
     541.571343E                                                           *TL    S
     541.571343E                                                           *TV    S
       6.4100E+6E                                                          *P     S
F      0.000000E                                                           *PA    S
*--------------------HEAT STRUCTURES
R08          0R05         0R06         20R04        22R02       21E *ICMP
             2            3            4            5           6   *ICELL
             7            8            9S                            *ICELL
R03          1R02         10S                                        *ICELL
             1            2            3            4R02        5   *ICELL
             1            2            3            4S               *ICELL
             2            3E                                         *ICELL
R08          20R05        0R05         22R04        0R02        0E  *UCMP
```

```
               1              2              3R02           4              3  *UCELL
               2              1S                                              *UCELL
R02            0              10R02          0S                               *UCELL
               4R03           3              2              1S                *UCELL
R04            0R02           0E                                              *UCELL
R24            12R06          9R03           6R06           9S                *MATS
R18            6R18           9F                                              *MATS
R08 5.10540E-3      0.685800       5.10540E-3     10.000000      0.685800  *RADIG
    5.10540E-3R04   0.644525R02    0.571500R06    0.711200E                *RADIG
R08 1.24460E-3      0.088900       5.18435E-3     0.031750       0.088900  *TH
    6.18435E-3R06   0.012700R06    0.053975F                               *TH
F     0.000000E                                                            *UPPS
R32 541.571343R12 567.500000R08 552.300000R48 541.571343E                  *TWGV
F     0.000000F                                                            *HILG
F     0.000000E                                                            *HIVG
F     0.000000E                                                            *TILG
F     0.000000F                                                            *TIVG
R09   33.898952     1.388600      17.287714      0.738780       1.388600   *WAIG
      17.287714R04  2.304050       2.550813      2.848255       2.214599   *WAIG
      3.311234      7.627232       2.542411      4.956850       4.407869E  *WAIG
R0P   0.000000R02   1.600000       0.000000R02   1.600000R05    0.000000   *HOLG
R06   1.600000E                                                            *HOLG
R08   0.000000R02   1.600000       0.000000R02   1.600000R05    0.000000   *HOVG
R05   1.600000F                                                            *HOVG
R08   0.000000R02 305.370000       0.000000R02 305.370000R06    0.000000   *TOLG
R05 305.370000F                                                            *TOLG
R08   0.000000R02 305.370000       0.000000R02 305.370000R06    0.000000   *TOVG
R05 305.370000F                                                            *TOVG
R08   42.162876     1.568604      38.228926      0.738780       1.568604   *WAUG
      38.228926R04  2.349460       2.719942      2.911549       2.382671   *WAUG
      3.567533      8.206085       2.735362      5.343799       4.742394E  *WAUG
*---------------------------------------------------------------------------------------
*   DATA CHANGED TO AGREE WITH CONTROL LOGIC IN FP-1
*   VALVE IS OPEN UNTIL TRIP COMES ON
*   THEN VALVE IS CLOSED USING A TABLE (TIME,RELATIVE POSITION)
*   . TRIP 7 , SV 1
*
VALVE                      23            23 STEAM LINE VALVE
               6              0             22             26              7  *CN    02
               1              0              3              5              0  *CN    03
               7              1              6              0              0  *CN    04
               0              0                                               *CN    06
         1.0E+20            0.0            0.0            1.0                 *CN    07
          0.1214         0.0151            1.6            1.6         305.37  *CN    08
          305.37    4.63292E-2       0.242900          0.451                  *CN    09
*
F     5.01191F                                                             *DX
F   2.32199E-1F                                                            *VOL
F   4.63292E-2E                                                            *FA
      0.2446   R04          0.0           6.49            0.0E             *FRICF
      0.2446   R04          0.0           6.49            0.0E             *FRICR
      1.0      R06          0.0E                                           *GRAV
F       0.2429E                                                            *HD
R05             0             1             0F                             *ICFLG
F               1E                                                         *NFF
F     1.0       E                                                          *ALP
F     0.0       E                                                          *VL
F     0.0       E                                                          *VV
F   541.571343E                                                            *TL
F   541.571343E                                                            *TV
R05  6.4900E+6      2.1500E+6E                                             *P
F     0.0       E                                                          *PA
*
            0.0          0.451            1.0         0.411S     *VMTB1
            2.0          0.350            5.0         0.166S     *VMTB1
            7.5            0.0         1000.0           0.0E     *VMTB1
*---------------------------------------------------------------------------------------
*    MODIFIED TO AGREE WITH FP-1 DATA
*    CONSTANT MASS FLOW UNTIL TRIP ON
*    THEN MASS FLOW READ FROM A TABLE(TIME,MASS FLOW)
```

```
*       TRIP 5 . SV 1
*
FILL                    24             24 STEAM GENERATOR FEEDWATER
         25 .            0              0                             *CN    02
          5              1              5            0              0 *CN
        0.0         1.0F20            0.0                             *CN
        2.0     1.62146E-2            0.0          0.0          482.0 *CN    05
     57.5E+5           0.0         12.800          0.0          482.0 *CN    06
        1.0            1.0                                            *CN    09
        0.0         12.800            1.0        2.53S                *VMTB
        2.0         0.8101           2.67        0.00S                *VMTB
       500.          0.00E                                            *VMTB
*----------------------------------------------------------------------------
BREAK                   25             25 STM GEN SEC BRK
         26              0              3            1              0 *CN    02
    5.011910      0.232198            1.0        488.0         21.5E5 *CN    04
     -   0.0           0.0         1.0E20        21.5E5           0.0 *CN    05
*****************************************************************************
TEE                      3              3 PUMP SUCTION
      2          4          7         0.0 *ICHF* 1              *CN02
*
* MAIN TUBE
*
..      0          3          4           5         0           *CN03
                                                                *CN04
        0          0          0           0         0           *CN05
  0.14209    0.03571        6.0         6.0     300.0           *CN06
    300.0        0.0        0.0      1.0E20       1.0           *CN07
      0.0        0.0     1.0E20         1.0                     *CN08
*
* SIDE TUBE
*
        0          3          3           0                     *CN09
                                                                *CN10
        0          0          0           0         0           *CN11
  0.14209    0.03571        6.0         6.0     300.0           *CN12
    300.0        0.0        0.0      1.0E20       1.0           *CN13
      0.0        0.0     1.0E20         1.0                     *CN14
*
* MAIN TUBE
*
     6.35000E-1    1.80340E+0    6.35000E-1E        *DX
     2.74675E-2    1.14380E-1    2.74675E-2E        *VOL
     3.66131E-2R 2 6.34249E-2    3.66131E-2E        *FA
F           0.0F                                    *FRICF
F           0.0E                                    *FRICR
   -6.26590E-1   -5.52200E-1     5.52200E-1S        *GRAV
     6.26590E-1E
     2.15910E-1R 2 2.84174E-1    2.15910E-1E        *HD
F             0E                                    *ICFLG
F             1E                                    *NFF
F           0.0E                                    *ALP
F           0.0E                                    *VL
F           0.0E                                    *VV
F         564.3E                                    *TL
F         615.0E                                    *TV
F      148.4E+5E                                    *P
F           0.0E                                    *PA
F           0.0E                                    *QPPP
F             7E                                    *MATID
F         593.0E                                    *TW
                                                    *CONC
                                                    *S
                                                    *POWTB1
                                                    *POWRF1
                                                    *QP3TB1
                                                    *QP3RF1
*
* SIDE TUBE
*
```

```
     1.31410E+0E  2 [illegible].22300E-1E                                   *DX
     7.73710E-2       4.00000E-2       5.00481E-2E          *VOL
F 2  5.34240E-2       5.87143E-2       5.16000E-2E          *FA
F 3         0.0       1.86100E-1E                           *FRIC FF=0.1861
F 3         0.0       1.86100E-1E                           *FRIC REV
            0.0       6.79400E-1       1.00000E+0S          *GRAV
     7.11500E-1E
F 2  2.84174E-1       2.95787E-1       2.55000E-1E          *HD
F              0F                                           *ICFLG
F              1E                                           *NFF
F           0.0E                                            *A_P
F           0.0E                                            *VL
F           0.0F                                            *VV
F         564.3E                                            *TL
F         615.0F                                            *TV
F     148.4E+5E                                             *P
F           0.0E                                            *PA
F           0.0E                                            *OPPP
F              7E                                           *MATID
F         593.0E                                            *TW
                                                            *CONC
                                                            *S
                                                            *POWTB1
                                                            *POWRF1
                                                            *OP3TB1
                                                            *OP3RF1
*=================================================================================
PUMP                                   4              4  PUMP NO. 2
          2           4           4           6           7          *CN02
*IDHF*    1           0           2           1           1          *CN03
          4           0           0           0           0          *CN04
          0           0           0           0           0          *CN05
   0.10795     0.02858         6.0         6.0       300.0           *CN06
     300.0        1.43       153.0         0.0                       *CN07
    941.54       500.0       0.315       614.0     369.561           *CN08
    363.50         0.0      1.0E20         1.0           0           *CN09
       0.0         0.0      1.0E20         1.0                       *CN10
*
*  OPTION FOR LOFT PUMP DATA
*
              2                                                      *CN11
*
*   ARRAY DATA CARDS
*
F    1.35213E+0E                                            *DX
F    4.95548E-2E                                            *VOL
F    3.65131E-2E                                            *FA
F           0.0E                                            *FRICF
F           0.0E                                            *FRICR
     5.25590E-1R  2          0.0E                           *GRAV
F    2.15910E-1E                                            *HD
F              0E                                           *ICFLG
               1             0             1E               *NFF
F           0.0F                                            *A_P
            0.0           6.77          0.0E                *VL
            0.0           6.77          0.0E                *VV
F         564.3E                                            *TL
F         615.0E                                            *TV
F     148.4E+5E                                             *P
F           0.0E                                            *PA
F           0.0E                                            *OPPP
F              7E                                           *MATID
F         593.0E                                            *TW
                                                            *CONC
                                                            *S
                                                            *PMPTB
                                                            *PMPRF
                                                            *OP3TB
                                                            *OP3RF
*=================================================================================
```

```
*
*   THIS COMPONENT IS THE SAME AS COMPONENT 4
*   EXCEPT FOR THE JUNCTION NUMBERS ON CN02
*
PUMP                        5              5 PUMP NO. 1
        2         4         5              7         7           *CN02
*ICHF*  1         0         2              1         1           *CN03
        4         0         0              0         0           *CN04
        0         0         0              0         0           *CN05
  0.10795   0.02858       6.0            6.0     300.0           *CN06
    300.0      1.43     153.0            0.0                     *CN07
   941.54     500.0     0.315          614.0   369.551           *CN08
   363.50       0.0    1.0E20            1.0         0           *CN09
      0.0       0.0    1.0E20            1.0                     *CN10
*
*   OPTION FOR LOFT PUMP DATA
*
      -         2                                                *CN11
*
*    ARRAY DATA CARDS
*
F    1.35213E+0E                                  *DX
F    4.75548E-2E                                  *VOL
F    3.65131E-2F                                  *FA
F          0.0E                                   *FRICF
F          0.0E                                   *FRICR
     5.25590E-1R 2          0.0E                  *GRAV
F    2.15910E-1E                                  *HD
F            0F                                   *ICFLG
             1              0              1E     *NFF
F          0.0E                                   *ALP
           0.0           6.77            0.0E     *VL
           0.0           5.77            0.0E     *VV
F        564.3E                                   *TL
F        515.0E                                   *TV
F     148.4E+5E                                   *P
F          0.0E                                   *PA
F          0.0F                                   *QPPP
F            7F                                   *MATID
F        573.0F                                   *TW
                                                  *CONC
                                                  *S
                                                  *PMPTR
                                                  *PMPRF
                                                  *QP3TR
                                                  *QP3RF
*========================================================================
TEE                          6             6 PUMP DISCHARGE
        2         4          7           0.0 *ICHF* 1            *CN02
*
* MAIN TUBE
*
        0         2          7             8         0           *CN03
                                                                 *CN04
        0         0          0             0         0           *CN05
  0.10795   0.02858        6.0           6.0     300.0           *CN06
    300.0       0.0        0.0        1.0E20       1.0           *CN07
      0.0       0.0     1.0E20           1.0                     *CN08
*
* SIDE TUBE
*
        0         1          6             0                     *CN09
                                                                 *CN10
        0         0          0             0         0           *CN11
  0.10795   0.02858        6.0           6.0     300.0           *CN12
    300.0       0.0        0.0        1.0E20       1.0           *CN13
      0.0       0.0     1.0E20           1.0                     *CN14
*
* MAIN TUBE
*
   1.30817E+0     1.11760E+0E                     *DX
```

```
       4.73557E-2       4.53076E-2E                          *VOL
R  2 3.65131E-2R  1 4.34249E-2E                              *FA
R  2          0.0             0.0E                           *FRIC PS-CL FF=-0.12
R  2          0.0             0.0E                           *FRIC REV FF=-0.12 ?
F             0.0F                                           *GRAV
F  2 2.15910E-1       2.84174E-1E                            *HD
F               0E                                           *ICFLG
F               1E                                           *NFF
F             0.0F                                           *ALP
F             0.0F                                           *VL
F             0.0F                                           *VV
F           564.3E                                           *TL
F           615.0F                                           *TV
F        148.4E+5F                                           *P
F             0.0E                                           *PA
F             0.0E                                           *QPPP
F               7F                                           *MATID
F           593.0F                                           *TW
                                                             *CONC
                                                             *S
                                                             *POWTB1
                                                             *POWRF1
                                                             *QP3TB1
                                                             *QP3RF1
*
* SIDE TUBE
*
       5.42920E-1E                                           *DX
       2.54394E-2F                                           *VOL
F      3.65131E-2E                                           *FA
F             0.0E                                           *FRICF
F             0.0E                                           *FRICR
F             0.0E                                           *GRAV
F      2.15910E-1E                                           *HD
F               0E                                           *ICFLG
F               1F                                           *NFF
F             0.0E                                           *ALP
F             0.0E                                           *VL
F             0.0E                                           *VV
F           564.3E                                           *TL
F           615.0E                                           *TV
F        148.4E+5E                                           *P
F             0.0E                                           *PA
F             0.0F                                           *QPPP
F               7E                                           *MATID
F           593.0E                                           *TW
                                                             *CONC
                                                             *S
                                                             *POWTB1
                                                             *POWRF1
                                                             *QP3TB1
                                                             *QP3RF1
*===============================================================================
TEE                               7               7 INTACT-LOOP COLD LEG
         5           4            7             0.0 *ICHF* 1              *CN02
*
* MAIN TUBE
*
         0           9            8               9         0             *CN03
                                                                          *CN04
         0           0            0               0         0             *CN05
   0.14209     0.03571          6.0             6.0     300.0             *CN06
     300.0         0.0          0.0          1.0E20       1.0             *CN07
       0.0         0.0       1.0E20             1.0                       *CN08
*
* SIDE TUBE
*
         0           1           14               0                       *CN09
                                                                          *CN10
         0           0            0               0         0             *CN11
```

```
0.3416675  0.0114875        0.0           5.0      300.0                 *CN12
    100.0        0.0        0.0        1.0E20       1.0                  *CN13
      0.0        0.0     1.0E20           1.0                            *CN14
*
* MAIN TUBE
*
R3   0.193457  R3  0.236245  R3  0.455667  E          *DX
R3   0.324712  R3  0.0149136 R3  0.1295343 E          *VOL
F    0.0534249 E                                      *FA
          0.0 R8   0.0               0.20225    E     *FRIC CL-VSL FF=0.202
          0.0 R8   0.0               0.0        F     *FRIC VSL-CL FF=-0.266
F    0.0        F                                     *GRAV
F    0.234174   F                                     *HD
F               0F                                    *ICFLG
F               1F                                    *NFF
F             0.0F                                    *ALP
F             0.0F                                    *VL
F             0.0F                                    *VV
F           564.3F                                    *TL
F           615.0F                                    *TV
F        148.4E+5F                                    *P
F             0.0F                                    *PA
F             0.0F                                    *QPPP
F               7F                                    *MATID
F           593.0F                                    *TW
                                                      *CONC
                                                      *S
                                                      *POWTB1
                                                      *POWRF1
                                                      *QP3TB1
                                                      *QP3RF1
*
* SIDE TUBE
*
     1.50000E+0F                                      *DX
     8.93381E-3F                                      *VOL
F    5.93920E-3F                                      *FA
            0.0      0.4941      E                    *FRICF
            0.0      0.4941      E                    *FRICR
   -1.00000E+0                0.0F                    *GRAV
F    8.73252E-2E                                      *HD
F               0F                                    *ICFLG
F               1E                                    *NFF
F             0.0E                                    *ALP
F             0.0E                                    *VL
F             0.0E                                    *VV
F           500.0E                                    *TL
F           615.0E                                    *TV
F        148.4E+5F                                    *P
F             0.0E                                    *PA
F             0.0E                                    *QPPP
F               7E                                    *MATID
F           500.0E                                    *TW
                                                      *CONC
                                                      *S
                                                      *POWTB1
                                                      *POWRF1
                                                      *QP3TB1
                                                      *QP3RF1
***********************************************************************
*   NOTE THAT NODES=4 , CHANGED FOR FP-1 DECK (HEAT TRANSF. WALL-FLUID)
*
PRIZER                         8         8 PRESSURIZER
       3           4          93        10       7                   *CN02
*ICONF*  1           0        0.0                                    *CN03
  0.4242       0.075        2.0        2.0     300.0                 *CN04
   300.0         0.0        0.0        0.0       0.0                 *CN05
*
* ARRAY DATA
*
```

```
     ?.?07??E-1     1.15000E+0     2.00000E-1F        *DX
     ?.24850E-1     5.00000E-1     1.27700E-2E        *VOL
R 3  5.55253E-1     5.73212E-3E                       *FA
R 3        0.0      4.66877E-3E                       *FRICF
R 3        0.0      4.66877E-3E                       *FRICR
R 3 -1.0000E+0     -5.0410E-1E                        *GRAV
R 3  9.43360E-1     8.54304E-2E                       *HD
F             0F                                      *ICFLG
F             1E                                      *NFF
         0.7174        0.0000           0.0E          *ALP
F          0.0E                                       *VL
F          0.0E                                       *VV
F        614.3F                                       *TL
F        614.3E                                       *TV
       148.4E+5     148.361E+5     148.223E+5E        *P
F          0.0F                                       *PA
F          0.0E                                       *QPPP
F             7E                                      *MATID
F        614.3E                                       *TW
                                                      *CONC
                                                      *S
*****************************************************************************
*   CONSTANT VELOCITY - SET TO ZERO
*
FILL               93          93 PRESSURISER OUTLET
      93            1           0                                   *CN02
                                                                    *CN03
     0.0      1.0E20          0.0          0.0                      *CN04
 4.699E-1  2.4414E-2          0.0          0.0      550.3           *CN05
 148.4E+5        0.0          0.0          0.0      550.3           *CN06
                                                                    *CN07
                                                                    *CN08
                                                                    *CN09
                                                                    *CN10
*****************************************************************************
*   CONSTANT VELOCITY - SET TO ZERO
*
FILL               11          11 ACCUMULATOR TOP
      11            1           0                                   *CN02
                                                                    *CN03
     0.0     -1.0E20          0.0          0.0                      *CN04
   0.555       0.707          0.0          0.0      300.0           *CN05
  43.0E5      43.0E5          0.0          0.0      300.0           *CN06
                                                                    *CN07
                                                                    *CN08
                                                                    *CN09
                                                                    *CN10
*****************************************************************************
*   NOTE THAT NODES=0 GIVING NO WALL-FLUID HEAT TRANSFER
*
TEE                            12           12 ECC LINE - HPIS
       1            0           7          0.0          0           *CN02
*
* MAIN TUBE
*
       0            1          15           14          0           *CN03
                                                                    *CN04
                                                                    *CN05
0.0436625  0.0134874          0.0          6.0      300.0           *CN06
   300.0         0.0          0.0       1.0E20        1.0           *CN07
                                                                    *CN08
*
* SIDE TUBE
*
       0            1          18            0                      *CN09
                                                                    *CN10
                                                                    *CN11
0.0436625  0.0134874          0.0          6.0      300.0           *CN12
   300.0         0.0          0.0       1.0E20        1.0           *CN13
                                                                    *CN14
```

```
*
*  MAIN TUBE
*
F    1.00000E+0F                                          *DX
F    5.93920E-3E                                          *VOL
F    5.93920E-3F                                          *FA
          0.0     0.4941    E                             *FRICF
          0.0     0.4941    E                             *FRICR
F         0.0E                                            *GRAV
F    8.73252E-2F                                          *HD
F           0E                                            *ICFLG
F           1E                                            *NFF
F         0.0F                                            *ALP
F         0.0F                                            *VL
F         0.0E                                            *VV
F       450.0F                                            *TL
F       615.0E                                            *TV
F     148.4E+5F                                           *P
F         0.0F                                            *PA
                                                          *QPPP
                                                          *MATID
                                                          *TW
                                                          *CONC
                                                          *S
                                                          *POWTB1
                                                          *POWRF1
                                                          *QP3TB1
                                                          *QP3RF1
*
*  SIDE TUBE
*
F    5.00000E+0E                                          *DX
F    4.53565E-3E                                          *VOL
F    9.07132E-4E                                          *FA
F         0.0E                                            *FRICF
F         0.0E                                            *FRICR
F         0.0E                                            *GRAV
F    3.39852E-2E                                          *HD
F           0F                                            *ICFLG
F           1E                                            *NFF
F         0.0E                                            *ALP
F         0.0E                                            *VL
F         0.0F                                            *VV
F       450.0F                                            *TL
F       615.0E                                            *TV
F     148.4E+5F                                           *P
F         0.0E                                            *PA
                                                          *QPPP
                                                          *MATID
                                                          *TW
                                                          *CONC
                                                          *S
                                                          *POWTB1
                                                          *POWRF1
                                                          *QP3TB1
                                                          *QP3RF1
*=======================================================================
*    NOTE THAT NODES=0 GIVING NO WALL-FLUID HEAT TRANSFER
*
TEE                        13          13 ECC LINE - LPIS
       1          0         7         0.0        0              *CN02
*
*  MAIN TUBE
*
       0          1        15          15        0              *CN03
                                                                *CN04
                                                                *CN05
0.0435625  0.0134874      6.0         5.0     300.0             *CN06
    300.0        0.0      0.0      1.0E20       1.0             *CN07
                                                                *CN08
```

```
        3             J            3            2          0                  *CN03
        5             1            2            0          0                  *CN04
                                                                              *CN05
        3             0                                                       *CN06
     20.0           0.0          0.0          0.0                             *CN07
*
4.36625E-2  1.34874E-2       6.0          6.0     300.0                       *CN08
   300.0    5.547E-2     2.636E-1         0.0       0.0                       *CN09
                                                                              *CN10
*
* ARRAY DATA
*
F   1.07222E+0E                                         *DX
F   2.61555E-2E                                         *VOL
    3.28522E-2P 2 5.54700E-2E                           *FA
  0.013521        0.006651    49.5155     E             *FRICF
  0.013521        0.006551    49.5155     E             *FRICR
         -1.0P 2          0.0E                          *GRAV
   2.04520E-1P 2 2.63600E-1E                            *HD
F            0E                                         *ICFLG
F            1E                                         *NFF
F          0.0E                                         *ALP
F          0.0E                                         *VL
F          0.0F                                         *VV
        307.2           400.0E                          *TL
        525.6           615.0E                          *TV
      43.0E+5         148.4E+5E                         *P
F          0.0F                                         *PA
                                                        *QPPP
                                                        *MATID
                                                        *TW
                                                        *CONC
                                                        *S
0.0 1.0   10000.0 1.0 E                                 *VTB1
                                                        *VTB2
                                                        *VRF
                                                        *QP3TR
                                                        *QP3RF
*=========================================================================
*   NOTE THAT NODES=0 GIVING NO WALL-FLUID HEAT TRANSFER
*   UNKNOWN VALUES FOR RADIUS AND THICKNESS OF PIPE
*
PIPE                          15            15 ACCUMULATOR
       3            0          11            17          0                    *CN02
       1            0           1             0                               *CN03
                                                                              *CN04
                                                                              *CN05
     1.0          0.1         0.0           0.0      300.0                    *CN06
   300.0          0.0         0.0        1.0E20        1.0                    *CN07
                                                                              *CN08
*
* ARRAY DATA
*
        0.565        0.9316      1.12500E-2E            *DX
        0.707         1.166      1.40777E-2E            *VOL
R 3 1.25135E+0    3.26522E-2E                           *FA
R 3        0.0    0.013521    E                         *FRICF
R 3        0.0    0.013521    E                         *FRICR
F        -1.0E                                          *GRAV
R 3 1.25954E+0    2.04520E-1E                           *HD
F           0F                                          *ICFLG
F           1E                                          *NFF
          1.0            0.0            0.0E            *ALP
F         0.0E                                          *VL
F         0.0E                                          *VV
F       307.2E                                          *TL
F       307.2E                                          *TV
F      43.0E5                E                          *P
       43.0E5  R2     0.0    E                          *PA
                                                        *QPPP
```

```
                                                              *MATID
                                                              *TW
                                                              *CONC
                                                              *S
                                                              *POWTB1
                                                              *POWRF1
                                                              *QP3TB1
                                                              *QP3RF1
*******************************************************************************
*   USES TRIP 2 AND SIGNAL VARIABLE 3
*   CONSTANT VELOCITY UNTIL TRIP  ON THEN PRESSURE-VELOCITY TABLE
*
FILL               15          16 HPIS INJECTION
       18           7           0                                      *CN02
        2           3           4          0          0                *CN03
      0.0      1.0E20         0.0        0.0                           *CN04
      5.0 4.53556E-3          0.0        0.0      307.2                *CN05
   1.0E+5         0.0         0.0        0.0      307.2                *CN06
                                                                       *CN07
                                                                       *CN08
      1.0         1.0                                                  *CN09
                                                                       *CN10
*
*  FILL TABLE - (PRESSURE,VELOCITY)
*  THIS IS FOR L2-3,LB-1 AND FP-1
*
     1.0000E+0        1.76554    0.85013E+5        1.76554S            *VMTB
     83.589E+5        0.73564    1000.0E+5         0.73564E
*******************************************************************************
*   USES TRIP 3 AND SIGNAL VARIABLE 1
*   CONSTANT MASS FLOW UNTIL TRIP ON THEN TIME-MASS FLOW TABLE
*
FILL               17          17 ILCL ACCUMULATOR A INJECTION
       19           8           0                                      *CN02
        3           1         -13          0          0                *CN03
      0.0      1.0E20         0.0        0.0                           *CN04
      1.0 5.98920E-3          0.0        0.0      303.0                *CN05
  41.4E+5         0.0         0.0        0.0      303.0                *CN06
                                                                       *CN07
                                                                       *CN08
      1.0         1.0                                                  *CN09
                                                                       *CN10
*
*  FILL TABLE - (TIME,MASS FLOW)
*  FOR FP-1
*
            0.0            0.0            0.2             3.0 S        *VMTB
            2.0           10.8            4.0            13.8 S
            6.0           15.6            8.0            15.8 S
           12.0           15.3           15.0            14.5 S
           28.0           13.6           52.0            11.0 S
           69.0            3.4           70.0             0.0 S
         1000.0            0.0E
*          70.0            9.6          100.0             8.5 S
*         135.0            7.6          145.0             7.4 S
*        1000.0            7.4E
*
*******************************************************************************
*   RENODED AS USED IN L2/3 DECK FOR TRAC-PF1(MOD1)
*   ICHF=1
*
TEE                            31              31 BROKEN-LOOP HOT LEG
        2           4           7        0.0          1                *CN02
*
* MAIN TUBE
*
        0          26          31         32          0                *CN03
                                                                       *CN04
        0           0           0          0          0                *CN05
  0.14207     0.03571         6.0        6.0      300.0                *CN06
```

```
     300.0          0.0          0.0         1.0E20         1.0                     *CN07
       0.0          0.0       1.0E20            1.0                                 *CN08
*
* SIDE TUBE
*
         0            3           43              0                                 *CN09
                                                                                    *CN10
         0            0            0              0           0                     *CN11
  0.10795      0.02858          6.0            5.0       300.0                      *CN12
    300.0          0.0          0.0         1.0E20         1.0                      *CN13
      0.0          0.0       1.0E20            1.0                                  *CN14
*
* MAIN TUBE
*
R 3 5.58385E-1     5.25780E-1     4.67490E-1     5.58510E-1     1.98750E+0S *DX
R 2 1.07723E+0     1.98750E+0     5.10290E-1     5.46290E-1     4.86280E-1S *DX
    2.54000E-1     1.71450E-1     3.00000E-1     2.79400E-1R 2 2.11840E-1S *DX
R4  0.19717     0.29922  0.244476  0.815976 E                                *DX
*
R 3 4.24600E-2     4.72800E-3     3.75790E-3     4.55030E-3     1.96860E-1S *VOL
R 2 1.13830E-1     1.96860E-1     4.07280E-3     4.06350E-3     3.17150E-3S *VOL
    2.75000E-2     1.85000E-2     1.89000E-2     5.85060E-3R 2 1.76670E-3S *VOL
R4  0.0015674   0.002492  0.00204496  0.0423948  E                           *VOL
*
R 3 5.34250E-2     1.39130E-2R 3 8.36470E-3R 3 1.91410E-2R 3 8.36470E-3S *FA
    5.34250E-2R 2 7.46240E-3     5.34250E-2S                                *FA
R9  8.36470E-3R1  5.19560E-2E                                               *FA
*
    0.0         R 2 2.20351E-1     2.39561E-1     2.54000E-1          0.0S *FRICF
    7.72000E-3R 3 1.40000E-2     1.93000E-2R 3          0.0    1.40000E-1S *FRICF
    1.70000E-1     1.12000E-1R 2          0.0     4.39700E-2R4          0.0S *FRICF
    0.0189903R  0.347932  0.0 E                                              *FRICF
    0.035       R 2 2.20351E-1     2.39561E-1     2.54000E-1          0.0S *FRICR
    7.72000E-3R 3 1.40000E-2     1.93000E-2R 3          0.0    1.40000E-1S *FRICR
    1.70000E-1     1.12000E-1R 2          0.0     4.39700E-2R4          0.0S *FRICR
    0.0189038   0.347932  0.0 E                                              *FRICR
*
R 5        0.0     6.21372E-1R 2 1.00000E+0          0.0R 5-1.00000E+0S *GRAV
  -6.65355E-1R 2        0.0     2.91528E-1S                                 *GRAV
R 5 1.00000E+0  0.592407    R3         0.0E                                 *GRAV
*
R 3 2.84000E-1     1.33000E-1R 3 1.03000E-1R 3 1.75000E-2R 3 1.03000E-1S *HD
    2.84000E-1R 2 1.19000E-2     2.84000E-1S                                *HD
R9  1.03200E-1R1  2.57200E-1E                                               *HD
*
R25          0             2              0F                                 *ICFLG
F            1F                                                              *NFF
F          0.0F                                                              *ALP
F          0.0E                                                              *VL
F          0.0E                                                              *VV
*
R 2 5.65500E+2     5.65120E+2     5.64770E+2     5.64450E+2     5.64070E+2S *TL
    5.62730E+2     5.62000E+2     5.61280E+2     5.59930E+2     5.59590E+2S *TL
    5.59220E+2     5.58890E+2     5.58720E+2     5.58600E+2     5.58400E+2S *TL
    5.58210E+2     5.58070E+2     5.57920E+2     5.57800E+2     5.57670E+2S *TL
    5.57550E+2     5.57420E+2S                                              *TL
    5.57270E+2     5.57100E+2     5.56760E+2E                               *TL
*
F        615.0F                                                              *TV
F     149.4E+5F                                                              *P
F          0.0E                                                              *PA
F          0.0E                                                              *QPPP
F            7E                                                              *MATID
*
R 4 5.65500E+2R 4 5.65120E+2R 4 5.64770E+2R 4 5.64450E+2R 4 5.64070E+2S *TW
R 4 5.62730E+2R 4 5.62000E+2R 4 5.61280E+2R 4 5.59930E+2R 4 5.59590E+2S *TW
R 4 5.59220E+2R 4 5.58890E+2R 4 5.58720E+2R 4 5.58600E+2R 4 5.58400E+2S *TW
R 4 5.58210E+2R 4 5.58070E+2R 4 5.57920E+2R 4 5.57800E+2R 4 5.57670E+2S *TW
R 4 5.57550E+2R 4 5.57420E+2S                                            *TW
R 4 5.57270E+2R 4 5.57100E+2R 4 5.56760E+2E                              *TW
```

```
                                                                                    *CONC
                                                                                    *S
                                                                                    *POWTB1
                                                                                    *POWRF1
                                                                                    *QP3TB1
                                                                                    *QP3RF
*
* SIDE TUBF
*
    1.38700E+0     8.14000E-1     5.10440E+0E       *DX
    5.40000E-2     3.14000E-2     1.98600E-1E       *VOL
R 3 3.8800E-2       3.3300E-03E                     *FA
F 3         0.0            0.0E                     *FRICF
P 3         0.0            0.0E                     *FRICR
            0.0    2.24200E-1     1.91200E-1S       *GRAV
            0.0E
F 3 2.22300E-1      65.200E-3E                      *HD
F              0E                                   *ICFLG
F              1E                                   *NFF
F            0.0E                                   *ALP
F            0.0E                                   *VL
F            0.0E                                   *VV
F          565.5E                                   *TL
F          515.0E                                   *TV
F       148.4E+5F                                   *P
F            0.0E                                   *PA
F            0.0E                                   *QPPP
F              7E                                   *MATID
F          565.5E                                   *TW
                                                    *CONC
                                                    *S
                                                    *POWTB1
                                                    *POWRF1
                                                    *QP3TB1
                                                    *QP3RF1
*==========================================================================
*   CONSTANT VELOCITY - SET TO ZERO
*
FILL                  32          32 BROKEN-HOT-LEG TERMINAL
      32               1           0                                    *CN02
                                                                        *CN03
      0.0       1.0E20         0.0          0.0                         *CN04
 0.815975   0.0423948          0.0          0.0       555.5             *CN05
 148.4E+5          0.0         0.0          0.0       556.5             *CN06
                                                                       -*CN07
                                                                        *CN08
                                                                        *CN09
                                                                        *CN10
*==========================================================================
*   REVISED AS USED IN L2/3 DECK FOR TRAC-PF1(MOD1)
*   ICHF=1
*
TEE                          41            41 BROKEN-LOOP COLD LEG TEE
       2           4          7            0.0          1              *CN02
*
* MAIN TUBE
*
       0           2         41             44          0              *CN03
                                                                       *CN04
       0           0          0              0          0              *CN05
  0.14209    0.03571        6.0            6.0      300.0              *CN06
    300.0        0.0        0.0         1.0E20        1.0              *CN07
      0.0        0.0     1.0E20            1.0                         *CN08
*
* SIDE TUBE
*
       0           2         43              0                         *CN09
                                                                       *CN10
       0           0          0              0          0              *CN11
  0.10735    0.02655        6.0            6.0      300.0              *CN12
```

```
*
* SIDE TUBE
*
         0            1          19            0                                 *CN09
                                                                                  *CN10
                                                                                  *CN11
0.0159925  0.0071374        0.0          5.0     300.0                            *CN12
    300.0        0.0        0.0       1.0E20       1.0                            *CN13
                                                                                  *CN14
*
* MAIN TUBE
*
     4.35380E+0E                                        *DX
     1.04557E-1F                                        *VOL
     5.54700E-2     5.98920E-3E                         *FA
      49.5155             0.0E                          *FRICF
      49.5155             0.0E                          *FRICR
F            0.0E                                       *GRAV
     2.63500E-1     8.73252E-2E                         *HD
F              0F                                       *ICFLG
F              1E                                       *NFF
F            0.0E                                       *A_P
F            0.0F                                       *VL
F            0.0E                                       *VV
F          400.0E                                       *TL
F          615.0E                                       *TV
F       148.4E+5F                                       *P
F            0.0E                                       *PA
                                                        *QPPP
                                                        *MATID
                                                        *TW
                                                        *CONC
                                                        *S
                                                        *POWTB1
                                                        *POWRF1
                                                        *QP3TB1
                                                        *QP3RF1
*
* SIDE TUBE
*
             1.0E                                       *DX
     5.93920E-3F                                        *VOL
F    5.93920E-3E                                        *FA
F            0.0F                                       *FRICF
F            0.0E                                       *FRICR
F            0.0E                                       *GRAV
F    8.73252E-2F                                        *HD
F              0F                                       *ICFLG
F              1E                                       *NFF
F            0.0F                                       *A_P
F            0.0F                                       *VL
F            0.0E                                       *VV
F          400.0E                                       *TL
F          615.0E                                       *TV
F       148.4E+5F                                       *P
F            0.0F                                       *PA
                                                        *QPPP
                                                        *MATID
                                                        *TW
                                                        *CONC
                                                        *S
                                                        *POWTB1
                                                        *POWRF1
                                                        *QP3TB1
                                                        *QP3RF1
*==========================================================================
*   VALVE IS CONTROLLED BY TRIP 5.
*
VALVE              14         14 ECC LINE - CHECK VALVE
        2           0         17          16         7                        *CN02
```

```
     300.0          0.0          0.0        1.0E20       1.0                    *CN13
       0.0          0.0       1.0E20           1.0                              *CN14
*
* MAIN TUBE
*
R2   0.80774                                                          E    *DX
R2   0.0512676                                                        E    *VOL
R3   0.053425                                                         E    *FA
     0.0          1.847          0.030579   E         *FRIC VSL-BLCL -0.17
     0.1291       1.847          0.030579   E         *FRIC BLCL-VSL 0.129
F    0.0          F                                                        *GRAV
R3   0.284                                                            E    *HD
R3             0                    E                                      *ICFLG
F              1E                                                          *NFF
F            0.0E                                                          *ALP
F            0.0E                                                          *VL
F         -  0.0E                                                          *VV
     550.95   562.46                                                  E    *TL
F         516.38E                                                          *TV
F      148.4E+5E                                                           *P
F            0.0E                                                          *PA
F            0.0E                                                          *QPPP
F              7E                                                          *MATID
  ..      550.9          561.01      R2   561.03.        562.53S           *TW
        562.56       R2   562.58E                                          *TW
                                                                           *CONC
                                                                           *S
                                                                           *POWTB1
                                                                           *POWRF1
                                                                           *QP3TB1
                                                                           *QP3RF1
*
* SIDE TUBE
*
      8.85000E-1     7.28340E+0E                         *DX
      3.03300E-2     2.76800E-1E                         *VOL
R 2   0.0388     3.3300E-03E                             *FA
R 2         0.0          0.0E                            *FRICF
R 2         0.0          0.0E                            *FRICP
            0.0      1.09000E-1             0.0E         *GRAV
R 2  2.22300E-1       55.200E-3E                         *HD
F             0E                                         *ICFLG
F             1E                                         *NFF
F           0.0E                                         *ALP
F           0.0E                                         *VL
F           0.0E                                         *VV
         553.30      562.88 E                            *TL
F         615.0E                                         *TV
F      148.4E+5E                                         *P
F           0.0E                                         *PA
F           0.0E                                         *QPPP
F             7E                                         *MATID
F        553.3E                                          *TW
                                                         *CONC
                                                         *S
                                                         *POWTB1
                                                         *POWRF1
                                                         *QP3TB1
                                                         *QP3RF1
********************************************************************************
*     --  TRIP 200
*
VALVE                 43        43 BROKEN-LOOP COLD LEG VALVE
        4             4        44          42        7                *CN02
        0             0         3           2        0                *CN03
      200             1        -4           0        0                *CN04
        0             0         0           0        0                *CN05
        0             0                                               *CN06
    1.0E+20         0.0           0.0            0.0                  *CN07
 1.42095-01   3.5710E-02          6.0            6.0      3.00E+02    *CN08
```

```
 300.0      1.397630E-02   1.327200E-01             1.0            1.0  *CN09
        0.0            0.0            0.0            0.0                *CN10
*
* ARRAY DATA
*
 0.80774  0.513081  1.145039  1.02236                         E        *DX
 0.0512576  0.00505142  0.02623801 0.0472489                  E        *VOL
 0.053425  0.013875  0.0083647  0.02352     0.051955          E        *FA
 0.030679  0.0       0.1515     0.0460103   0.1717            E        *FRICF
 0.030679  0.0       0.1515     0.0460103   0.1717            E        *FRICR
F   0.0                                                       E        *GRAV
  0.284  0.13292  0.1032  0.17305  0.2572                     E        *HD
F2    0      2    R2      0                                   E        *ICFLG
F       1                                                     E        *NFF
F     0.0                                                     E        *ALP
F     0.0                                                     E        *VL
F     0.0                                                     E        *VV
 554.53  553.72  551.91  550.35                               E        *TL
F  616.38                                                     E        *TV
F  148.4E+5                                                   E        *P
F  0.0                                                        E        *PA
F  0.0                                                        E        *QPPP
F   7                                                         E        *MATID
R4  554.47  R4  554.0  R4  552.5  R4  551.0                   E        *TW
                                                                       *CONC
                                                                       *S
 0.0   1.0  2.5  0.55                                                  *VTB1
 5.0    0.0    1000.0    0.0                                  E        *VTB1
                                                                       *VTB2
                                                                       *VRF
                                                                       *QP3TB
                                                                       *QP3RF
*=====================================================================
*  CONSTANT VELOCITY - SET TO ZERO
*
FILL                 42          42 BROKEN-COLD-LEG TERMINAL
       42             1           0                                    *CN02
                                                                       *CN03
        0.0      1.0E20        0.0           0.0                       *CN04
 1.02235   0.0472489          0.0           0.0       550.3            *CN05
 148.4E+5            0.0          0.0           0.0       550.3        *CN06
                                                                       *CN07
                                                                       *CN08
                                                                       *CN09
                                                                       *CN10
*=====================================================================
*
*
PIPE                        81                81 UPPER PLENUM INJECTION PIPE
            1                0                51               81          7  *CN02
            0                0                 0                0             *CN03
                                                                              *CN04
                                                                              *CN05
  3.505200E-02  3.555000E-03  0.            0.              3.072000E+02  *CN06
  3.072000E+02  0.0  0.0  1.0E20  1.0                                         *CN07
                                                                              *CN08
*
*    ARRAY DATA
*
F    2.5000E+00E                                                        * DX
F    2.41245E-03F                                                       * VOL
F    9.6497E-04F                                                        * FA
F    0.          E                                                      * FRIC
F    0.          E                                                      * FRIC
F    1.0000E+00E                                                        * GRAV
F    3.5052E-02F                                                        * HD
F    0    E                                                             *ICFLG
F              1F                                                       * NFF
F    5.9503E-06F                                                        * ALP
     0.              -2.9327E-05F                                       * VL
```

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       0.              -2.3327E-05E                                                       * VV
 F     5.9792E+02E                                                                        * TL
 F     6.1531E+02F                                                                        * TV
 F     1.5190E+07E                                                                        * P
 F     0.0 E                                                                              * PA
                                                                                          *OPPP
                                                                                          *MATID
                                                                                          *TW
                                                                                          *CONC
                                                                                          *S
                                                                                          *POWTB1
                                                                                          *POWRF1
                                                                                          *QP3TB1
                                                                                          *QP3RF1
*
*************************************************************************
*
FILL                       61              61 UPPER PLENUM INJECTION
            61             8               0                                              *CN02
          1010             1              21          0           0                       *CN03
           0.0       1.0E20              0.0                                              *CN04
  2.500000E+00  2.412430E-03  0.              0.              3.080000E+02               *CN05
  41.40000E+05  0.    0.                                                                  *CN06
  ..                                                                                      *CN07
                                                                                          *CN08
      0.0825                                                                              *CN09
                                                                                          *CN10
           0.0            0.0             1.0            0.0S     * VMTB
          38.0            7.2            40.0            5.9S
          78.0            0.0           100.0            0.0S
         200.0           0.67           255.0           0.70S
         260.0            0.0           266.0           1.80S
         272.0           0.50           345.0           0.50S
         347.0           31.0           352.0           30.0S
         358.0           20.0           363.0           18.2S
         375.0           16.9           400.0           10.0S
         445.0            4.0           450.0            0.0S
        1000.0          0.0E
*
*************************************************************************
*
PIPE                       82              82 UPPER PLENUM INJECTION PIPE
             1             0              62             82              7              *CN02
             0             0               0              0                             *CN03
                                                                                          *CN04
                                                                                          *CN05
  3.505200E-02  3.555000E-03  0.              0.              3.072000E+02               *CN05
  3.072000E+02   0.0  0.0  1.0E20   1.0                                                   *CN07
                                                                                          *CN08
*
*  ARRAY DATA
*
 F     2.5000E+00E                                                                        * DX
 F     2.4124E-03F                                                                        * VOL
 F     9.6497F-04E                                                                        * FA
 F     0.         E                                                                       * FRIC
 F     0.         E                                                                       * FRIC
 F     1.0000E+00E                                                                        * GRAV
 F     3.5052E-02E                                                                        * HD
 F     0    E                                                                             * ICFLG
 F              1E                                                                        * NFF
 F     1.8330E-06F                                                                        * ALP
       0.              -1.2689E-05E                                                       * VL
       0.              -1.2689E-05E                                                       * VV
 F     5.9792F+02F                                                                        * TL
 F     6.1535F+02F                                                                        * TV
 F     1.5200F+07F                                                                        * P
 F     0.0    E                                                                           * PA
                                                                                          * QPPP
                                                                                          * MATID
```

```
                                                                                    * TW
                                                                                    * CONC
                                                                                    * S
                                                                                    * POWTB1
                                                                                    * POWRF1
                                                                                    * QP3TB1
                                                                                    * QP3RF1
*
*==========================================================================================
*
FILL                      62                52 UPPER PLENUM INJECTION
         62                6                 0                                      *CN02
         1010          1             21        0          0                         *CN03
        0.0          1.0E20             0.0                                         *CN04
  2.500000E+00  2.412430E-03  0.               0.            3.080000E+02           *CN05
  41.40000E+05  0.    0.                                                            *CN06
    -                                                                               *CN07
                                                                                    *CN08
       0.0875                                                                       *CN09
                                                                                    *CN10
        0.0            0.0            1.0            0.0S       * VMTB
       38.0            7.2           40.0            5.9S
       78.0            0.0          100.0            0.0S
      200.0            0.67         255.0            0.70S
      250.0            0.0          266.0            1.80S
      272.0            0.50         345.0            0.50S
      347.0           31.0          352.0           30.0S
      358.0           20.0          363.0           18.2S
      375.0           16.9          400.0           10.0S
      445.0            4.0          450.0            0.0S
     1000.0            0.0E
*
*==========================================================================================
*
PIPE                      83                83 UPPER PLENUM INJECTION PIPE
             1             0              63            83             7           *CN02
             0             0               0             0                         *CN03
                                                                                   *CN04
                                                                                   *CN05
  3.505200E-02  3.556000E-03  0.               0.            3.072000E+02          *CN06
  3.072000E+02  0.0   0.0  1.0E20    1.0                                           *CN07
                                                                                   *CN08
*
*     ARRAY DATA
*
F    2.5000E+00E                                                                   * DX
F    2.4124E-03E                                                                   * VOL
F    9.5497E-04E                                                                   * FA
F    0.         E                                                                  * FRIC
F    0.         E                                                                  * FRIC
F    1.0000E+00E                                                                   * GRAV
F    3.5052E-02E                                                                   * HD
F     0    E                                                                       * ICFLG
F               1E                                                                 * NFF
F    2.6250E-06E                                                                   * ALP
     0.              -1.2657E-05E                                                  * VL
     0.              -1.2657E-05E                                                  * VV
F    5.9791E+02E                                                                   * TL
F    6.1535E+02E                                                                   * TV
F    1.5200E+07E                                                                   * P
F    0.0    E                                                                      * PA
                                                                                   *QPPP
                                                                                   *MATID
                                                                                   *TW
                                                                                   *CONC
                                                                                   *S
                                                                                   *POWTB1
                                                                                   *POWRF1
                                                                                   *QP3TB1
                                                                                   *QP3RF1
```

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*
*=============================================================================
*
FILL                    63              53 UPPER PLENUM INJECTION
          63             8               0                                *CN02
        1010         1         21        0         0                      *CN03
         0.0       1.0E20              0.0                                *CN04
  2.500000E+00  2.412430E-03  0.            0.          3.080000E+02      *CN05
  41.40000E+05  0.    0.                                                  *CN06
                                                                          *CN07
                                                                          *CN08
      0.0825                                                              *CN09
                                                                          *CN10
         0.0             0.0          1.0         0.0S     * VMTB
        38.0             7.2         40.0         5.9S
        78.0             0.0        100.0         0.0S
     - 200.0            0.67        255.0        0.70S
       250.0             0.0        266.0        1.80S
       272.0            0.50        345.0        0.50S
       347.0            31.0        352.0        30.0S
       358.0            20.0        363.0        18.2S
       375.0            16.9        400.0        10.0S
       445.0             4.0        450.0         0.0S
      1000.0            0.0E
*
*=============================================================================
*
PIPE                    84              84 UPPER PLENUM INJECTION PIPE
           1             0              64            84            7     *CN02
           0             0               0             0                  *CN03
                                                                          *CN04
                                                                          *CN05
  3.505200E-02  3.555000E-03  0.            0.          3.072000E+02      *CN06
  3.072000F+02   0.0     0.0    1.0E20   1.0                              *CN07
                                                                          *CN08
*
*    ARRAY DATA
*
F    2.5000E+00F                                                          * DX
F    2.4124F-03E                                                          * VOL
F    9.6497E-04E                                                          * FA
F    0.         E                                                         * FRIC
F    0.         F                                                         * FRIC
F    1.0000E+00E                                                          * GRAV
F    3.5052F-02E                                                          * HD
F     0       E                                                           * ICFLG
F              1E                                                         * NFF
F    2.5303E-05F                                                          * ALP
     0.              -1.2758E-05E                                         * VL
     0.              -1.2758E-05E                                         * VV
F    5.9791E+02E                                                          * TL
F    5.1536E+02E                                                          * TV
F    1.5200F+07E                                                          * P
F    0.0        E                                                         * PA
                                                                          *QPPP
                                                                          *MATID
                                                                          *TW
                                                                          *CONC
                                                                          *S
                                                                          *POWTB1
                                                                          *POWRF1
                                                                          *QP3TB1
                                                                          *QP3RF1
*
*=============================================================================
*
FILL                    64              54 UPPER PLENUM INJECTION
          64             8               0                                *CN02
        1010             1              21         0         0            *CN03
         0.0        1.0E20             0.0                                *CN04
```

```
  2.500000E+00  2.412430E-03  0.              0.              3.080000E+02  *CN05
  41.400000E+05  0.    0.                                                   *CN06
                                                                            *CN07
                                                                            *CN08
       0.0825                                                               *CN09
                                                                            *CN10
          0.0             0.0            1.0            0.0S     * VMTB
         38.0             7.2           40.0            5.3S
         78.0             0.0          100.0            0.0S
        200.0             0.67         255.0            0.70S
        260.0             0.0          266.0            1.80S
        272.0             0.50         345.0            0.50S
        347.0            31.0          352.0           30.0S
        358.0            20.0          363.0           18.2S
        375.0            16.9          400.0           10.0S
        445.0             4.0          450.0            0.0S
     - 1000.0             0.0E
*
**************************************************************************
*
PIPE                       85             85 UPPER PLENUM INJECTION PIPE
             1              0             65             85             7  *CN02
             0              0              0              0                *CN03
                                                                           *CN04
                                                                           *CN05
  3.505200E-02  3.556000E-03  0.              0.             3.072000E+02  *CN06
  3.072000E+02    0.0   0.0    1.0E20    1.0                               *CN07
                                                                           *CN08
*
*    ARRAY DATA
*
F    2.5000E+00F                                                           * DX
F    2.4124E-03F                                                           * VOL
F    9.6497E-04F                                                           * FA
F    0.         F                                                          * FRIC
F    0.         F                                                          * FRIC
F    1.0000E+00E                                                           * GRAV
F    3.5052E-02F                                                           * HD
F       0      E                                                           * ICFLG
F              1F                                                          * NFF
F    4.7030E-06F                                                           * ALP
     0.                -1.2837E-05E                                        * VL
     0.                -1.2837E-05E                                        *VV
F    5.0791E+02F                                                           * TL
F    5.1537E+02E                                                           * TV
F    1.5203E+07F                                                           * P
F       0.0     F                                                          * PA
                                                                           *UPPP
                                                                           *MATID
                                                                           *TW
                                                                           *CONC
                                                                           *S
                                                                           *POWTB1
                                                                           *POWRF1
                                                                           *QP3TB1
                                                                           *QP3RF1
*
**************************************************************************
*
FILL                       65             55 UPPER PLENUM INJECTION
           65               8              0                               *CN02
         1010               1             21          0          0         *CN03
          0.0          1.0E20            0.0                               *CN04
  2.500000E+00  2.412430E-03  0.              0.             3.080000E+02  *CN05
  41.400000E+05  0.               0.                                       *CN06
                                                                           *CN07
                                                                           *CN08
       0.1675                                                              *CN09
                                                                           *CN10
          0.0             0.0            1.0            0.0S     * VMTB
```

```
           38.0            7.2            40.0            5.9S
           78.0            0.0           100.0            0.0S
          200.0            0.67          255.0            0.70S
          260.0            0.0           266.0            1.80S
          272.0            0.50          345.0            0.50S
          347.0           31.0           352.0           30.0S
          358.0           20.0           363.0           18.2S
          375.0           16.9           400.0           10.0S
          445.0            4.0           450.0            0.0S
         1000.0            0.0E
*
*=====================================================================
*
PIPE                  86            86 UPPER PLENUM INJECTION PIPE
             1         0            66            86           7   *CN02
             0         0             0             0               *CN03
                                                                    *CN04
                                                                    *CN05
  3.505200E-02  3.555000E-03  0.         0.           3.072000E+02 *CN06
  3.072000E+02  0.0      0.0   1.0E20   1.0                        *CN07
                                                                    *CN08
*
*    ARRAY DATA
*
F    2.5000E+00E                                                   * DX
F    2.4124E-03E                                                   * VOL
F    9.6497E-04E                                                   * FA
F    0.         E                                                  * FRI(
F    0.         E                                                  * FRIC
F    1.0000E+00E                                                   * GRAV
F    3.5052E-02E                                                   * HD
F      0        E                                                  * ICFLG
F              1E                                                  * NFF
F    5.3957E-06E                                                   * ALP
     0.              -1.2615E-05E                                  * VL
     0.              -1.2615E-05E                                  * VV
F    5.9791E+02E                                                   * TL
F    5.1538E+02E                                                   * TV
F    1.5204E+07E                                                   * P
F     0.0       E                                                  * PA
                                                                    *QPPP
                                                                    *MATID
                                                                    *TW
                                                                    *CONC
                                                                    *S
                                                                    *POWTB1
                                                                    *POWRF1
                                                                    *QP3TB1
                                                                    *QP3R
*
*=====================================================================
*
FILL                  66            66 UPPER PLENUM INJECTION
            66         8             0                              *CN02
          1010         1            21         0      0            *CN03
           0.0    1.0E20           0.0                              *CN04
  2.500000E+00  2.412430E-03  0.         0.           3.080000E+02 *CN05
 41.40000E+05  0.       0.                                          *CN06
                                                                    *CN07
                                                                    *CN08
        0.1575                                                      *CN09
                                                                    *CN10
            0.0            0.0             1.0            0.0S    * VMTB
           38.0            7.2            40.0            5.9S
           78.0            0.0           100.0            0.0S
          200.0            0.67          255.0            0.70S
          260.0            0.0           266.0            1.80S
          272.0            0.50          345.0            0.50S
          347.0           31.0           352.0           30.0S
          358.0           20.0           363.0           18.2S
```

```
        375.0            16.9            400.0           10.0S
        445.0             4.0            450.0            0.0S
       1000.0             0.0E
*
*************************************************************************
*
PIPE                      87             87 UPPER PLENUM INJECTION PIPE
            1              0             67              87           7   *CN02
            0              0              0               0               *CN03
                                                                          *CN04
                                                                          *CN05
  3.505200E-02  3.555000E-03  0.              0.            3.072000E+02  *CN06
  3.072000E+02  0.0     0.0     1.0E20    1.0                             *CN07
                                                                          *CN08
*
*  ARRAY DATA
*     -
F    2.5000E+00F                                                          * DX
F    2.4124E-03E                                                          * VOL
F    9.6497E-04E                                                          * FA
F    0.         E                                                         * FRIC
F    0.         F                                                         * FRIC
F    1.0000E+00E                                                          * GRAV
F    3.5052E-02E                                                          * HD
F         0         E                                                     * ICFLG
F                  1E                                                     * NFF
F    4.9541E-06F                                                          * ALP
     0.                -1.2082E-05E                                       * VL
     0.                -1.2082E-05E                                       * VV
F    5.9770E+02E                                                          * TL
F    5.1537E+02F                                                          * TV
F    1.5203E+07E                                                          * P
F     0.0       E                                                         * PA
                                                                          * OPPP
                                                                          *MATID
                                                                          *TW
                                                                          *CONC
                                                                          *S
                                                                          *POWTB1
                                                                          *POWRF1
                                                                          *QP3TB1
                                                                          *QP3RF1
*
*************************************************************************
*
FILL                      67             67 UPPER PLENUM INJECTION
           67              8              0                               *CN02
         1010              1             21          0         0          *CN03
          0.0         1.0E20            0.0                               *CN04
 2.500000E+00  2.412430E-03  0.              0.            3.080000E+02   *CN05
 41.40000E+05  0.    0.                                                   *CN06
                                                                          *CN07
                                                                          *CN08
       0.1675                                                             *CN09
                                                                          *CN10
          0.0            0.0            1.0             0.0S      * VMTB
         38.0            7.2           40.0             5.9S
         78.0            0.0          100.0             0.0S
        200.0           0.67          255.0             0.70S
        260.0            0.0          266.0             1.80S
        272.0           0.50          345.0             0.50S
        347.0           31.0          352.0            30.0S
        356.0           20.0          363.0            18.2S
        375.0           16.9          400.0            10.0S
        445.0            4.0          450.0             0.0S
       1000.0            0.0E
*
*************************************************************************
*
PIPE                      88             88 UPPER PLENUM INJECTION PIPE
```

```
              1            0            58           88           7   *CN02
              0            0             0            0               *CN03
                                                                      *CN04
                                                                      *CN05
   3.505200F-02  3.555000E-03  0.          0.          3.072000E+02   *CN06
   3.072000E+02  0.0      0.0     1.0E20     1.0                      *CN07
                                                                      *CN08
*
*   ARRAY DATA
*
F    2.5000E+00E                                                      * DX
F    2.4124E-03E                                                      * VOL
F    9.6497E-04E                                                      * FA
F    0.         F                                                     * FRIC
F    0.         E                                                     * FRIC
F    1.0000E+00E                                                      * GRAV
F    3.5052E-02F                                                      * HD
F     0        E                                                      * ICFLG
F              1F                                                     * NFF
F    4.6921E-06F                                                      * ALP
     0.                -1.2745E-05E                                   * VL
     0.                -1.2745E-05E                                   * VV
F    5.9790E+02F                                                      * TL
F    6.1537E+02F                                                      * TV
F    1.5203E+07F                                                      * P
F     0.0       E                                                     * PA
                                                                      *QPPP
                                                                      *MATID
                                                                      *TW
                                                                      *CONC
                                                                      *S
                                                                      *POWTB1
                                                                      *POWRF1
                                                                      *QP3TB1
                                                                      *QP3RF1
*
*=============================================================================
*
FILL                        68            58 UPPER PLENUM INJECTION
            68              8             0                           *CN02
          1010              1            21           0        0      *CN03
           0.0         1.0E20           0.0                           *CN04
   2.500000E+00  2.412430E-03  0.          0.          3.080000E+02   *CN05
   41.400000E+05  0.     0.                                           *CN06
                                                                      *CN07
                                                                      *CN08
        0.1675                                                        *CN09
                                                                      *CN10
           0.0            0.0           1.0          0.0S     * VMTB
          38.0            7.2          40.0          5.9S
          78.0            0.0         100.0          0.0S
         200.0           0.67         255.0          0.70S
         260.0            0.0         265.0          1.80S
         272.0           0.50         345.0          0.50S
         347.0           31.0         352.0          30.0S
         358.0           20.0         363.0          18.2S
         375.0           16.9         400.0          10.0S
         445.0            4.0         450.0          0.0S
        1000.0           0.0E
*
*=============================================================================
*
PIPE                        89            89 UPPER PLENUM INJECTION PIPE
              1             0            69           89          7   *CN02
              0             0             0            0              *CN03
                                                                      *CN04
                                                                      *CN05
   3.505200F-02  3.555000E-03  0.          0.          3.072000E+02   *CN06
   3.072000F+02  0.0  0.0   1.0E20     1.0                            *CN07
                                                                      *CN08
```

```
*
*    ARRAY DATA
*
F    2.5000E+00E                                                                    * DX
F    2.4124E-03F                                                                    * VOL
F    9.5497E-04F                                                                    * FA
F    0.         E                                                                   * FRIC
F    0.         E                                                                   * FRIC
F    1.0000E+00E                                                                    * GRAV
F    3.5052E-02F                                                                    * HD
F      0        E                                                                   * ICFLG
F               1E                                                                  * NFF
F    1.2552E-06F                                                                    * ALP
     0.                  -1.2874E-05E                                               * VL
     0.                  -1.2874E-05E                                               * VV
F    5.9735E+02E                                                                    * TL
F    5.4537E+02F                                                                    * TV
F    1.5203E+07F                                                                    * P
F    0.0        E                                                                   * PA
                                                                                    *UPPP
                                                                                    *MATID
                                                                                    *TW
                                                                                    *CONC
                                                                                    *S
                                                                                    *POWTB1
                                                                                    *POWRF1
                                                                                    *QP3TB1
                                                                                    *QP3RF1
*
*==========================================================================================
*
FILL                    69            59 UPPER PLENUM INJECTION
         69              8             0                                            *CN02
        1010             1            21          0          0                      *CN03
         0.0        1.0E20           0.0                                            *CN04
  2.500000E+00  2.412430E-03  0.           0.          3.080000E+02                 *CN05
  41.40000E+05  0.        0.                                                        *CN06
                                                                                    *CN07
                                                                                    *CN08
      0.0000                                                                        *CN09
                                                                                    *CN10
         0.0           0.0           1.0          0.0S      * VMTB
        38.0           7.2          40.0          5.9S
        78.0           0.0         100.0          0.0S
       200.0          0.67         255.0          0.70S
       260.0           0.0         266.0          1.80S
       272.0          0.50         345.0          0.50S
       347.0          31.0.        352.0         30.0S
       358.0          20.0         363.0         18.2S
       375.0          16.9         400.0         10.0S
       445.0           4.0         450.0          0.0S
      1000.0          0.0E
*
*==========================================================================================
*
PIPE                    90            90 UPPER PLENUM INJECTION PIPE
          1              0            70          90          7                     *CN02
          0              0             0           0                                *CN03
                                                                                    *CN04
                                                                                    *CN05
  3.505200E-02  3.555000E-03  0.           0.          3.072000E+02                 *CN06
  3.072000E+02  0.0       0.0    1.0E20      1.0                                    *CN07
                                                                                    *CN08
*
*   ARRAY DATA
*
F    2.5000E+00F                                                                    * DX
F    2.4124E-03E                                                                    * VOL
F    9.5497E-04F                                                                    * FA
F    0.         E                                                                   * FRIC
```

```
F    0.          F                                                                         * FRIC
F    1.0000E+00F                                                                           * GRAV
F    3.5052E-02F                                                                           * HD
F     0      F                                                                             * ICFLG
F                1F                                                                        * NFF
F    1.7754E-06E                                                                           * ALP
     0.                -1.2586E-05E                                                                * VL
     0.                -1.2586E-05E                                                                * VV
F    5.9734E+02E                                                                           * TL
F    6.1538E+02F                                                                           * TV
F    1.5204E+07F                                                                           * P
F    0.0         F                                                                         * PA
                                                                                           *UPPP
                                                                                           *MATID
                                                                                           *TW
                                                                                           *CONC
                                                                                           *S
                                                                                           *POWTB1
                                                                                           *POWRF1
                                                                                           *QP3TB1
                                                                                           *QP3RF1
*
***************************************************************************************
*
FILL                          70                70 UPPER PLENUM INJECTION
            70                 8                 0                                         *CN02
           1010                1                21               0         0               *CN03
          0.0             1.0E20               0.0                                         *CN04
  2.500000E+00   2.412430E-03   0.               0.               3.080000E+02    *CN05
  41.40000E+05   0.    0.                                                                  *CN06
                                                                                           *CN07
                                                                                           *CN08
        0.0000                                                                             *CN09
                                                                                           *CN10
           0.0               0.0              1.0              0.0S       * VMTB
          38.0               7.2             40.0              5.9S
          78.0               0.0            100.0              0.0S
         200.0              0.67            255.0             0.70S
         260.0               0.0            266.0             1.80S
         272.0              0.50            345.0             0.50S
         347.0              31.0            352.0             30.0S
         358.0              20.0            363.0             18.2S
         375.0              16.9            400.0             10.0S
         445.0               4.0            450.0              0.0S
        1000.0              0.0E
*
***************************************************************************************
*
PIPE                          91                91 UPPER PLENUM INJECTION PIPE
             1                 0                71               91               7    *CN02
             0                 0                 0                0                    *CN03
                                                                                       *CN04
                                                                                       *CN05
  3.505200E-02   3.555000E-03   0.               0.               3.072000E+02    *CN06
  3.072000E+02   0.0    0.0      1.0E20     1.0                                        *CN07
                                                                                       *CN08
*
*    ARRAY DATA
*
F    2.5000E+00E                                                                           * DX
F    2.4124E-03E                                                                           * VOL
F    9.6497E-04F                                                                           * FA
F    0.          F                                                                         * FRIC
F    0.          F                                                                         * FRIC
F    1.0000E+00F                                                                           * GRAV
F    3.5052E-02E                                                                           * HD
F         0      F                                                                         * ICFLG
F               1F                                                                         * NFF
F    3.7557E-06F                                                                           * ALP
     0.                -1.0607E-05E                                                                * VL
```

```
      0.             -1.[illegible]E-05E                                        * VV
F    5.9734E+02F                                                                 * TL
F    6.1537E+02F                                                                 * TV
F    1.5203E+07E                                                                 * P
F      0.0      E                                                                * PA
                                                                                 *OPPP
                                                                                 *MATID
                                                                                 *TW
                                                                                 *CONC
                                                                                 *S
                                                                                 *POWTB1
                                                                                 *POWRF1
                                                                                 *OP3TB1
                                                                                 *OP3RF1
*
*************************************************************************************
*
FILL                      71             71 UPPER PLENUM INJECTION
           71              8              0                                      *CN02
          1010             1             21          0        0                  *CN03
         0.0          1.0E20            0.0                                      *CN04
  2.500000E+00  2.412430E-03  0.                0.            3.080000E+02       *CN05
  41.400000E+05  0.            0.                                                *CN06
                                                                                 *CN07
                                                                                 *CN08
       0.0000                                                                    *CN09
                                                                                 *CN10
         0.0           0.0            1.0           0.0S     * VMTB
        38.0           7.2           40.0           5.9S
        79.0           0.0          100.0           0.0S
       200.0           0.67         255.0           0.70S
       260.0           0.0          266.0           1.80S
       272.0           0.50         345.0           0.50S
       347.0          31.0          352.0          30.0S
       358.0          20.0          363.0          18.2S
       375.0          16.9          400.0          10.0S
       445.0           4.0          450.0           0.0S
      1000.0           0.0E
*
*************************************************************************************
*
PIPE                      92             92 UPPER PLENUM INJECTION PIPE
            1              0             72          92            7             *CN02
            0              0              0           0                          *CN03
                                                                                 *CN04
                                                                                 *CN05
  3.505200E-02  3.555000E-03  0.                0.            3.072000E+02       *CN06
  3.072000E+02  0.0  0.0   1.0E20    1.0                                         *CN07
                                                                                 *CN08
*
*  ARRAY DATA
*
F    2.5000E+00E                                                                 * DX
F    2.4124E-03F                                                                 * VOL
F    9.6497E-04E                                                                 * FA
F    0.         E                                                                * FRIC
F    0.         E                                                                * FRIC
F    1.0000E+00F                                                                 * GRAV
F    3.5052E-02E                                                                 * HD
F         0     E                                                                * ICFLG
F              1F                                                                * NFF
F    4.1450E-06E                                                                 * ALP
     0.              -1.2557E-05E                                                * VL
     0.              -1.2557E-05E                                                * VV
F    5.9735E+02F                                                                 * TL
F    6.1537E+02E                                                                 * TV
F    1.5202E+07E                                                                 * P
F    0.0      E                                                                  * PA
                                                                                 *OPPP
                                                                                 *MATID
```

```
                                                                                    *TW
                                                                                    *CONC
                                                                                    *S
                                                                                    *POWTB1
                                                                                    *POWRF1
                                                                                    *QP3TB1
                                                                                    *QP3RF1
*
*****************************************************************************
*
FILL                          72              72 UPPER PLENUM INJECTION
            72                 8               0                                    *CN02
          1010                 1              21              0      0              *CN03
           0.0            1.0E20             0.0                                    *CN04
  2.500000E+00  2.412430E-03  0.            0.              3.080000E+02            *CN05
  41.40000E+05  0.    0.                                                            *CN06
                                                                                    *CN07
                                                                                    *CN08
        0.0000                                                                      *CN09
                                                                                    *CN10
           0.0               0.0             1.0            0.0S     * VMTB
          38.0               7.2            40.0            5.9S
          78.0               0.0           100.0            0.0S
         200.0              0.67           255.0            0.70S
         260.0               0.0           266.0            1.80S
         272.0              0.50           345.0            0.50S
         347.0              31.0           352.0            30.0S
         358.0              20.0           363.0            18.2S
         375.0              16.9           400.0            10.0S
         445.0               4.0           450.0             0.0S
        1000.0              0.0E
*
*****************************************************************************
*
TEE                          101             101        CORE BYPASS
*      JCELL       NODES        MAT        CUST        ICHF
           3           4          7         0.0           1                  *CN02
*
*  MAIN TUBE
*
*   ICONC1     NCELL1       JUN1        JUN2       IPOW1
           0           5        101         105           0                  *CN03
*   IQPTR1     IQPSV1     NQPTB1      NQPSV1      NQPRF1
           0           0          0           0           0                  *CN05
*   RADIN1        TH1     HOUTL1      HOUTV1      TOUTL1
    0.00174        0.04        0.0         0.0       300.0                  *CN06
*   TOUTV1      PWIN1     PWOFF1      RPWMX1      PWSCL1
      300.0         0.0        0.0      1.0E20         1.0                  *CN07
*    QPIN1     QPOFF1     RQPMX1      QPSCL1
        0.0         0.0     1.0E20         1.0                              *CN08
*
*  SIDE TUBE
*
*   ICONC2     NCELL2       JUN3       IPOW2
           0           1        109           0                             *CN09
*   IQPTR2     IQPSV2     NQPTB2      NQPSV2      NQPRF2
           0           0          0           0           0                  *CN11
*   RADIN2        TH2     HOUTL2      HOUTV2      TOUTL2
    0.00195        0.04        0.0         0.0       300.0                  *CN12
*   TOUTV2      PWIN2     PWOFF2      RPWMX2      PWSCL2
      300.0         0.0        0.0      1.0E20         1.0                  *CN13
*    QPIN2     QPOFF2     RQPMX2      QPSCL2
        0.0         0.0     1.0E20         1.0                              *CN14
*
*  MAIN TUBE
*
R 2          0.6          0.46R 2        0.97E          *DX1
R 2  2.2045-03       1.693E-03R 2   3.570E-03E          *VOL1
    1.295E-03R 4   5.030E-03        1.295E-03E          *FA1
F           0.0F                                        *FRICIF
```

```
F            0.0E                                                  *FRIC1R
F            1.0F                                                  *GRAV1
        3.480E-03R 4    1.44E-02        3.480E-03F                 *HD1
                 1R 4          0                 1E                *ICFLG1
F              1E                                                  *NFF1
F            0.0F                                                  *ALP1
F            0.0F                                                  *VL1
F            0.0F                                                  *VV1
F          593.0E                                                  *TL1
F          515.0E                                                  *TV1
F       148.4E+5E                                                  *P1
F            0.0F                                                  *PA1
F            0.0E                                                  *QPPP1
F              7F                                                  *MATID1
F          570.0E                                                  *TW1
*
* SIDE TUBE
*
          0.050E                                                   *DX2
       2.742E-04E                                                  *VOL2
F      1.041E-03E                                                  *FA2
F            0.0E                                                  *FRIC2F
F            0.0F                                                  *FRIC2R
F            0.0F                                                  *GRAV2
F       0.003391E                                                  *HD2
               0              1E                                   *ICFLG2
F              1E                                                  *NFF2
F            0.0E                                                  *ALP2
F            0.0E                                                  *VL2
F            0.0E                                                  *VV2
F          593.0F                                                  *TL2
F          515.0F                                                  *TV2
F       148.4E+5E                                                  *P2
F            0.0E                                                  *PA2
F            0.0E                                                  *QPPP2
F              7E                                                  *MATID2
F          570.0E                                                  *TW2
*
************************************************************************
*
TEE                         102           102       CORE BYPASS
*     JCELL      NODES       MAT          CUST        ICHF
          3          4         7           0.0           1              *CN02
*
* MAIN TUBE
*
*   ICONC1     NCELL1       JUN1          JUN2       IPOW1
          0          5       102           106           0              *CN03
*   IQPTR1     IQPSV1     NOPTB1        NOPSV1      NOPRF1
          0          0         0             0           0              *CN05
*   RADIN1        TH1    HOUTL1        HOUTV1      TOUTL1
    0.00174       0.04       0.0           0.0       300.0              *CN06
*   TOUTV1     PWIN1      PWOFF1        RPWMX1      PWSCL1
      300.0        0.0       0.0        1.0E20         1.0              *CN07
*    QPIN1    QPOFF1      RQPMX1        QPSCL1
        0.0        0.0    1.0E20           1.0                          *CN08
*
* SIDE TUBE
*
*   ICONC2     NCELL2       JUN3         IPOW2
          0          1       110             0                          *CN09
*   IQPTR2     IQPSV2     NOPTB2        NOPSV2      NOPRF2
          0          0         0             0           0              *CN11
*   RADIN2        TH2    HOUTL2        HOUTV2      TOUTL2
    0.00196       0.04       0.0           0.0       300.0              *CN12
*   TOUTV2     PWIN2      PWOFF2        RPWMX2      PWSCL2
      300.0        0.0       0.0        1.0E20         1.0              *CN13
*    QPIN2     QPOFF2     RQPMX2        QPSCL2
        0.0        0.0    1.0E20           1.0                          *CN14
*
```

```
*  MAIN TUBE
*
R 2          0.6             0.46R 2         0.97E        *DX1
R 2   2.208E-03       1.693E-03R 2   3.570E-03E        *VOL1
      1.295E-03R 4   6.030E-03       1.295E-03F        *FA1
F            0.0E                                      *FRIC1
F            0.0F                                      *FRIC1
F            1.0E                                      *GRAV1
     3.480F-03R 4     1.44E-02       3.480F-03E        *HD1
               1R 4            0               1E      *ICFLG1
F              1E                                      *NFF1
F            0.0E                                      *ALP1
F            0.0F                                      *VL1
F            0.0E                                      *VV1
F          593.0E                                      *TL1
F          615.0E                                      *TV1
F       148.4E+5E                                      *P1
F            0.0E                                      *PA1
F            0.0E                                      *QPPP1
F              7E                                      *MATID1
F          570.0E                                      *TW1
*
*  SIDE TUBE
*
           0.050E                                      *DX2
       2.742F-04F                                      *VOL2
F      1.041F-03F                                      *FA2
F            0.0E                                      *FRIC2
F            0.0E                                      *FRIC2
F            0.0E                                      *GRAV2
F        0.00391F                                      *HD2
               0               1E                      *ICFLG2
F              1F                                      *NFF2
F            0.0E                                      *ALP2
F            0.0E                                      *VL2
F            0.0E                                      *VV2
F          593.0E                                      *TL2
F          615.0F                                      *TV2
F       148.4E+5F                                      *P2
F            0.0F                                      *PA2
F            0.0E                                      *QPPP2
F              7E                                      *MATID2
F          570.0E                                      *TW2
*
*************************************************************************
*
TEE                            103          103       CORE BYPASS
*      JCELL      NODES         MAT         CUST        ICHF
           3          4           7          0.0           1              *CN02
*
*  MAIN TUBE
*
*   ICONC1     NCELL1        JUN1         JUN2        IPOW1
         0          5         103          107           0              *CN03
*   IOPTR1     IOPSV1      NOPTB1       NOPSV1      NOPRF1
         0          0           0            0           0              *CN05
*   RADIN1        TH1      HOUTL1       HOUTV1      TOUTL1
   0.00174       0.04         0.0          0.0       300.0              *CN06
*   TOUTV1      PWIN1      PWOFF1       RPWMX1      PWSCL1
     300.0        0.0         0.0       1.0E20         1.0              *CN07
*    QPIN1     QPOFF1      RQPMX1       QPSCL1
       0.0        0.0      1.0E20          1.0                          *CN08
*
*  SIDE TUBE
*
*   ICONC2     NCELL2        JUN3        IPOW2
         0          1         111            0                          *CN09
*   IOPTR2     IOPSV2      NOPTB2       NOPSV2      NOPRF2
         0          0           0            0           0              *CN11
*   RADIN2        TH2      HOUTL2       HOUTV2      TOUTL2
```

```
   0.00175         0.04         0.0          0.0         300.0                *CN12
*   TOUTV2         PWIN2       PWOFF2       RPWMX2       PWSCL2
   300.0           0.0          0.0         1.0E20        1.0                 *CN13
*   OPIN2         OPOFF2       RUPMX2       OPSCL2
     0.0           0.0        1.0E20         1.0                              *CN14
*
* MAIN TUBE
*
P 2          0.6              0.46R 2          0.97E        *DX1
P 2   2.209E-03          1.693E-03R 2    3.570E-03E        *VOL1
     1.295E-03R 4    6.030E-03           1.295E-03E        *FA1
F            0.0E                                           *FRIC1
F            0.0E                                           *FRIC1
F            1.0F                                           *GRAV1
     3.490E-03R 4      1.44E-02          3.480E-03E        *HD1
             1R 4             0                  1E        *ICFLG1
F      -     1E                                             *NFF1
F           0.0E                                            *ALP1
F           0.0E                                            *VL1
F           0.0F                                            *VV1
F         593.0E                                            *TL1
F         615.0F                                            *TV1
F       148.4E+5F                                           *P1
F           0.0F                                            *PA1
F           0.0F                                            *OPPP1
F             7F                                            *MATID1
F         570.0F                                            *TW1
*
* SIDE TUBE
*
          0.050F                                            *DX2
     2.742E-04F                                             *VOL2
F    1.041F-03E                                             *FA2
F           0.0E                                            *FRIC2
F           0.0E                                            *FRIC2
F           0.0F                                            *GRAV2
F      0.003391E                                            *HD2
             0              1E                              *ICFLG2
F            1E                                             *NFF2
F           0.0E                                            *ALP2
F           0.0F                                            *VL2
F           0.0F                                            *VV2
F         593.0F                                            *TL2
F         615.0F                                            *TV2
F       148.4E+5F                                           *P2
F           0.0E                                            *PA2
F           0.0F                                            *OPPP2
F             7F                                            *MATID2
F         570.0E                                            *TW2
*
*******************************************************************************
*
TEE                             104            104        CORE BYPASS
*     JCELL       NODES          MAT          CUST       ICHF
          3           4            7           0.0          1                 *CN02
*
* MAIN TUBE
*
*   ICONC1      NCELL1         JUN1          JUN2       IPOW1
          0           5          104           108          0                 *CN03
*   IOPTR1      IOPSV1       NOPTB1        NOPSV1      NOPRF1
          0           0            0             0          0                 *CN05
*   RADIN1         TH1       HOUTL1        HOUTV1      TOUTL1
    0.00174        0.04          0.0           0.0      300.0                 *CN06
*   TOUTV1       PWIN1       PWOFF1        RPWMX1      PWSCL1
     300.0         0.0          0.0        1.0E20        1.0                  *CN07
*    OPIN1      OPOFF1       RUPMX1        OPSCL1
       0.0         0.0       1.0E20           1.0                             *CN08
*
* SIDE TUBE
```

```
*
*  ICONC2      NCELL2      JUN3      IPUW2
        0           1        112         0                              *CN09
*  IOPTR2      IOPSV2     NOPTB2    NOPSV2     NOPRF2
        0           0          0         0          0                   *CN11
*  RADIN2         TH2     HOUTL2    HOUTV2     TOUTL2
  0.00195        0.04        0.0       0.0      300.0                   *CN12
*  TOUTV2       PWIN2     PWOFF2    RPWMX2     PWSCL2
    300.0         0.0        0.0    1.0E20        1.0                   *CN13
*   QPIN2      QPOFF2     RQPMX2    QPSCL2
      0.0         0.0     1.0E20       1.0                              *CN14
*
* MAIN TUBE
*
R 2         0.6          0.46R 2        0.97E        *DX1
R 2   2.208E-03      1.693E-03R 2  3.570E-03E        *VOL1
    1.295E-03R 4   5.030E-03       1.295E-03E        *FA1
F           0.0E                                     *FRIC1
F           0.0E                                     *FRIC1
F           1.0F                                     *GRAV1
    3.480E-03R 4    1.44E-02       3.480E-03E        *HD1
              1R 4         0               1E        *ICFLG1
F             1E                                     *NFF1
F           0.0F                                     *ALP1
F           0.0F                                     *VL1
F           0.0E                                     *VV1
F         593.0E                                     *TL1
F         615.0F                                     *TV1
F      148.4E+5E                                     *P1
F           0.0E                                     *PA1
F           0.0F                                     *QPPP1
F             7F                                     *MATID1
F         570.0E                                     *TW1
*
* SIDE TUBE
*
          0.050F                                     *DX2
      2.742E-04E                                     *VOL2
F     1.041E-03E                                     *FA2
F           0.0E                                     *FRIC2
F           0.0E                                     *FRIC2
F           0.0F                                     *GRAV2
F       0.00391E                                     *HD2
              0            1E                        *ICFLG2
F             1F                                     *NFF2
F           0.0E                                     *ALP2
F           0.0E                                     *VL2
F           0.0E                                     *VV2
F         593.0E                                     *TL2
F         615.0E                                     *TV2
F      148.4E+5E                                     *P2
F           0.0E                                     *PA2
F           0.0E                                     *QPPP2
F             7E                                     *MATID2
F         570.0E                                     *TW2
*************************************************************************
*
*   - NZMAX SET TO 60 FROM 50
*
*  THE FOLLOWING ARRAYS HAVE BEEN REPLACED BY FP-1 VALUES
*  TAKEN FROM TRAC-PD2(MOD1) ANALYSIS
*   - CPOWR
*   - RDZF
*   - ZPWTB
*   - RADRD
*   - RPWTP
*   - NFAX
*   - PDAPT
*------------------------------------------------------------------------
VESSEL                     50            50 VESSEL
```

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*
*BASED ON /PD2IA/LOFT1/L2-3/RUN1/L2-3IND WITH FOLLOWING MODIFICATIONS:
*
* OCT/NOV 1982, PTG
* - INCORPORATE DISTRIBUTED HEAT SLABS
* - CHANGE INITIAL HSTN'S FROM 593 K TO 570 K TO HELP INHIBIT
*   FILM BOILING AT START OF STEADY STATE RUN
* - MINOR CHANGE TO LEVEL 3 DOWNCOMER FA-T AND Z (TO .375)
*
* OCT 1983, PTG
* - REVISE AXIAL POWER SHAPE PER PC & TK
*
* AUG 1965, GLS
* - REVISE ELEVATION OF CORE, 0.13 M LOWER
*
* SEP 1985, J.BIRCHLEY
* - INCLUDE FRICTION FACTOR VALUES FOR ENTRY INTO, THROUGH
*   AND EXIT FROM CORE
*   REVISE FLUID VOLUME AND AREA FRACTIONS
*
*NASX*       12 *NRSX*        4 *NTSX*         4 *NCSR*       28 *IVSSBF*    0   *CARD 2
*IDCU*       12 *IDCL*        2 *IUCK*         3 *ICRU*        8 *ICRL*      3   *CARD 3
*ICPR*        3 *ILCSP*       0 *IUCSP*        0 *IUHP*        0 *ICONC*     0   *CARD 4
*NFFA*        0 *NFFR*        0 *NFFT*         0 *NVENT*       0                 *CARD 5
*IRPWTY*      7 *NDGX*        0 *NVHX*         0 *NRTS*        0                 *CARD 6
*
*IRPWTB*    100 *IRPWSV*      1 *NRPWTB*      25 *NRPWSV*      0 *NRPWRF*    0   *CARD 7
*IZPWTB*      0 *IZPWSV*      1 *NZPWTB*       1 *NZPWSV*      0 *NZPWRF*    0   *CARD 8
*IRFTB*     101 *NMWRX*       1 *NFCI*         1 *NFCIL*       1 *NZMAX*    60   *CARD 9
*
*NRODS*      16 *NODES*      10 *NODHS*        4 *INHSMX*      1                 *CARD 10
*REACT*      0. *TNEUT*      0.*RPWDIF*-1.E20 *RRPWMX*1.E30 *RPWSCL*  1.0   *CARD 11
*RPOWRI*37.0E6*ZPWIN*        0. *ZPWOFF*      0. *RZPWMX*     0.                 *CARD 12
*SHELV*      0. *PLDR*       0. *PDRAT* 1.336 *FUCRAC*  0.7 *HGAPO*1.0E+3   *CARD 13
*DTXHT(1)*4.0 *DTXHT(2)*50. *DZNHT*1.0E-3                                      *CARD 14
*
 **SKIPPED**                                                                    *CARD 15
 **SKIPPED**                                                                    *CARD 16
 **SKIPPED**                                                                    *CARD 17
*
        0.527           0.727           1.248S                      *Z
        1.553           1.781S                                      *Z
        2.010           2.467           2.924S                      *Z
        3.400           4.846S                                      *Z
        5.130           5.900E                                      *Z
        0.105           0.231           0.329           0.470E      *RADIUS
  1.570796327     3.141592654     4.712388981     6.283185308E      *THETA
* VESSEL SOURCE CARDS
           11              10               3               1      *ILHL
           11              15               3               9      *ILCL
           11              12               3              31      *BLHL
           11              13               3              41      *BLCL
           11               9              -2             105      *BYPS
           11               6              -2             105      *BYPS
           11              11              -2             107      *BYPS
           11               8              -2             108      *BYPS
            9               1               2              81      *UPINJ
            9               2               2              82      *UPINJ
            9               3               2              83      *UPINJ
            9               4               2              84      *UPINJ
            9               5               2              85      *UPINJ
            9               6               2              86      *UPINJ
            9               7               2              87      *UPINJ
            9               8               2              88      *UPINJ
            9               9               2              89      *UPINJ
            9              10               2              90      *UPINJ
            9              11               2              91      *UPINJ
            9              12               2              92      *UPINJ
            8               9               3             109      *BYPS
            8              10               3             110      *BYPS
```

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            8          11           3         111     *BYPS
            8          12           3         112     *BYPS
            3           9           2         101     *BYPS
            3          10           2         102     *BYPS
            3          11           2         103     *BYPS
            3          12           2         104     *BYPS
        0.955       0.960       0.965S                *RDPWR
        0.975       0.990S                            *RDPWR
        1.016       1.060R 3    0.000E                *RDPWR
*
*   THE FOLLOWING DATA IS FOR FP-1
*
R 4    1.5856R 4    1.2039 R 4    0.7245E             *CPOWR
            1           2           3          4S     *IDROD
            8          12E                            *IDROD
R 4    1.2803       1.0939        1.2365E             *RPKF
 *(DUMMY)* 1.0S                                       *ZPWTB
        0.1500      1.2541      1.4586 S              *ZPWTB
        1.4995      1.0337      0.0477 E              *ZPWTB
 R 4     33.103 4     127.1R 4    154.8E              *RDX
          0.0     7.7449E-4   1.5489E-3S              *RADRD
   2.3235E-3      3.0479E-3S                          *RADRD
   3.8725E-3      4.6470E-3   4.7420E-3S              *RADRD
   5.0508E-3      5.3590E-3E                          *RADRD
R 5         1           3R 2          2E              *MATRD
          0.0     37.0E6           0.3     32.425E6 S *RPWTB
          0.9     9.8748E6        1.28     5.5142E6 S *RPWTB
         1.38      3.9896E6       1.40     3.2985E6 S *RPWTB
         1.46      2.9950E6       1.52     2.6480E6 S *RPWTB
         1.59      2.3320E6       1.61     2.2712E6 S *RPWTB
          2.0      2.1547E6        3.0     2.0515E6 S *RPWTB
          4.0      1.9873E6        6.0     1.8751E6 S *RPWTB
          8.0      1.7919E6       10.0     1.7251E6 S *RPWTB
         15.0      1.6047E6       20.0     1.5183E6 S *RPWTB
         30.0      1.3962E6       40.0     1.3085E6 S *RPWTB
         60.0      1.1357E6      100.0     1.0700E6 S *RPWTB
        200.0      0.9500E6      300.0     0.8400E6 S *RPWTB
      100000.      5.2560E4 E                         *RPWTB
*
*
*
F           1F                                        *NFAX
F         0.0F                                        *FPUO2
F        0.93E                                        *FTD
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0S                                      *GMIX
   9.81010E-1    0.0      1.01030E-2   1.78300E-3    0.0   *GMIX
   7.09910E-3    0.0E                                      *GMIX
F         1.0E                                             *GMLES
R 4    2.4100E+6   R 6   2.1200E+5    E                    *PGAPT
```

```
F           0.0F                                                             *PLVOL
F           0.0F                                                             *PSLEN
F           0.0E                                                             *CLENN
*
*    LEVEL 1
*
R 4       0.0087 S                                                           *HSA
R 4       0.0333 S                                                           *HSA
R 4       0.0431 S                                                           *HSA
R 4       1.096  E                                                           *HSA
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092E          *HSX
F           0.0E                                                             *CFZL-T
F           0.0E                                                             *CFZL-Z
F           0.0F                                                             *CFZL-R
F           0.0F                                                             *CFZV-T
F           0.0F                                                             *CFZV-Z
F           0.0E                                                             *CFZV-R
F         1.118E                                                             *VOL
F           1.0E                                                             *FA-T
F           1.0F                                                             *FA-Z
R8 1.0 R4 1.0 R4 0.0 E                                                       *FA-R
F           0.1F                                                             *HD-T
F           0.1E                                                             *HD-Z
F           0.1E                                                             *HD-R
F         570.0E                                                             *HSTN
F             6E                                                             *MATHS
F           0.0F                                                             *ALPN
F           0.0F                                                             *VVN-T
F           0.0F                                                             *VVN-Z
F           0.0F                                                             *VVN-R
F           0.0F                                                             *VLN-T
F           0.0F                                                             *VLN-Z
F           0.0E                                                             *VLN-R
F         615.0E                                                             *TVN
F         593.0E                                                             *TLN
F       148.4E5E                                                             *PN
F           0.0E                                                             *PAN
*
*    LEVEL 2
*
R 4         0.0 S                                                            *HSA
R 4         0.0 S                                                            *HSA
R 4         0.0 S                                                            *HSA
R 4      0.3024 E                                                            *HSA
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
            0.0            0.075            0.085            0.092S          *HSX
```

```
            0.0         0.075       0.085       0.092S     *HSX
            0.0         0.075       0.085       0.092S     *HSX
            0.0         0.075       0.085       0.092S     *HSX
            0.0         0.075       0.085       0.092S     *HSX
            0.0         0.075       0.085       0.092E     *HSX
F           0.0E                                           *CFZL-T
F           0.0E                                           *CFZL-Z
F           0.0E                                           *CFZL-R
F           0.0E                                           *CFZV-T
F           0.0E                                           *CFZV-Z
F           0.0E                                           *CFZV-R
F         1.118E                                           *VOL
F           1.0E                                           *FA-T
R12       .409R 4       .582E                              *FA-Z
R8 1.0 R4 1.0 R4 0.0 E                                     *FA-R
F            .1E                                           *HD-T
F            .1E                                           *HD-Z
F            .1E                                           *HD-R
F         570.0E                                           *HSTN
F             6E                                           *MATHS
F           0.0E                                           *ALPN
F           0.0E                                           *VVN-T
F           0.0E                                           *VVN-Z
F           0.0E                                           *VVN-R
F           0.0E                                           *VLN-T
F           0.0E                                           *VLN-Z
F           0.0E                                           *VLN-R
F         615.0E                                           *TVN
F         593.0E                                           *TLN
F       148.4E5E                                           *PN
F           0.0E                                           *PAN
*
*   LEVEL 3
*
R 4     0.1341 S                                           *HSA
R 4     0.5150 S                                           *HSA
R 4     0.6676 S                                           *HSA
R 4     2.1207 E                                           *HSA
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.005       0.010       0.0153S    *HSX
            0.0         0.025       0.035       0.040S     *HSX
            0.0         0.025       0.035       0.040S     *HSX
            0.0         0.025       0.035       0.040S     *HSX
            0.0         0.025       0.035       0.040E     *HSX
F           0.0E                                           *CFZL-T
R12         5.5R 4        0.0E                  *FF=5.5    *CFZL-Z
F           0.0E                                           *CFZL-R
F           0.0E                                           *CFZV-T
R12         5.5R 4        0.0E                  *FF=5.5    *CFZV-Z
F           0.0E                                           *CFZV-R
R12       .656R 4       0.582E                             *VOL
R12         .7R 4        .582E                             *FA-T
R12      0.448R 4        .582E                             *FA-Z
R8 0.7 R4 0.0 R4 0.0 E                                     *FA-R
R12    1.22E-2R 4       0.100E                             *HD-T
R12    1.22E-2R 4       0.100E                             *HD-Z
R12    1.22E-2R 4       0.100E                             *HD-R
F         570.0E                                           *HSTN
F             6E                                           *MATHS
F           0.0E                                           *ALPN
```

```
F          0.0F                                                         *VVN-T
F          0.0F                                                         *VVN-Z
F          0.0F                                                         *VVN-R
F          0.0F                                                         *VLN-T
F          0.0F                                                         *VLN-Z
F          0.0E                                                         *VLN-R
F        515.0E                                                         *TVN
F        593.0E                                                         *TLN
F      148.4F5E                                                         *PN
F          0.0E                                                         *PAN
*
*    LEVEL 4
*
R 4        0.0 S                                                        *HSA
R 4        0.0 S                                                        *HSA
R 4     0.1703 S                                                        *HSA
R 4   - 1.2410 E                                                        *HSA
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.050          0.060          0.0665S           *HSX
           0.0          0.050          0.060          0.0665S           *HSX
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.050          0.060          0.0665S           *HSX
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.050          0.060          0.0665S           *HSX
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.050          0.060          0.0665S           *HSX
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.025          0.035          0.040S            *HSX
           0.0          0.025          0.035          0.040S            *HSX
           0.0          0.025          0.035          0.040S            *HSX
           0.0          0.025          0.035          0.040E            *HSX
F          0.0E                                                         *CFZL-T
R12        0.0F           0.0E                                          *CFZL-Z
F          0.0E                                                         *CFZL-R
F          0.0F                                                         *CFZV-T
R12        0.0F           0.0E                                          *CFZV-Z
F          0.0E                                                         *CFZV-R
R12       .478R 4        .582E                                          *VOL
R12     0.251R 4         .582E                                          *FA-T
R12     0.448R 4         .582E                                          *FA-Z
R4         0.0R4        0.251R4          0.0R4           0.0E           *FA-R
R12   1.22E-2R 4        0.100E                                          *HD-T
R12   1.22E-2R 4        0.100E                                          *HD-Z
R12   1.22E-2R 4        0.100E                                          *HD-R
F        570.0E                                                         *HSTN
F            6F                                                         *MATHS
F          0.0E                                                         *ALPN
F          0.0E                                                         *VVN-T
F          0.0F                                                         *VVN-Z
F          0.0E                                                         *VVN-R
F          0.0E                                                         *VLN-T
F          0.0E                                                         *VLN-Z
F          0.0F                                                         *VLN-R
F        515.0E                                                         *TVN
F        593.0E                                                         *TLN
F      148.4F5E                                                         *PN
F          0.0E                                                         *PAN
*
*    LEVEL 5
*
R 4        0.0 S                                                        *HSA
R 4        0.0 S                                                        *HSA
R 4     0.1273 S                                                        *HSA
R 4     0.9277 E                                                        *HSA
           0.0          0.050          0.060          0.0665S           *HSX
           0.0          0.050          0.060          0.0665S           *HSX
           0.0          0.050          0.050          0.0665S           *HSX
           0.0          0.050          0.060          0.0665S           *HSX
```

	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.050	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.050	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.025	0.035	0.040S	*HSX
	0.0	0.025	0.035	0.040S	*HSX
	0.0	0.025	0.035	0.040S	*HSX
	0.0	0.025	0.035	0.040E	*HSX
F	0.0F				*CFZL-T
R12	0.6F	0.0E			*CFZL-Z
F	0.0F				*CFZL-R
F	0.0E				*CFZV-T
R12	0.6F	0.0E			*CFZV-Z
F	0.0E				*CFZV-R
R12	.478R 4	.582E			*VOL
R12	0.251R 4	.582E			*FA-T
R12	0.448R 4	.582E			*FA-Z
R4	0.0R4	0.251R4	0.0R4	0.0E	*FA-R
R12	1.22E-2R 4	0.100E			*HD-T
R12	1.22E-2R 4	0.100E			*HD-Z
R12	1.22E-2R 4	0.100E			*HD-R
F	570.0E				*HSTN
F	6F				*MATHS
F	0.0E				*ALPN
F	0.0E				*VVN-T
F	0.0F				*VVN-Z
F	0.0F				*VVN-R
F	0.0F				*VLN-T
F	0.0F				*VLN-Z
F	0.0E				*VLN-R
F	615.0E				*TVN
F	593.0E				*TLN
F	143.4E5E				*PV
F	0.0F				*PAN
*					
*	LEVEL 6				
*					
R 4	0.0 S				*HSA
R 4	0.0 S				*HSA
R 4	0.1279 S				*HSA
R 4	0.9281 E				*HSA
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.050	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.050	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.050	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.050	0.060	0.0665S	*HSX
	0.0	0.025	0.035	0.040S	*HSX
	0.0	0.025	0.035	0.040S	*HSX
	0.0	0.025	0.035	0.040S	*HSX
	0.0	0.025	0.035	0.040E	*HSX
F	0.0E				*CFZL-T
R12	0.6F	0.0E			*CFZL-Z
F	0.0F				*CFZL-R
F	0.0E				*CFZV-T
R12	0.6F	0.0E			*CFZV-Z
F	0.0F				*CFZV-R
R12	.478R 4	.582E			*VOL
R12	0.251R 4	.582E			*FA-T
R12	0.448R 4	.582E			*FA-Z

```
R4          0.0R4       0.251R4          0.0R4          0.0E         *FA-R
R12    1.22E-2R 4       0.100E                                       *HD-T
R12    1.22E-2R 4       0.100E                                       *HD-Z
R12    1.22E-2R 4       0.100E                                       *HD-R
F          570.0F                                                    *HSTN
F              6F                                                    *MATHS
F            0.0F                                                    *ALPN
F            0.0E                                                    *VVN-T
F            0.0E                                                    *VVN-Z
F            0.0F                                                    *VVN-R
F            0.0F                                                    *VLN-T
F            0.0E                                                    *VLN-Z
F            0.0E                                                    *VLN-R
F          615.0F                                                    *TVN
F          593.0E                                                    *TLN
F        148.4E5E                                                    *PN
F            0.0F                                                    *PAN
*
*     LEVEL 7
*
R 4          0.0 S                                                   *HSA
R 4          0.0 S                                                   *HSA
R 4       0.2552 S                                                   *HSA
R 4       1.9516 E                                                   *HSA
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.050        0.060        0.0665S            *HSX
             0.0        0.025        0.035        0.040S             *HSX
             0.0        0.025        0.035        0.040S             *HSX
             0.0        0.025        0.035        0.040S             *HSX
             0.0        0.025        0.035        0.040E             *HSX
F            0.0F                                                    *CFZL-T
R12          0.6F         0.0E                                       *CFZL-Z
F            0.0F                                                    *CFZL-R
F            0.0E                                                    *CFZV-T
R12          0.6F         0.0E                                       *CFZV-Z
F            0.0F                                                    *CFZV-R
R12        .478R 4       .582E                                       *VOL
R12       0.2R1R 4       .582E                                       *FA-T
R12       0.448R 4       .582E                                       *FA-Z
R4           0.0R4      0.251R4          0.0R4          0.0E         *FA-R
R12    1.22E-2R 4       0.100E                                       *HD-T
R12    1.22E-2R 4       0.100E                                       *HD-Z
R12    1.22E-2R 4       0.100E                                       *HD-R
F          570.0E                                                    *HSTN
F              6E                                                    *MATHS
F            0.0F                                                    *ALPN
F            0.0E                                                    *VVN-T
F            0.0E                                                    *VVN-Z
F            0.0E                                                    *VVN-R
F            0.0E                                                    *VLN-T
F            0.0E                                                    *VLN-Z
F            0.0F                                                    *VLN-R
F          615.0E                                                    *TVN
F          593.0F                                                    *TLN
F        148.4E5E                                                    *PN
F            0.0E                                                    *PAN
*
*     LEVEL 8
*
R 4          0.0 S                                                   *HSA
```

```
R 4       0.0 S                                                    *HSA
R 4       0.2552 S                                                 *HSA
R 4       1.8516 E                                                 *HSA
            0.0          0.050        0.050        0.0665S         *HSX
            0.0          0.050        0.050        0.0665S         *HSX
            0.0          0.050        0.060        0.0665S         *HSX
            0.0          0.050        0.050        0.0665S         *HSX
            0.0          0.050        0.060        0.0665S         *HSX
            0.0          0.050        0.050        0.0665S         *HSX
            0.0          0.050        0.050        0.0665S         *HSX
            0.0          0.050        0.050        0.0665S         *HSX
            0.0          0.050        0.060        0.0665S         *HSX
            0.0          0.050        0.050        0.0665S         *HSX
            0.0          0.050        0.060        0.0665S         *HSX
            0.0          0.050        0.060        0.0665S         *HSX
            0.0          0.025        0.035        0.040S          *HSX
            0.0          0.025        0.035        0.040S          *HSX
            0.0          0.025        0.035        0.040S          *HSX
            0.0          0.025        0.035        0.040E          *HSX
F           0.0E                                                   *CFZL-T
R12         0.6F           0.0E                                    *CFZL-Z
F           0.0E                                                   *CFZL-R
F           0.0E                                                   *CFZV-T
R12         0.6F           0.0E                                    *CFZV-Z
F           0.0F                                                   *CFZV-R
R12       .478R 4        .582E                                     *VOL
R12       0.251R 4       .582E                                     *FA-T
R12       0.448R 4       .582E                                     *FA-Z
R4          0.0R4        0.251R4        0.0R4         0.0E         *FA-R
R12     1.22E-2R 4       0.100E                                    *HD-T
R12     1.22E-2R 4       0.100E                                    *HD-Z
R12     1.22E-2R 4       0.100E                                    *HD-R
F         570.0F                                                   *HSTN
F             0E                                                   *MATHS
F           0.0E                                                   *ALPN
F           0.0F                                                   *VVN-T
F           0.0E                                                   *VVN-Z
F           0.0E                                                   *VVN-R
F           0.0F                                                   *VLN-T
F           0.0F                                                   *VLN-Z
F           0.0F                                                   *VLN-R
F         515.0E                                                   *TVN
F         503.0F                                                   *TLN
F       148.4E5E                                                   *PN
F           0.0E                                                   *PAN
*
*   LEVEL 9
*
R 4       0.2100 S                                                 *HSA
R 4       0.8060 S                                                 *HSA
R 4       0.5172 S                                                 *HSA
R 4       1.9370 E                                                 *HSA
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .00250       .00500       .0071S           *HSX
            0.0         .02000       .03000       .0341S           *HSX
            0.0         .02000       .03000       .0341S           *HSX
            0.0         .02000       .03000       .0341S           *HSX
            0.0         .02000       .03000       .0341S           *HSX
            0.0         .025         .035         .040 S           *HSX
            0.0         .025         .035         .040 S           *HSX
            0.0         .025         .035         .040 S           *HSX
            0.0         .025         .035         .040 E           *HSX
F           0.0E                                                   *CFZL-T
R 4         0.0R 4        1.2R 4       0.5R 4        0.0E          *CFZL-Z
```

```
F            0.0F                                                           *CFZL-R
F            0.0F                                                           *CFZV-T
R 4          0.0R 4        1.2R 4          0.5R 4          0.0E             *CFZV-Z
F            0.0F                                                           *CFZV-R
R12        0.895R 4         .582E                                           *VOL
R12        0.366R 4         .582E                                           *FA-T
R 4         0.85R E        0.366R 4        0.5820E                          *FA-Z
R3 0.365 R4 0.0 R4 0.0 E                                                    *FA-R
R12      1.22E-2R 4        0.100E                                           *HD-T
R12      1.22E-2R 4        0.100E                                           *HD-Z
R12      1.22E-2R 4        0.100E                                           *HD-R
F          570.0E                                                           *HSTN
F              6F                                                           *MATHS
F            0.0F                                                           *ALPN
F            0.0E                                                           *VVN-T
F            0.0F                                                           *VVN-Z
F            0.0F                                                           *VVN-R
F            0.0E                                                           *VLN-T
F            0.0F                                                           *VLN-Z
F            0.0F                                                           *VLN-R
F          615.0E                                                           *TVN
F          593.0E                                                           *TLN
F       148.4R5E                                                            *PN
F            0.0F                                                           *PAN
*
*   LEVEL 10
*
R 4       1.0940 S                                                          *HSA
R 4       4.2018 S                                                          *HSA
R 4       1.3944 S                                                          *HSA
R 4       5.9840 E                                                          *HSA
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0010           .002          .00304S            *HSX
             0.0           .0200           .030          .03410S            *HSX
             0.0           .0200           .030          .03410S            *HSX
             0.0           .0200           .030          .03410S            *HSX
             0.0           .0200           .030          .03410S            *HSX
             0.0           .0250           .035          .0400S             *HSX
             0.0           .0250           .035          .0400S             *HSX
             0.0           .0250           .035          .0400S             *HSX
             0.0           .0250           .035          .0400E             *HSX
F            0.0E                                                           *CFZL-T
F            0.0E                                                           *CFZL-Z
F            0.0F                                                           *CFZL-R
F            0.0F                                                           *CFZV-T
F            0.0E                                                           *CFZV-Z
F            0.0E                                                           *CFZV-R
R12        0.885R 4         .715E                                           *VOL
R 4          1.0R 3        0.0R 4          .7150F                           *FA-T
R 4         0.85R 4        0.0R 4          .250S                            *FA-Z
            0.981          0.449           0.981           0.449E           *FA-Z
R8 0.0   R4 0.0 R4 0.0 E                                                    *FA-R
R12      1.22E-2R 4        0.100E                                           *HD-T
R12      1.22E-2R 4        0.100E                                           *HD-Z
R12      1.22E-2R 4        0.100E                                           *HD-R
F          570.0E                                                           *HSTN
F              6E                                                           *MATHS
F            0.0E                                                           *ALPN
F            0.0E                                                           *VVN-T
F            0.0F                                                           *VVN-Z
F            0.0F                                                           *VVN-R
F            0.0F                                                           *VLN-T
F            0.0F                                                           *VLN-Z
F            0.0E                                                           *VLN-R
```

```
F          615.0F                                                          *TVN
F          593.0F                                                          *TLN
F        148.465E                                                          *PN
F            0.0F                                                          *PAN
*
*   LEVEL 11
*
R 4        .2149 S                                                         *HSA
R 4       0.3251 S                                                         *HSA
R 4       1.0697 S                                                         *HSA
R 4       1.1556 E                                                         *HSA
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0200          .030          .03410S             *HSX
             0.0          .0200          .030          .03410S             *HSX
             0.0          .0200          .030          .03410S             *HSX
             0.0          .0200          .030          .03410S             *HSX
             0.0          .0250          .035          .0400S              *HSX
             0.0          .0250          .035          .0400S              *HSX
             0.0          .0250          .035          .0400S              *HSX
             0.0          .0250          .035          .0400E              *HSX
F            0.0E                                                          *CFZL-T
F            0.0F                                                          *CFZL-Z
R8           0.0R4        159.00R4        0.0E                             *CFZL-R
F            0.0E                                                          *CFZV-T
F            0.0F                                                          *CFZV-Z
R8           0.0R4        159.00R4        0.0E                             *CFZV-R
R12       0.951R 4          1.25E                                          *VOL
R12       0.366R 4          .362E                                          *FA-T
R12       0.365R 4          .000E                                          *FA-Z
R8        0.366R4         0.045R4           0.0E                           *FA-R
R12     1.22E-2R 4        0.100E                                           *HD-T
R12     1.22E-2R 4        0.100E                                           *HD-Z
R8      1.22E-2R 4      0.00276R 4       0.100E                            *HD-R
F          570.0E                                                          *HSTN
F              6F                                                          *MATHS
F            0.0F                                                          *ALPN
F            0.0F                                                          *VVN-T
F            0.0F                                                          *VVN-Z
F            0.0F                                                          *VVN-R
F            0.0F                                                          *VLN-T
F            0.0E                                                          *VLN-Z
F            0.0E                                                          *VLN-R
F          615.0F                                                          *TVN
F          593.0F                                                          *TLN
F        148.465E                                                          *PN
F            0.0F                                                          *PAN
*
*   LEVEL 12
*
R 4       0.5827 S                                                         *HSA
R 4       2.2371 S                                                         *HSA
R 4       0.7426 S                                                         *HSA
R 4          0.0 E                                                         *HSA
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0010          .002          .00304S             *HSX
             0.0          .0200          .030          .03410S             *HSX
             0.0          .0200          .030          .03410S             *HSX
```

```
            0.0          .0200          .030          .03410S     *HSX
            0.0          .0200          .030          .03410S     *HSX
            0.0          .0250          .035          .0400S      *HSX
            0.0          .0250          .035          .0400S      *HSX
            0.0          .0250          .035          .0400S      *HSX
            0.0          .0250          .035          .0400E      *HSX
F           0.0E                                                  *CFZL-T
F           0.0E                                                  *CFZL-Z
F           0.0F                                                  *CFZL-R
F           0.0E                                                  *CFZV-T
F           0.0E                                                  *CFZV-Z
F           0.0F                                                  *CFZV-R
R12       0.885R 4     0.000E                                     *VOL
R12       0.366R 4     0.000E                                     *FA-T
R12       0.000R 4     0.000E                                     *FA-Z
R3 0.365 R4 0.0 R4 0.0 E                                          *FA-R
R12     1.22E-2R 4     0.100E                                     *HD-T
R12     1.22E-2R 4     0.100E                                     *HD-Z
R12     1.22E-2R 4     0.100E                                     *HD-R
F         570.0E                                                  *HSTN
F             6F                                                  *MATHS
F           0.0E                                                  *ALPN
F           0.0F                                                  *VVN-T
F           0.0E                                                  *VVN-Z
F           0.0F                                                  *VVN-R
F           0.0E                                                  *VLN-T
F           0.0E                                                  *VLN-Z
F           0.0E                                                  *VLN-R
F         615.0E                                                  *TVN
F         593.0F                                                  *TLN
F       148.4E5E                                                  *PN
F           0.0F                                                  *PAN
*
*    RUN DATA
*
F           0.0E                                                  *BURN 1
F         559.0F                                                  *RDTN 1
F           0.0F                                                  *BURN 2
F         559.0F                                                  *RDTN 2
F           0.0F                                                  *BURN 3
F         559.0F                                                  *RDTN 3
F           0.0F                                                  *BURN 4
F         559.0F                                                  *RDTN 4
F           0.0E                                                  *BURN 5
F         559.0E                                                  *RDTN 5
F           0.0E                                                  *BURN 6
F         559.0E                                                  *RDTN 6
F           0.0E                                                  *BURN 7
F         559.0E                                                  *RDTN 7
F           0.0E                                                  *BURN 8
F         559.0F                                                  *RDTN 8
F           0.0F                                                  *BURN 9
F         559.0F                                                  *RDTN 9
F           0.0E                                                  *BURN10
F         559.0E                                                  *RDTN10
F           0.0E                                                  *BURN11
F         559.0E                                                  *RDTN11
F           0.0E                                                  *BURN12
F         559.0E                                                  *RDTN12
F           0.0E                                                  *BURN13
F         559.0E                                                  *RDTN13
F           0.0E                                                  *BURN14
F         559.0E                                                  *RDTN14
F           0.0F                                                  *BURN15
F         559.0E                                                  *RDTN15
F           0.0F                                                  *BURN16
F         559.0E                                                  *RDTN16
F           0.0F                                                  *BURN17
F         559.0F                                                  *RDTN17
F           0.0E                                                  *BURN18
```

```
************************************TIME STEP DATA*****************************************
*        1.0E-5           1.0E+0           3.0E+1           1.0E+1
         1.0E-5           1.0E+0           0.1E-1           1.0E+1
         5.0E+0           1.0E-1           1.0E+0           1.0E+0
        -1.0
```

TABLE 3.5. Input deck listing for transient

```
****
          1              0              1              0
*
*************************************************************************
LOFT POST-TEST LP-FP-1 TRANSIENT DECK FOR TRAC-PF1/MOD1
* RESTART FROM TRCRST LAST RECORD OF STEADY STATE RUN
* BREAKS AND ACCUMULATOR B ACTIVES.
* BREAK CONDITIONS TAKEN FROM STEADY STATE.
*************************************************************************
*
*********************NAMELIST DATA****************************************
 $INOPTS ICFLOW=2, CHM12=1.0, CHM22=0.84, NOAIR=0, IGEOM3=1, NLT=18,
        IMFR=3,NFRC1=2
 $END
*********************MAIN CONTROL CARDS***********************************
     -1     0.000000                                               *MCC 01
      0            1   *NCOMP*    53   *NJUN*     53           1   *MCC 02
   5.0E-4       5.0E-6        1.0E-5          1.0E-1               *MCC 03
     10           50              25                               *MCC 04
*NTSV*  3    *NTCB*  0   *NTCF*    0   *NTRP*     10   *NTCP*      1 *MCC 05
*
      1            2              3              4               5S *COMP
      5            7              8             93S                 *COMP
     23           24             25S                                *COMP
     11           12             13S                                *COMP
     14           15             16             17              31S *COMP
     32           41             42             50              43S *COMP
     81           82             83             84              85S *COMP
     86           87             88             89              90S *COMP
     91           92             61             62              63S *COMP
     64           65             66             67              68S *COMP
     69           70             71             72             101S *COMP
    102          103            104E                                *COMP
********************************SIGNAL VARIABLE DATA*********************************
     0
**********************************CONTROL BLOCK DATA*******************************
************************************TRIP DATA**************************************
     0            0              0              0               0  *TRIP DI
     0
*************************************COMPONENT DATA*********************************
*
*===================================================================================
BREAK             32            32 BROKEN-HOT-LEG TERMINAL
       32          1             3              1          0            *CN02
        0          1            17              0          0            *CN03
 0.815975   0.0423948          0.0          615.3     150.1E5           *CN04
      0.0        0.0        1.0E20            0.0         0.0           *CN05
                                                                        *CN06
      1.0        1.0           1.0            1.0         1.0           *CN07
     0.0  150.1E5      1.0      150.1E5 S          *PTB
     1.0191     1.0E5S
     2.0     1.61E5      3.0      1.61E5 S
     7.0     1.71E5     21.3      2.79E5 S
    24.4     2.88E5     74.8      2.50E5 S
   140.0     2.61E5    269.0      2.60E5 S
   285.0     2.65E5    357.0     2.645E5 S
   381.0    2.694E5    401.0      2.86E5 S
   467.0     3.08E5    500.0      3.08E5 E
*    2.0      3.5E5      6.0       2.3E5 S
*   33.0      3.6E5     53.0      3.34E5 S
*   70.0     3.17E5    100.0       3.0E5 S
*  310.0      2.7E5    500.0       2.7E5 E
*===================================================================================
BREAK             42            42 BROKEN-COLD-LEG TERMINAL
       42          1             3              1          0            *CN02
        0          1            17              0          0            *CN03
 1.022350   0.0472489          0.0          615.5     150.4E5           *CN04
      0.0        0.0        1.0E20            0.0         0.0           *CN05
                                                                        *CN06
      1.0        1.0           1.0            1.0         1.0           *CN07
```

```
    0.0  150.4E5     1.0    150.4E5 S          *PT3
    1.0191    1.0E5S
    2.0   1.61E5     3.0     1.51E5 S
    7.0   1.71E5    21.3     2.79E5 S
   24.4   2.88E5    74.8     2.60E5 S
  140.0   2.61E5   269.0     2.60E5 S
  285.0   2.65E5   357.0   2.645E5 S
  391.0  2.684E5   401.0     2.56E5 S
  457.0   3.08E5   500.0     3.08E5 E
*   2.0    3.5E5     6.0      2.3E5 S
*  33.0    3.6E5    53.0     3.34E5 S
*  70.0   3.17E5   100.0      3.0E5 S
* 310.0    2.7E5   500.0      2.7E5 E
*=============================================================================
END
*************************************TIME STEP DATA***************************************
        1.0E-5          5.0E-3          1.0          10.0
           1.0             0.2          2.0           0.5
        1.0E-5          1.0E-2          5.0          10.0
           1.0             0.5          2.0           1.0
        1.0E-5             0.1        345.0          10.0
           5.0             0.5          5.0           5.0
*       1.0E-5          1.0E-2        500.0          10.0
*          5.0             0.5          5.0           5.0
          -1.0
END
```

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(See instructions on the reverse)

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11. ABSTRACT *(200 words or less)*

This report assesses thermal-hydraulic aspects of LOFT LP-FP-1 experiment making use of TRAC-PF1/MOD1. LP-FP-1 experiment studies the system thermal-hydraulic and core thermal response for initial and boundary conditions similar to a large-break design basis LOCA leading to fission product release from the fuel cladding gap region. It also assesses the fission product retention effectiveness of the PWR-ECCS in best estimate conditions.

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