NUREG/IA-0029

International Agreement Report

Assessment of RELAP5/MOD2, Cycle 36.04 Against FIX–II Split Break Experiment No. 3051

Prepared by
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Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555

October 1989

Prepared as part of
The Agreement on Research Participation and Technical Exchange
under the International Thermal-Hydraulic Code Assessment
and Application Program (ICAP)

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John Eriksson

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ICAP
Assessment of RELAP5/MOD2, Cycle 36.04 Against FIX-II Split Break Experiment No. 3051

ABSTRACT

The FIX-II split break experiment No. 3051 has been analyzed using the RELAP5/MOD2 code. The code version used, Cycle 36.04, is the frozen version of the code.

Three calculations were carried out to study the sensitivity of various parameters to the change of break discharge and passive heat structures. The differences between the calculations and the experiment have been quantified over intervals in real time for a number of variables available from the measurements during the experiment.

Approved by
Eric Hellstrand

LIST OF CONTENTS

APPENDICES

1 INTRODUCTION

There is a growing interest in modifying existing rules for reactor licensing and safety thermal-hydraulic calculation away from those stated in Appendix K (Ref 1) towards procedures based on best estimate types of calculations. Although Appendix K furnishes a set of skillfully and simply phrased rules, its present conservatism on safety is regarded as being in growing contradiction to the increasing knowledge gained from experimental programs. The many advanced best estimate thermal-hydraulic reactor codes in existence today also demonstrate this.

When the simply formulated older calculation rules are replaced by best estimate type calculation procedures another measure of reliability has to be established to ensure conservatism. Plans for conducting code assessments for the purpose of determining the accuracy and the validity of advanced LWR system codes were proposed some years ago (Ref 2). Today the International Code Assessment Program (ICAP) with this goal is being carried out under the auspices of the USNRC (Ref 3).

These calculations are presented as a Swedish contribution to the ICAP. The contribution is funded by the Swedish Nuclear Power Inspectorate.

In the present study the RELAP5/MOD2 version 36.04 is assessed against LOCA experiment No. 3051 carried out in the FIX-II test facility at Studsvik. The experiment is one from the second test series.

Test No. 3051 is a split break simulation and had the smallest break area of all the FIX-II tests, see Table 1. The break area was 10 per cent of the scaled down area of a recirculation line in the reactor.

A description of the test facility and this particular test is provided in Chapter 2. A description of the input model is given in Chapter 3. The base case and sensitivity calculations are discussed in Chapters 4 and 5. Run statistics are given in Chapter 6. General conclusions are drawn in Chapter 7.

Appendix A contains the complete input lists. The data comparison plots are included in Appendix B. Results of the statistical analyses of differences between experiment and predictions for discrete time intervals are included in Appendix C. Finally Appendix D describes the data package on magnetic tape, prepared for use in the ICAP evaluation work.

2 FACILITY AND TEST DESCRIPTION

The FIX-II integral test facility was completed at the end of 1981. It has been run by Studsvik Energiteknik AB under contract with the Swedish Nuclear Power Inspectorate. The experimental program comprises investigations of the fuel-to-coolant heat transfer. Various blowdown and pump trip situations conceivable in Swedish BWR's are simulated.

2.1 Test facility

The test facility is shown in Figure 1. The volume scaling is 1:777 of the Oskarshamn-II reactor, which is of the ASEA-ATOM external recirculation pump design. An exhaustive description of the FIX-II test facility may be obtained from Ref (4), which also provides additional references where various problems pertaining to the construction period are discussed. Therefore, only some fundamental aspects of the facility will be presented here.

The core model involves a full length rod bundle, which in the geometry is closely related to a fuel element of the ASEA-ATOM design and which is electrically heated by DC. Here, however, there are only 6 x 6 rod simulators instead of the 8 x 8 rods in a fuel element. Figures 2 and 3a show details from the core simulator design. As seen, filler bodies are placed between the square-section fuel channel and the circular-section pressure vessel to reduce the water-filled volume, which otherwise may influence the test by the leakage of steam to the upper plenum during depressurization. The water surrounding the fillers is externally recirculated and cooled by 200 to 250 kW.

The upper part of the pressure vessel, Figure 3b, holds the steam separator and the steam condenser volume with its three sprinklers. During steady state power operation the steam outlet is closed. The turbine power is modelled by the partial circulation of water from the downcomer through an external 6 MW cooler with feedback to the sprinklers of the steam condenser and to the upper part of the downcomer. The flow rate in the two branches with cooled water is adjusted to control the pressure and the inlet subcooling. The remaining downcomer flow, representing the recirculation coolant flow in the reference reactor, splits at the lower downcomer end into two loops. One loop represents three of the intact recirculation lines of the reference reactor, while the other loop, representing a fourth recirculation line, incorporates the break devices. Both loops have its own recirculation pump. The intact loop pump speed is controlled according to a predetermined speed history.

The FIX-II has, as part of the core model, an external bypass simulator, Figure 30, through which about 12 % of the recirculation mass flow is diverted through a control valve. This bypass is heated separately to represent the channel wall heat transfer. At the lower end of the bypass there is a stagnant water volume to simulate the reference reactor space for the control rod guide tubes.

Since the FIX-II facility has been designed for blowdown experiments only, no emergency core cooling equipment is installed.

The data collection system is constructed around a signal processor controlling 192 measurement channels. The selection of measurements is made in a signal exchange terminal. A multipurpose minicomputer transfers the raw-data of measured parameters to a magnetic tape. From this tape, the final analysis at the central computer gives the desired tables and plots from an experiment. The data acquisition system includes measurements to obtain:

- pressures (PT)
- differential pressures (dPT)
- temperatures of fluids (TE)
- mass flows (dPT, PT, TE)
- electric currents (I) and voltages (U)
- pump speeds (nT)
- water level positions (CE)
- valve positions

at places shown in the instrumentation diagram, Figure 4.

For recording clad temperatures there were about 100 thermocouples engaged at 16 axial levels of the heated length in the 36-rod bundle.

2.2 The experiment

The preparation of the experiment is initiated several hours before the actual experiment. For the heat-up of the facility, a 200 kW preheater is involved for a period lasting about 5 h. The recirculation pumps are also running during this period. Initial conditions are then established by switching the power supplies to the bundle and to the bypass with the 6 MW cooler and the condenser spray in operation. The preheater is now disconnected. For about 10 to 30 minutes, the electric power to the rod bundle and the bypass heating is gradually increased until the initial test conditions are reached. Necessary calibrations are made, and once the equilibrium conditions are approved, the sequence control equipment is activated for break opening, valve manoeuvres, power reduction, pump speed changes and so forth, according to a programmed scheme for the test. For the split break test No. 3051, the transient ends 137 s after opening of the break.

In the present FIX-II experiment, the speed of the pump in the intact recirculation line decreased from the break time to about 20 % of the initial speed at end of the transient. The speed of the broken recirculation line pump was not explicitly controlled.

The break flow escaping through the fast opening break valve, Figure 1, is discharged into the receiving tank, T2. Initially, the tank is partly filled with cold water for efficient pool condensation of the break flow.

The split break assembly consists of a T-piece on the line from pump P2 to the lower plenum. A break flow limiting orifice, downstream of the break isolation valve, consists of an exhangeable conical inlet part followed by a restriction pipe. In experiment No. 3051, the restriction pipe diameter was 6.8 mm corresponding to a 10 % area of one recirculation line.

Apart from the heat removal from the filler body space, see Chapter 2.1, some 100 kW are also lost by the non-perfect insulation encapsulating the recirculation lines and the pressure vessel. The magnitude of the steady state heat losses was one argument for not performing experiments with very small break areas at FIX-II.

The main measured parameters for the steady state before break are reproduced from Ref (5) in Table 4. The test performance chronology, related to the programming of the sequence control equipment, is given in Table 5.

Experimental raw data were collected for the whole period of the transient. However, internal flows were then only qualified until about 50 s due to uncertainties in the two-phase flow rate measurements.

A summary of the main results (including event times, maximum cladding temperatures and some peak mass flows) is given in Table 6.

2.3 Measurement uncertainty

To obtain estimates for the accuracy of the measured data, test procedures were adapted within the experimental program. Probable errors and errors corresponding to a 95 % confidence level as derived from these tests are summarized in Table 2a. The probable errors of derived quantities, mostly mass flows, are given in Table 2b. The pump speeds are measured using a tachometer of a 1 r/s accuracy. The pump characteristics were verified against the manufacturer's data for cold water single phase operation.

3 CODE AND MODEL DESCRIPTIONS

The assessment calculation for the FIX-II experiment No. 3051 was done using RELAP5/MOD2, Cycle 36.04. The code was implemented in June 1986 on a CDC computer at the Stockholm Comsource Centre where the calculations were carried through. The descriptive document available for this code at the time of preparing the calculation input was the rather detailed code manual (Ref 7) which also contained an input data manual. The code features are discussed in Chapter 3.1.

Existing FIX-II input for RELAP5/MOD2 (Ref 6) and a previous RELAP5/MOD2 calculation (Ref 8), formed the basis for the present RELAP5/MOD2 input. Details of the input are discussed in Chapter 3.2.

3.1 The Code Features

An extensive code description for the RELAP5/MOD2 is given in (Ref 7). The main characteristics of the code are summarized in Table 3.

Since the RELAP5/MOD2 code is primarily developed for PWR application, the question arises whether the code fails to predict some important features for a BWR-type application like the present FIX-II experiment.

Key questions are, for instance, the behaviour of droplets under top spray cooling, the effects of lower plenum and guide tube flashing on the water distribution in the system, dryout and post dryout phenomena. For experiment 3051 only the effects of mass distribution could be addressed since no dryout was observed in the experiment.

3.2 The Input Model

The model geometry used in the present calculations is closely related to geometries used in several previous calculations for FIX-II experiments using previous RELAP5/MOD1 code versions (Refs 6 and 8). The nodalization diagram for the geometric modelling used is shown in Figure 5. Figures 6 and 7 depict the modelling in the geometry of the test facility.

To reproduce fundamental measured steady state quantities, see Table 4, the input for the steady state search run got some additional components and control systems:

I To obtain the steady state dome pressure, a time dependent volume outside of the opened steam relief valve was added. This volume had the experimentally measured dome pressure.

II The speed of the pumps P1 and P2 was regulated using the RELAP5 control system to reproduce the measured mass flows.

III To divert the correct mass flow into the core bypass, the junction from the lower plenum was modelled as a motor valve. By trip logic that valve was regulated to give the experimental bypass mass flow. When entering into the transient calculation, the valve setting was fixed.

IV The measured steam separator collapsed level was satisfied by connecting an auxiliary time dependent volume to the top of the steam separator. The connecting junction was modelled to regulate the collapsed level by water exchange depending of the level offset.

Evidently, some non-zero flows (points I and IV) will remain at the junctions from the pressure- and level regulating time dependent volumes. These flows are quite small and are influenced by the system heat balance.

The input for the steady state calculation is given in the Appendix A.

4 THE BASE CACE CALCULATION

The transient calculation of the base case (called Case A) was continued from the restart-plot file obtained from the steady state calculation. To verify the quality of the steady state, the opening of the break was delayed by 30 s.

The calculation of the transient itself was carried out without any particular problems. The smooth lapse of the CPU-time, Plot B.34 and of the computation mass error, Plot B.35 indicate that.

A set of results from the base case calculation and the sensitivity calculations were selected to satisfy the requirement on assessment parameters given in Table 3 of Ref 3. Those parameters are listed in the Table 8 and the corresponding plots reproduced in Appendix B. Since some of the parameters are not available from the measurements, only comparisons between the different calculations are shown in some of the plots. For the mass flow comparisons, it should be pointed out that the experimental data are not reliable after voiding has begun which for most measurements occur 40 to 50 s after break opening time.

The total mass inventory is dependent on the feed and spray water flow, the flow through the relief valve and the break flow. The spray flow and the feed water valves are closed about two seconds after the break. There is a good agreement between calculation and experiment of the mass flow rate through the steam relief valve, Plot B.27. The break mass flow, Plot B.29, which in the experiment is derived from the increasing content of a flow receiving tank, Plot B.30, was overpredicted in the base case calculation, particularly up to 45 s. The measured mass flow shows a pronounced peak during the very first seconds after the break. This peak is not realistic and is caused by steam replacing water in the tube leading from the break to the receiving tank. This results in an apparent volume increase equivalent to a water mass of about 37 kg from about 3 s until the end of the test. At the end of the test, the break valve is closed causing refill of the break line. Taking this into account the base case calculation overestimated the mass loss through the break by about 23 kg.

The thermal-hydraulic conditions in the system are also influenced by heat exchange with the core and other boundary structures. Plot B.3 shows the calculated heat exchange with all the passive wall structures in the loop except for the separate filler body space with a knwon cooling power of about 256 kW. The heat returning from the passive structures exceeds the core decay heat from about 50 s onwards. The structural wall material thickness of the components was generally modelled as 0.09 times the tube inner diameter.

The system pressure, Plots B.20, B.21 and B.33, was well predicted until 40 s. Afterwards the predictions decreased faster than in the experiment. The cycling of the steam relief valve dominates the behaviour of the system pressure.

Flow rates are measured at the bypass inlet, at the discharge sides of the two main pumps and also in the broken loop between break and vessel inlet; these flow rates are depicted in Plots B.22 through B.25. Two additional measurements of in-loop mass flows are the differential pressures over the orifice in the steam separator, Plot B.17 and over the core inlet restriction, Plot B.2. The mass flows evaluated from the experiment, i.e. Plots B.22 through B.25, are not reliable after the formation of steam has started at the respective location. The times for the first steam formation range between 40 and 50 s and are indicated by increasing flow oscillations. Up to that time the predicted base case flow rates compare well with the measurements. The flows in the broken loop from the pump side and the lower plenum side, Plots B.24 and B.25, are in agreement with the break flow behaviuor.

Plots B.1, B.13 and B.28 show calculated fluid densities at the core bottom, at the reactor vessel bottom and upstream of the break. Fluid densities were not directly measured in the experiment.

At the downcomer bottom, Plot B.18, the first steam is formed at about 40 s when the steam relief valve is opened. The calculation predicts saturation before this point in time. Notice that the thermocouple response may have been affected by structural material. Shortly after 40 s the loop conditions are saturated and the fluid temperatures continue strongly coupled with the pressure.

The fluid inventories of the core, Plot B.12, the upper plenum, Plot B.16, the downcomer, Plot B.14, and of the lower plenum, Plot B.15, are compared as differential pressures which are directly measured in the experiment. The differential pressure over the core is generally underpredicted which means that the mass of water in the core was larger than calculated. Underprediction of the friction losses could also have contributed to the discrepancy.

The differential pressure in the lower plenum, Plot B.15, is initially slightly high but is after opening of the steam relief valve reasonably well predicted.

The comparisons of the rod clad temperatures are done at the clad inner surface which is closest to the thermocouple positions of the heated rods in the experiment. The calculated temperatures, Plots B.4 through B.9, agree reasonably well at various levels of the core with the measurements in the experiment except for early and late in the transient. No dryout was ever measured or calculated and heat transfer coefficients typical for two phase cooling provided a strong link between the clad and fluid temperatures. The discrepancies late in the transient were therefore a result of the pressure (and fluid temperature) prediction.

During the steady state and early in the transient the clad temperatures in the experiment appear higher than the predicted temperatures by as much as 10 K. This disagreement is too large to be explained by the thermocouple location in the calculation model.

Heat transfer coefficients (HTC) evaluated from the measurements and calculated HTC are compared in Figure 8. The calculated HTC show a larger variation with time than those obtained from the measurements. Since the temperature differences are small the measurement uncertainty could be significant. No definite explanation could be identified for the discrepancy.

5 SENSITIVITY CALCULATIONS

Although the results from the base case calculation (Case A) compared well with the experiment for many parameters an improved prediction quality could obviously be obtained by adequate input updates.

Case B

The modelling of the present 10 % split break had used a motor valve applying an opening time of 1.2 s known from the experiment. The junction characteristics of that break valve had been a choking model combined with and abrupt area change option. The default value of unity had been applied for the break discharge coefficient.

Case B was run with a break discharge coefficient of 0.76 for subcooled upstream conditions. This value was determined from several sensitivity studies. A discharge coefficient of unity was retained for saturated upstream conditions.

The overall results were generally improved by this change. In particular differential pressures over the core, Plot B.12, over the downcomer, Plot B.14, over the upper plenum, Plot B.16, and over the steam separator, Plot B.17, were in a better agreement with the experiment. Improvements in temperature predictions were also obtained as a consequence of a slightly lower depressurization rate.

Case C

Case C was devoted to modelling of heat exchange with the surroundings. Since this was the smallest break size ever tested in FIX-II it could be expected that the heat exchange could affect the results. Case C used the break discharge coefficients as in the Case B.

The previously used heat transfer had been determined from steady state conditions. It had been noted that the exact core inlet subcooling was difficult to reproduce. The offset was 2 to 3 K.

To obtain a cooler fluid entering the core the outer surface heat transfer coefficient was split into three coefficients in the ratios of 1:3:9 such that most structures had about the same heat transfer coefficient as earlier. Some structures in the flow path from the feed water inlet to the core inlet, like the pumps and the vessel bottom volume, got the high outer surface heat transfer coefficient. The low heat transfer coefficient was applied on the steam dome structures.

As it turned out this rather large change in the outer surface heat transfer coefficients had a very limited influence on the predicted core inlet subcooling. The steady state fluid temperature decrease down to the core inlet is consequently still not fully explained. The results were nearly identical to that of Case B.

6 RUN STATISTICS

The transient calculation model used with the base case RELAP5/MOD2 prediction for the FIX-II test No. 3051 was modelled by:

58	volumes
60	junctions
69	heat structures

The volumes number includes two pump components and five time dependent volumes and among the junctions there are two valve components and four time dependent junctions.

The computer efficiency is summarized in Table 7 from the major edit printouts, see also Plot B.34. The table also gives the number of time step reductions from requested time steps forced by the current transport limit in the interval from the previous major edit.

The transient calculation needs were:

Computer time	CPU = 2113. s
Number of time steps	DT = 1278
Number of volumes	C = 58
Transient real time	RT = 145.s

A code efficiency factor of

$$\frac{CPU \times 10^3}{C \times DT} = 28.5$$

is obtained, compare Ref 3. The computer used was a Cyber 170-810.

7 CONCLUSIONS

The present calculation for the FIX-II test No. 3051, a 10 % split break, was the latest out of a series of RELAP5 calculations performed for experiments done with the FIX-II facility. That means that improvements on earlier calculation inputs were incorporated in the input used for the present calculations. The code version used was RELAP5/MOD2, Cycle 36.04.

As in the experiment the calculations showed no dryout during the transient. Comparison of clad temperatures are therefore less meaningful since these are linked to the fluid temperature by large heat transfer coefficients. The major cause for the temperature discrepancies is the slight underprediction of the pressure and thereby the fluid temperatures which are near saturation temperatures towards the end of the test.

The sensitivity studies addressed the discharge coefficient and heat exchange with the surroundings. Changing the discharge coefficient from unity to 0.76 for subcooled blowdown improved the prediction of mass inventory in the core, downcomer, and upper and lower plenum. The sensitivity of the heat exchange with the surroundings did not significantly affect the results.

The mass inventories in the core and downcomer were generally underpredicted in the calculations. The redistribution of mass caused by flashing in lower plenum and guide tubes were correctly predicted by the code.

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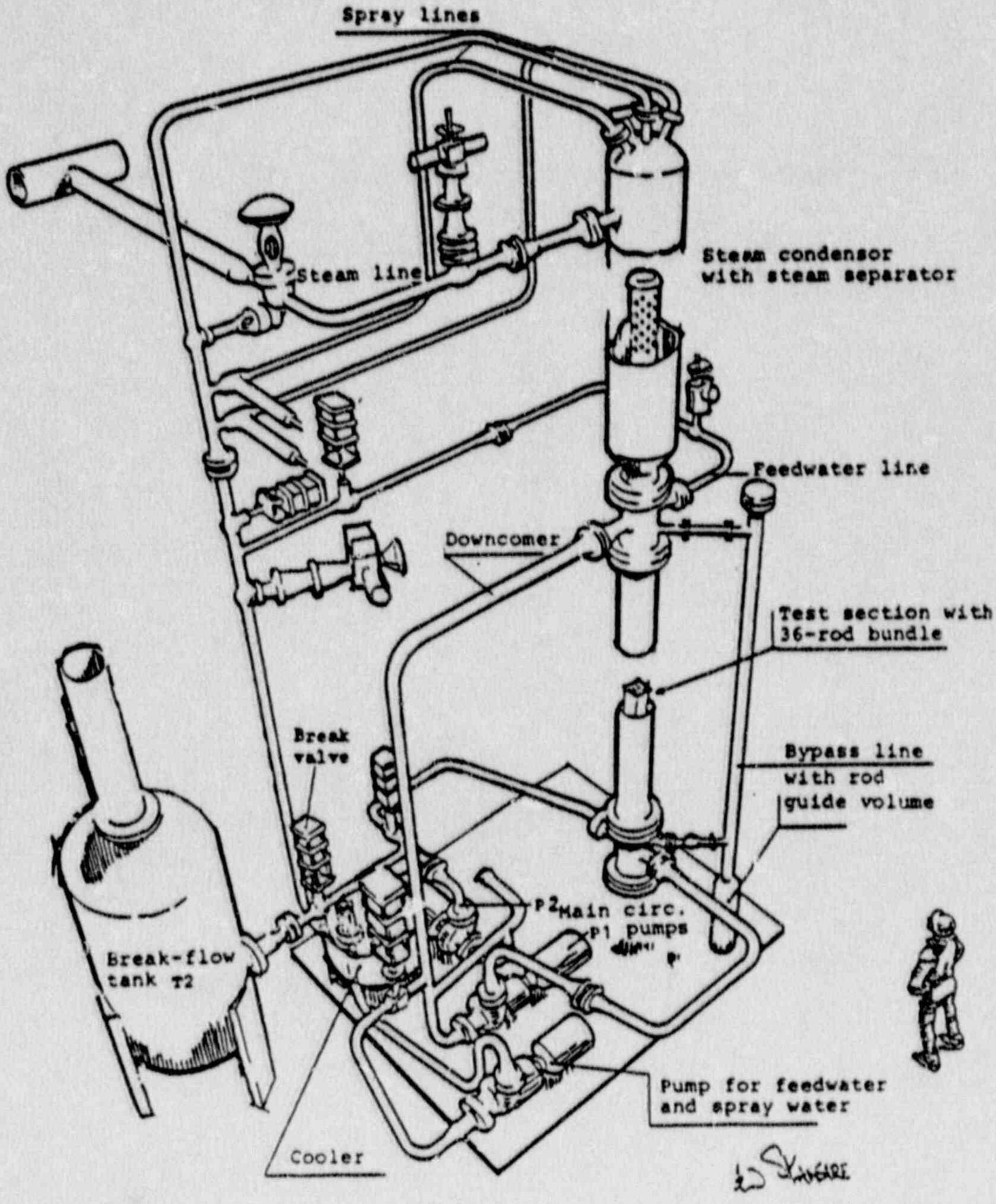


Figure 1

View of the FIX-II facility, condition for split break experiments.

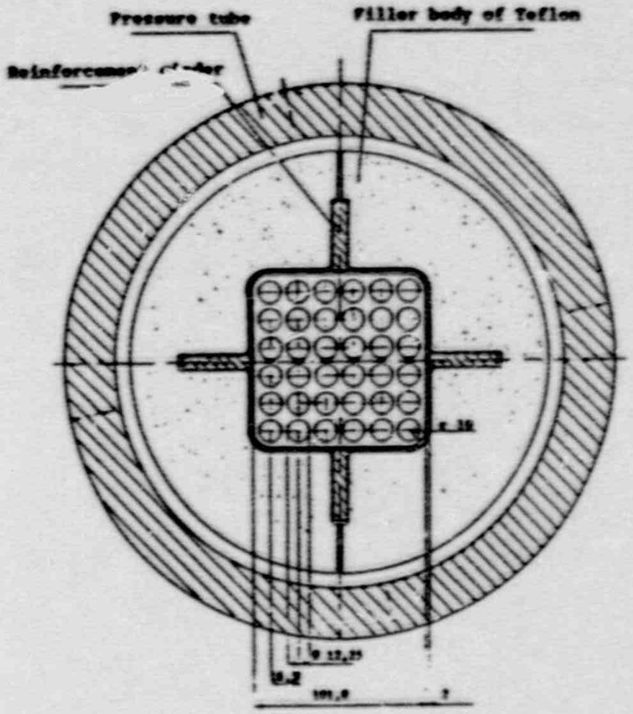


Figure 2a

Cross section of pressure vessel and rod bundle

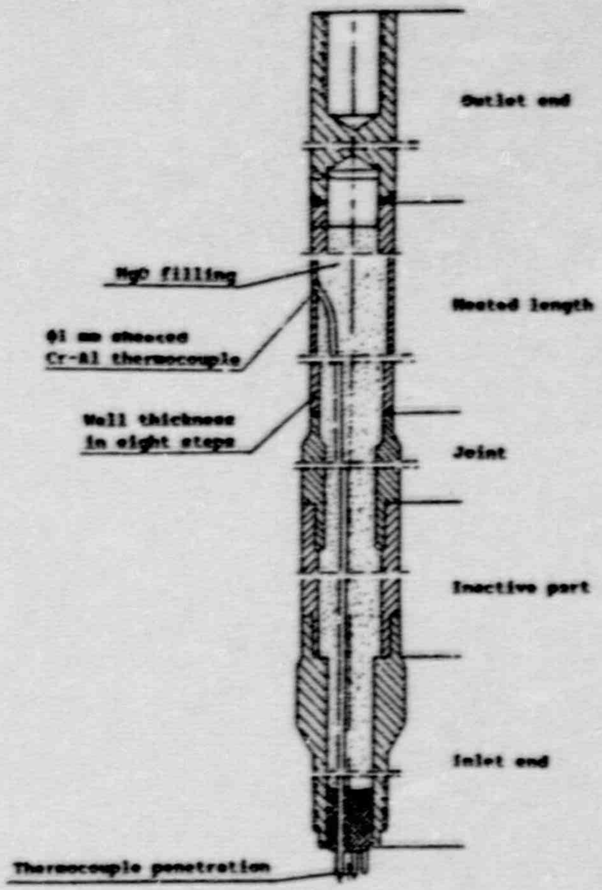


Figure 2b

Design of a fuel rod simulator

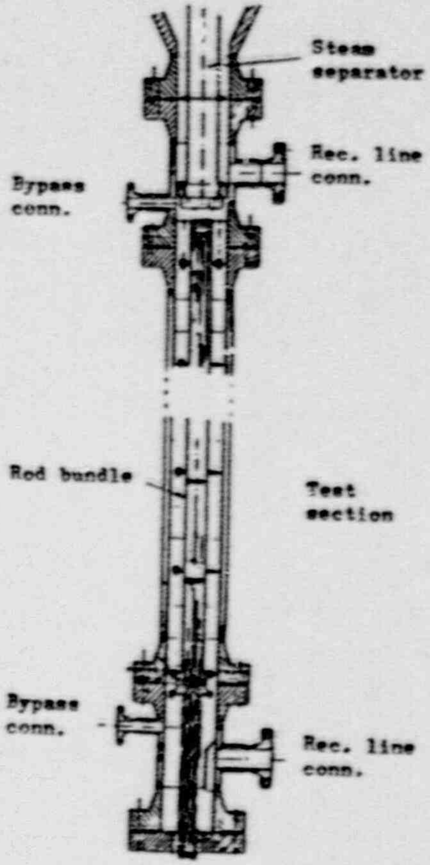


Figure 3a

Lower plenum and core region

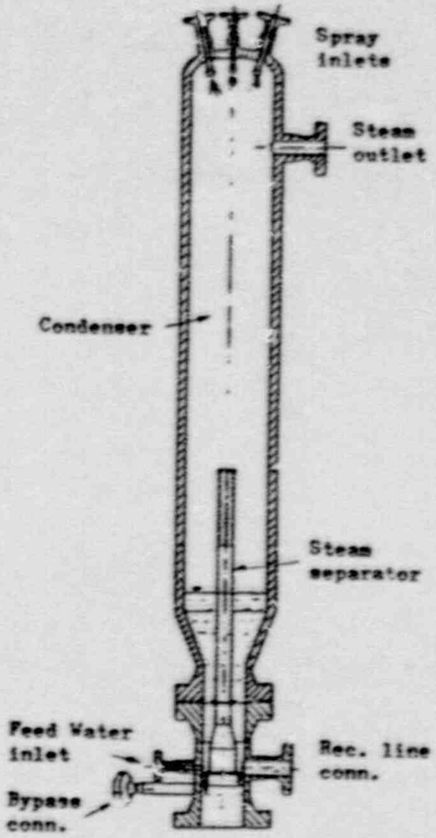


Figure 3b

Steam separator and steam condenser

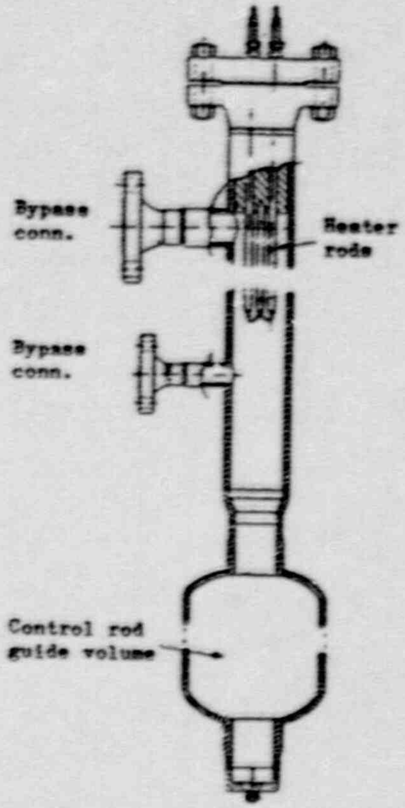


Figure 3c

The external core bypass

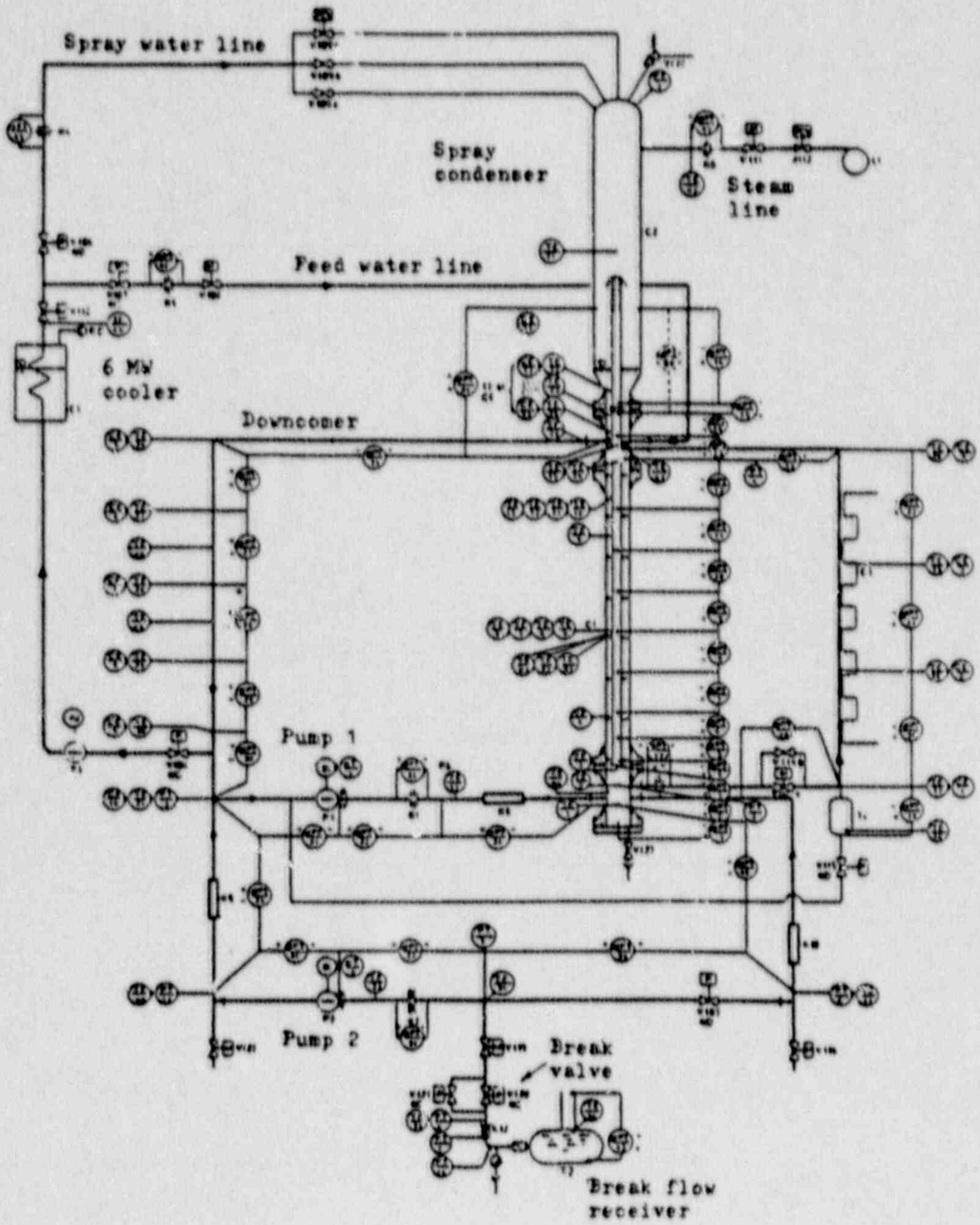


Figure 4

Instrumentation diagram for FIX-II

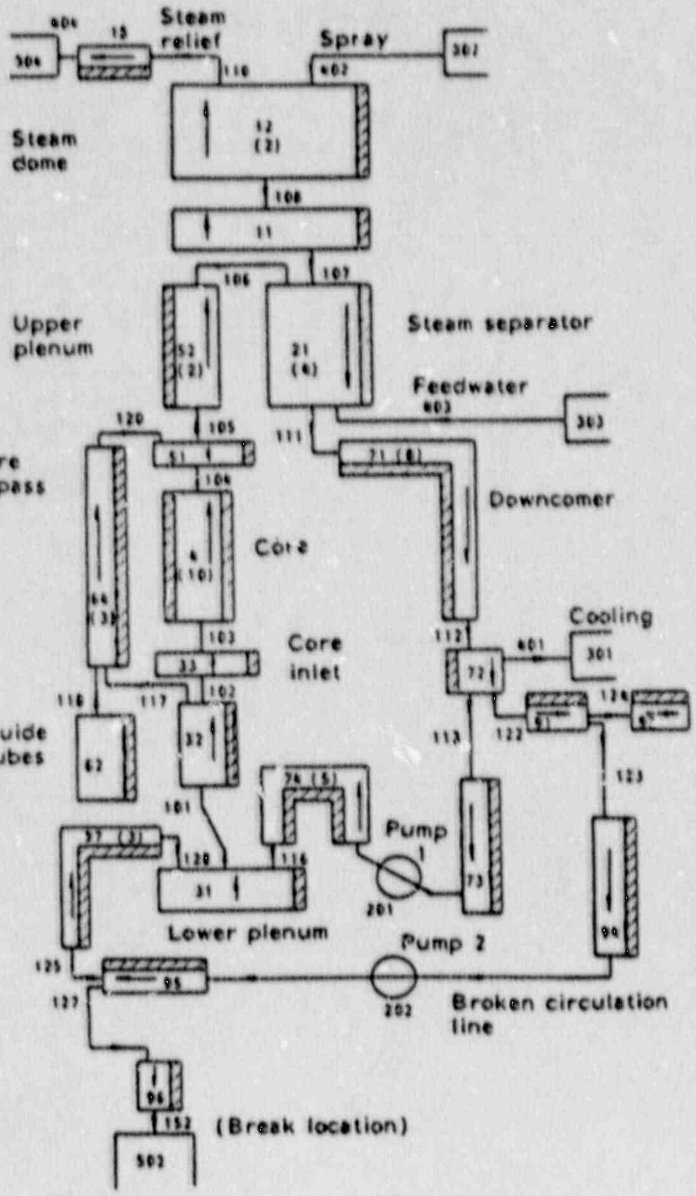


Figure 5

The nodalization diagram for FIX-II

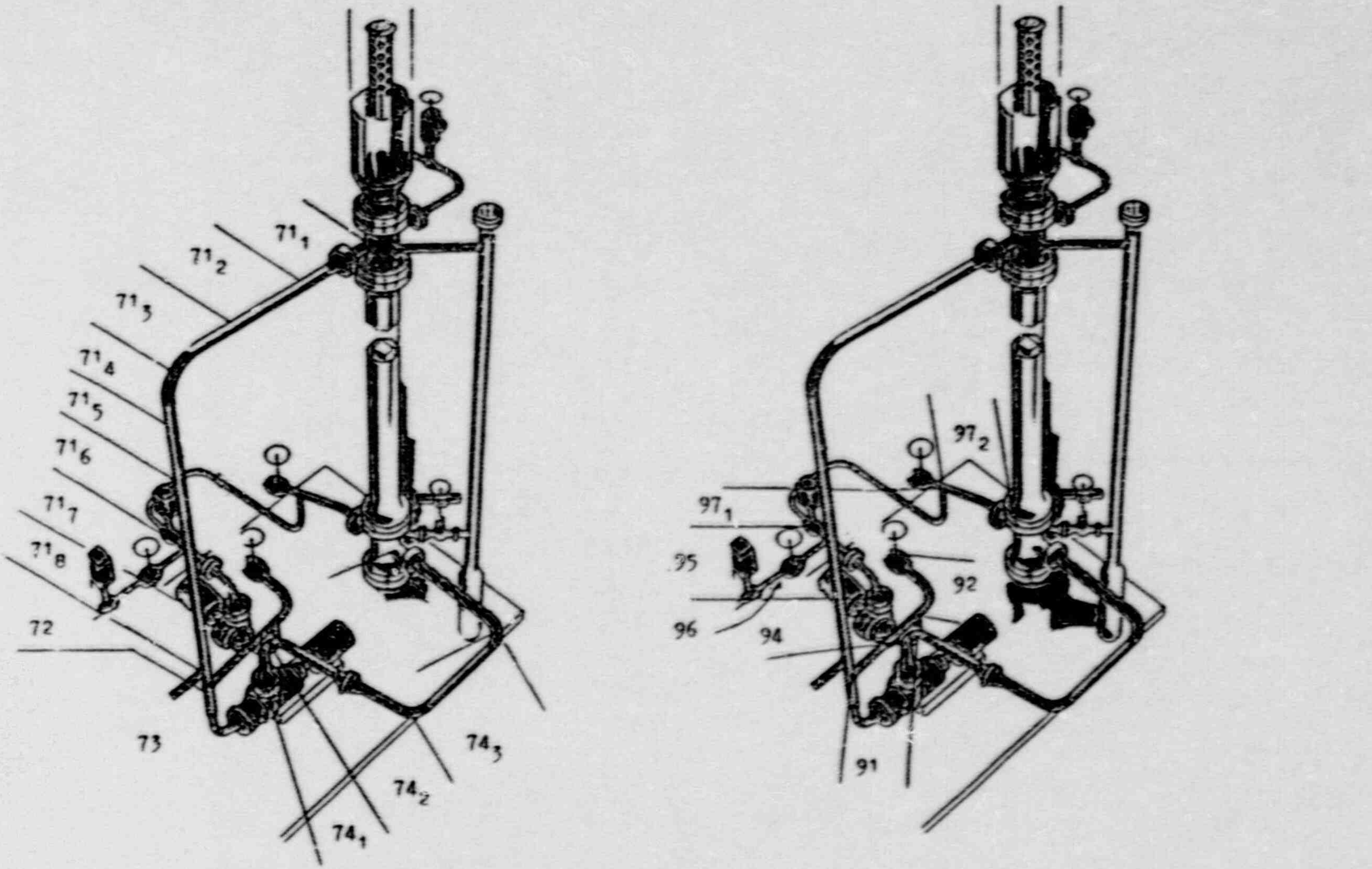


Figure 6

Nodalization of the recirculation lines

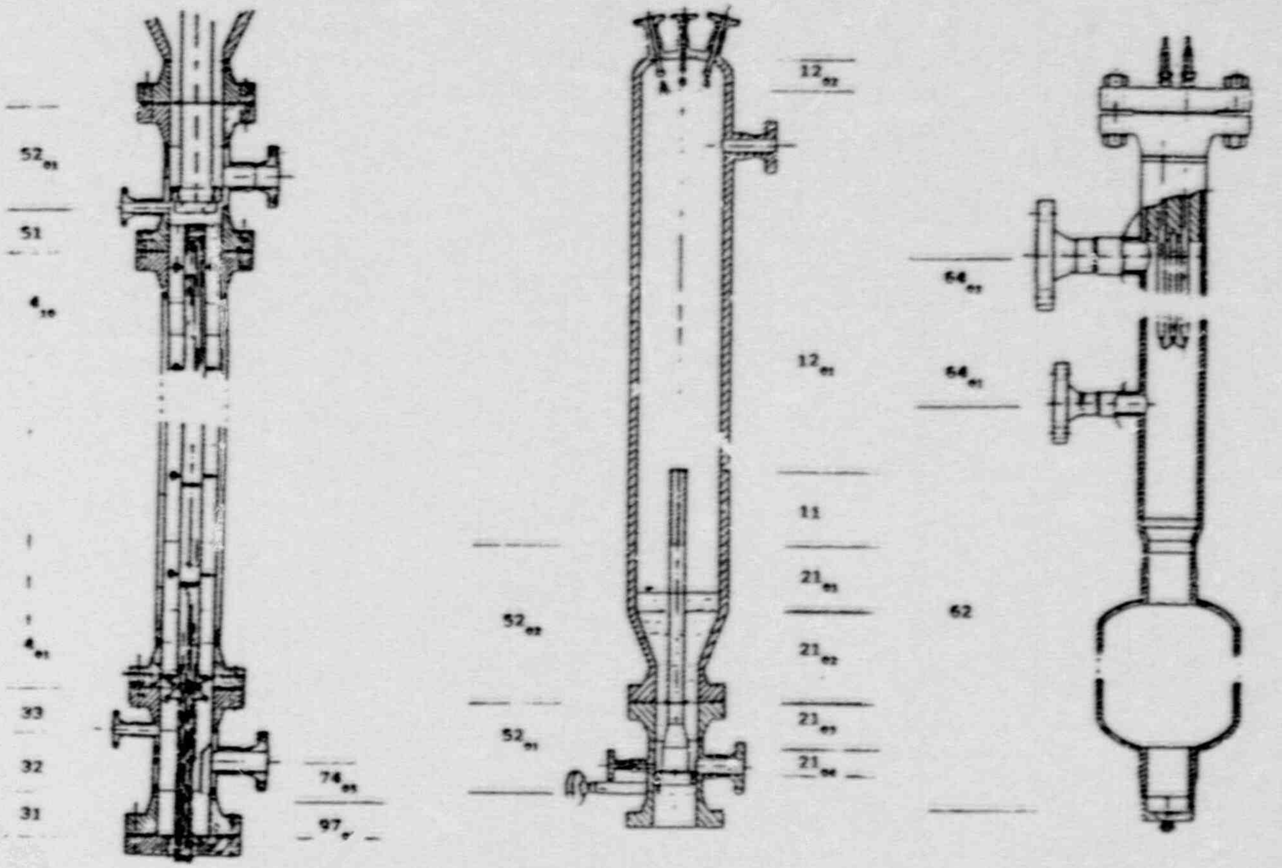


Figure 7

Nodalization of the main volumes of the FIX-II (compare Figure 3).

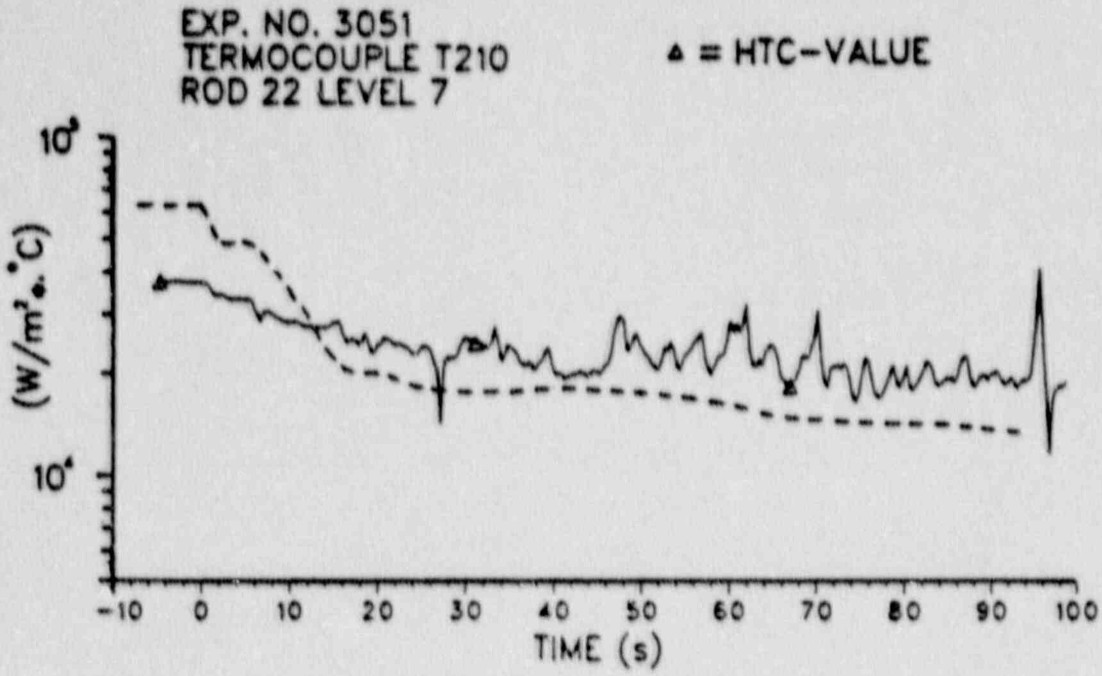


Figure 8

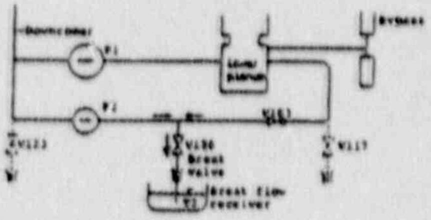
Comparison of heat transfer coefficents at the case model volume 4.05. Dotted line for prediction.

Table 1

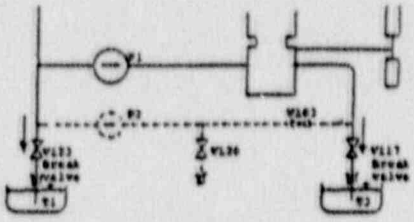
Test matrix of reported FIX-II LOCA tests

Break classification	Split breaks							Guillotine		
Type of simulation (see Figure 13)	A							B	C	
Relative break area (%)	10	31		48	100	150	200	155*	200	
Breaks I.D. (mm)	6.8	12.0		15.0	21.6	26.4	30.5	16.0+ 21.6	21.6+ 21.6	
Inital bundel power (MW) -hot channel -average	 2.35	 2.35	 3.35	 3.35	 2.35	 2.35	 2.35	 2.35	 2.35	 3.35
LOCA test ident. No.	3051	3013	3024 3025 3026 3027	3031	3061	3071	3041	4011	5061	5051 5052

Break type A
Split break



Break type B
Simplified guillotine break



Break type C
Guillotine break

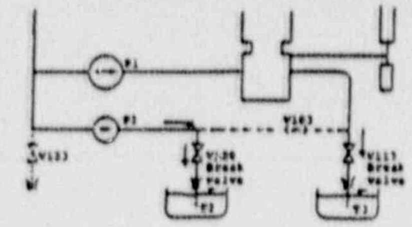


Table 2.A

Evaluated measurement errors

Quantity	Probable error	Error corresponding to 95 % confidence level
Pressures	0.014 MPa	0.04 MPa
Fluid temperatures	1°C	2°C
Cladding temperatures	1.6°C	3.2°C
Small range differential pressures (5 to 7.5 kPa)	0.13 kPa	0.3 kPa
Medium range differential pressures (25 to 50 kPa)	0.22 kPa	0.5 kPa
High range differential pressures (100 to 700 kPa)	0.26 kPa	0.65 kPa

Table 2.B

Errors in derived quantities

Quantity	Probable error
Mass flow rate in orifice meter K1 (P1)	0.2 kg/s
Mass flow rate in orifice meter K2 (P2)	0.14 kg/s
Mass flow rate in orifice meter K6 (steam flow)	~10 % of actual value
Mass flow rate in orifice meter K7 (Bypass)	~10 % of actual value
Break mass flow rate	~10 % of actual value
Electric power to bundle and bypass heaters	1 % of max value

Table 3

RELAP5/Mod 2 code features

COMPUTATION PROCESSING FEATURES

- Several problem type and execution control options as
  - a. steady state initialisation using fictitious structure heat capacities for faster convergence
  - b. transient calculation
  - c. strip type execution, to select requested parameters from a restart file
  - d. trip system, to decide on actions during calculation due to reaching specified conditions in calculation parameters.
  - e. ability to delete or add hydrodynamic components, structure components and control variables at a restart of calculation.

CLASSIFICATION OF HYDRODYNAMIC MODEL

- One-dimensional, with provisions for
  - a. choked flow model
  - b. abrupt area change model
  - c. cross flow junctions.
- Two-fluid, six equation, space-time numerical solution scheme.
- flow regime oriented field characteristics depending on mass flux and void fraction for
  - a. horizontal flow with bubbly, slug, mist and stratified fields
  - b. vertical flow with bubbly, slug, annular-mist (and stratified) fields
  - c. high mixing flow with bubbly and mist fields (for pumps).

Table 3 con't

HYDRODYNAMIC COMPONENENTS (Input systematics)

- Volume type components
  - a. single volume
  - b. pipe and annulus, for condensed input of several similar single volumes
  - c. time dependent volume, for defining a boundary source with a time dependent fluid state
  - d. branch, a volume capable of two or more connecting junctions at either end
  - e. pump, characterized by rated values for flow, head, torque, density and moment of inertia. The single phase homologous curve, two-phase multipliers and phase difference tables to model the dynamic pump behaviour
  - f. special system components for steam separator, jetmixer, turbine and accumulator.
- Junction type components
  - a. single junction
  - b. time dependent junction, for a time dependent junction flow whith a time dependent or controlled flow state
  - c. cross-flow junction, to model a small cross flow, a tee branch or a small leak flow
  - d. valve, various operation characteristics available for check valve, trip valve, inertial valve and relief valve.

INTERPHASE CONSTITUTIVE EQUATIONS

- Interphase drag
  - a. steady drag due to viscous shear depending on flow regime. Semi-empirical mechanisms to describe flow regime transitions
  - b. dynamic drag due to virtual mass effect.
- Interphase mass and heat transfer depending on flow regime and the fluid fields to saturation temperature differences

Table 3 con't

FLUID TO WALL CONSTITUTIVE EQUATIONS

- Wall friction due to wall shear effects formulated for flow regimes and based on a two-phase multiplier approach.

- Wall heat transfer depending on flow characteristics defined for

  a. single-phase forced convection (Dittus-Boelter)

  b. saturated nucleate boiling (Chen)

  c. subcooled nucleate boiling (modified Chen)

  d. critical heat flux (Biasi or modified Zuber)

  e. transition film boiling (Chen)

  f. film boiling (Bromley-Pomeranz and Dougall-Rohsenow)

  g. condensation (partly Dittus-Boelter).

- Interfacial mass transfer at the wall depending on wall, fluid and saturation temperatures for

  a. subcooled and saturated boiling

  b. transition film and film boiling

  c. condensation.

HEAT STRUCTURES

These may be rectangular, cylindrical or spherical in shape. The structure position is defined through component numbers of left and right hand side hydraulic components. A structure is physically defined by the geometry and the temperature dependent conductivity and volumetric heat capacity data. The structure model is further specified by the number of internal mesh points in the direction of heat flow.

CONTROL COMPONENTS

By these new (control) variables are defined from calculated parameters using algebra, standard functions, trip type operands or integrals.

Table 4

Initial conditions, for test No. 3051

Quantity		Measured	Predicted Case	 Case B	 Case C
Pressure in the steam dome	(MPa)	6.99	6.99	6.99	6.99
Power to the 36-rod bundle (incl connections)	(MW)	2.38	2.38	2.38	2.38
Power to the bypass heaters	(kW)	61.1	61.1	61.1	61.1
Cooling power in the filler body space	(kW)	256.	255.	255.	255.
Mass flow rate through pump P1	(kg/s)	4.85	4.85	4.85	4.90
Mass flow rate through pump P2	(kg/s)	1.59	1.59	1.59	1.62
Mass flow rate in the bypass	(kg/s)	.69	.69	.69	.71
Mass flow rate in the 36-rod bundle	(kg/s)	5.75	5.75	5.75	5.81
Mass flow rate in the spray line	(kg/s)	3.08	3.08	3.08	3.08
Mass flow rate in the feed water line	(kg/s)	1.95	1.95	1.95	1.95
Temperature of water at the bundle inlet	(C)	267.	268.	268.	268.
Temperature of feed and spray water	(C)	179.	179.	179.	179.
Water level in the spray condenser	(m)	.835	.836	.836	.834
Rotational speed of pump P1	(/s)	24.63	25.44	25.44	25.43
Rotational speed of pump P2	(/s)	31.64	33.39	33.39	33.36
Head of pump P1	(kPa)	118.6	123.5	123.5	123.3

Table 5

List of events in test No 3051

Event	Time (s) Imposed action	 System reaction	Predicted Case A	 Case B	 Case C
The break occurs (valve V120 starts to open)	.0		.0	.0	.0
Start of coast down of pump P1	.0		.0	.0	.0
Start of power decay (rod bundle and bypass)	.0		.0	.0	.0
The SRV starts to open	.5		.5	.5	.5
The SRV is fully open	1.1		1.1	1.1	1.1
The SRV starts to close	1.5		1.5	1.5	1.5
Minimum in steam dome pressure occurs		1.9	2.	2.	2.
The spray flow is closed	2.0		2.0	2.0	2.0
The feed water flow is closed	2.1		2.1	2.1	2.1
Valve V104 to the evaporation cooler is closed	2.2		2.2	2.2	2.2
The SRV is closed	2.8		2.8	2.8	2.8
Maximum of steam dome pressure		8.9	8.5	9.0	8.5
Flow reversal in the intact RCL		20.	18.5	19.5	19.5
The SRV starts to open	39.6		39.6	39.6	39.6
The SRV is fully open	40.3-137.2		40.3	40.3	40.3
Cavitaion in the broken RCL pump P2		45.	44.	45.	46.
Flashing starts in the LP (at saturation)		45.	45.	45.	45.
Level swell (recovery) in the downcomer		45.	44.	45.	46.
Flashing starts in the bypass guide tubes volume		49.6	52.	53.	53
Peak in the bypass flow into the UP		51.	55.	55.	56.
Test stop signal	136.1		-	-	-

Abbrevations: LP = Lower plenum
UP = Upper plenum
RCL = Recirculation line
SRV = Steam relief valve

Table 6

Summary of the main results in test No 3051

		Measured	Predicted		
			Case A	Case B	Case C
Total time of transient (break discharge)	(s)	136.1	-	-	-
Initial dryout		None	- - None - -		
Bundle uncovery		Not achieved	- - Not achieved - -		
Break mass flow 2 s after the break *	(kg/s)	2.7	2.	2.0	2.0
Max. brek flow rate from lower plenum	(kg/s)	<1.	.6	<.0	<.0
Max. break flow through pump P2	(kg/s)	2.7	2.5	2.5	2.5
Max. dome pressure after break time	(MPa)	7.10	7.14	7.17	7.18
Dome pressure at the end of test	(Mpa)	(2.04)	1.81	1.97	1.92
Max. rod temperature, end of blowdown	(C)	227.	229.	216.	219.
Integrated break mass flow	(kg)	110.	138.	119.	121.
Integrated steam relief mass flow	(kg)	52.	50.	52.	51.

* Approx. at the maximum break flow of the test

Table 7

Run statistics data (Case A)

Time (s)	Computer CPU time (s)	No. of time steps	No. of time step reductions in interval				
			quality	extrap.	mass	propty.	Courant
-30.	-679.	-480	-	-	-	-	-
0.*	0.	0	0	0	0	0	0
10.	234.	160	0	0	0	0	0
30.	572.	393	1	0	1	0	0
60.	1182.	776	2	0	2	0	0
100.	1663.	1030	18	0	3	12	71
145.	2113.	1278	3	0	5	0	65

* Time of break opening

Table 8

Parameters plotted and used in the assessment comparison.

COMPONENT	CONTINUOUS PARAMETER *	EXPERIMENT (IDENTIFIER)	PREDICTION (MINOR EDIT)	PLOT IDENTIF. EXP.	CALC.	PLOT NO.
CORE	FLUID DENSITY. BOTTOM	***	RHO 04.01		RH1?	B. 1
	MASS FLOW RATE. INLET *	DPT 6	P 33.01 - P04.01	D 6	PD6?	B. 2
	HEATING POWER	X 001	CNTRLVAR 57	X001	XP1?	B. 3
	CLAD TEMPERATURE. LEVEL 1	TE 191. TE 206. TE 211. TE 246	HTTEMP 4.0100	TC 1	HT1?	B. 4
	-"- . LEVEL 3	TE 198. TE183. TE 243. TE 248	HTTEMP 4.0300	TC 3	HT2?	B. 5
	-"- . LEVEL 5	TE 202. TE 227. TE 232. TE 237. TE 252	HTTEMP 4.0400	TC 5	HT3?	B. 6
	-"- . LEVEL 9	TE 102. TE 137. TE 167. TE 172. TE 187. TE 197. TE 272	HTTEMP 4.0600	TC 9	HT4?	B. 7
	-"- . LEVEL 12	TE 118. TE 123. TE 128. TE 148. TE 223	HTTEMP 4.0700	TC12	HT5?	B. 8
	-"- . LEVEL 15	TE 175. TE 190. TE 275	HTTEMP 4.1000	TC15	HT6?	B. 9
	INLET TEMPERATURE	TE 3	TEMPF 33.01	T 3	TF1?	B.10
	OUTLET TEMPERATURE	TE 14	TEMPF 51.01	T 14	TF2?	B.11
	CORE INVENTORY *	DPT 5 + DPT 6+ DPT 7 + DPT 8+ DPT 9 + DPT 10+ DPT 11 + DPT 12	P 04.01- P 51.01 **	D CO	PDC?	B.12
VESSEL	FLUID DENSITY. BOTTOM	***	RHO 31.01		RH2?	B.13
	DOWNCOMER MASS INVENTORY *	DPT 27 + DPT 28 + DPT 29 + DPT 30	P 71.03 - P 72.01 **	D DC	PDD?	B.14
	LOWER PLENUM MASS INVENTORY *	DP 2 + DP3 - DP 1	P 31.01 - P 32.01 **	D LP	PDL?	B.15
	UPPER PLENUM MASS INVENTORY *	DP 13 + DP 14	P 51.01 - P 52.01 **	D UP	PDU?	B.16
	PRESSURE LOSS. S.S. ORIFICE	DP 56	P 52.01 - P 52.02	D 56	PDS?	B.17
	DOWNCOMER TEMPERATURE. BOTTOM	TE 31	TEMPF 71.08	T 31	TF3?	B.18
	UPPER PLENUM TEMPERATURE	TE 15	TEMPF 52.01	T 15	TF4?	B.19
	LOWER PLENUM PRESSURE	PT 3	P 31.01	P 3	P 1?	B.20
	UPPER PLENUM PRESSURE	PT 4	P 52.01	P 4	P 2?	B.21
	MASS FLOW RATE. BYPASS	X 602	MFLOWJ 117	X602	MF1?	B.22

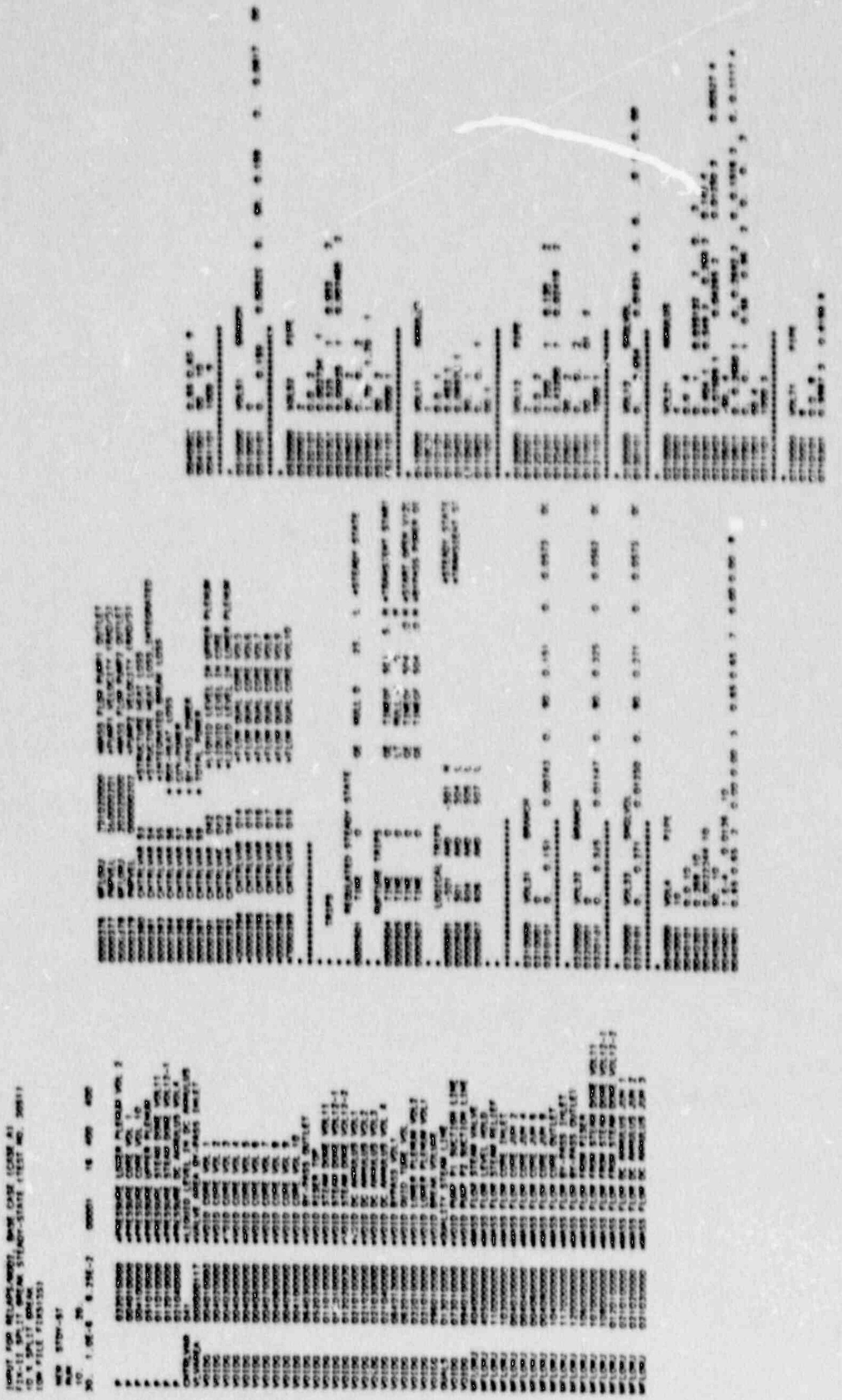
COMPONENT	COMPARISON PARAMETER *	EXPERIMENT (IDENTIFIER)	PREDICTION (MINOR EDIT)	PLOT IDENTIF. EXP.	CALC.	PLOT NO.
RECIRCULATION LINE	MASS FLOW RATE, I. L. PUMP (ORIFICE R1)	X 603	MFLOWJ 201.02	X603	MF2?	B.23
	MASS FLOW RATE, B. L. PUMP (ORIFICE R2)	X 604	MFLOWJ 202.02	X604	MF3?	B.24
	MASS FLOW RATE, B. L. VESSEL INLET (SPOOL PIECE K10)	X 610	MFLOWJ 97.02	X610	MF4?	B.25
SYSTEM	MASS INVENTORY	***	TMASS		MAT?	B.26
	MASS FLOW RATE, STEAM RELIEF	X 607	MFLOWJ 404	X607	MF5?	B.27
	HEAT LOSS, PASSIVES	***	CNTRLVAR 53		HL1?	B. 3
BREAK	FLUID DENSITY	***	RHO 96.01		RH3?	B.28
	MASS FLOW RATE	X 636	MFLOWJ 152	X636	MF6?	B.29
	MASS FLOW RATE, INTEGRATED	X 661	CNTRLVAR 55	X661	ML1?	B.30
	INLET TEMPERATURE	TE 34	TEMPF 96.01	T 34	TF5?	B.31
	INLET SUBCOOLING	***	TEMPG 96.01 - TEMPF 96.01		TSU?	B.32
	INLET PRESSURE	PT 6	P 96.01	P 6	P 3?	B.33
RELAP5/MOD2	COMPUTAION CPU TIME	***	CPUTIME		CPU?	B.34
	COMPUTATION MASS ERROR	***	EMASS		MAE?	B.35

* THE COMPARISON PARAMETERS ARE THOSE REPORTED AS DIRECTLY MEASURED OR AS COMPUTED RESULTS FROM THE EXPERIMENT.
PRESSURE DIFFERENCE INSTEAD OF MASS FLOW RATE OR OF MASS INVENTORY.

** CORRECTIONS APPLIED TO RESUME THE CORRECT PRESSURE SENSOR LEVELS.

*** NO DATA AVAILABEL FROM THE EXPERIMENT.

Input base case, Case A



```
0710401   0.009146 3 0.007726 4
0710601   0. 3 -90. 4
0710801   0. 0. 4
0710901   0.00 0.00 2   0.10 0.10 3   0.00 0.00 7
0711001   00 4
0711101   1000 3
**********************
*
0720000   VOL72     BRANCH
0720001   0
0720101   0.  0.300    0.002925  0.  -90. -0.300    0.  0.     0
**********************
*
0730000   VOL73     SNGLVOL
0730101   0.  1.240    0.01179   0.  -90. -0.750    0.  0.  00
**********************
*
0740000   VOL74     PIPE
0740001   5
0740101   0.00 5
0740201   0.  1   0.001385  2  0.  4
0740301   0.553 1   1.117 2   2.874 3   1.580 4   0.215 5
0740401   0.00380 1 0.00475 2 0.01275 3 0.00823 4 0.00226 5
0740601   90. 1    0. 4   -90. 5
0740801   0. 0. 4  0. 0.0015 5
0740901   0.17 0.17 1   0.79 0.79 2   0.22 0.22 3   1.00 1.00 4
0741001   00 5
0741101   1000  1   1000  2   1000  3   1000  4
**********************
*
0820000   VOL82     SNGLVOL
0820101   0.  1.221    0.03227  0.  -90. -1.221   0.  0.      00
**********************
*
0840000   VOL84     PIPE
0840001   3
0840101   0.0 3
0840301   1.467 1   1.335 2   1.308 3
0840401   0.01181 1 0.00843 2 0.01157 3
0840601   90.  3
0840801   0. 0.0690 1   0. 0.0672 2   0.   0.0829 3
0840901   2.00 0.00 2
0841001   00 3
0841101   1000 2
*
* PUMPEN CIRCULATION LINE
**********************
*
0910000   VOL91     BRANCH
0910001   0
0910101   0.  1.248    0.00570  0.  0.  0.  0.  0.  00
**********************
*
0920000   VOL92     SNGLVOL
0920101   0.  1.339    0.00580  0.  0.  0.  0.  0.  00
**********************
*
0940000   VOL94     SNGLVOL
0940101   0.  1.180    0.00256  0.  -45. -0.830   0.  0.  00
**********************
*
0950000   VOL95     BRANCH
0950001   0
0950101   0.  1.690    0.00336    0.  14.3  0.417  0.  0.  00
**********************
*
0960000   VOL96     BRANCH
0960001   0
0960101   0.  1.475    0.00629  0.  0.  0.  0.  0.  00
**********************
*
0970000   VOL97     PIPE
0970001   3
0970101   0.0  3
0970301   2.788    1   1.422   2   0.215   3
0970401   0.00530  1   0.00757  2   0.00236  3
0970601   5.4  1   0.  2  -90.  3
0970701   0.391  1   0.      2  -0.215   3
0970801   0.   0.  2   0.   0.000042  3
0970901   1.43  1.43  1   1.00  1.00  2
0971001   00  3
0971101   0000 1    0000 2
*
**********************
*
2010000   PUMP1     PUMP
2010101   0.         0.750    0.01010   0.   16.4 0.393    0
2010108   073010000     0.00427   0.17     0.27     0000
2010109   074000000     0.000908  3.00     3.00     0000
2010201   1   4.85   0.   0.
2010202   1   4.85   0.   0.
2010301   0    0    0   -1   0   0   0
2010302   303.69   0.5267    0.0393   50.   81.7   1.   1000.
2010303   0.   0.   0.   0.   0.
*  NYA HOMOLOGA PUMPKURVOR. DATA KOMMER FRAN ASEA-ATOMS [illegible]
*  TORQUE-KURVORNA SAKNAR BETYDELSE I DETTA FALL OCH HAR DARFOR INTE
* KONTROLLERATS. KALLAN FOR EN DEL DATA AR OKAND.
2011100   1   1
2011101   0.00,1.181     0.27,1.180     0.47,1.160
2011102   0.64,1.130     1.00,1.000
2011200   2   1
2011201   0.00,0.84      0.09,0.87      0.19,0.89
2011202   0.39,0.93      0.59,0.962     0.80,0.99     1.00,1.00
2011300   1   2
2011301   0.0,-0.560    0.41,-0.16    0.51,-0.05    0.76,0.48
2011302   1.00,1.00
2011400   2   2
2011401   0.0,-1.16      0.5,0.00       0.68,0.38     1.00,1.00
2011500   1   3
2011501    -1.00,2.00    -0.95,1.81    -0.62,1.52    -0.50,1.39
2011502     0.00,1.16
2011600   1   4
2011601    -1.00,2.00    -0.79,1.53    -0.63,1.25    -0.30,0.93
2011602     0.00,0.72
2011700   2   3
2011701    -1.00,2.31    -0.83,2.78    -0.68,2.29    -0.56,1.95
2011702    -0.37,1.49    -0.22,1.19    -0.10,0.99     0.00,0.84
2011800   2   4
2011801    -1.00,2.31    -0.79,2.78    -0.59,2.37    -0.41,2.04
2011802    -0.21,1.78     0.00,1.55
* TWO PHASE MULTIPLIER TABLES
2013000   0
2013001  0.0,0.0  0.1,0.0  0.15,0.05  0.24,0.8  0.3,0.96  0.4,0.98
2013002  0.6,0.97  0.8,0.9  0.9,0.8  0.96,0.5  1.0,0.0
2013100   0
2013101  0.0,0.0  0.1,0.0  0.15,0.05  0.24,0.8  0.3,0.96  0.4,0.98
2013102  0.6,0.97  0.8,0.9  0.9,0.8  0.96,0.5  1.0,0.0
* TWO PHASE DIFFERENCE FOR PUMP HEAD (SEMISCALE)
2014100   1   1
2014101 0.0,0.0  0.1,0.83  0.2,1.09  0.5,1.02  0.7,1.01 0.9,0.94 1.0,1.0
2014200   1   2
2014201 0.0,0.0  0.1,-0.04  0.2,0.4  0.3,0.1  0.4,0.21  0.8,0.67
2014202 0.9,0.80  1.0,1.0
2014300   1   3
2014301 -1.0,-1.16  -0.9,-1.24  -0.8,-1.77  -0.7,-2.36  -0.6,-2.79
2014302 -0.5,-2.91  -0.4,-2.67  -0.25,-1.69  -0.1,-0.5  0.0,0.0
2014400   1   4
2014401 -1.0,-1.16  -0.9,-0.78  -0.8,-0.5  -0.7,-0.31  -0.6,-0.17
2014402 -0.5,-0.08  -0.35,0.0  -0.2,0.05  -0.1,0.08  0.0,0.11
* TWO PHASE DIFFERENCE FOR PUMP TORQUE (= SINGLE PHASE, WHICH MEANS
* THAT FULLY DEGRADED TORQUE IS ZERO)
2014800   2   1
2014801   0.00,0.84      0.09,0.87      0.19,0.89
2014802   0.39,0.93      0.59,0.962     0.80,0.99     1.00,1.00
2015000   2   2
2015001   0.0,-1.16      0.5,0.00       0.68,0.38     1.00,1.00
2015100   2   3
2015101    -1.00,2.31    -0.83,2.78    -0.68,2.29    -0.56,1.95
2015102    -0.37,1.49    -0.22,1.19    -0.10,0.99     0.00,0.84
2015200   2   4
2015201    -1.00,2.31    -0.79,2.78    -0.59,2.37    -0.41,2.04
2015202    -0.21,1.78     0.00,1.55
** PUMP1 REGULATOR
2016100   0          CNTRLVAR 006
2016101   0.    0.        1000.      1000.
** PUMP1 CONTROL SYSTEM
20500100  [illegible]    TRIPUNIT 1.       1.       0
20500101  601
*
20500200  [illegible]   SUM      1.       0.       0
20500201  4.85      -1.0      [illegible]    201020000
*
20500300  [illegible]    MULT     1.       0.       0
20500301  CNTRLVAR  1
20500302  CNTRLVAR  2
*
20500400  INTEGRL1  INTEGRAL  50.      100.   0   3   -140.   160.
20500401  CNTRLVAR  003
*
20500500  P1SPTAB   FUNCTION  1.       0.       1
20500501  TIME    0        201
*
20500600  P1VEL     MULT      1.       0.       1
20500601  CNTRLVAR  4
20500602  CNTRLVAR  5
*
*  PUMP P1 SPEED TABLE
20220100   [illegible]   504   1.   1.
20220101   0.  1.000   4.  .784   8.  .671   15.  .464
20220102   17.  .336   25.  .275   80.  .183   200.  .183
*
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2020000   PUMP2     PUMP
2020101   0.         0.750    0.01050   0.   72.0 [illegible]   0
2020108   094010000    0.0011    0.35     0.35
2020109   095000000    0.000349  3.00     3.00
2020201   1    1.59 0.   0.
2020202   1    1.59 0.   0.
2020301   0    0    -1   -1   0    0    0
2020302   303.69    0.4918    0.01050   25.       [illegible]     1.         1000.
2020303   0.   0.   0.   0.   0.
2021100   1    1
2021101   0.0  1.135    0.2  1.125    0.4  1.120
2021102   0.6  1.100    0.8  1.055    1.0  1.000
```

```
2021200   2   1
2021201   0.0  0.91      1.0  1.00
2021300   1   2
2021301   0.0 -0.980     0.2 -0.395    0.4 -0.180    0.5 -0.098
2021302   0.6  0.145     0.8  0.565    1.0  1.000
2021400   2   2
2021401   0.0 -0.47      0.2 -0.21     0.4  0.07
2021402   0.6  0.35      0.8  0.66     1.0  1.00
2021500   1   3
2021501     -1.00,2.00    -0.95,1.81    -0.87,1.53    -0.50,1.39
2021502      0.00,1.138
2021600   1   4
2021601     -1.00,2.00    -0.79,1.53    -0.63,1.25    -0.30,0.93
2021602      0.00,0.72
2021700   2   3
2021701     -1.00,3.31    -0.83,2.79    -0.68,2.73    -0.58,1.95
2021702     -0.37,1.49    -0.22,1.19    -0.10,0.49     0.00,0.51
2021800   2   4
2021801     -1.00,3.31    -0.79,2.79    -0.59,2.37    -0.41,2.04
2021802     -0.21,1.78     0.00,1.55
2023000   0
2023001   0.0 0.00  0.1 0.00  0.2 0.05  0.3 0.80  0.4 0.98  0.5 0.98
2023002   0.6 0.97  0.7 0.90  0.8 0.80  0.9 0.50  1.0 0.00
2023100   0
2023101   0.0 0.00  0.1 0.10  0.2 0.15  0.3 0.24  0.4 0.30  0.5 0.40
2023102   0.6 0.50  0.7 0.60  0.8 0.90  0.9 0.96  1.0 1.00
** PUMP2 REGULATOR                                   *STEADY STATE C.
2026100   0          CNTRLVAR  019
2026101   0.   0.          1000.      1000.
** PUMP2 CONTROL SYSTEM
20500700  MASSDIFF2  SUM        1.        0.        0
20500701  1.59    -1.0       MFLOWJ    202020000
*
20500800  SSMULT2    MULT     1.        0.        0
20500801  CNTRLVAR  1
20500802  CNTRLVAR  7
*
20500900  INTEGRAL2  INTEGRAL  200.     200.   0   3   170.  230.
20500901  CNTRLVAR  008
*
20501200  P2SPTAB    FUNCTION  1.       0.        1
20501201  TIME     0          202
*
20501900  P2VEL      MULT     1.        0.        1
20501901  CNTRLVAR  5
20501902  CNTRLVAR  10
*
*  PUMP P2 SPEED TABLE
20220200  HTC-T    504    1.   1.
20220201  0.  1.000   20.  1.000   80.  1.016   200. 1.016
*
************************
*
1010000   JUN31-32  SNGLJUN
1010101   031010000 032000000 0.       0.       0.       1100
1010201   1         8.44      0.       0.
************************
*
1020000   JUN32-33  SNGLJUN
1020101   032010000 033000000 0.       0.       0.       1100
1020201   1         8.75      0.       0.
************************
*
1030000   JUN33-41  SNGLJUN
1030101   033010000 004000000 0.000473  0.340    0.300    0000
```

```
1030201   1         5.75      0.       0.
************************
*
1040000   JUN41-51  SNGLJUN
1040101   004010000 051000000 0.       0.10     0.10     0100
1040201   1         4.875     1.075    0.
************************
*
1050000   JUN51-52  SNGLJUN
1050101   051010000 052000000 0.       0.       0.       1100
1050201   1         5.365     1.075    0.
************************
*
1060000   JUN52-21  SNGLJUN
1060101   052010000 021000000 0.03218  1.       1.       1020
1060201   1         5.365     1.075    0.
************************
*
1070000   JUN11-21  SNGLJUN
1070101   011000000 021000000 0.0      0.0      0.0      1000
1070201   1         4.155    -1.075    0.
************************
*
1080000   JUN12-11  SNGLJUN
1080101   012000000 011010000 0.       0.       0.       1000
1080201   1         4.155    -1.075    0.
************************
*
1100000   JUN12-13  SNGLJUN
1100101   012010000 013000000 0.001432  0.95   0.95   1000    *STEADY ST
1100201   1         0.        0.       0.
************************
*
1110000   JUN21-71  SNGLJUN
1110101   021010000 071000000 0.       1.00     1.00     1100
1110201   1         11.47     0.       0.
************************
*
1120000   JUN71-72  SNGLJUN
1120101   071010000 072000000 0.       0.       0.       1000
1120201   1         11.47     0.       0.
************************
*
1130000   JUN72-73  SNGLJUN
1130101   072010000 073000000 0.00     0.       0.       1000
1130201   1         4.85      0.       0.
************************
*
1180000   JUN74-31  SNGLJUN
1180101   074010000 031010000 0.       0.00     0.00     1100
1180201   1         4.85      0.       0.
*
************************
*
1170000   BY-PASS   VALVE
1170101   034010000 064000000 0.000581  0.        0.        0000
1170201   1         0.69      0.       0.
1170300   SRVVLV    *   MOTORVALVE IN BY-PASS INLET
1170301   34
1170400   1.0  34.20
1170401   .000 .000 .000 .125 .0808 .0808 .200 .1301 .1301
1170402   .500 .1955 .1955 1.00 .2037 .2037
*
2050200   BPFLOWPT  SUM    1.    0.    0
2050201   3.69     -1.     MFLOWJ    117000000
```

```
*
20502300  SSMULBP   MULT     1.    0.    0
20502301  CNTRLVAR  1
20502302  CNTRLVAR  32
*
20502400  INTEGBP   INTEGRAL  .8  0.23  0  3  0.  1.
20502401  CNTRLVAR  33
*
************************
*
1190000   JUN64-62  SNGLJUN
1190101   064000000 062000000 0.00479   3.       0.       1000
1190201   1         0.        0.       0.
************************
*
1200000   JUN64-51  SNGLJUN
1200101   064010000 051010000 0.00176   2.00     2.00     0000
1200201   1         7.09      0.       0.
************************
*
1220000   JUN73-81  SNGLJUN
1220101   073010000 081000000 0.       0.00     0.00     0100
1220201   1         1.59      0.       0.
************************
*
1230000   JUN81-84  SNGLJUN
1230101   081010000 084000000 0.       0.00     0.00     0100
1230201   1         1.59      0.       0.
************************
*
1240000   JUN81-82  SNGLJUN
1240101   081010000 082000000 0.       0.00     0.00     0000
1240201   1         0.        0.       0.
************************
*
1250000   JUN82-87  SNGLJUN
1250101   082010000 087000000 18.0E-4   12.5     12.5     0000
1250201   1         1.69      0.       0.
************************
*
*1260000  [illegible]  SNGLJUN
*1260101  [illegible] [illegible] 0.       1.00     1.00     0100
*1260201  1         0.        0.       0.
************************
*
1270000   [illegible]  SNGLJUN
1270101   [illegible] [illegible] 0.       1.00     1.00     0100
1270201   1         0.        0.       0.
************************
*
1280000   JUN87-31  SNGLJUN
1280101   087010000 031010000 0.       0.00     0.00     0100
1280201   1         1.59      0.       0.
*
* COOLING SYSTEM
************************
*
3010000   COOLING       TMDPVOL
3010101   0.001000  1.   0.   0.   0.   0.   0.   0.      10
3010200   3
3010201   0.        [illegible]   0.
************************
*
4010000   COOLING       TMDPJUN
4010101   071000000     301000000     0.
```

```
4010200   1     604
4010201   0.   5.03    0.   0.   1.9  5.03   0.   0.   2.2  0.   0.   0.
************************
*
3020000   SPRAYFLOW    TMDPVOL
3020101   0.002526  1.  0.  0.  90.  1.  0.  0.02578  10
3020200   3
3020201   0.          7500000.  452.15
************************
*
4020000   SPRAYFLOW    TMDPJUN
4020101   302000000    012010000     0.
4020200   1   604
4020201   0.   3.00   0.   0   1.7  3.00   0.   0.   3.0  0.   0.
************************
*
3030000   SUBCOOLING   TMDPVOL
3030101   0.000531  1.  0.  0.  0.  0.  0.  0.      10
3030200   3
3030201   0.          7500000.  452.15
************************
*
4030000   SUBCOOLING   TMDPJUN
4030101   303000000    021010000     0.
4030200   1   604
4030201   0.  1.9500 0.   0.   1.9  1.9500 0.   0.   2.1  0.   0.   0.
*
* STEAM RELIEF
************************
*
3040000   RELIEF    TMDPVOL
3040101   .00836    1.  0.  0.  0.  0.  0.  0.   00
3040200   2
3040201   0.         100000.  1.
*
*
************************
*
4040000   RELIEF    TMDPJUN
4040101   013010000  304000000  .000084
4040200   1   0    CNTRLVAR   100
4040201   0.   0.   0.   0.
4040202   1.E6  0.   1.E6  0.
*
*  STEAM RELIEF FLOW MODEL
20509300   RHOP   MULT   1.   0.   0
20509301   RHOG   013010000   P   013010000
*
20509400   SQRT   POWERR   .    0.   0
20509401   CNTRLVAR  93     .5
*
20209300   NORMAREA
20209301   0.   0.     .5  0.    1.1  1.
20209302   1.5  1.    2.8  0.    39.6  0.
20209303   40.3  1.
*
20509700   TRSTIME   TRIPUNIT   1.   0.   1
20509701   604
*
20509800   FLTTIME    INTEGRAL    1.   0.   1
20509801   CNTRLVAR   97
*
20509900   VLVAREA   FUNCTION   1.034E-4   0.   0
20509901   CNTRLVAR   98     93
*

20510000   WRSFLOW   MULT    .5636  0.   0
20510001   CNTRLVAR  99   CNTRLVAR  94
*
* DUMP VOLUMES
************************
*
5020000   DUMP3    TMDPVOL
5020101   1.00     1.00    0.   0.   0.   0.   0.   0.   00
5020200   2
5020201   0.   100000.   1.0
*
* SPLIT RUPTURE IN CIRCULATION LINE
************************
*
1520000   BRKV120   VALVE
1520101   096010000 502000000   0.0000353 0.  0.   0100  1.00  1.00 401.
1520201   1   0.   0.   0.
1520300   MTRVLV
1520301   0000606    0000505   5.00      0.0   *OPENING TIME .20 SEC
*
*
* HEAT STRUCTURES
14010000         1    7    2    1    0.         * CORE
14010100         0    1
14010101         4  0.004725    2  0.006125
14010201         1  .4         -2  .6
14010301         0.0 .4         1.0 .6
14010400         0
14010401         570. 7
14010501         0          0    0    1    13.248    1
14010601         00401000 0    1    1    13.248    1
14010701         1    0.0764   0.   0.   1
14010901         0    0.01742  0.   0.   1
14020000         1    7    2    1    0.
14020100         0    1
14020101         4  0.005175    2  0.006125
14020201         1  .4         -2  .6
14020301         0.0 .4         1.0 .6
14020400         4010
14020501         0          0    0    1    13.248    1
14020601         00402000 0    1    1    13.248    1
14020701         1    0.1030   0.   0.   1
14020901         0    0.01742  0.   0.   1
14030000         1    7    2    1    0.
14030100         0    1
14030101         4  0.005275    2  0.006125
14030201         1  .4         -2  .6
14030301         0.0 .4         1.0 .6
14030400         4010
14030501         0          0    0    1    13.248    1

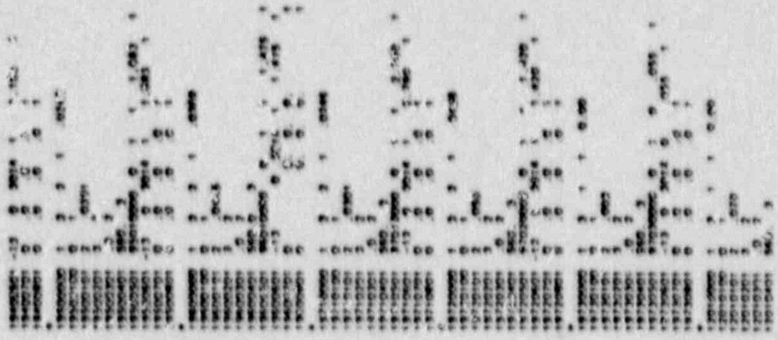
14030601         00403000 0    1    1    13.248    1
14030701         1    0.1138   0.   0.   1
14030901         0    0.01742  0.   0.   1
14040000         1    7    2    1    0.
14040100         0    1
14040101         4  0.005375    2  0.006125
14040201         1  .4         -2  .6
14040301         0.0 .4         1.0 .6
14040400         4010
14040501         0          0    0    1    13.248    1
14040601         00404000 0    1    1    13.248    1
14040701         1    0.1700   0.   0.   1
14040901         0    0.01742  0.   0.   1
14050000         1    7    2    1    0.

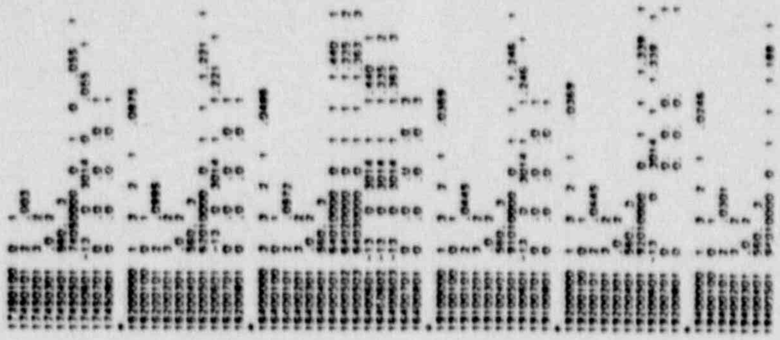
14050100     4020
14050400     4010
14050501     0          0    0    1    13.248    1
14050601     00405000 0    1    1    13.248    1
14050701     1    0.1190   0.   0.   1
14050901     0    0.01742  0.   0.   1
14060000     1    7    2    1    0
14060100     4020
14060400     4010
14060501     0          0    0    1    13.248    1
14060601     00406000 0    1    1    13.248    1
14060701     1    0.1133   0.   0.   1
14060901     0    0.01742  0.   0.   1
14070000     1    7    2    1    0.
14070100     4020
14070400     4010
14070501     0          0    0    1    13.238    1
14070601     00407000 0    1    1    13.248    1
14070701     1    0.1130   0.   0.   1
14070901     0    0.01742  0.   0.   1
14080000     1    7    2    1    0
14080100     4020
14080400     4010
14080501     0          0    0    1    13.248    1
14080601     00408000 0    1    1    13.243    1
14080701     1    0.1024   0.   0.   1
14080901     0    0.01742  0.   0.   1
14090000     1    7    2    1    0.
14090100     0    1
14090101     4  0.004975    2  0.006125
14090201     1  .4         -2  .6
14090301     0.0 .4         1.0 .6
14090400     4010
14090501     0          0    0    1    13.248    1
14090601     00409000 0    1    1    13.248    1
14090701     1    0.0877   0.   0.   1
14090901     0     0.01742  0.   0.   1
14100000     1    7    2    1    0.
14100100     0    1
14100101     4  0.003825    2  0.006125
14100201     1  .4         -2  .6
14100301     0.0 .4         1.0 .6
14100400     4010
14100501     0          0    0    1    13.238    1
14100601     00410000 0    1    1    13.248    1
14100701     1    0.0514   0.   0.   1
14100901     0    0.01742  0.   0.   1
*
10640000     1    2    2    1    0.    * BY PASS
10640100     0    1
10640101     1    0.006125
10640201     2    1
10640301     1.0  1
10640400     0
10640401     570. 2
10640501     0          0    0    1    2.87      1
10640601     06401000 0    1    1    2.87      1
10640701     2    0.25      0.        0.        1
10640901     0    0           0.        0.        1
*    [illegible] IN HEAT AND [illegible] STRUCTURE THE SAME
10650000     1    2    2    1    0
10650100     0640
10650400     0640
10650501     0          0    0    1    2.87      1
10650601     06502000 0    1    1    2.87      1
```

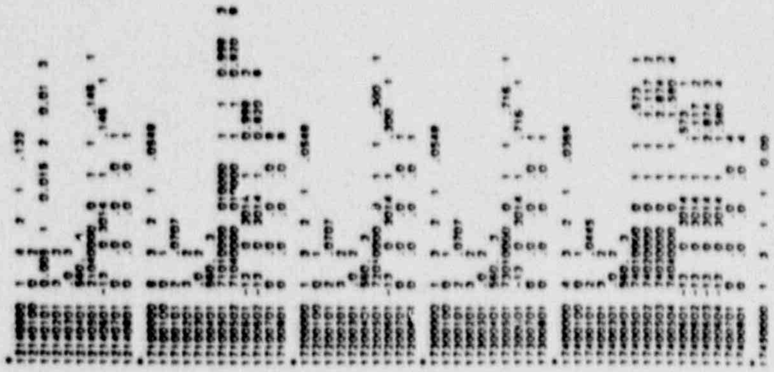
```
10650701     2   0.48    0.       0.       1
10650901     0   0.01742  0.       0.       1
10660000     1   2   2   1   0.
10660100     0640
10660400     0640
10660501     0          0   0   1   2.67    1
10660601     064030000 0   1   1   2.67    1
10660701     2   0.27    0.       0.       1
10660901     0   0.01742  0.       0.       1
*
*
* BOX WALL TO ACCOUNT FOR HEAT LOSSES
14000000   10   2   1   1   0.
14000100    0   1
14000101    1   0.002
14000201    3   1
14000301    0.  1
14000401  450.  1
14000402  540.  2
14000501  -401            -1   3400   0   0.15     10
14000601   904010000  010000     1   0   0.15     10
14000701   0   0.   0.   0.       10
14000901   0   0.   0.   0.       10
*
*  GENERAL TABLE GIVING HEAT TRANSFER COEFF. AT OUTSIDE OF BOX WALL
*
20240000   HTC-T
20240001   0.    2.3500E3  * HTC DETERMINED TO GIVE HEAT LOSS OF APPR'X
*
*  GENERAL TABLES GIVING THE TEMPERATURES AT THE OUTSIDE OF THE
*  BOX WALL. TEMPERATURE IS SUPPOSED TO VARY LINEARLY BETWEEN 403 K
*  AT INLET TO 493 K AT OUTLET
*
20240100   TEMP
20240101   0.    407.5
*
20240200   TEMP
20240201   0.    416.5
*
20240300   TEMP
20240301   0.    425.5
*
20240400   TEMP
20240401   0.    434.5
*
20240500   TEMP
20240501   0.    443.5
*
20240600   TEMP
20240601   0.    452.5
*
20240700   TEMP
20240701   0.    461.5
*
20240800   TEMP
20240801   0.    470.5
*
20240900   TEMP
20240901   0.    479.5
*
20241000   TEMP
20241001   0.    488.5
*
*
13100000   1   4   1   1   0.00

13100100  0   2
13100101  0.005   1   0.015  2   0.08  3
13100201  3   3
13100301  .0  3
13100401  560.   4
13100501  31010000  0   1   0   .179   1
13100601  -13   0   3014  0   .179   1
13100701  0   .0   .0   .0   1
13100801  0   .0   .0   .0   1
*
13200000  1   4   2   1   .132
13200100  0   2
13200101  0.005   1   0.015  2   0.01  3
13200201  3   3
13200301  .0  3
13200401  560.   4
13200501  32010000  0   1   1   .325   1
13200601  -13   0   3014  1   .325   1
13200701  0   .0   .0   .0   1
13200801  0   .0   .0   .0   1
*
13300000  1   4   2   1   .132
13300100  0   2
13300101  0.005   1   0.015  2   0.03  3
13300201  3   3
13300301  .0  3
13300401  560.   4
13300501  33010000  0   1   1   .271   1
13300601  -13   0   3014  1   .271   1
13300701  0   .0   .0   .0   1
13300801  0   .0   .0   .0   1
*
15100000  1   3   2   1   .132
15100100  0   1
15100101  2   .162
15100201  3   2
15100301  .0  2
15100401  560.   3
15100501  51010000  0   1   1   .179   1
15100601  -13   0   3014  1   .179   1
15100701  0   .0   .0   .0   1
15100801  0   .0   .0   .0   1
*
15210000  1   3   2   1   .063
15210100  0   1
15210101  2   .065
15210201  3   2
15210301  .0  2
15210401  560.   3
15210501  52010000  0   1   1   .437   1
15210601  0   0   0   1   .437   1
15210701  0   .0   .0   .0   1
15210801  0   .0   .0   .0   1
*
15220000  1   3   2   1   .050
15220100  0   1
15220101  2   .052
15220201  3   2
15220301  .0  2
15220401  560.   3
15220501  52020000  0   1   1   .953   1
15220601  0   0   0   1   .953   1
15220701  0   .0   .0   .0   1
15220801  0   .0   .0   .0   1
*

11100000  1   4   2   1   .250
11100100  0   2
11100101  0.005   1   0.015  2   0.033  3
11100201  3   3
11100301  .0  3
11100401  560.   4
11100501  11010000  0   1   1   .458   1
11100601  -13   0   3014  1   .458   1
11100701  0   .0   .0   .0   1
11100801  0   .0   .0   .0   1
*
11210000  1   4   2   1   .292
11210100  0   2
11210101  0.005   1   0.015  2   0.033  3
11210201  3   3
11210301  .0  3
11210401  560.   4
11210501  12010000  0   1   1   2.290   1
11210601  -13   0   3014  1   2.290   1
11210701  0   .0   .0   .0   1
11210801  0   .0   .0   .0
*
11220000  1   4   1   1   0.00
11220100  0   2
11220101  0.005   1   0.015  2   0.033  3
11220201  3   3
11220301  .0  3
11220401  560.   4
11220501  12020000  0   1   0   .490   1
11220601  -13   0   3014  0   .490   1
11220701  0   .0   .0   .0   1
11220801  0   .0   .0   .0   1
*
12110000  1   4   2   1   .290
12110100  0   2
12110101  0.005   1   0.015  2   0.033  3
12110201  3   3
12110301  .0  3
12110401  560.   4
12110501  21010000  0   1   1   .404   1
12110601  -13   0   3014  1   .404   1
12110701  0   .0   .0   .0   1
12110801  0   .0   .0   .0   1
*
12120000  1   4   2   1   .170
12120100  0   2
12120101  0.005   1   0.015  2   0.07  3
12120201  3   3
12120301  .0  3
12120401  560.   4
12120501  21020000  0   1   1   [illegible]   1
12120601  -13   0   3014  1   .549   1
12120701  0   .0   .0   .0   1
12120801  0   .0   .0   .0   1
*
12130000  1   4   2   1   .132
12130100  0   2
12130101  0.005   1   0.015  2   0.01  3
12130201  3   3
12130301  .0  3
12130401  560.   4
12130501  21030000  0   1   1   .266   1
12130601  -13   0   3014  1   .266   1
12130701  0   .0   .0   .0   1
12130801  0   .0   .0   .0   1
```







```
12010501 20101000 0   1   0  0.50  1
12010601 -13  0  3014  0   0.50  1
12010701 0   .0   .0   .0   1
12010801 0   .0   .0   .0   1
*
12020000 1   7   1   1   0.00
12020100 0   1
12020101 7  .020
12020201 3   7
12020301 .0  7
12020401 560.  7
12020501 20201000  0   1   0   0.300  1
12020601 -13  0  3014  0   0.30  1
12020701 0   .0   .0   .0   1
12020801 0   .0   .0   .0   1
*
13110000      3   5   2   1   0.        * COPPER RODS
13110100      0   1
13110101      3  0.0045      2  0.0070
13110201      1   3          4   5
13110301      0.0 5
13110400      0
13110401      570.  5
13110501      0          0   0   1   5.40   1
13110502      0          0   0   1  11.70   2
13110503      0          0   0   1   9.80   3
13110601      03101000 0   1   1   5.40   1
13110602      03201000 0   1   1  11.70   2
13110603      03301000 0   1   1   9.80   3
13110701      0   0.00    0.   0.   3
13110901      00  0.01742   0.   0.   3
15110000      1   5   2   1   0.        * COPPER CABLES
15110100      0   1
15110101      4  0.004
15110201      4   4
15110301      0.0 4
15110400      0
15110401      570.  5
15110501      0          0   0   1   7.40   1
15110601      05101000 0   1   1   7.40   1
15110701      0   0.00    0.   0.   1
15110901      00  0.01742   0.   0.   1
*
*
*
20100100  TBL/FCTN  1   -1      * MG O
20100101       473. 5.50     573. 4.65     673. 3.75      773. 3.10
20100102       873. 2.75     973. 2.50    1073. 2.30
20100151       3300000.  3300000.  3328000.  3465000.
20100152       3630000.  3713000.  3740000.
*
20100200  TBL/FCTN  2    7   * INCONEL 600
20100201  293.  1088.     10.874    0.0122    0.00002862 0. 0. 0. 0.
20100251  293.  1088.     2665370.  4173.5   -1.7262     0. 0. 0. 0.
*
20100300  S-STEEL
*
20100400  TBL/FCTN    1  1     * COPPER
20100401  390.0
20100451  3.48E+06
*
*
* CORE POWER REDUCTION
20200100  POWER   604          1          2.380E6
20200101    0.00 1.000  0.25 0.995  2.00 0.758  5.00 0.479
```

```
20200102   7.50 0.353  10.0 0.242  12.5 0.171  15.0 0.128 20.0 0.083
20200103  25.00 0.064 30.00 0.063 50.00 0.061 75.00 0.060 200.0 0.055
* BY-PASS POWER REDUCTION
20200200  POWER   607          1          61.1E3
20200201   0.00 1.000  1.00 0.697  2.00 0.500  5.00 0.387
20200202  10.00 0.260 14.00 0.030 20.00 0.00  200.00 0.0
*
*
*LIQUID LEVEL IN DOME DC ANNULUS AND DOWNCOMER TO BREAK
*HEIGHT OF LIQUID - FCT OF LIQUID VOID
20201100  NORMAREA         *VOL21-2
20201101  0.   0.   .7960      .2740      1.0       0.549
20201200  NORMAREA         *VOL21-3
20201201  0.   0.   0.490      0.150      1.0       0.298
20201300     TEMP
20201301   0.      290.
20201400   HTC-T
20201401    0.      21.8        *AUXILIARY HEAT TRANSFER COEFF. TO QUIT
                                 THE FLOWS THROUGH SS JUNCTIONS 405 AND 40[illegible]
*
20501100  LIQH21-2        FUNCTION  1.    0.   1
20501101  VOIDF     021020000        011
20501200  LIQH21-3        FUNCTION  1.    0.   1
20501201  VOIDF     021030000        012
20504100  LIQLEVDC        SUM       1.    0.   1
20504101  1.115    0.300        VOIDF      072010000
20504102  0.820             VOIDF      071080000
20504103  0.820             VOIDF      071070000
20504104  0.820             VOIDF      071060000
20504105  0.820             VOIDF      071050000
20504106  0.820             VOIDF      071040000
20504107  .146              VOIDF      021040000
20504108  1.                CNTRLVAR   012
20504109  1.                CNTRLVAR   011
20504110           0.404    VOIDF      021510000
*LIQUID LEVEL IN UPPER PLENUM AND STEAM PIPE
*HEIGHT OF LIQUID - FCT OF LIQUID VOID
20202100  NORMAREA         *VOL52-1
20202101  0.   0.     0.150       0.023       0.336      0.089
20202102  0.654       0.239       0.875       0.389      1.0       0.525
20502100  LIQH52-1         FUNCTION  1.    0.   1
20502101  VOIDF      052010000        021
20504200  LIQLEVUP          SUM      1.    0.   1
20504201  0.    0.178       VOIDF     051010000
20504202  1.0               CNTRLVAR  021
20504203  0.952             VOIDF     052020000
*LIQUID LEVEL IN CORE
20504300  LIQLCORE          SUM      0.358      0.   1
20504301  0.    1.      VOIDF      004010000
20504302  1.            VOIDF      004020000
20504303  1.            VOIDF      004030000
20504304  1.            VOIDF      004040000
20504305  1.            VOIDF      004050000
20504306  1.            VOIDF      004060000
20504307  1.            VOIDF      004070000
20504308  1.            VOIDF      004080000
20504309  1.            VOIDF      004090000
20504310  1.            VOIDF      004100000
*LIQUID LEVEL IN LOWER PLENUM
20504400  LIQLEVLP          SUM      1.    0.   1
20504401  0.    0.150       VOIDF     031010000
20504402  0.325             VOIDF     32010000
20504403  0.271             VOIDF     33010000
*
*ROD CLADDING TEMP SAVE UP
20506100  CLADTEMP1         MULT     1.    0.   1
```

```
20506101  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL1
20506200  CLADTEMP2         MULT      1.   0.   1
20506201  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL2
20506300  CLADTEMP3         MULT      1.   0.   1
20506301  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL3
20506400  CLADTEMP4         MULT      1.   0.   1
20506401  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL4
20506500  CLADTEMP5         MULT      1.   0.   1
20506501  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL5
20506600  CLADTEMP6         MULT      1.   0.   1
20506601  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL6
20506700  CLADTEMP7         MULT      1.   0.   1
20506701  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL7
20506800  CLADTEMP8         MULT      1.   0.   1
20506801  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL8
20506900  CLADTEMP9         MULT      1.   0.   1
20506901  HTTEMP     [illegible]      *ROD CLADDING INNER TEMP VOL9
20507000  CLADTEMP10        MULT      1.   0.   1
20507001  HTTEMP     [illegible]      *ROD CLADDING MIDDLE TEMP VOL10
*
*HEAT TRANSFER COEFF (HEAT RATE/(SURFACE TEMP-FLUID TEMP))
20508100  HTCOEF1   SUM       1.   0.   1
20508101    0.    1.      HTHTC      [illegible]
20508200  HTCOEF2   SUM       1.   0.   1
20508201    0.    1.      HTHTC      [illegible]
20508300  HTCOEF3   SUM       1.   0.   1
20508301    0.    1.      HTHTC      [illegible]
20508400  HTCOEF4   SUM       1.   0.   1
20508401    0.    1.      HTHTC      [illegible]
20508500  HTCOEF5   SUM       1.   0.   1
20508501    0.    1.      HTHTC      [illegible]
20508600  HTCOEF6   SUM       1.   0.   1
20508601    0.    1.      HTHTC      [illegible]
20508700  HTCOEF7   SUM       1.   0.   1
20508701    0.    1.      HTHTC      [illegible]
20508800  HTCOEF8   SUM       1.   0.   1
20508801    0.    1.      HTHTC      [illegible]
20508900  HTCOEF9   SUM       1.   0.   1
20508901    0.    1.      HTHTC      [illegible]
[illegible]  HTCOEF10  SUM       1.   0.   1
[illegible]    0.    1.      HTHTC      [illegible]
* LIQUID LEVEL CONTROL SYSTEM FOR DC (STEADY STATE ONLY)
[illegible]  [illegible]   [illegible]
[illegible]  1.    1.    0.    0.    0.    0.    0.    0.    00
[illegible]  2
[illegible]  0.       7.0E6    7.
*
[illegible]  LEVCTRJUN    TMDPJUN
[illegible]  [illegible]   [illegible]   0.[illegible]
[illegible]  1    0       CNTRLVAR   04[illegible]
[illegible]  -1.       -1.         0.   0.
[illegible]  [illegible]        1.         0.   [illegible]
*
[illegible]  LEVCTR    SUM   1.   0.   1
[illegible]  8.750    -1.     CNTRLVAR  041
*
[illegible]  STLEV    [illegible]   10.   0.   2   1   -2.   7.
[illegible]  CNTRLVAR  [illegible]
[illegible]  CNTRLVAR  [illegible]
*
[illegible]  RELIEF     TMDPVOL
[illegible]  [illegible]   1.   0    0.   90.   1.   0.   0   00   *STEADY STATE C
[illegible]  2
[illegible]  0.       6900000.   1.0   *REGULATED STEADY STATE
*
```

```
*
4060000   DOMECNTRL  VALVE     *STEADY STATE CARD
4060101   013010000     306000000    0.   0.    0.  1000  *STEAD  STATE C
4060201   1.   0.   0.   0.   *STEADY STATE CARD
4060300   TRPVLV
4060301   601
*
*
*
20505000    STR-HTLOSS    SUM    1.    0.    0
20505001  0.     .17900    HTRNR    310000100
20505002         .26955    HTRNR    320000100
20505003         .22476    HTRNR    330000100
20505004         .14846    HTRNR    510000100
20505005         .17298    HTRNR    521000100
20505006         .29539    HTRNR    522000100
20505007         .71943    HTRNR    110000100
20505008       3.45575    HTRNR    121000100
20505009         .40000    HTRNR    122000100
20505010         .63460    HTRNR    211000100
20505011         .58641    HTRNR    212000100
20505012         .23721    HTRNR    213000100
20505013         .12109    HTRNR    214000100
20505014         .34363    HTRNR    710000100
20505015         .34363    HTRNR    710000200
20505016         .34363    HTRNR    710000300
20505017         .28234    HTRNR    710000400
20505018         .28234    HTRNR    710000500
20505019         .28234    HTRNR    710000600
20505020         .28234    HTRNR    710000700
20505100    STR-HTLOSS    SUM    1.    0.    0
20505101  0.     .28234    HTRNR    710000800
20505102         .10330    HTRNR    720000100
20505103         .24653    HTRNR    730000100
20505104         .13285    HTRNR    740000100
20505105         .25898    HTRNR    740000200
20505106         .66634    HTRNR    740000300
20505107         .36632    HTRNR    740000400
20505108         .05500    HTRNR    745000100
20505109         .67128    HTRNR    620000100
20505110         .42972    HTRNR    640000100
20505111         .40764    HTRNR    640000200
20505112         .41621    HTRNR    640000300
20505113         .28889    HTRNR    910000100
20505114         .50000    HTRNR    201000100
20505115        -.23751    HTRNR    311000101
20505116        -.51458    HTRNR    311000201
20505117        -.43102    HTRNR    311000301
20505118        -.18599    HTRNR    511000101
20505119         .30000    HTRNR    202000100
20505120         .31045    HTRNR    920000100
*
20505200    STR-HTLOSS    SUM    1.    0.    0
20505201  0.     .18363    HTRNR    940000100
20505202         .26013    HTRNR    950000100
20505203         .34198    HTRNR    960000100
20505204         .42969    HTRNR    971000100
20505205         .36224    HTRNR    972000100
20505206         .05500    HTRNR    973000100
20505300   TOTAL    SUM    1.    0.    0
20505301   0.    1.    CNTRLVAR 50
20505302         1.    CNTRLVAR 51
20505303         1.    CNTRLVAR 52
*
20505400   STR-HTINT    INTEGRAL    1.    0.    0
```

```
20505401   CNTRLVAR  50
*
20505500   BREAK-LOSS   INTEGRAL    1.    0.    0
20505501   MFLOWJ   152000000
*
20505600   BOX-HTLOSS    SUM    1.    0.    0
20505601   0.     .150     HTRNR     400000100
20505602          .150     HTRNR     400000200
20505603          .150     HTRNR     400000300
20505604          .150     HTRNR     400000400
20505605          .150     HTRNR     400000500
20505606          .150     HTRNR     400000600
20505607          .150     HTRNR     400000700
20505608          .150     HTRNR     400000800
20505609          .150     HTRNR     400000900
20505610          .150     HTRNR     400001000
*
20505700   COR-POW       FUNCTION    1.          0.    0
20505701   TIME   0      001
*
20505800   BYPASS-POW    FUNCTION    1.          0.    0
20505801   TIME      0      002
*
20505900   TOT-POW       SUM    1.    0.    0
20505901   0.           1.    CNTRLVAR 57
20505902                1.    CNTRLVAR 58
*
*
************ INITIAL VALUES
*
0310200    3    7091130.   541.94
0320200    3    7089300.   541.99
0330200    3    7087050.   542.03
0510200    2    7013880.   0.07256
0130200    2    6990690.   1.0
0720200    3    7028270.   542.12
0730200    3    7032340.   542.07
0620200    3    7048850.   539.79
0910200    3    7029610.   541.85
0920200    3    7029690.   539.76
0940200    3    7032280.   541.85
0950200    3    7099000.   541.79
09 200     3    7097930.   536.87
2010200    3    7095820.   542.09
2020200    3    7085780.   541.86
0041201    3    7051360.   546.52   0.     0.     0.  1
0041202    2    7047790.   0.00697  0.     0.     0.  2
0041203    2    7044310.   0.01824  0.     0.     0.  3
0041204    2    7041370.   0.03582  0.     0.     0.  4
0041205    2    7037680.   0.05676  0.     0.     0.  5
0041206    2    7033630.   0.07723  0.     0.     0.  6
0041207    2    7029180.   0.09555  0.     0.     0.  7
0041208    2    7024360.   0.11875  0.     0.     0.  8
0041209    2    7020350.   0.14343  0.     0.     0.  9
0041210    2    7014540.   0.14199  0.     0.     0.  10
0521201    2    7012460.   0.07239  0.     0.     0.  1
0521202    2    6992690.   0.16714  0.     0.     0.  2
0111201    2    6997480.   0.88179  0.     0.     0.  1
0121201    2    6991910.   0.79839  0.     0.     0.  1
0121202    2    6991420.   0.74924  0.     0.     0.  2
0211201    2    6992780.   0.37564  0.     0.     0.  1
0211202    2    6994130.   0.04125  0.     0.     0.  2
0211203    2    7009840.   0.0      0.     0.     0.  3
0211204    2    6998030.   542.37   0.     0.     0.  4
0711201    3    6998930.   542.23   0.     0.     0.  1
```

```
0741201    3    7088210.   541.88   0.     0.     0.  5
0641201    3    7039700.   545.56   0.     0.     0.  1
0641202    3    7038290.   537.96   0.     0.     0.  2
0641203    3    7018850.   526.57   0.     0.     0.  3
0971201    3    7088620.   541.54   0.     0.     0.  3
*
*   JUNCTION INITIAL VALUES
0041300    0
0041301    1.286    1.484    0.   1    1.425    1.889    0.   2
0041302    1.710    2.012    0.   3    2.136    2.611    0.   4
0041303    2.630    3.373    0.   5    3.162    4.028    0.   6
0041304    3.499    4.788    0.   7    4.803    5.390    0.   8
0041305    4.527    5.849    0.   9
0521300    1
0521301    1.358    1.287    0.   1
0121300    1
0121301   -3.27     0.18    0.   1
0211300    1
0211301    9.52    0.     0.   1
0711300    1
0711301    11.37   0.    0.   1
0741300    1
0741301    4.85   0.     0.   4
0641300    1
0641301    0.68    0.    0.   2
0971300    1
0971301    1.58     0.    0.     3
*
```

Input Case B

```
*       INPUT FOR RELAP5/MOD2,   CASE B
*       FIX-II SPLIT BREAK STEADY-STATE (TEST NO. 3051)
*       10 % SPLIT BREAK
*       (ON FILE FIX5101)
*
0000100   RESTART  TRANSNT
0000101   RUN
0000103   480
0000105   10.        20.
0000201   70.  1.0E-6   .125     00001    8 160   160
*
*
**********************
*
*     TRIPS
*
*0000501   TIME     0          GE   NULL 0    25.    L  *STEADY STATE
*
* SPLIT RUPTURE IN CIRCULATION LINE
*************************
*
1520000   BRKV120   VALVE
1520101   096010000 502000000   0.0000363 0.  0.   0100   .76  1.00 *DIA 6.8 MM
1520201   1    0    0.   0.
1520300   MTRVLV
1520301   0000606   0000505   5.00     0.0  *OPENING TIME  20 SEC
*
*
  END
```

Input Case C

```
*       INPUT FOR RELAP5/MOD2,  CASE C
*       FIX-II SPLIT BREAK STEADY-STATE (TEST NO. 3051)
*       10 % SPLIT BREAK
        *ON FILE FIX5(C1)
*
0000100  NEW  STDY-ST
0000101  RUN
0000105  10.     20.
0000201  32.  1.0E-6  6.25E-2   00001    10  400   400
*
*
0000302  P        032010000   *PRESSURE LOWER PLENUM VOL 2
0000303  P        004010000   *PRESSURE CORE VOL 1
0000312  P        004100000   *PRESSURE CORE VOL 10
         * * * * * * * * * * * *
           *
              *
                *
                  *
                    *
                      *
                        *
                          *
                            *
                              *
         * * * * * * * * * * * *
1520000  BRKV120   VALVE
1520101  098010000 502000000   0.0000363 0.  0.   0100   .76   .76 +01
1520201  1   0.   0.   0.
1520300  MTRVLV
1520301  0000606   0000505   5.00      0.0   *OPENING TIME .20 SEC
         * * * * * * * * * * * *
           *
              *
                *
                  *
                    *
                      *
                        *
                          *
                            *
                              *
         * * * * * * * * * * * *
1310000  1   4   1   1    0.00
1310100  0   2
1310101  0.005   1   0.015  2   0.08  3
1310201  3   3
1310301  .0  3
1310401  560.  4
1310501  310100000  0   1   0   .179   1
1310601  -13   0  3016  0    .179   1
1310701  0   .0   .0   .0   1
1310801  0   .0   .0   .0   1
*
1320000  1   4   2   1    .132
1320100  0   2
1320101  0.005   1   0.015  2   0.01  3
1320201  3   3
1320301  .0  3
1320401  560.  4
1320501  320100000  0   1   1   .225   1
1320601  -13   0  3015  1    .225   1
1320701  0   .0   .0   .0   1
1320801  0   .0   .0   .0   1
*
1330000  1   4   2   1    .132
1330100  0   2
1330101  0.005   1   0.015  2   0.03  3
1330201  3   3
1330301  .0  3
1330401  560.  4
1330501  330100000  0   1   1   .271   1
1330601  -13   0  3016  1    .271   1
1330701  0   .0   .0   .0   1
1330801  0   .0   .0   .0   1
*
1510000  1   3   2   1    .132
1510100  0   1
1510101  2   .182
1510201  3   2
1510301  .0  2
1510401  560.  3
1510501  510100000  0   1   1   .179   1
1510601  -13   0  3016  1    .179   1
1510701  0   .0   .0   .0   1
1510801  0   .0   .0   .0   1
*
1521000  1   3   2   1    .063
1521100  0   1
1521101  2   .065
1521201  3   2
1521301  .0  2
1521401  560.  3
1521501  520100000  0   1   1   .437   1
1521601  0   0   0   1    .437   1
1521701  0   .0   .0   .0   1
1521801  0   .0   .0   .0   1
*
1522000  1   3   2   1    .050
1522100  0   1
1522101  2   .052
1522201  3   2
1522301  .0  2
1522401  560.  3
1522501  520200000  0   1   1   .953   1
1522601  0   0   0   1    .953   1
1522701  0   .0   .0   .0   1
1522801  0   .0   .0   .0   1
*
1110000  1   4   2   1    .250
1110100  0   2
1110101  0.005   1   0.015  2   0.033  3
1110201  3   3
1110301  .0  3
1110401  560.  4
1110501  110100000  0   1   1   .458   1
1110601  -13   0  3014  1    .458   1
1110701  0   .0   .0   .0   1
1110801  0   .0   .0   .0   1
*
1121000  1   4   2   1    .250
1121100  0   2
1121101  0.005   1   0.015  2   0.033  3
1121201  3   3
1121301  .0  3
1121401  560.  4
1121501  120100000  0   1   1   2.200   1
1121601  -13   0  3010  1   2.200   1
1121701  0   .0   .0   .0   1
1121801  0   .0   .0   .0   1
*
1122000  1   4   2   1    2.00
1122100  0   2
1122101  0.004   1   0.016  2   0.073  3
1122201  3   3
1122301  .0  3
1122401  560.  4
1122501  120100000  0   1   0   .400   1
1122601  -13   0  3014  0    .400   1
1122701  0   .0   .0   .0   1
1122801  0   .0   .0   .0   1
*
1211000  1   4   2   1    .257
1211100  0   2
1211101  0.005   1   0.019  2   0.033  3
1211201  3   3
1211301  .0  3
1211401  560.  4
1211501  210100000  0   1   1   .404   1
1211601  -13   0  3015  1    .404   1
1211701  0   .0   .0   .0   1
1211801  0   .0   .0   .0   1
*
1212000  1   4   2   1    .170
1212100  0   2
1212101  0.005   1   0.013  2   0.032  3
1212201  3   3
1212301  .0  3
1212401  560.  4
1212501  210200000  0   1   1   .549   1
1212601  -13   0  3015  1    .549   1
1212701  0   .0   .0   .0   1
1212801  0   .0   .0   .0   1
*
1213000  1   4   2   1    .132
1213100  0   2
1213101  0.005   1   0.017  2   0.01  3
1213201  3   3
1213301  .0  3
1213401  560.  4
1213501  210300000  0   1   1   .285   1
1213601  -13   0  3015  1    .285   1
1213701  0   .0   .0   .0   1
1213801  0   .0   .0   .0   1
*
1214000  1   4   2   1    .132
1214100  0   2
1214101  0.005   1   0.017  2   0.01  3
1214201  3   3
1214301  .0  3
1214401  560.  4
1214501  210400000  0   1   1   .148   1
1214601  -13   0  3015  1    .148   1
1214701  0   .0   .0   .0   1
1214801  0   .0   .0   .0   1
*
1710000  4   3   2   1    .0543
1710100  0   1
1710101  2   .0707
1710201  3   2
1710301  .0  2
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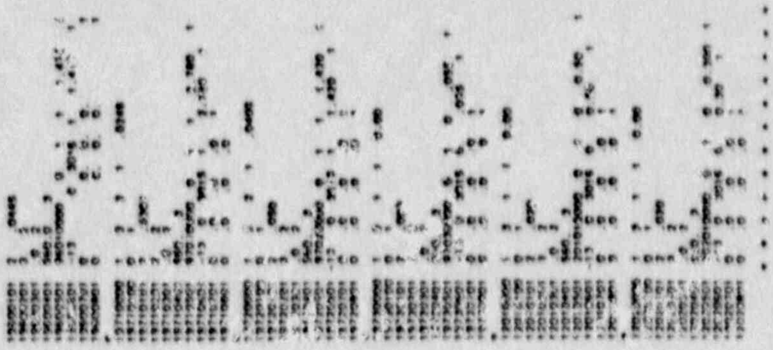

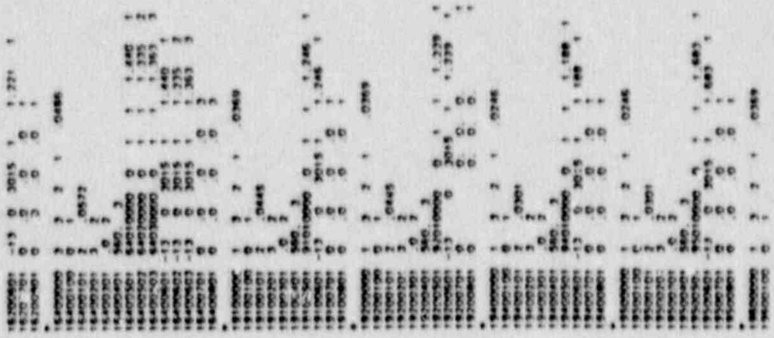

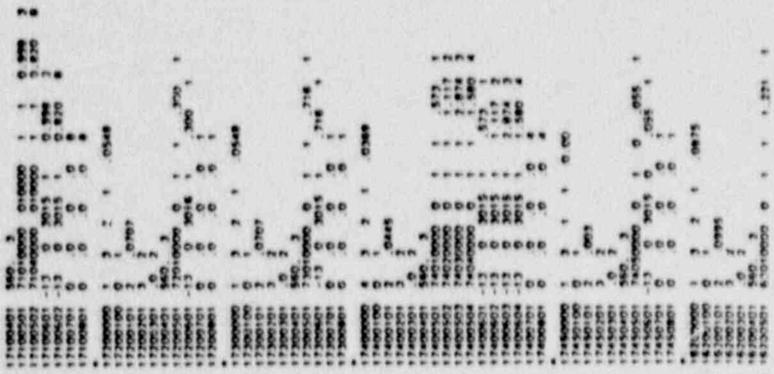

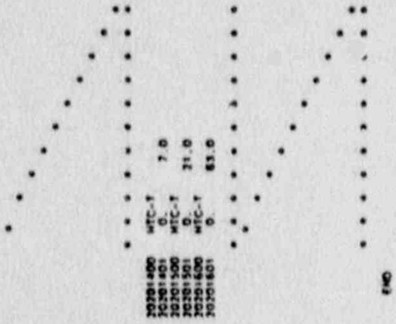

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20201400   MTC-T   7.0
20201401   0.
20201500   MTC-T   21.0
20201501   0.
20201600   MTC-T   63.0
20201601   0.
END
```

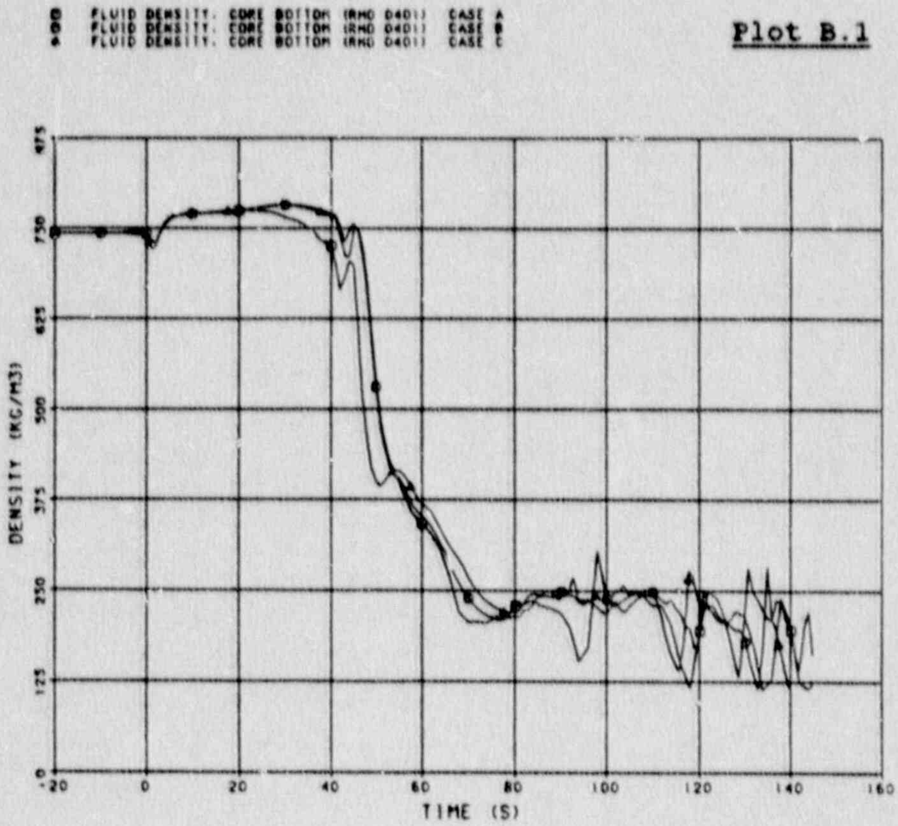
Data comparison plots

PLOT NO.	IDENT.	QUANTITY (EXPERIMENT) (CALCULATIONS)
B. 1	----	- - - - - - - - - - -
	RH1?	FLUID DENSITY, CORE BOTTOM (RHO 0401) CASE ?
B. 2	D 4	DIFF. PRESSURE, CORE INLET RESTRICTION (DPT 4) - EXPERIMENT
	PD4?	DIFF PRESSURE, CORE INLET RESTRICTION (P 3301 - P 401) CASE ?
B. 3	X801	ELECTRIC POWER, CORE - EXPERIMENT
	HP1?	CORE HEATING POWER (CNTRLVAR 57) CASE ?
	HL1?	HEAT LOSS FROM PASSIVES (CNTRLVAR 53) CASE ?
B. 4	TC 1	MEAN CLAD TEMP., LEVEL 1 (T191 T206 T211 T246) - EXPERIMENT
	HT1?	MEAN CLAD TEMPERATURE, LEVEL 1 (HTTEMP 401000105) CASE ?
B. 5	TC 3	MEAN CLAD TEMP., LEVEL 3 (T106 T183 T243 T248) - EXPERIMENT
	HT2?	MEAN CLAD TEMPERATURE, LEVEL 3 (HTTEMP 403000105) CASE ?
B. 6	TC 5	MEAN CLAD TEMP., LEVEL 5 (T202 T227 T232 T237 T252) - EXPERIMENT
	HT3?	MEAN CLAD TEMPERATURE, LEVEL 5 (HTTEMP 404000105) CASE ?
B. 7	TC 9	MEAN CLAD TEMP., LEVEL 9 (T102 T137 T167 T172 T187 T197 T272) - EXPERIMENT
	HT4?	MEAN CLAD TEMPERATURE, LEVEL 9 (HTTEMP 406000105) CASE ?
B. 8	TC12	MEAN CLAD TEMP., LEVEL 12 (T118 T123 T128 T148 T223) - EXPERIMENT
	HT5?	MEAN CLAD TEMPERATURE, LEVEL 12 (HTTEMP 407000105) CASE ?
B. 9	TC15	MEAN CLAD TEMP., LEVEL 15 (T175 T190 T275) - EXPERIMENT
	HT6?	MEAN CLAD TEMPERATURE, LEVEL 15 (HTTEMP 410000105) CASE ?
B.10	T 3	FLUID TEMPERATURE, CORE INLET (TE 3) - EXPERIMENT
	TF1?	FLUID TEMPERATURE, CORE INLET (TEMPF 3301) CASE ?
B.11	T 14	FLUID TEMPERATURE, CORE OUTLET (TE 14) - EXPERIMENT
	TF2?	FLUID TEMPERATURE, CORE OUTLET (TEMPF 5101) CASE ?
B.12	D CO	DIFF. PRESSURE, CORE (DPT 5 + DPT 6 + ... + DPT 12) - EXPERIMENT
	PDC?	DIFF PRESSURE, CORE (FROM P 401 - P 5101) CASE ?
B.13	----	- - - - - - - - - - -
	RH2?	FLUID DENSITY, VESSEL BOTTOM (RHO 3101) CASE ?
B.14	D DC	DIFF. PRESSURE, DOWNCOMER (DPT 27 + ... + DPT 30) - EXPERIMENT
	PDD?	DIFF PRESSURE, DOWNCOMER (FROM P 7103 - P 7201) CASE ?
B.15	D LP	DIFF. PRESSURE, LOWER PLENUM (DPT 2 + DPT 3 - DPT 1) - EXPERIMENT
	PDL?	DIFF PRESSURE, LOWER PLENUM (FROM P 3101 - P 3301) CASE ?
B.16	D UP	DIFF. PRESSURE, UPPER PLENUM (DPT 13 + DPT 14) - EXPERIMENT
	PDU?	DIFF PRESSURE, UPPER PLENUM (FROM P 5101 - P 5201) CASE ?
B.17	D 56	DIFF. PRESSURE, STEAM SEPARATOR ORIFICE (DPT 56) - EXPERIMENT
	PDS?	DIFF PRESSURE, STEAM SEPARATOR ORIFICE (P 5201 - P 5202) CASE ?
B.18	T 31	FLUID TEMPERATURE, DOWN COMER BOTTOM (TE 31) - EXPERIMENT
	TF3?	FLUID TEMPERATURE, DOWNCOMER BOTTOM (TEMPF 7108) CASE ?

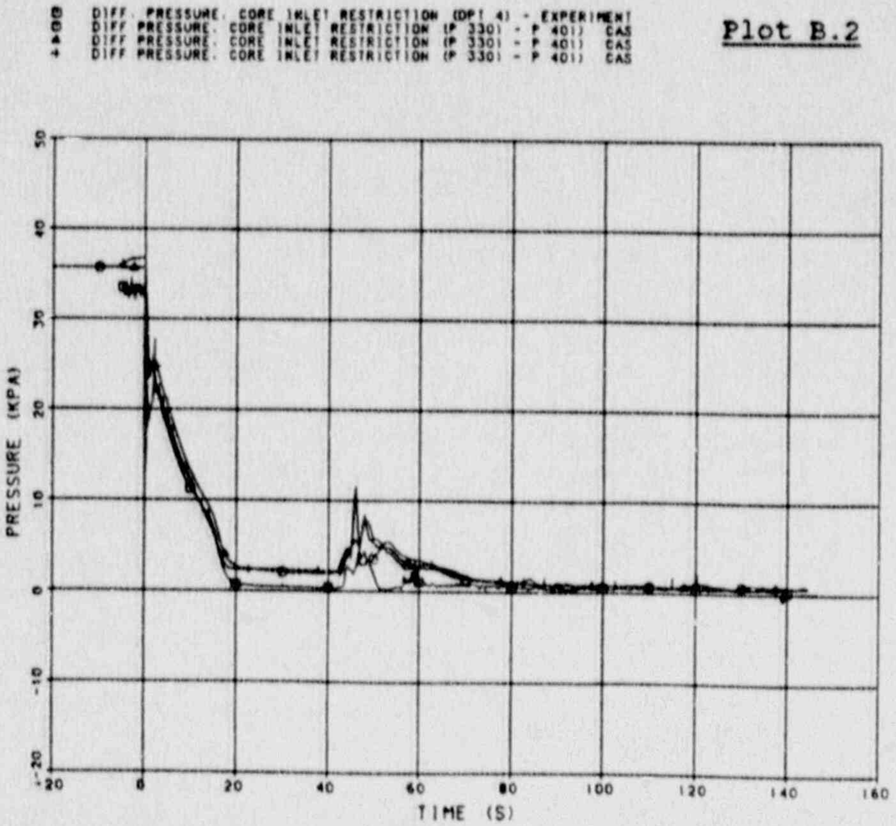
PLOT NO.	IDENT.	QUANTITY (EXPERIMENT) (CALCULATIONS)
B.19	T 15	FLUID TEMPERATURE, UPPER PLENUM (TE 15) - EXPERIMENT
	TF4?	FLUID TEMPERATURE, UPPER PLENUM (TEMPF 520[illegible] CASE ?
B.20	P 3	PRESSURE, LOWER PLENUM (PT 3) - EXPERIMENT
	P 1?	PRESSURE, LOWER PLENUM (P 3101) CASE ?
B.21	P 4	PRESSURE, UPPER PLENUM (PT 4) - EXPERIMENT
	P 2?	PRESSURE, UPPER PLENUM (P 5201) CASE ?
B.22	X602	MASS FLOW RATE, BYPASS - EXPERIMENT
	MF1?	MASS FLOW RATE, BYPASS (MFLOWJ 117) CASE ?
B.23	X603	MASS FLOW RATE, I.L. PUMP - EXPERIMENT
	MF2?	MASS FLOW RATE, I.L. PUMP (MFLOWJ 20102) CASE ?
B.24	X604	MASS FLOW RATE, B.L. PUMP - EXPERIMENT
	MF3?	MASS FLOW RATE, B.L. PUMP (MFLOWJ 20202) CASE ?
B.25	X610	MASS FLOW RATE, B.L. VESSEL INLET (SPOOL PIECE KL3) - EXPERIMENT
	MF4?	MASS FLOW RATE, B.L. VESSEL INLET (MFLOWJ 9702) CASE ?
B.26	----	- - - - - - - - - - -
	MST?	TOTAL MASS, IN SYSTEM CASE ?
B.27	X607	MASS FLOW RATE, STEAM RELIEF - EXPERIMENT
	MF5?	MASS FLOW RATE, STEAM RELIEF (MFLOWJ 494) CASE ?
B.28	----	- - - - - - - - - - -
	RH3?	FLUID DENSITY, BREAK (RHO 9601) CASE ?
B.29	X636	MASS FLOW RATE, BREAK FROM TI INVENTORY - EXPERIMENT
	MF6?	MASS FLOW RATE, BREAK (MFLOWJ 152) CASE ?
B.30	X671	MASS LOSS, BREAK FLOW RECIEVER - EXPERIMENT
	ML1?	BREAK TOTAL MASS LOSS (CNTRLVAR 55) CASE ?
B.31	T 34	FLUID TEMPERATURE, BREAK INLET (TE 34) - EXPERIMENT
	TF5?	FLUID TEMPERATURE, BREAK INLET (TEMPF 9601) CASE ?
B.32	----	- - - - - - - - - - -
	TSU?	SUBCOOLING, BREAK INLET (TEMPG 9101 - TEMPF 9101) CASE ?
B.33	P 6	PRESSURE, BREAK INLET (PT 6) - EXPERIMENT
	P 3?	PRESSURE, BREAK INLET (P 9601) CASE ?
B.34	----	- - - - - - - - - - -
	CPU?	CPUTIME CASE ?
B.35	----	- - - - - - - - - - -
	MAE?	MASS ERROR CASE ?

RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.1

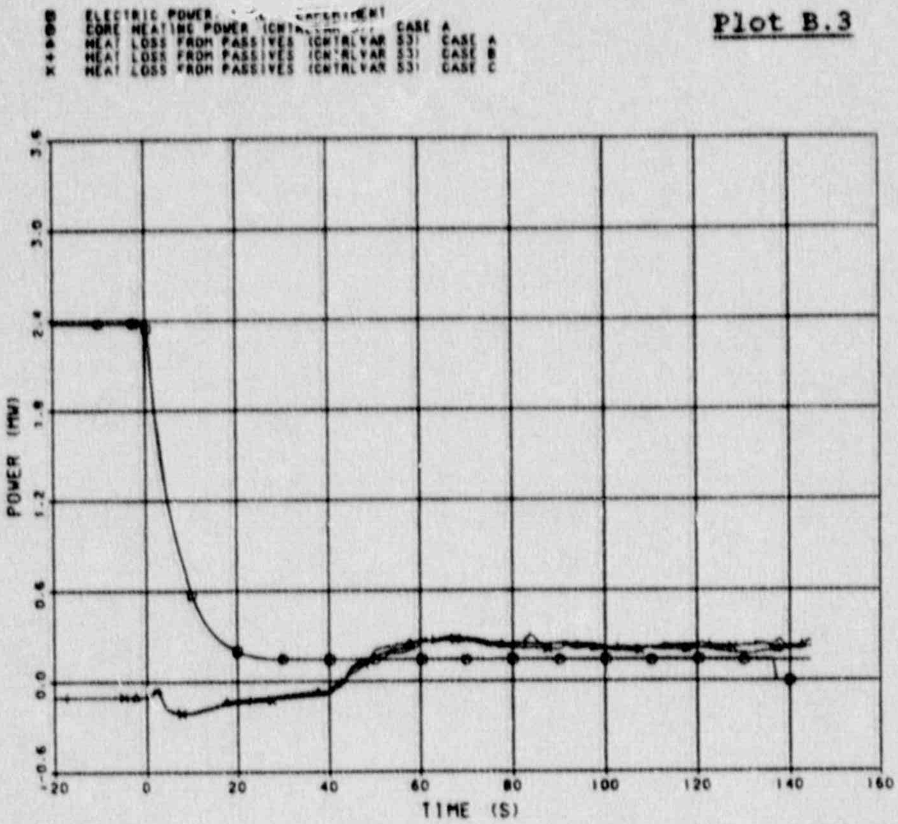


Plot B.2

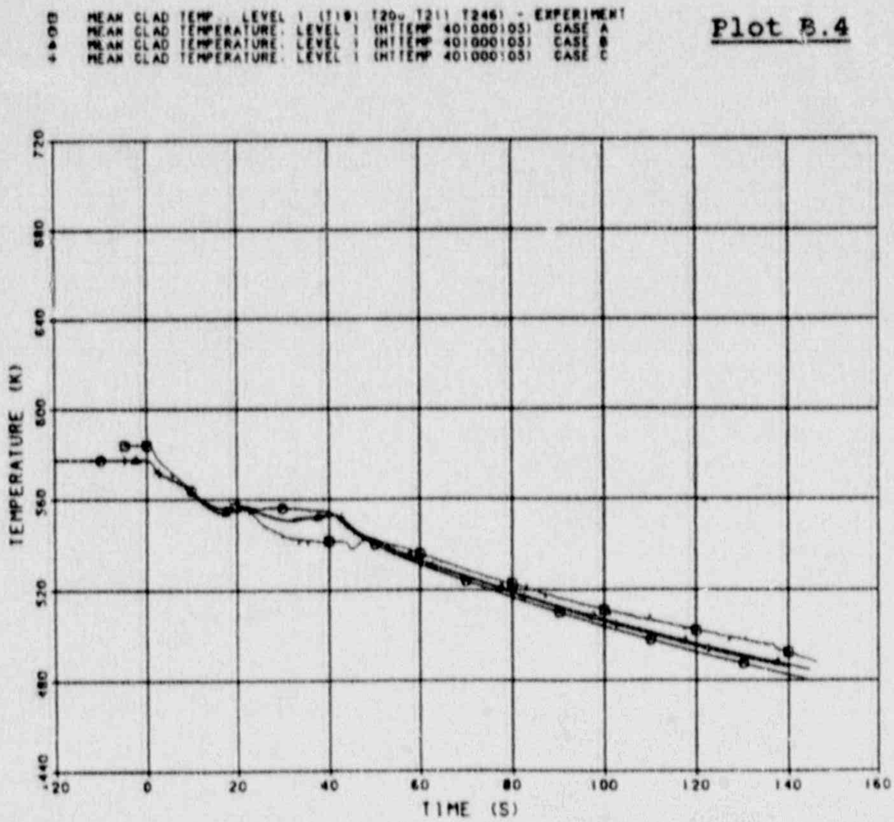


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.3

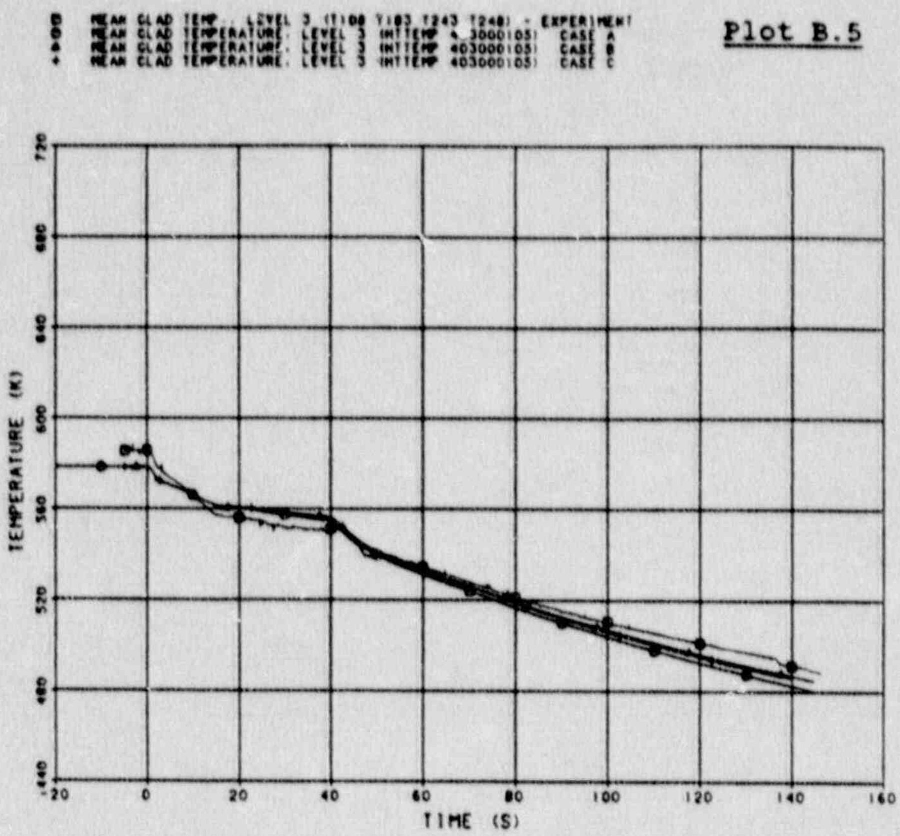


Plot B.4

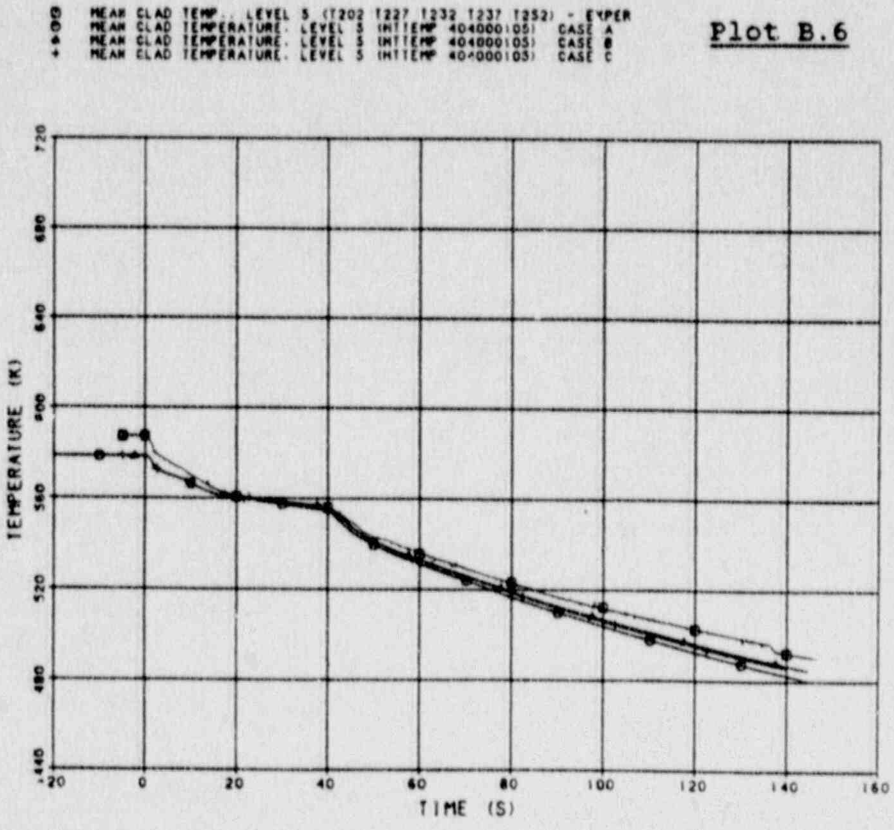


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

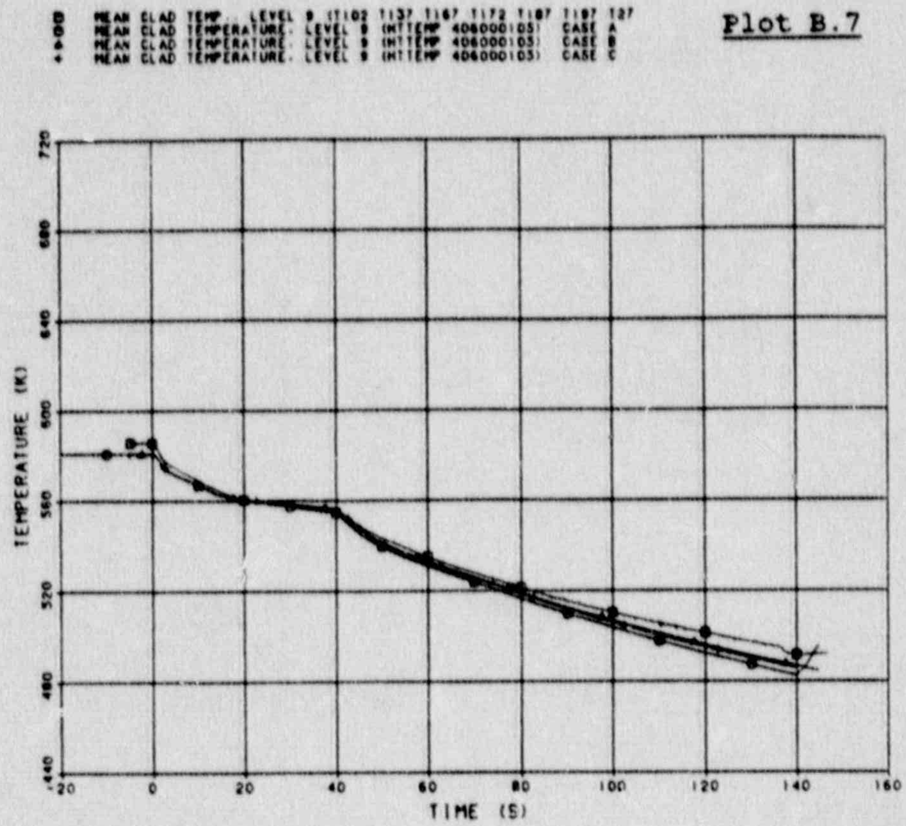
Plot B.5



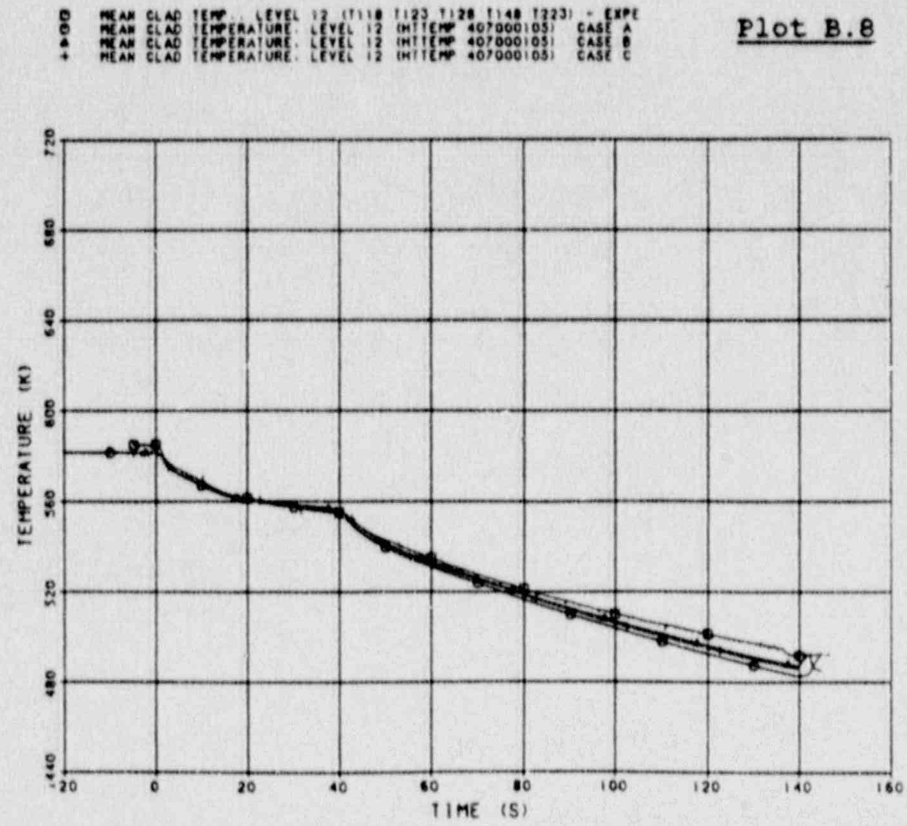
Plot B.6



RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051



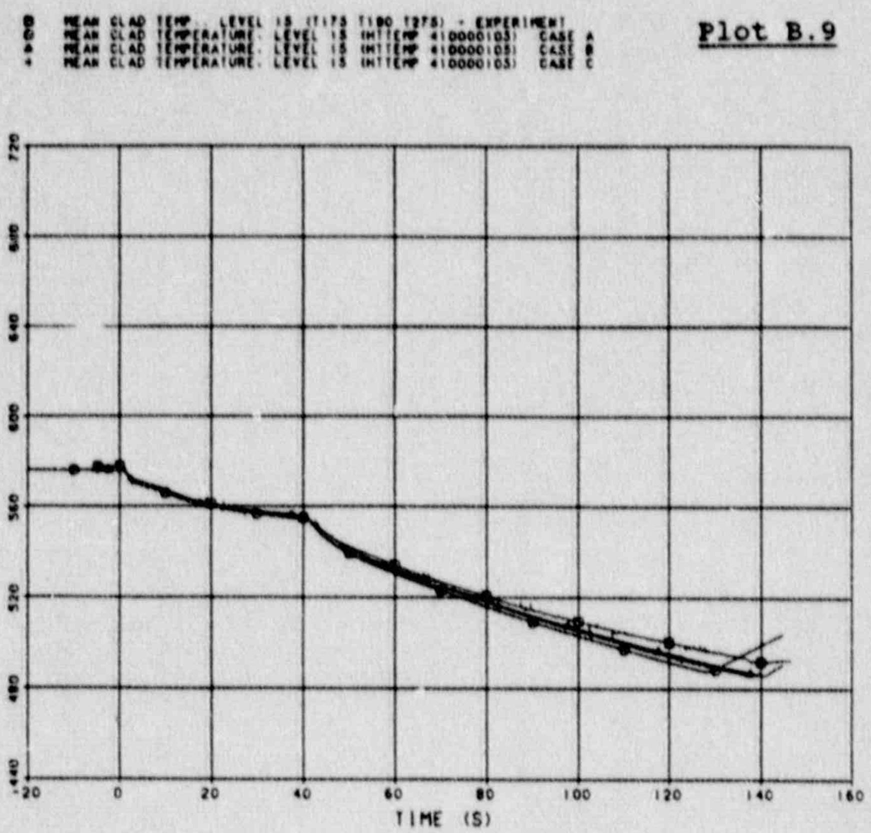
Plot B.7



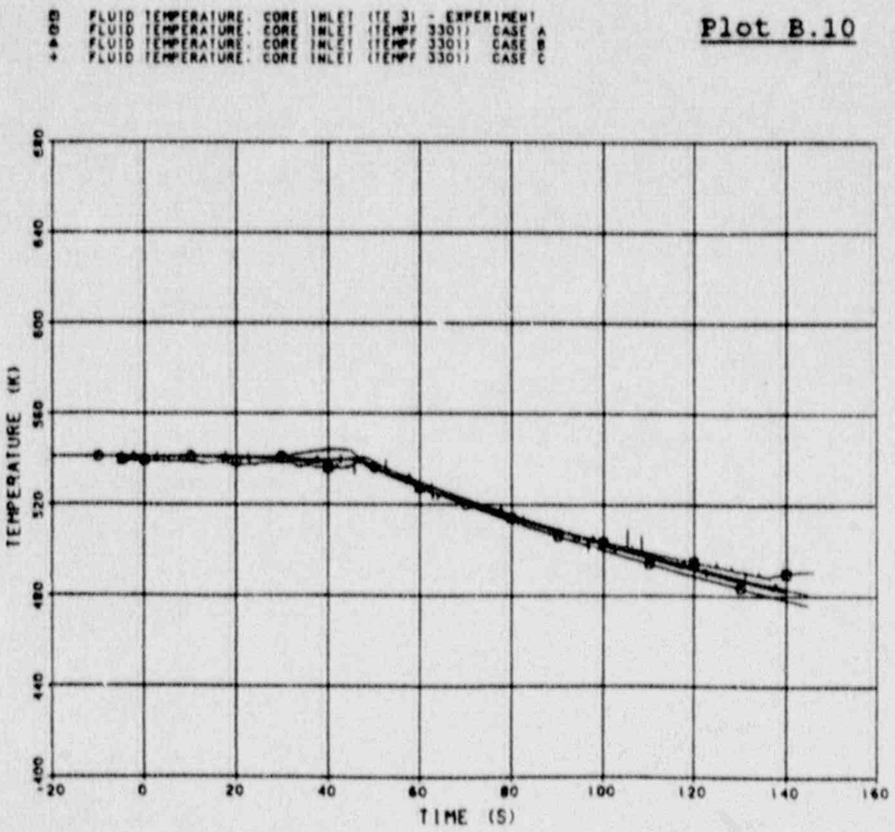
Plot B.8

RELAP5/MOD2 CALCULATION FOR FIX-II, EXP 3051

Plot B.9

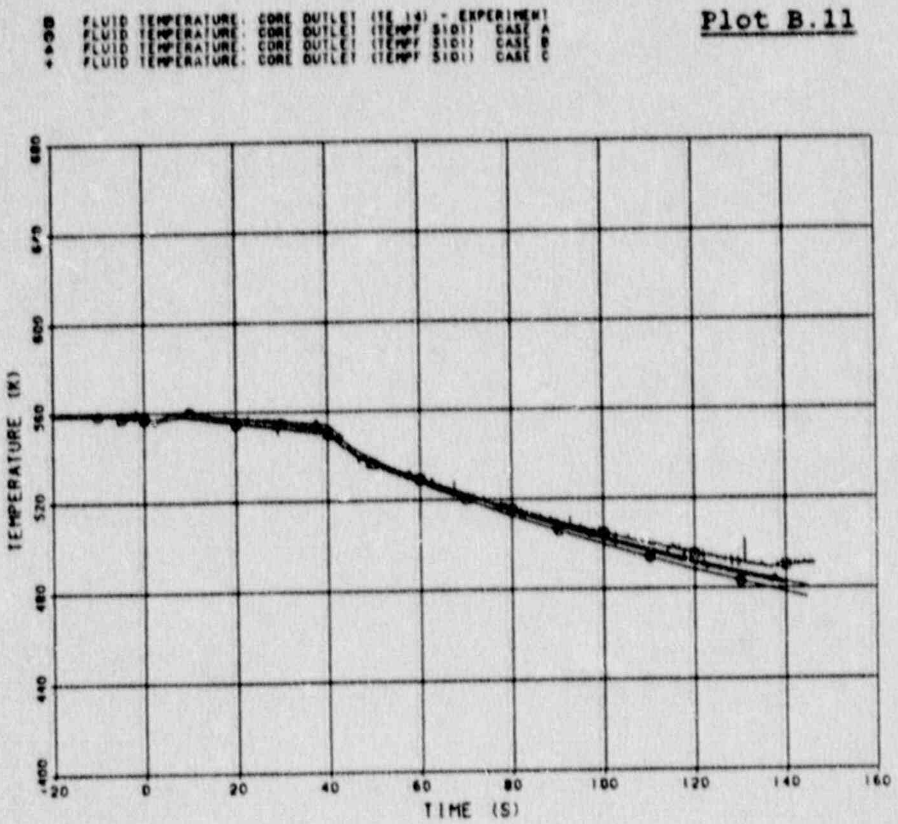


Plot B.10

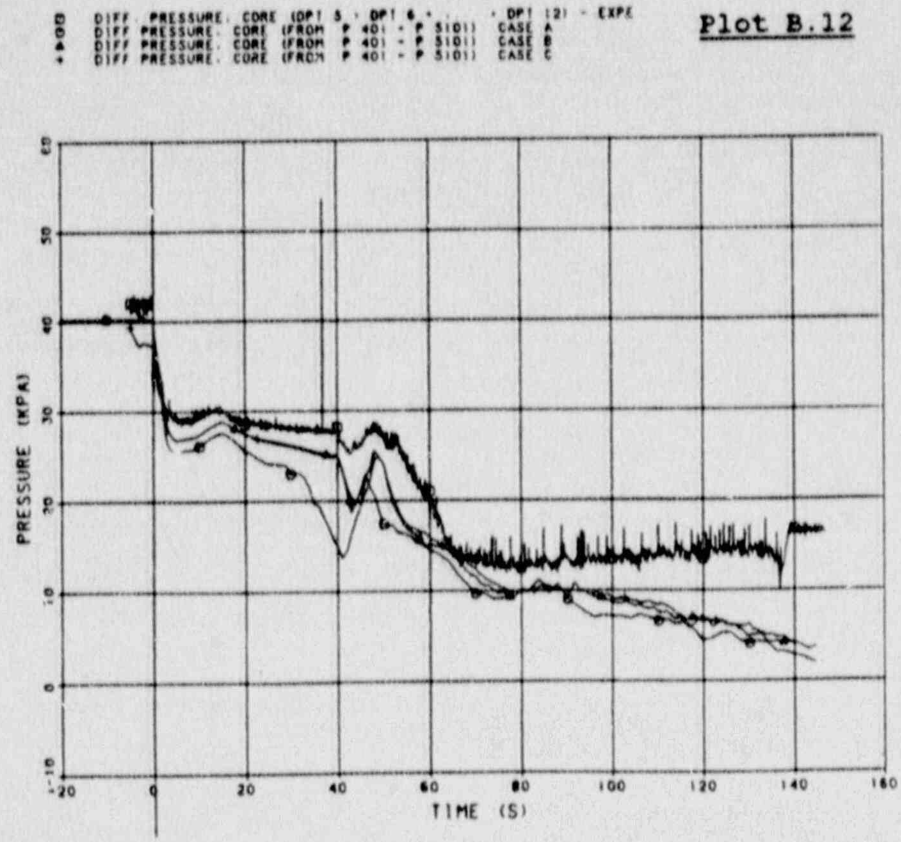


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.11

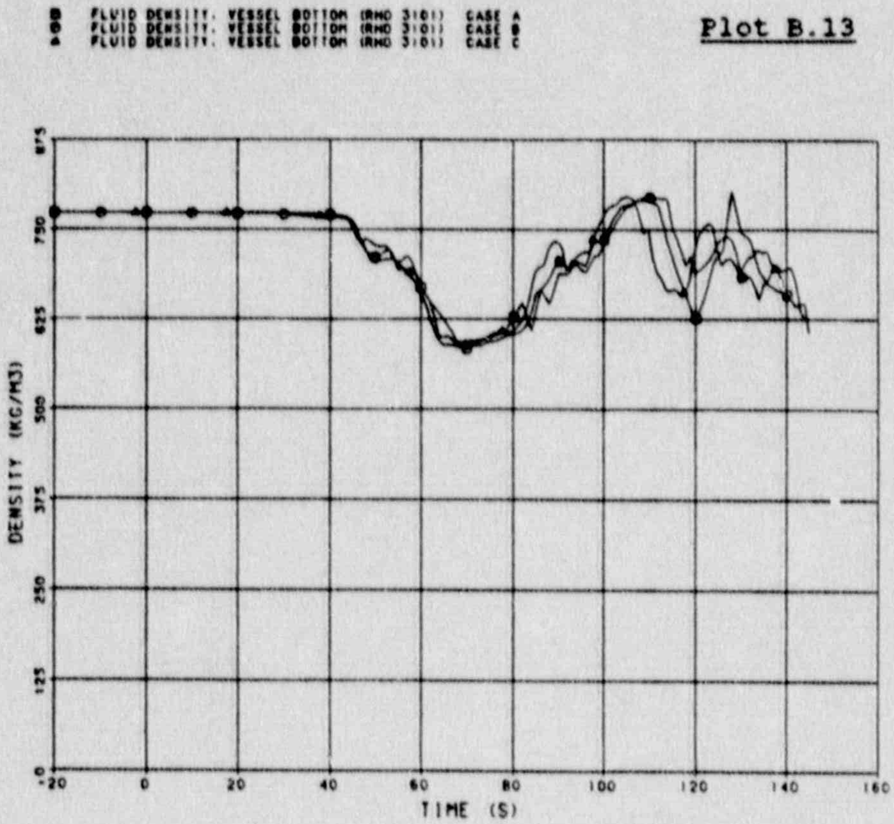


Plot B.12

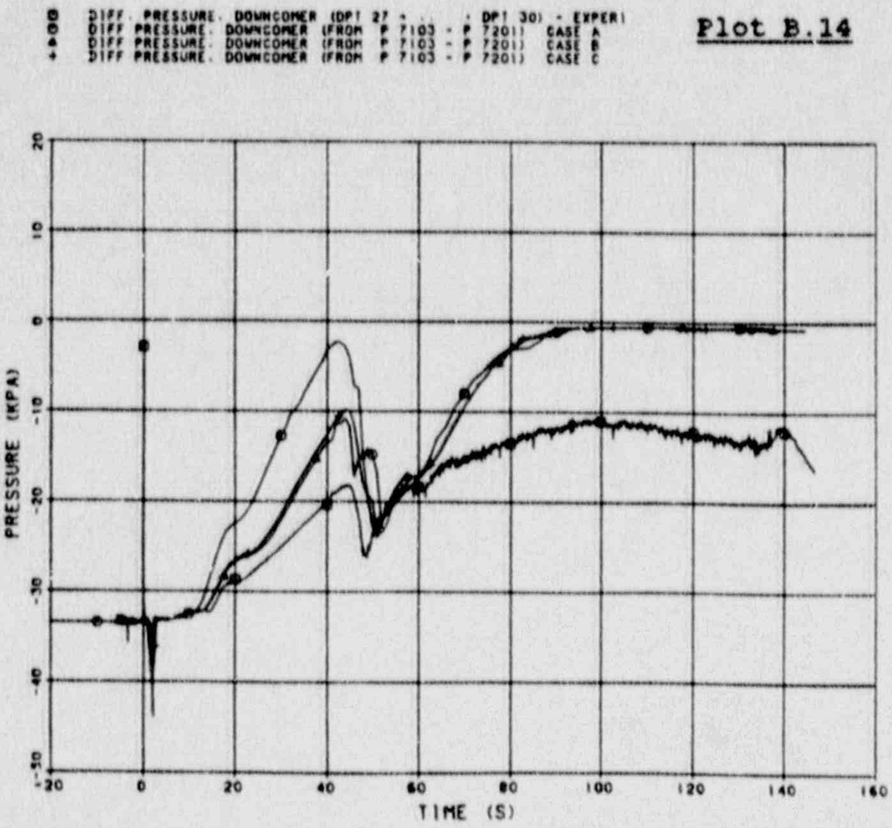


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.13

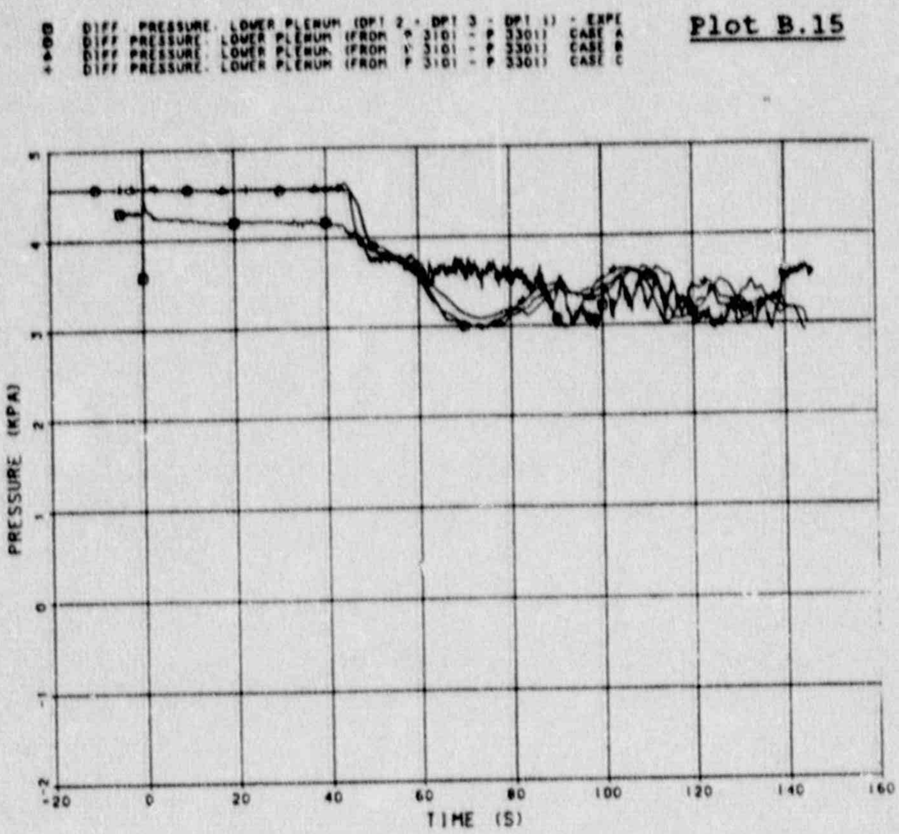


Plot B.14

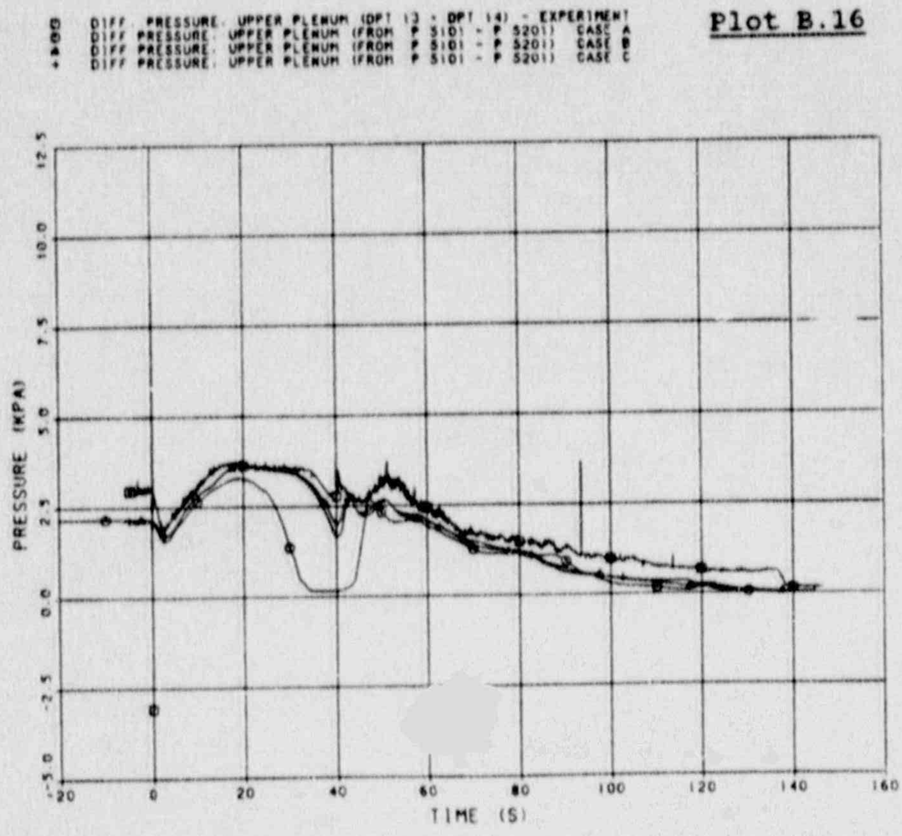


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.15

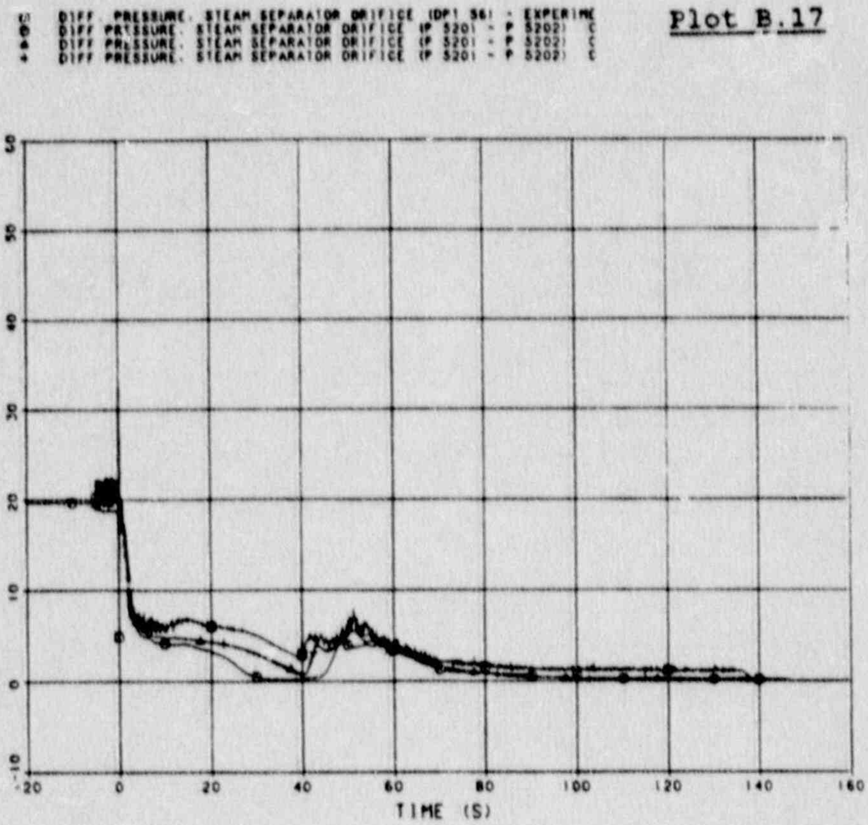


Plot B.16

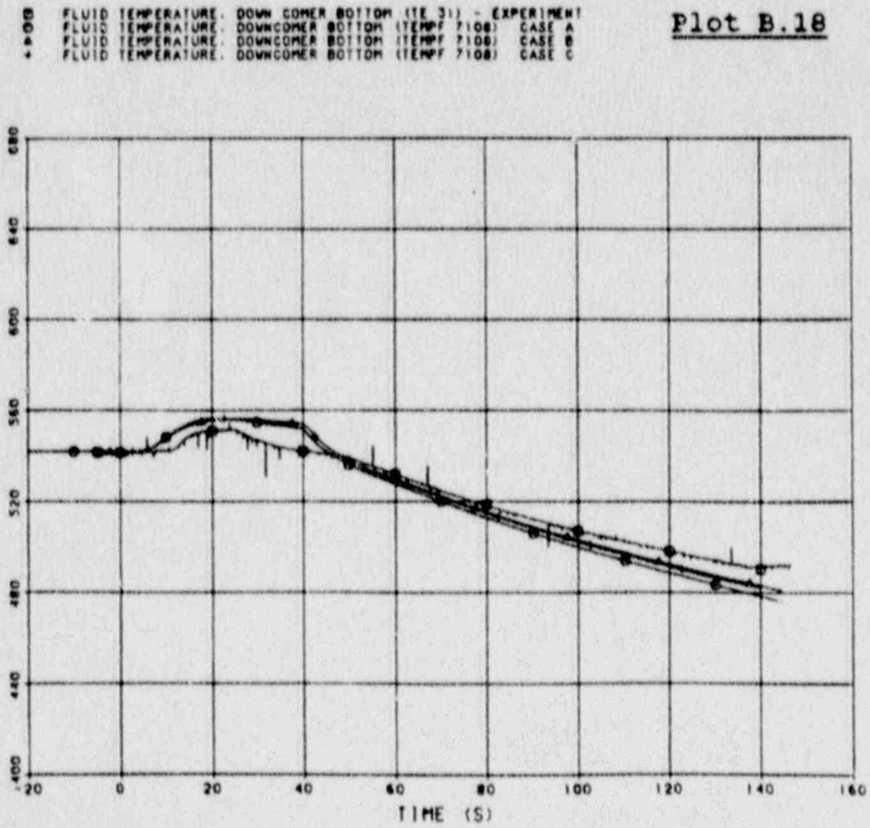


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.17

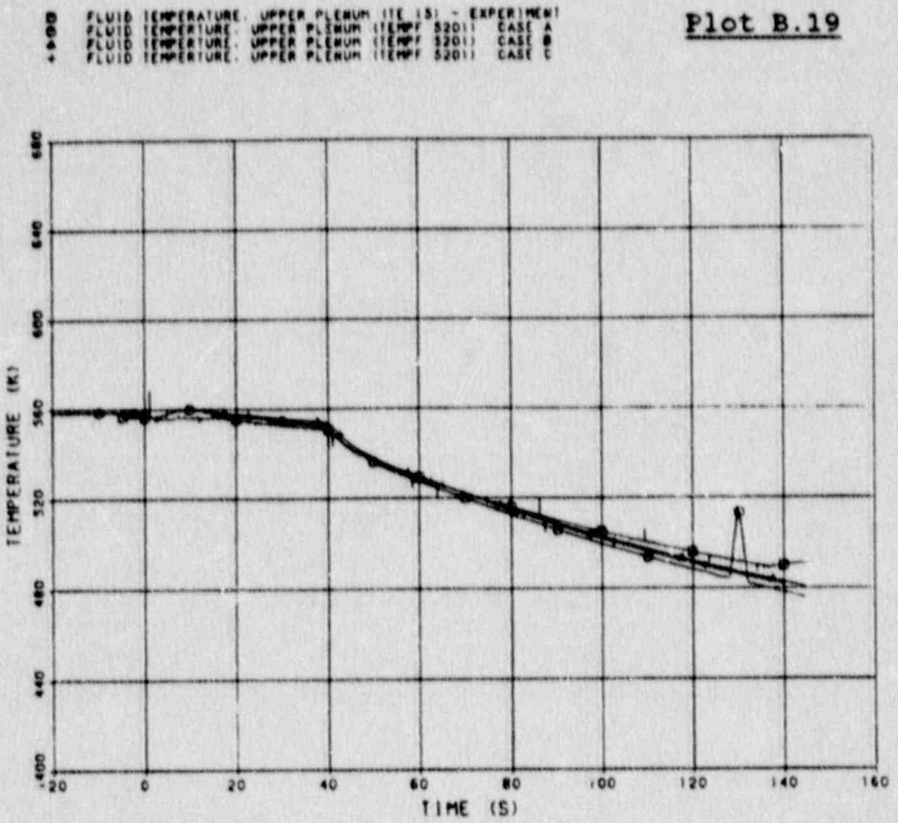


Plot B.18

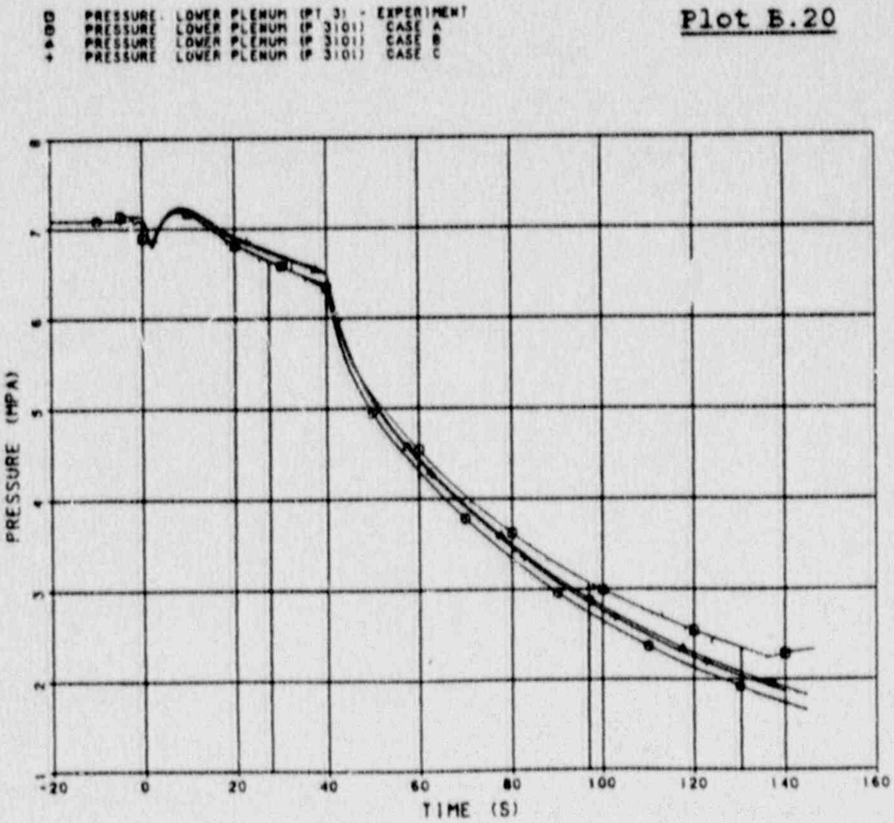


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.19

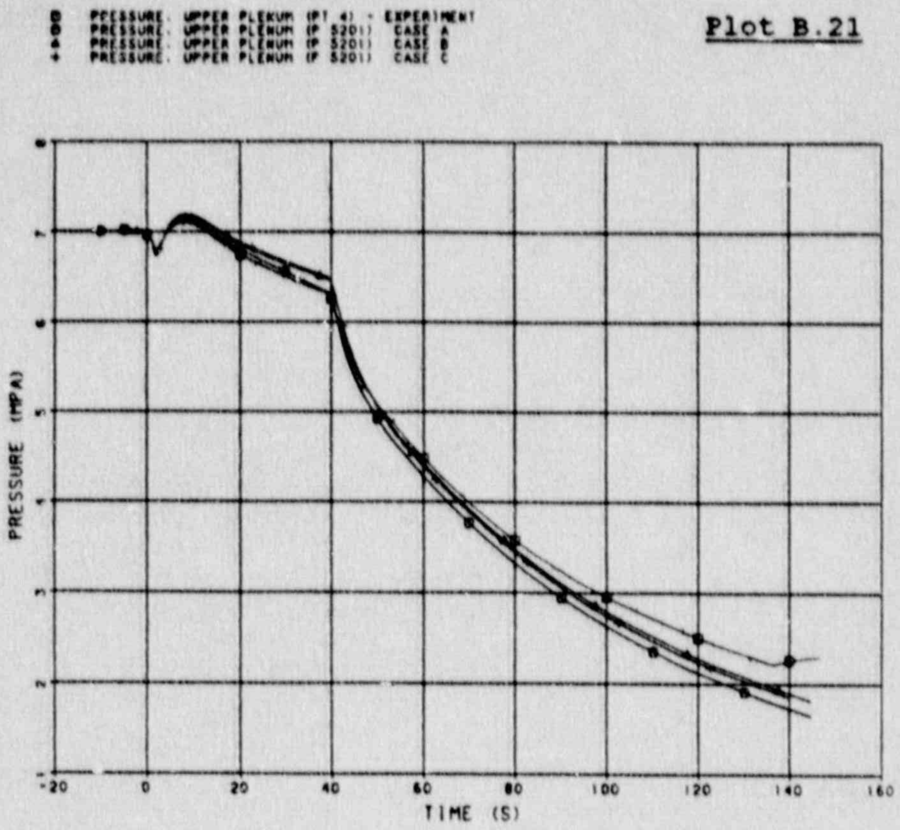


Plot B.20

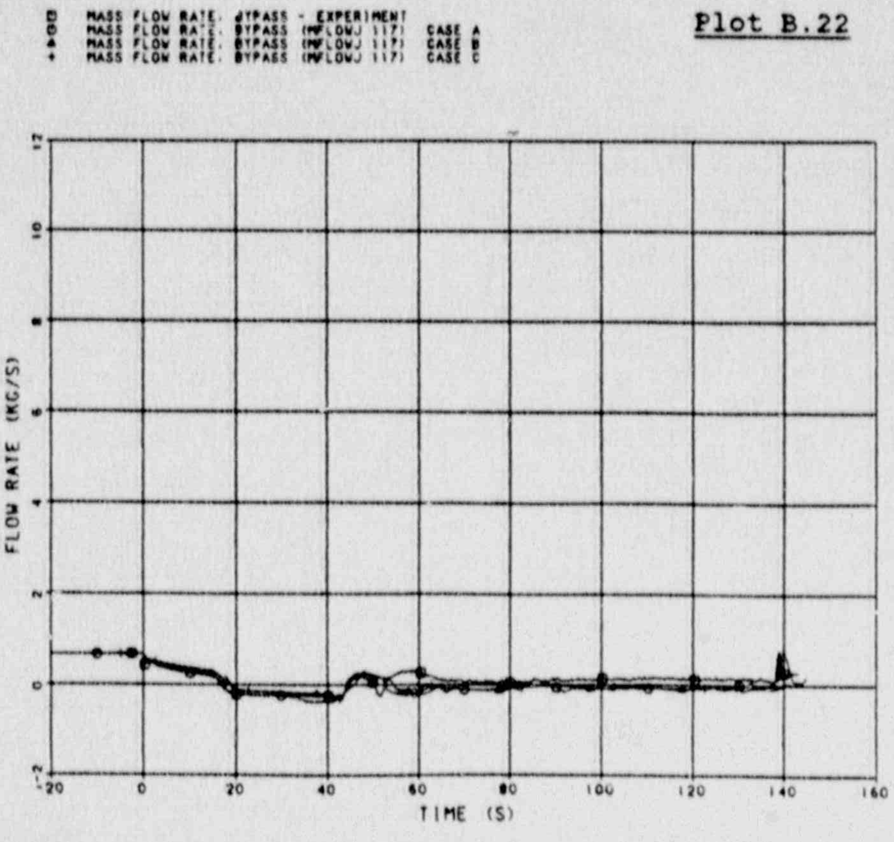


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.21



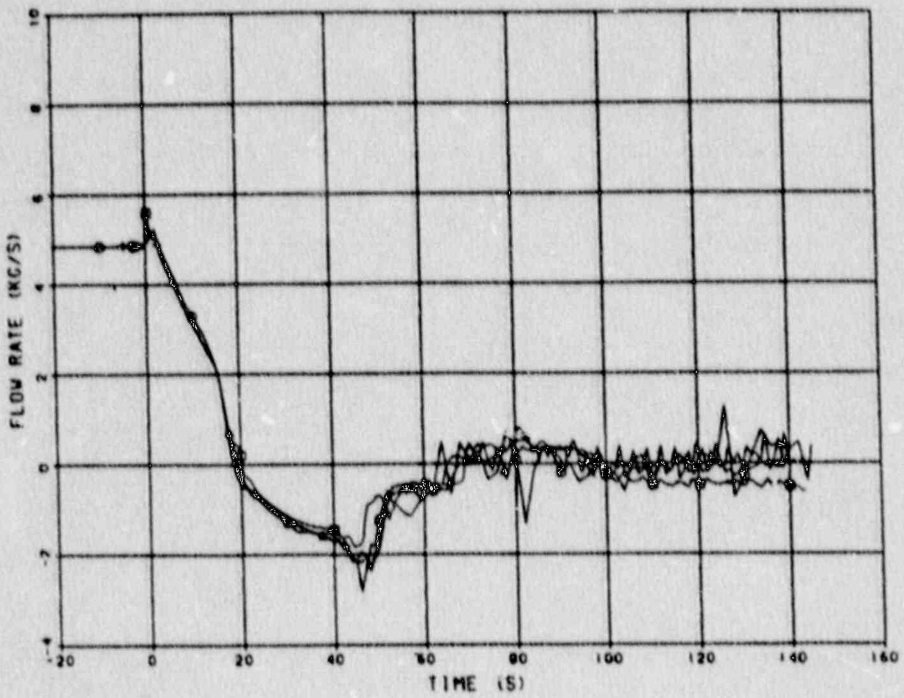
Plot B.22



RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

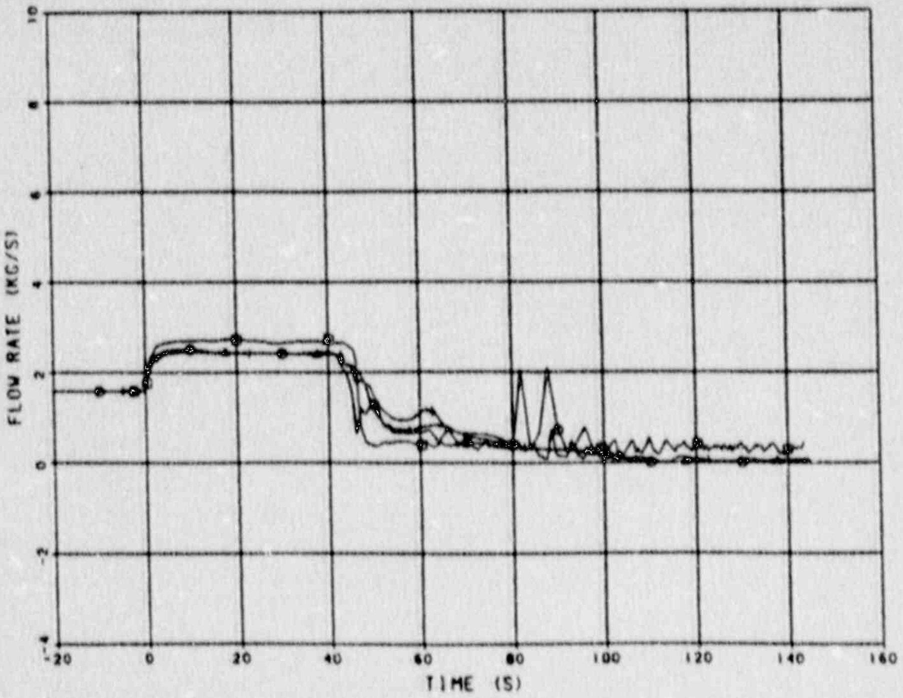
Plot B.23

- ▣ MASS FLOW RATE. I.L. PUMP - EXPERIMENT
- ⊙ MASS FLOW RATE. I.L. PUMP (MFLOWJ 20102) CASE A
- △ MASS FLOW RATE. I.L. PUMP (MFLOWJ 20102) CASE B
- + MASS FLOW RATE. I.L. PUMP (MFLOWJ 20102) CASE C

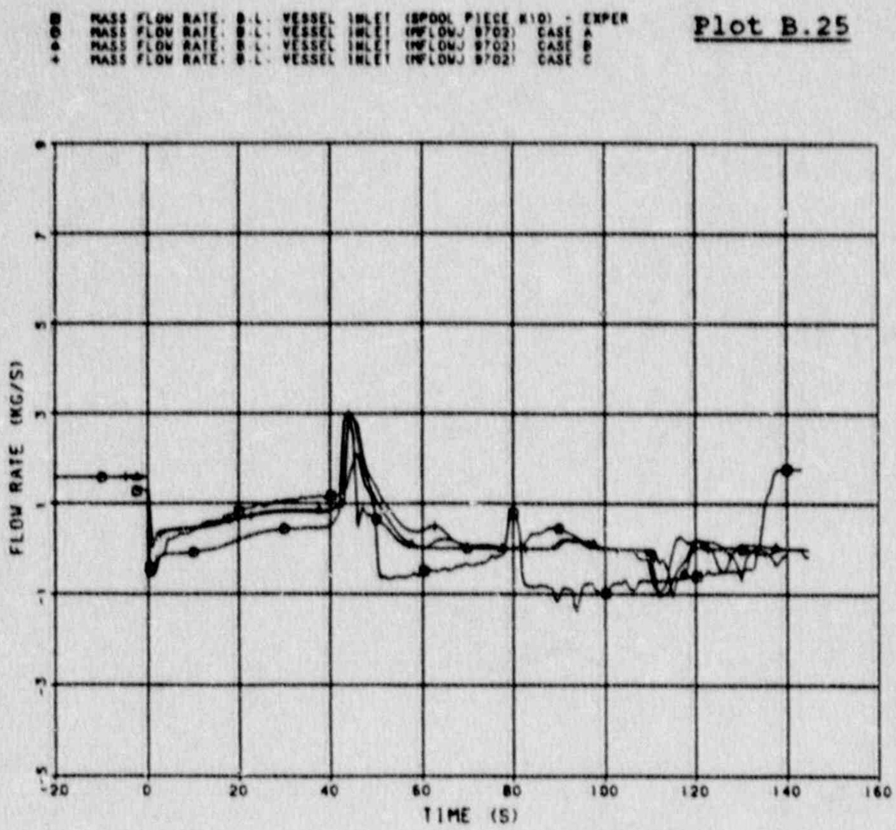


Plot B.24

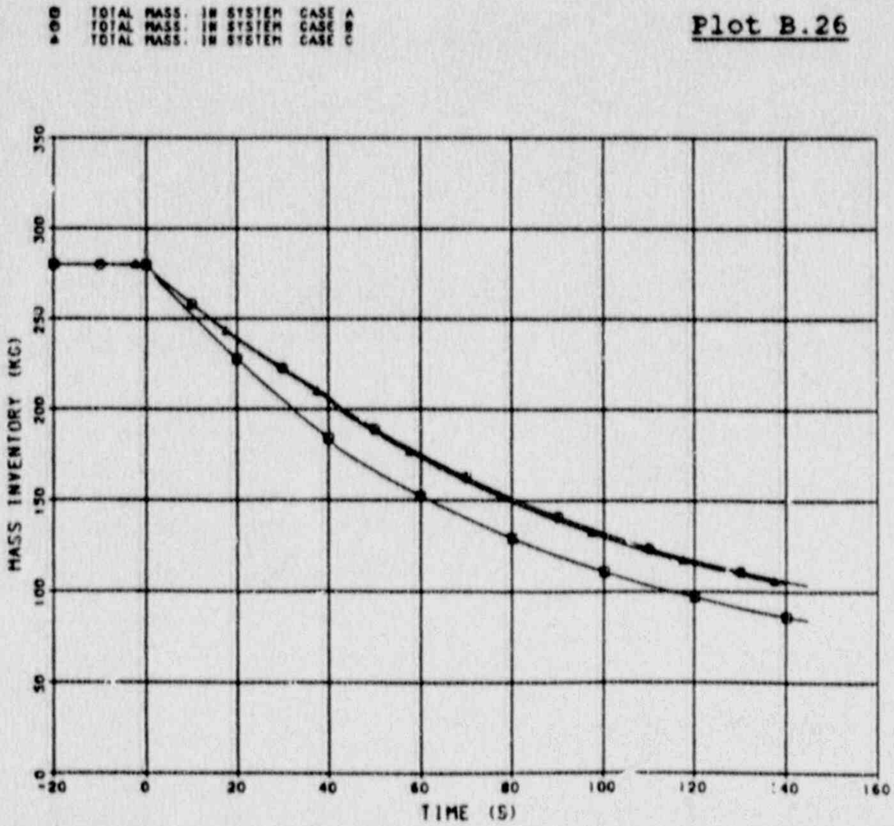
- ▣ MASS FLOW RATE. B.L. PUMP - EXPERIMENT
- ⊙ MASS FLOW RATE. B.L. PUMP (MFLOWJ 20202) CASE A
- △ MASS FLOW RATE. B.L. PUMP (MFLOWJ 20202) CASE B
- + MASS FLOW RATE. B.L. PUMP (MFLOWJ 20202) CASE C



RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051



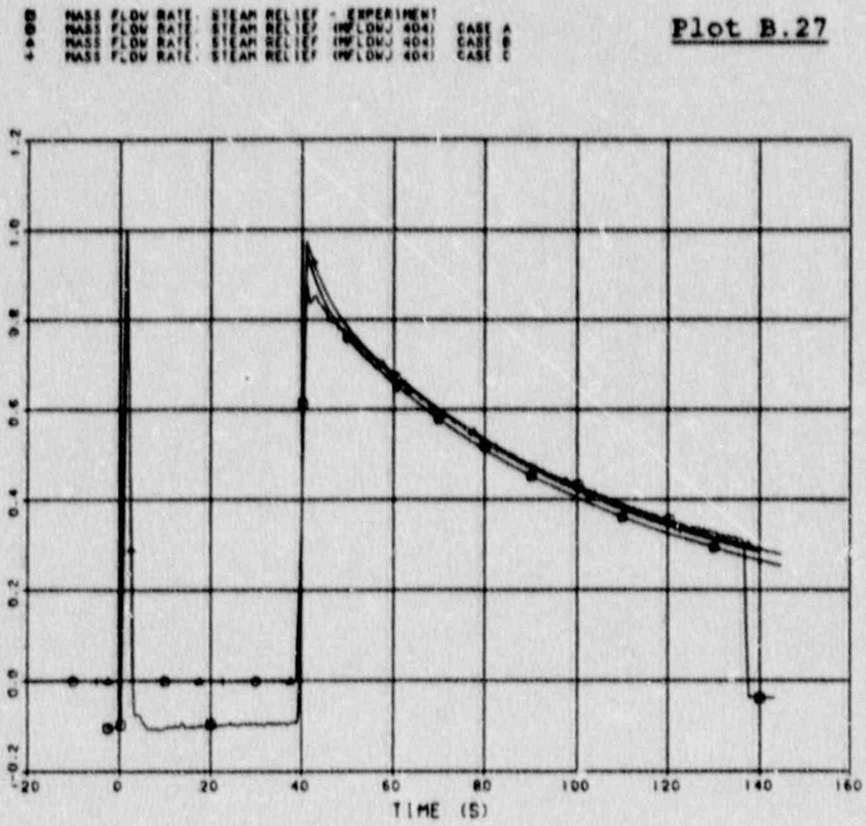
Plot B.25



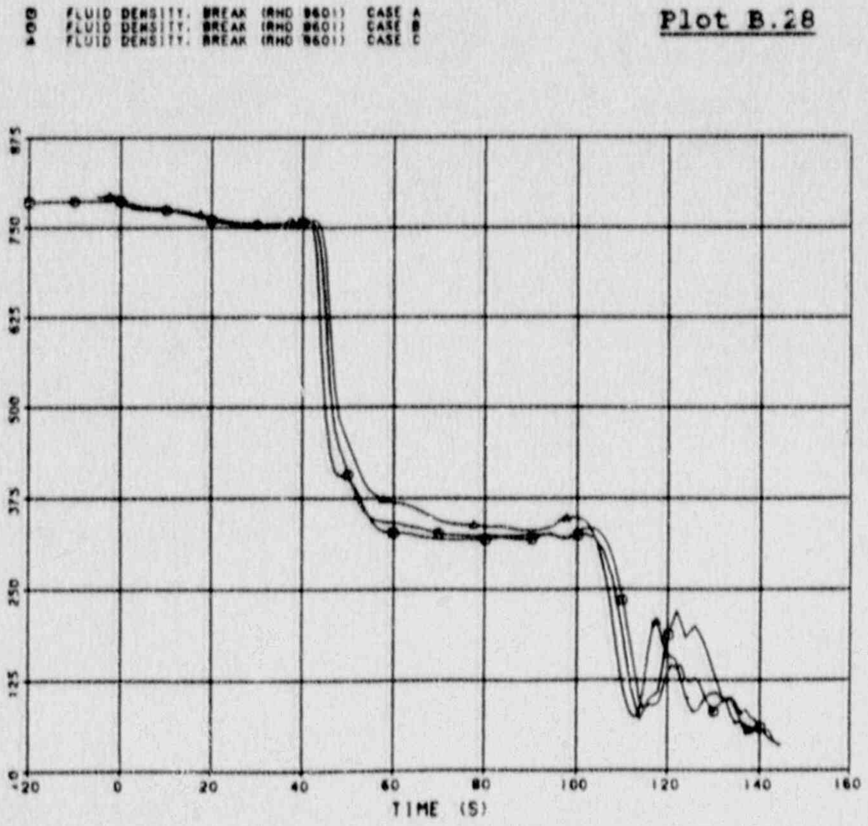
Plot B.26

RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.27

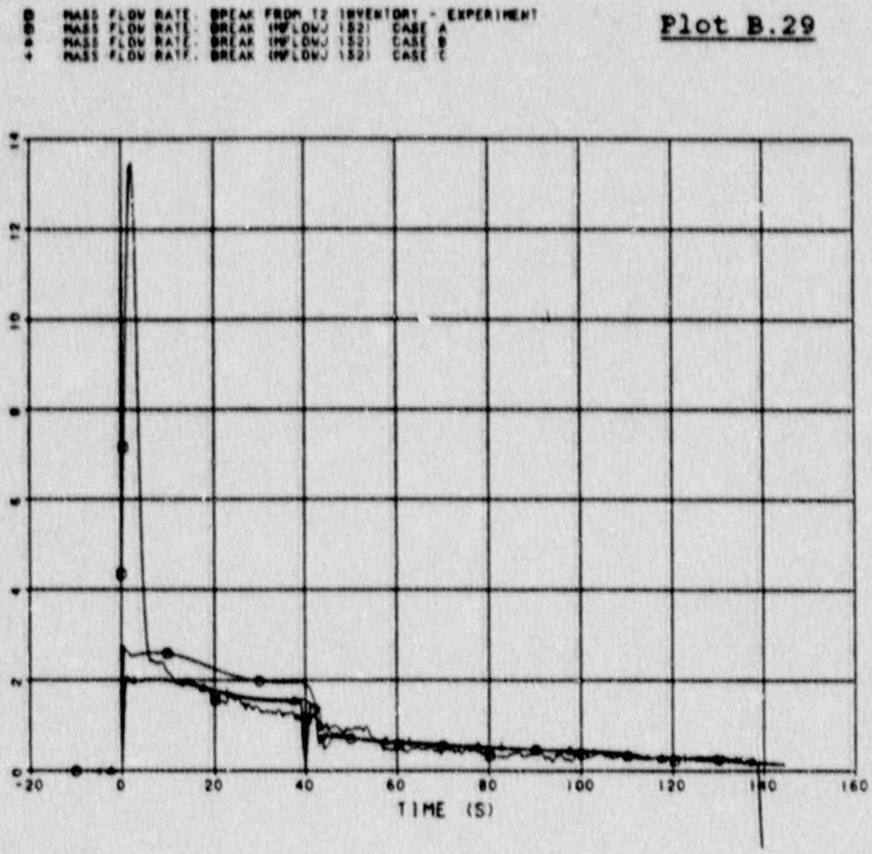


Plot B.28

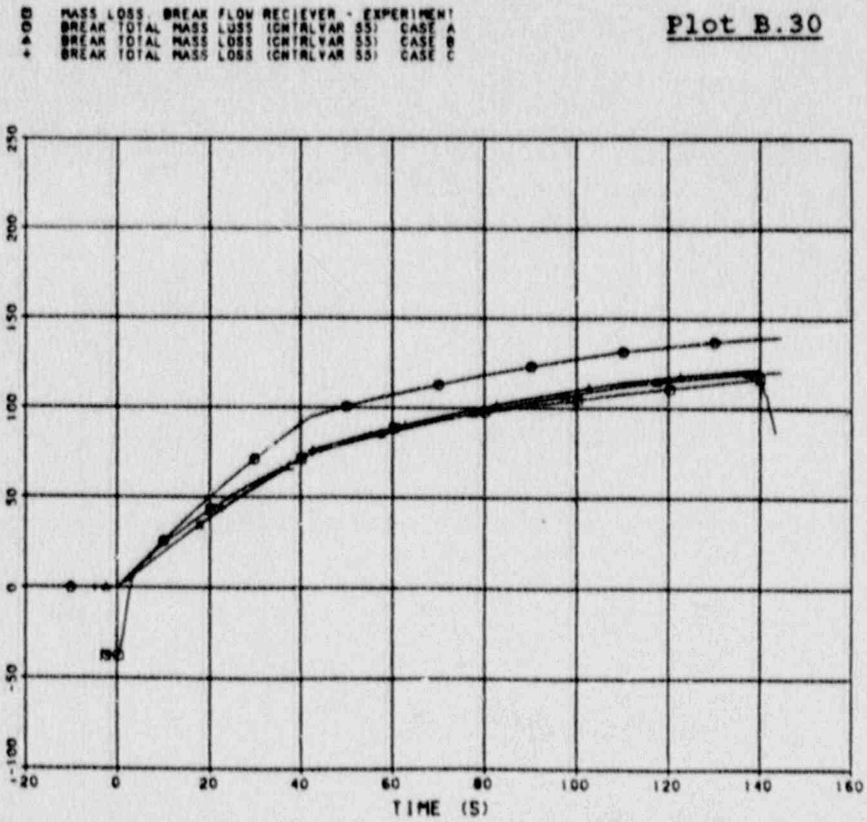


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.29

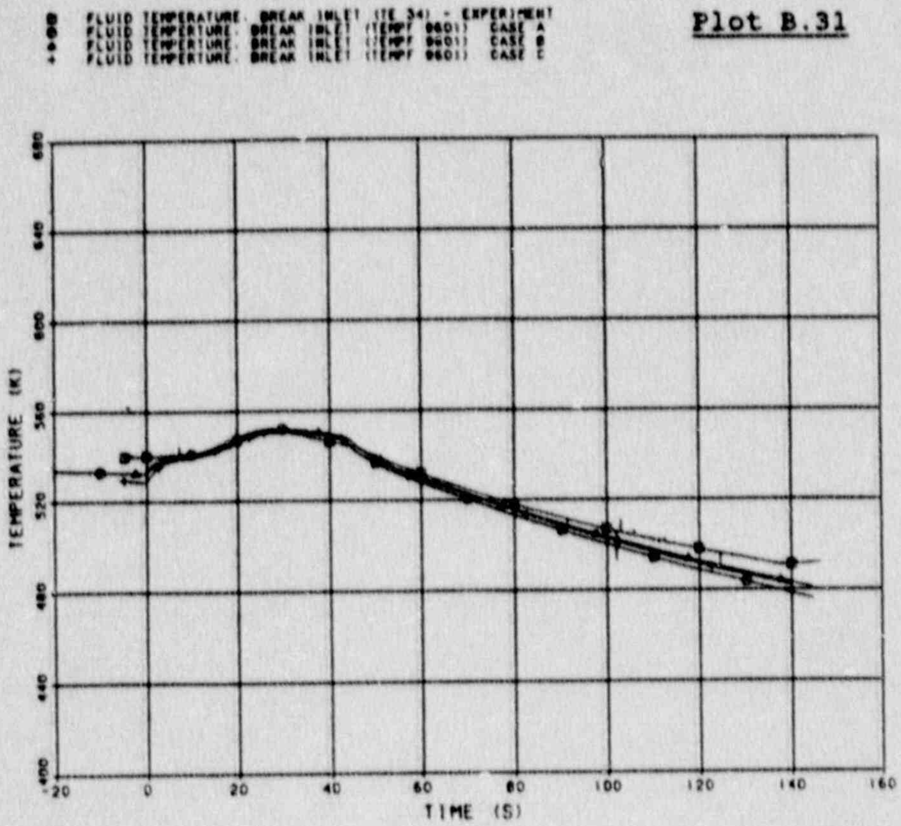


Plot B.30

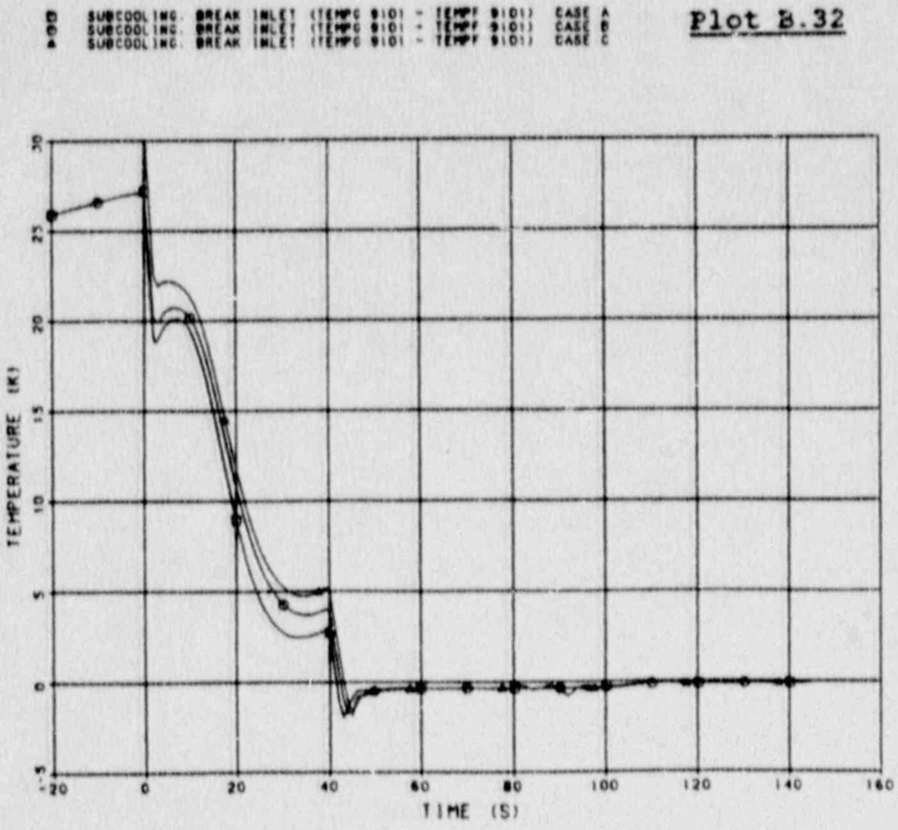


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Plot B.31

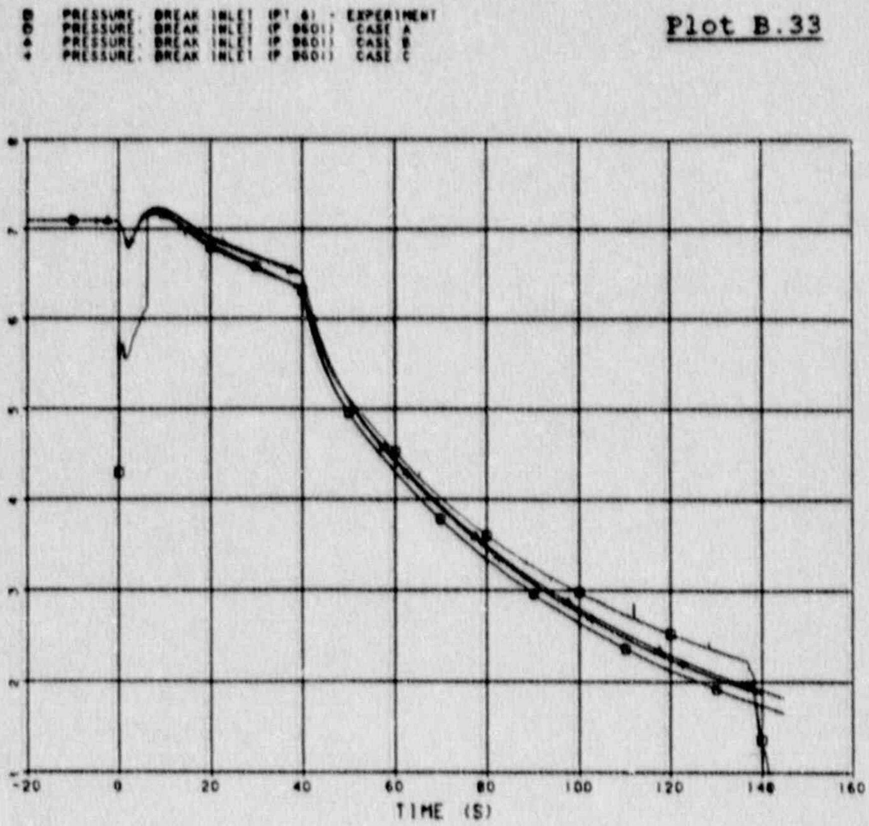


Plot B.32

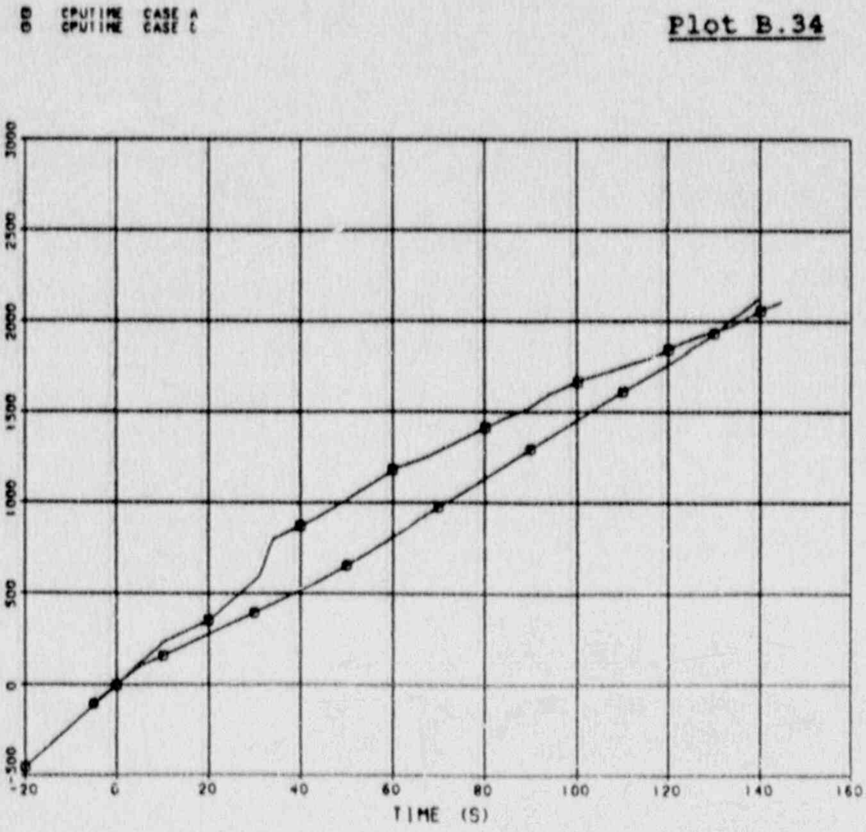


RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

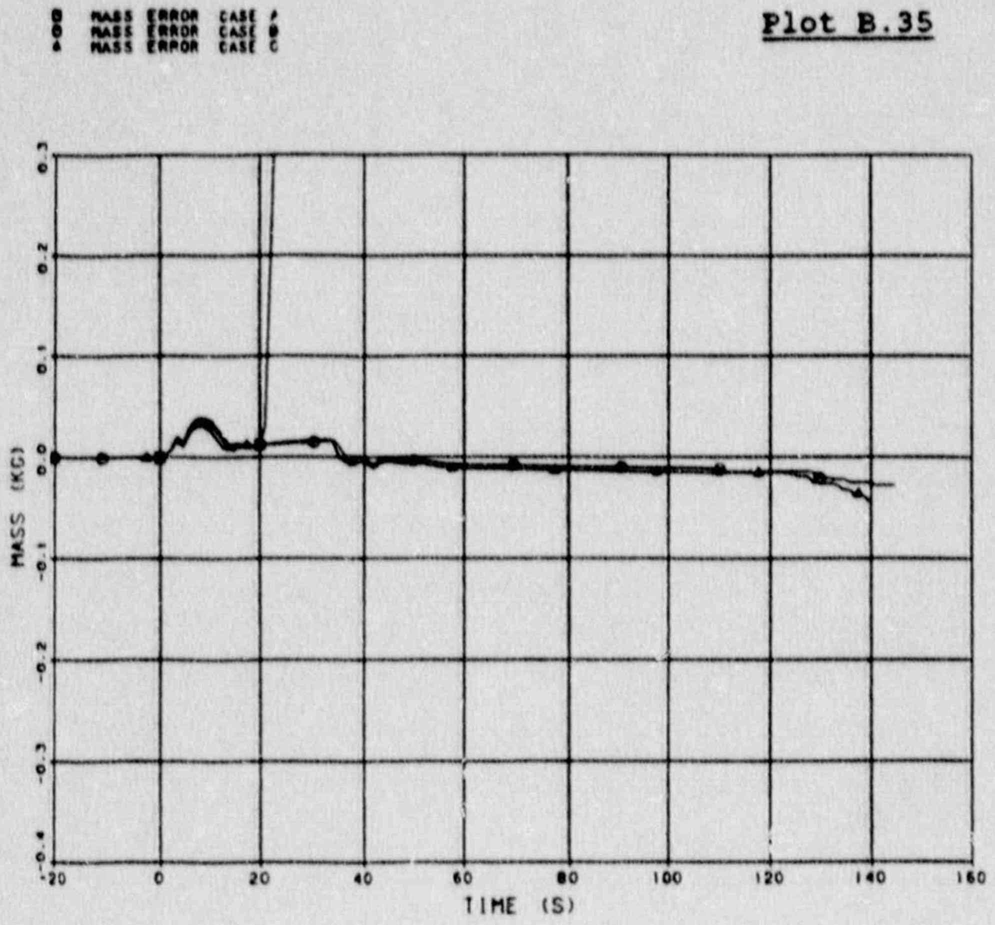
Plot B.33



Plot B.34



Plot B.35



RELAP5/MOD2 CALCULATION FOR FIX-II. EXP 3051

Calculation to experiment data uncertainties

Case A

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CALCULATION-TO-EXPERIMENT DATA UNCERTAINTY ANALYSIS FOR NRC/ICAP.
=================================================================

  FIRST LINE  : DIFFERENCE BETWEEN CALCULATED AND (AVERAGED) EXPERIMENTAL DATA AT END OF THE INTERVAL
  SECOND LINE : MEAN DIFFERENCE OVER THE INTERVAL
  THIRD LINE  : MEAN SIGMA OVER THE INTERVAL  (ROOT MEAN SQUARE OF THE DIFFERENCE)

  - CODES -                          - - - - TIME INTERVAL - - - -
 CALC.  EXP.   0.0 - 6.000     - 12.00     - 20.00     - 30.00     - 45.00     - 65.00     - 85.00     - 135.0
---------------------------------------------------------------------------------------------------------------

 P 1A - P  3   -.188E-01    .170E-02    .172E-01    .133E-01   -.119       -.227       -.333       -.446
               -.442E-01   -.208E-02    .645E-02    .109E-01   -.288E-01   -.188       -.274       -.374
                .676E-01    .756E-02    .780E-02    .263E-01    .483E-01    .201        .275        .407

 P 2A - P  4    .295E-01    .453E-01    .861E-01    .828E-01   -.857E-01   -.205       -.304       -.420
               -.346E-02    .422E-01    .465E-01    .559E-01    .138E-01   -.166       -.249       -.365
                .360E-01    .426E-01    .467E-01    .861E-01    .423E-01    .170        .250        .367

 P 3A - P  6   1.02         .281E-01    .387E-01    .336E-01   -.101       -.207       -.305       -.433
               1.27         .722E-01    .318E-01    .372E-01   -.606E-02   -.175       -.257       -.378
               1.38         .206        .328E-01    .373E-01    .383E-01    .179        .258        .380

 PD4A - D  4   -.959       -.241       1.89        1.73        1.33        1.86        -.163        .745E-02
               1.01        -.722        .411       1.73        1.74        2.23         .492        .270
               4.54         .777        .647       1.73        1.77        2.88         .643        .320

 PDLA - D LP    .315        .336        .348        .345        .484       -.488        .163E-01    .188E-01
                .282        .330        .357        .355        .278       -.130E-01   -.414        .154
                .285        .330        .357        .355        .379        .167        .462        .233

 PDCA - D CO   -3.22       -2.96       -2.93       -5.02       -7.29       -1.48       -6.01       -10.2
               -1.95       -3.33       -2.59       -4.01       -8.59       -6.60       -2.44       -8.14
               2.82        3.34        2.61        4.04        8.88        7.02        3.60        8.29

 PDUA - D UP   -.352       -.415       -.343       -2.08       -1.86       -.423       -.501       -.559
               -.464       -.421       -.463       -.853       -2.78       -.664       -.387       -.585
                .491        .426        .466        .985       2.80         .734        .396        .590

 PDDA - D DC   -.300E-02    .159       6.25        12.0        14.6        3.82        10.5        13.1
               -.423        .888E-01   4.06        8.76        15.0        4.31        9.14        11.6
               1.18         .139       4.52        8.92        15.1        6.68        9.33        11.6

 PDSA - D SG   -.926       -2.27       -2.72       -4.57       -3.86       -.627       -.880       -.898
                .469       -1.72       -2.67       -3.73       -3.69       -1.29       -.852       -.921
               1.97        1.75        2.67        3.79        3.76        1.60         .867        .927

 MF1A - X602   -.108       -.981E-01    .432E-01   -.192E-02   -.923E-01   -.198       -.215       -.198
               -.473E-01   -.110       -.794E-01    .106E-01   -.767E-01   -.196       -.182       -.193
                .782E-01    .110        .102        .158E-01    .833E-01    .318        .161        .196

 MF2A - X603   -.425E-01    .228       -.755       -.185       -.295        .488       -.506       1.04
               -.295E-01    .471E-01   -.141       -.199       -.167       -.296       -.240        .332
                .124        .617E-01    .325        .228        .198        .580        .524        .630

 MF3A - X604   -.168       -.206       -.297       -.226       -.902        .118        .423       -.211
               -.124       -.188       -.263       -.261       -.318        .234        .333       -.226
                .172        .188        .265        .262        .361        .555        .586        .322

 MF5A - X607    .966E-01    .101        .930E-01    .923E-01    .139E-01   -.188E-01   -.238E-01   -.370E-01
                .112        .104        .966E-01    .948E-01    .801E-01   -.745E-02   -.200E-01   -.288E-01
                .132        .104        .967E-01    .949E-01    .962E-01    .126E-01    .203E-01    .290E-01

 MF4A - X610   -.369       -.876       -.600       -.629        .879        .445       1.10        -.731
               -.436E-02   -.452       -.606       -.610       -.311        .386        .627        .625
                .267        .456        .607        .611        .789        .762        .981        .646

 MF6A - X636   -.233E-01    .631        .550        .590       -.298        .850E-01    .575E-01   -.650E-01
               -5.86        .305        .535        .573        .522       -.569E-01    .102        .108E-01
               6.87         .344        .539        .576        .638        .171        .116        .641E-01

 TF1A - T  3   2.42        2.28        2.78        2.45        6.60        -.290       -2.80       -7.71
               1.82        2.26        2.82        2.77        6.14         .823       -1.27       -5.23
               1.86        2.28        2.84        2.81        6.38        1.37        1.46        5.44

 TF2A - T 14   1.43        2.51        1.85        2.20         .760       -1.44       -6.09       -9.11
               1.36        1.88        1.71        2.14        1.43        -.738       -2.68       -6.61
               1.41        1.91        1.73        2.20        1.56        1.01        2.83        6.76

 TF4A - T 15   2.64        3.46        1.57        1.83        -.350       -1.94       -4.69       -9.12
               1.38        2.25        2.25        1.81        1.19        -1.12       -3.01       -5.24
               1.56        3.27        2.36        1.81        1.38        1.27        3.18        7.62

 TF3A - T 31   -6.66       7.15        5.48        7.65        1.10        -4.21       -5.59       -11.4
                .356       4.16        5.93        5.70        7.81        -3.06       -5.30       -8.91
                .660       4.92        6.01        5.80        8.20        3.33        5.36        9.01

 TF5A - T 34   -.400        .310       1.35        1.16        -1.04       -3.68       -6.70       -10.9
               -2.54       -.231       1.65        1.04        1.95        -3.24       -4.75       -8.41
               3.31         .311       1.75        1.05        2.13        3.31        4.79        8.53

 HT1A - TC 1   -2.61        .120       1.12        11.6        7.98        -4.61       -6.71       -11.1
               -5.08       -.676        .283       8.62        12.0        -2.49       -5.62       -9.04
               6.24        1.16         .800       8.62        12.3        3.05        5.65        9.13

 HT2A - TC 3   -2.43       1.84        4.43        5.79        -1.23       -3.76       -5.20       -10.6
               -4.51       -.143       3.95        4.73        3.41        -1.43       -4.45       -8.04
               4.70        1.36        4.03        4.77        4.16        2.54        4.61        8.17

 HT3A - TC 5   -5.27       -3.20       -.300E-01   -1.05       -3.79       -5.11       -7.34       -12.1
               -6.43       -3.93       -1.65       -.338       -1.68       -4.23       -5.99       -9.61
               6.50        3.97        1.90         .611       1.84        4.30        6.03        9.70

 HT4A - TC 9   -2.81       -1.66       -.190       -.360       -2.70       -3.72       -6.05       -10.4
               -3.07       -2.14       -1.13        .269E-01   -.913       -3.61       -4.68       -8.15
               3.13        2.10        1.24         .202       1.22        3.62        4.73        8.26

 HT5A - TC12   -1.90       -1.76       -.710       -.430       -2.09       -3.50       -5.58       -10.6
               -1.54       -1.56       -.852       -.607       -.597       -3.22       -4.41       -8.06
               1.67        1.57         .816        .647        .891       3.26        4.47        8.18

 HT6A - TC15   -1.43       -1.31       -1.28       -.550       -1.90       -3.62       -5.65       -.530
               -1.21       -1.28       -1.26       -.920       -.668       -3.07       -4.40       -7.14
               1.25        1.29        1.27         .951        .916       3.12        4.46        7.35

 ML1A - X671   -348.       -347.       -342.       -336.       -328.       -330.       -327.       -326.
               -334.       -347.       -344.       -339.       -331.       -330.       -328.       -326.
               335.        348.        344.        339.        331.        330.        328.        326.

 HP1A - X801   -.279E-01    .813E-02   -.551E-02    .324E-02   -.730E-03   -.168E-02   -.507E-02   -.960E-02
               -.273E-02    .230E-02    .602E-03   -.276E-03    .104E-02   -.182E-02   -.373E-02   -.756E-02
                .351E-01    .899E-02    .468E-02    .322E-02    .150E-02    .193E-02    .384E-02    .764E-02
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Case B

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CALCULATION-TO-EXPERIMENT DATA UNCERTAINTY ANALYSIS FOR NRC/ICAP.
*****************************************************************

  FIRST LINE  : DIFFERENCE BETWEEN CALCULATED AND (AVERAGED) EXPERIMENTAL DATA AT END OF THE INTERVAL
  SECOND LINE : MEAN DIFFERENCE OVER THE INTERVAL
  THIRD LINE  : MEAN SIGMA OVER THE INTERVAL  (ROOT MEAN SQUARE OF THE DIFFERENCE)

 - CODES -                          - - - - TIME INTERVAL - - - -

CALC.  EXP.  0.0 - 6.000  - 12.00     - 20.00     - 30.00     - 45.00     - 65.00     - 95.00     - 135.0
-----------------------------------------------------------------------------------------------------------
P 1B - P  3  -.100E-03   .457E-01    .721E-01    .109        .659E-01   -.821E-01   -.177       -.279
             -.300E-01   .276E-01    .985E-01    .821E-01    .117       -.944E-01   -.122       -.215
              .459E-01   .310E-01    .600E-01    .948E-01    .120        .714E-01    .128        .268
P 2B - P  4   .444E-01   .869E-01    .109        .144        .953E-01   -.814E-01   -.150       -.253
              .609E-02   .684E-01    .969E-01    .125        .154       -.281E-01   -.978E-01   -.207
              .356E-01   .696E-01    .671E-01    .126        .155        .944E-01    .101        .210
P 3B - P  6  1.04        .780E-01    .963E-01    .131        .908E-01   -.807E-01   -.153       -.265
             1.28        .103        .862E-01    .111        .141       -.315E-01   -.106       -.219
             1.40        .217        .868E-01    .112        .143        .891E-01    .110        .222
PD4B - D  4  1.71       1.35        2.10        1.98        2.39        1.84         .202        .342
             4.17       1.49        1.78        1.88        1.89        2.83         .647        .244
             6.12       1.61        1.82        1.88        1.90        3.04         .761        .272
PDLB - D LP   .318       .338        .349        .356        .486       -.494        .271       -.153E-01
              .285       .332        .361        .356        .391        .140E-01   -.332        .173
              .293       .333        .361        .356        .392        .218        .447        .216
PDCB - D CO  -1.88      -1.77       -1.07       -2.00       -5.56       -.145       -3.77       -9.82
             -.419      -2.04       -1.27       -1.69       -2.99       -4.70       -2.80       -6.84
             2.08       2.05        1.30        1.71        3.24        5.13        2.94        7.05
PDUB - D UP  -.260      -.263        .130E-01   -.727E-01   -.206       -.277       -.495       -.544
             -.371      -.259       -.220       -.412E-01   -.349       -.474       -.379       -.485
              .417       .269        .254        .603E-01    .445        .504        .397        .488
PDDB - D DC  -.280E-01  -.134       1.94        2.05        6.75        1.64       10.5         12.8
             -1.05       .154E-01    .864       2.13        5.96        2.15        8.63        11.5
             1.90        .127       1.06        2.18        5.73        3.14        9.01        11.6
PDSB - D SG  -.414      -1.47       -1.73       -1.99       -.825       -.236       -.918       -.901
             1.02       -1.12       -1.92       -1.87       -1.78       -.577       -.808       -.934
             2.08       1.16        1.93        1.87        1.88         .790        .835        .940
MF1B - X602  -.948E-01  -.453E-01    .178        .862E-01   -.727E-01   -.184       -.188       -.233
              .684E-02  -.860E-01    .326E-01    .834E-01    .246E-01   -.163       -.144       -.205
              .653E-01   .962E-01    .107        .842E-01    .816E-01    .310        .149        .206
MF2B - X603  -.189       .216E-01   -.906       -.482E-01   -.274        .330        .148        .395
             -.189      -.127       -.964E-01   -.967E-01   -.175       -.215        .467E-01    .348
              .250       .132        .151        .143        .203        .832        .297        .407
MF3B - X604  -.234      -.261       -.305       -.240       -.409        .350        .118       -.211
             -.204      -.247       -.281       -.269       -.301        .427        .896E-01   -.237
              .222       .247        .281        .271        .306        .654        .181        .275
MF5B - X607   .966E-01   .101        .930E-01    .923E-01    .423E-01    .301E-02   -.940E-03   -.121E-01
              .118       .104        .986E-01    .948E-01    .887E-01    .146E-01    .314E-02   -.812E-02
              .184       .104        .987E-01    .949E-01    .101        .189E-01    .482E-02    .892E-02
MF4B - X610   .176      -.363E-01   -.106       -.219       1.16         .647       1.07        -.551
              .863       .982E-01   -.739E-01   -.167       -.780E-01    .724        .536        .519
              .649       .115        .786E-01    .170        .451        .811        .754        .627
MF6B - X636  -.634       .369E-01    .945E-01    .160       -.239        .785E-01    .757E-01   -.349E-01
             -6.51      -.304       -.118E-01    .127        .991E-01   -.353E-01    .122        .237E-01
             7.43        .345        .659E-01    .145        .319        .164        .133        .781E-01
TF1B - T  3  2.40       2.18        2.86        2.09        2.98        1.86         .850       -3.34
             1.83       2.21        2.71        2.73        2.93        2.38        1.29        -1.64
             1.86       2.24        2.73        2.77        2.98        2.44        1.38         2.01
TF2B - T 14  1.53       2.51        1.15        3.21        2.86         .660      -3.15        -4.75
             1.45       1.86        1.41        2.34        3.29        1.12        -.180       -3.02
             1.50       1.90        1.45        2.45        3.32        1.32         .710        3.21
TF4B - T 15  2.76       3.53        1.99        2.74        1.90         .150      -1.76        -4.77
             1.47       3.38        2.55        2.49        2.89         .737       -.483       -3.33
             1.64       3.40        2.65        2.49        2.96         .961        .896        3.51
TF3B - T 31  -5.83      6.60        4.79        8.43        3.79       -2.09       -2.65        -7.06
              .321      3.70        5.12        5.82        9.59       -1.16       -2.75        -5.31
              .656      4.37        5.22        5.99        9.94        1.61        2.80         5.41
TF5B - T 34  -.880      -.180        .100        .870       1.85       -1.56       -2.75        -6.51
             -3.16      -.613        .794       -.473E-01   2.39       -1.28       -2.23        -4.83
             3.74        .642        .881        .389       2.56        1.55        2.27         4.96
HT1B - TC 1  -2.75     -1.01       -1.48        6.80        9.38       -2.67       -3.94        -6.95
             -5.16     -1.35       -1.57        3.30        9.56        -.627      -3.22        -5.58
             5.32       1.48        1.59        4.22        9.64        3.06        3.25         5.66
HT2B - TC 3  -2.45      1.94        4.10        6.70         .770      -1.31       -2.44        -6.39
             -4.56      -.183       3.60        5.26        4.79         .292      -2.06        -4.59
             4.77       1.37        3.46        5.34        5.20        2.05        2.11         4.72
HT3B - TC 5  -5.35     -3.12        -.170       -.150      -1.75       -3.18       -4.56        -7.86
             -6.52     -3.50       -1.72         .208       -.251      -2.50       -3.58        -6.16
             6.60       3.96        1.94         .314        .563       2.60        3.62         6.25
HT4B - TC 9  -2.87     -1.81        -.110        .860       -.710      -1.82       -3.29        -6.19
             -3.24     -2.08       -1.04         .594        .634      -1.88       -2.28        -4.72
             3.29       2.13        1.15         .639        .773       1.92        2.32         4.83
HT5B - TC12  -1.99     -1.06        -.840        .800       -.130      -1.62       -2.81        -6.40
             -1.75     -1.51        -.692       -.142E-01    .834      -1.49       -2.01        -4.64
             1.85       1.55         .768        .358        .964       1.59        2.08         4.75
HT6B - TC15  -1.38     -1.02        -.890        .350       -.800E-01  -1.49       -2.84        -6.11
             -1.26     -1.14        -.964       -.333        .391      -1.30       -1.99        -4.43
             1.30       1.16         .874        .632        .474       1.42        2.06         4.55
ML1B - X671  -351.     -354.       -353.       -352.       -349.       -350.       -347.        -346.
             -336.     -353.       -353.       -353.       -350.       -350.       -348.        -345.
              336.      353.        353.        353.        350.        350.        348.         345.
HP1B - X801  -.279E-01   .813E-02   -.851E-02    .324E-02   -.730E-03   -.168E-02   -.507E-02   -.250E-02
             -.548E-02   .258E-02    .602E-03   -.276E-03    .104E-02   -.162E-02   -.373E-02   -.756E-02
              .396E-01   .806E-02    .468E-02    .322E-02    .150E-02    .193E-02    .384E-02    .764E-02
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Case C

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CALCULATION-TO-EXPERIMENT DATA UNCERTAINTY ANALYSIS FOR NRC/ICAP.
=================================================================

    FIRST LINE  : DIFFERENCE BETWEEN CALCULATED AND (AVERAGED) EXPERIMENTAL DATA AT END OF THE INTERVAL
    SECOND LINE : MEAN DIFFERENCE OVER THE INTERVAL
    THIRD LINE  : MEAN SIGMA OVER THE INTERVAL  (ROOT MEAN SQUARE OF THE DIFFERENCE)

  - CODES -                          - - - - TIME INTERVAL - - - -
 CALC.  EXP.    0.0 - 6.000    - 12.00     - 20.00     - 30.00     - 45.00     - 65.00     - 95.00     - 135.0
-----------------------------------------------------------------------------------------------------------------
 P 1C - P  3      .120E-01   .857E-01    .986E-01    .132        .880E-01   -.109        -.221       -.314
                 -.228E-01   .441E-01    .870E-01    .118        .133       -.760E-01    -.165       -.259
                  .416E-01   .570E-01    .834E-01    .120        .135        .808E-01     .169        .304

 P 2C - P  4      .874E-01   .107        .136        .167        .886E-01   -.804E-01    -.195       -.288
                  .142E-01   .851E-01    .121        .161        .170       -.473E-01    -.131       -.251
                  .385E-01   .864E-01    .122        .162        .172        .706E-01     .135        .253

 P 3C - P  6     1.05        .840E-01    .123        .184        .780E-01   -.874E-01    -.197       -.300
                 1.29        .120        .110        .137        .166       -.523E-01    -.139       -.263
                 1.40        .224        .111        .137        .160        .740E-01     .143        .266

 PD4C - D  4     1.86       1.22        1.09        1.07        2.20        1.80          .215        .134
                 4.36       1.34        1.53        1.06        1.79        3.24          .660        .263
                 6.52       1.36        1.06        1.05        1.80        3.47          .806        .307

 PDLC - D LP      .321       .340        .353        .381        .814       -.310         .190        .184
                  .287       .335        .363        .382        .308        .849E-01    -.240        .100
                  .294       .335        .363        .382        .400        .188         .365        .270

 PDCC - D CO    -1.91      -1.74       -1.13       -2.11       -6.75       -.800E-02    -3.86       -8.93
                -1.58      -2.04       -1.27       -1.80       -3.27       -4.64        -2.41       -8.88
                 1.93       2.05        1.29        1.81        2.59        4.69         2.64        8.96

 PDUC - D UP     -.253      -.265        .247E-01   -.894E-01   -.303       -.209        -.833       -.550
                 -.406      -.249       -.204       -.652E-01   -.492       -.473        -.376       -.464
                  .452       .258        .240        .865E-01    .525        .503         .414        .460

 PDDC - D DC     -.200E-01  -.118       2.21        3.82        8.43        1.07        10.4        12.9
                 -.909       .183E-01   1.09        2.54        6.39        2.40         8.96       11.5
                 1.79        .178       1.31        2.56        6.56        4.15         9.25       11.6

 PDSC - D S6     -.494     -1.48       -1.73       -2.11        -.921       -.390        -.915       -.933
                  .610     -1.16       -1.93       -1.91       -1.98        -.448        -.906       -.929
                 1.76       1.19        1.93        1.82        2.08         .729         .934        .933

 MF1C - X602     -.673E-01  -.467E-01    .109        .819E-01   -.198       -.132        -.241       -.179
                  .120E-01  -.887E-01    .215E-01    .790E-01    .136E-01   -.131        -.139       -.102
                  .735E-01   .804E-01    .820E-01    .780E-01    .811E-01    .263         .143        .185

 MF2C - X603     -.193       .221E-01   -.803       -.850E-01   -.200       -.130        -.264       1.09
                 -.186      -.121       -.131       -.140       -.106       -.202         .807E-01    .369
                  .226       .130        .198        .160        .201        .882         .250        .494

 MF3C - X604     -.232      -.261       -.307       -.242       -.434        .407         .817E-01   -.195
                 -.190      -.247       -.283       -.272       -.293        .630         .126       -.239
                  .213       .247        .283        .275        .298        .746         .212        .267

 MF9C - X607      .966E-01   .101        .830E-01    .823E-01    .410E-01   -.110E-02    -.771E-02   -.103E-01
                  .118       .104        .886E-01    .840E-01    .891E-01    .111E-01    -.204E-02   -.119E-01
                  .184       .104        .887E-01    .849E-01    .101        .168E-01     .408E-02    .173E-01

 MF4C - X610      .151      -.881E-01   -.133       -.252       1.18         .817        1.06        -.840
                  .546       .741E-01   -.980E-01   -.198       -.142         .898         .850        .534
                  .640       .950E-01    .104        .200        .462        1.06          .757        .642

 MF6C - X636     -.606       .800E-01    .802E-01    .200       -.532        .867E-01     .830E-01   -.558E-01
                -6.48       -.279        .126E-01    .165        .243       -.222E-01     .130        .106E-01
                 7.40        .323        .664E-01    .170        .329        .172         .140        .798E-01

 TF1C - T  3     2.11       1.86        2.20        1.17        2.71        1.48         -.270       -4.25
                 1.54       1.81        2.34        2.07        2.29        2.07          .741       -2.61
                 1.58       1.84        2.38        2.15        2.43        2.14          .871        2.89

 TF2C - T 14     1.63       2.76        1.38        3.42        2.70         .270        -3.96       -6.70
                 1.52       2.08        1.57        2.89        3.47         .824        -.711       -3.89
                 1.57       2.11        1.60        2.69        3.93        1.12         1.98         4.15

 TF4C - T 15     2.87       3.79        2.23        2.97        1.80        -.230        -2.89       -5.75
                 1.54       3.50        2.74        2.75        3.06         .445        -1.05       -4.28
                 1.71       3.52        2.82        2.76        3.12         .812         1.43        4.43

 TF3C - T 31    -5.76       6.70        5.80        8.68        3.20       -2.48        -3.46       -8.06
                  .365      3.79        5.28        6.05        8.70       -1.43        -3.32       -6.28
                  .675      4.45        5.37        6.27        8.98        2.05         3.39        8.37

 TF5C - T 34    -2.26      -1.09        -.830       -.190       1.01       -1.02        -3.57       -7.52
                -5.45      -1.71        -.823E-01   -.745       1.51       -1.49        -2.77       -8.81
                 6.12       1.74         .883        .787       1.76        1.79         2.82        8.83

 HT1C - TC 1    -2.70      -1.17       -1.20        8.81        8.87       -3.06        -4.73       -7.93
                -5.12      -1.42       -1.68        2.09       10.0        -1.09        -3.77       -6.84
                 5.28       1.52        1.70        4.02       10.1         5.28         3.81        6.81

 HT2C - TC 3    -2.36       2.06        4.46        6.87         .790      -1.70        -3.25       -7.44
                -4.50       -.840E-01   3.74        5.55        4.97         .151E-01    -2.60       -5.54
                 4.71       1.38        3.60        5.61        5.38        2.11         2.68        5.66

 HT3C - TC 5    -5.25      -2.88         .190        .800E-01  -1.74       -3.55        -5.38       -6.91
                -6.45      -3.78       -1.52         .495       -.747E-01   -2.78        -4.14       -7.11
                 6.54       3.84        1.79         .556        .551        2.09         4.19        7.20

 HT4C - TC 9    -2.78      -1.35         .200        .780       -.740       -2.21        -4.08       -7.18
                -3.19      -1.95        -.826        .873        .703       -2.18        -2.83       -6.68
                 3.24       2.01         .976        .800        .930        2.20         2.89        6.77

 HT5C - TC12    -1.90       -.890        -.230        .730       -.160       -2.01        -3.61       -7.40
                -1.69      -1.38         -.472        .261       1.00        -1.76        -2.57       -5.59
                 1.79       1.42          .597        .426       1.13         1.68         2.64        5.70

 HT6C - TC15    -1.28       -.840        -.700        .870       -.600E-01   -1.86        -3.63       -7.12
                -1.18      -1.00         -.741       -.815E-01    .566       -1.57        -2.53       -5.40
                 1.22       1.02          .764        .404        .635        1.70         2.60        5.80

 QL1C - X671    -351.      -353.       -353.       -351.       -347.       -348.        -344.       -344.
                -336.      -352.       -353.       -352.       -349.       -349.        -346.       -343.
                 336.       352.        353.        352.        349.        349.         346.        343.

 HP1C - X801    -.279E-01   .813E-02   -.851E-02    .324E-02   -.730E-03   -.180E-02    -.807E-02   -.856E-02
                -.840E-02   .258E-02    .602E-03   -.276E-03    .104E-02   -.182E-02    -.373E-02   -.755E-02
                 .396E-01   .808E-02    .468E-02    .322E-02    .150E-02    .193E-02     .384E-02    .764E-02
```

Description for the accompaning date package

```
STUDSVIK
THIS TAPE CONTAINS DATA FROM THE ICAP PREDICTION CALCULATION
WITH THE RELAP5/MOD2/36.04 FOR THE FIX-II EXPERIMENT NO. 3051.


CONTENTS. FILE  1.           THIS DESCRIPTIVE TEXT
                2.           INPUT CASE A. STEADY STATE
                3.              " - "   B.   " - "
                4.              " - "   C. STEADY STATE
                5.           DATA. EXPERIMENT
                6.           "-" . CASE A
                7.           "-" . CASE B
                8.           "-" . CASE C


I.   COMPUTER
       NAME                  CYBER 170-810
       WORD SIZE             60


II.  TAPE FORMAT
       NUMBER OF TRACKS      9
       PACKING DENSITY       1600 BPI
       RECORD SIZE           80
       BLOCKING FACTOR       64
       CODED                 EBCDIC
       CONTROL WORDS         NO


III. DATA FORMAT. FOR EACH OF THE FILES 5 THROUGH 8

       TITLE RECORD(S). (FORMAT I5,A75)
           FIELD 1. THE NUMBER OF DATA CHANNELS ON THE FILE
           FIELD 2. PROBLEM IDENTIFICATION
                    UP TO FIVE ADDITIONAL IDENTIFICATION RECORDS
                    MAY BE ADDED BY 'C' IN COLUMN 1 OF FIELD 2

       DATA SET RECORD 1. (FORMAT 2I5,A60)
           FIELD 1. NUMBER OF DATA POINTS
           FIELD 2. THE ENGINEERING UNIT CODE (EUC) FOR THE
                    VARIABLE
           FIELD 3. IDENTIFYING TEXT OF THE DATA
       REMAINING DATA SET RECORDS FORMAT 5(E16.9)

     EACH DATA CHANNEL SUBMITTED IS GIVEN THROUGH TWO DATA
     SETS. THE FIRST OF WHICH IS THE TIME DATA SET.
     THE TWO SETS HAVE THE SAME NUMBER OF DATA POINTS.
     THE TIME DATA SET IS IDENTIFIED BY EUC=77 (FIELD 2)
     AND THE IDENTIFYING TEXT 'TIME' (FIELD 3).
```

NRC FORM 335
(2-89)
NRCM 1102,
3201, 3202

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(See instructions on the reverse)

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10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

The FIX-II split break experiment No. 3051 has been analyzed using the RELAP5/MOD2 code. The code version used, Cycle 36.04, is the frozen version of the code.

Three calculations were carried out to study the sensitivity of various parameters to the change of break discharge and passive heat structures. The differences between the calculations and the experiment have been quantified over intervals in real time for a number of variables available from the measurements during the experiment.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

RELAP, ICAP Program, Split Break

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