NUREG/IA-0104

International Agreement Report

RELAP5/MOD3 Assessment Using the Semiscale 50% Feed Line Break Test S–FS–11

Prepared by
E. J. Lee, B. D. Chung, H. J. Kim

Korea Institute of Nuclear Safety
P.O. Box 16, Daeduk–Danji
Daejon, Korea 305–353

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

June 1993

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

Published by
U.S. Nuclear Regulatory Commission

Available from

Superintendent of Documents
U.S. Government Printing Office
P.O. Box 37082
Washington, D.C. 20013-7082

and

National Technical Information Service
Springfield, VA 22161

NUREG/IA-0104

International Agreement Report

RELAP5/MOD3 Assessment Using the Semiscale 50% Feed Line Break Test S–FS–11

Prepared by
E. J. Lee, B. D. Chung, H. J. Kim

Korea Institute of Nuclear Safety
P.O. Box 16, Daeduk–Danji
Daejon, Korea 305–353

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

June 1993

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

Published by
U.S. Nuclear Regulatory Commission

NOTICE

This report is based on work performed under the sponsorship of The Korea Advanced Energy Institute of Korea. The information in this report has been provided to the USNRC under the terms of an information exchange agreement between the United States and Korea (Agreement on Thermal-Hydraulic Research between the United States Nuclear Regulatory Commission and The Korea Advanced Energy Research Institute, May 1, 1986). Korea has consented to the publication of this report as a USNRC document in order that it may receive the widest possible circulation among the reactor safety community. Neither the United States Government nor Korea or any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability of responsibility for any third party's use, or the results of such use, or any information, apparatus, product or process disclosed in this report or represents that its use by such third party would not infringe privately owned rights.

RELAP5/MOD3 ASSESSMENT USING THE SEMISCALE

50 % FEED LINE BREAK TEST S-FS-11

Abstract

The RELAP5/MOD3 5m5 code was assessed using the 1/1705 volume scaled Semiscale 50 % Feed Line Break (FLB) test S-FS-11. Test S-FS-11 was designed in three different phases:(a) blowdown phase, (b) stabilization phase, and (c) refill phase. The first objective was to assess the code applicability to 50 % FLB situation, the second was to evaluate FSAR conservatisms regarding SG heat transfer degradation, steam line check valve failure, break flow state, and peak primary system pressure, and the third was to validate the EOP effectiveness. The code was able to simulate the major T/H parameters except for the two-phase break flow and the secondary convective heat transfer rate. The two-phase break flow had still deficiencies. Correlations for the current boiling heat transfer coefficient were developed from the data for flow inside a heated tube, not for flow around heated tubes in a tube bundle. Results indicated that the assumption of 100 % heat transfer upto the liquid inventory depletion was not conservative, the failed affected steam generator main steam line check valve assumption was not conservative. The measured break flow experienced all types of flow conditions. The relative value to the 110 % design pressure limit was conservative. The automatic actions during the blowdown phase were effective in mitigating the consequences. The stabilization operation performed by operator actions was effective permiting natural circulation cooldown and depressurization. The voided secondary refill operations also verified the effectiveness of the operations while recovering the inventory in a voided steam generator.

List of Contents

List of Figures

List of Tables

This report presents RELAP5/MOD3 code assessment calculation using the Semiscale 50 % feed line break (FLB) test S-FS-11 data. The Semiscale test facility was scaled to be 1/1705 in volume and 1/1 in elevation scaled. The code and the experiment data were released from INEL under the auspices of USNRC. Test S-FS-11 was designed in three parts:(a) blowdown phase in which only automatically functioning plant protection systems (0-600 s), followed by (b) an operator controlled stabilization period including pressurizer warm-up heater operation, and a controlled intact loop(IL) steam generator(SG) feed operation (600-4000 s). Test S-FS-11 was concluded with (c) refill phase including break isolation and affected loop(AL) steam generator(SG) refill (4000-8000 s). The first objective was to provide the data base and the code applicability to 50 % FLB, the second was to evaluate the conservatisms used in FSAR such as the assumption of 100 % heat transfer reduction with liquid inventory depletion, the assumption of main steam line check valve failure, the assumption of break flow saturation state untill the inventory depletion, and 110 % of the desing peak primary pressure value. The third was to validate the EOP effectiveness. The code was able to simulate the major T/H parameters except for the secondary side convective heat transfer rate and pressure. The current convective boiling heat transfer correlations were developed from data for flow inside of a heated tube, not for flow around heated tube in a tube bundle. The AL SG auxiliary feedwater was injected earlier due to a rapid depressurization rate of the secondary pressure. The faster decrease in secondary pressure was attributable to the excessive steam exhaust. The secondary side convective heat transfer rate is a function of void and liquid inventory. The liquid

inventory and velocity affect the heat transfer rate significantly. The code overestimated the blowdown peak heat transfer rate probably due to the overestimated steam flowrate. AL SG heat transfer rate was underestimated during the refill phase so that the pressure was underestimated. Based on results it was found that the assumption of the 100 % heat transfer upto the liquid inventory depletion followed by a step change reduction in the heat transfer to 0 % was not conservative but it was estimated closely by the experiment and the code. The failed AL SG main steam line check valve assumption utilized for the C-E Systyem 80 FSAR Appendix 15 B bottom main feed line break calculations was not conservative based on the results of the experiment and the code. The intersecondary communication, due to the failure, produces increased steam flow from the intact SG, which increases or maintains its primary energy removal, thereby reducing the effect of losing the AL SG heat sink. The assumption regarding the break flow state(i.e., that saturated liquid was discharged until no liquid remained at which time saturated steam was discharged) was not appropriate because the measured break flow did not consist of only saturated liquid and saturated steam flow but exhibited a transition through the full range of condition(i.e.,subcooled liquid, to saturated liquid, to two-phase fluid, to saturated steam), and the code underpredicted the maximum flowrate. The estimated peak primary pressure represented a pressure near, but not quite at, 110 % of the design pressure limit. The relative value of 110 % design pressure limit motivated the need to perform best-estimate calculations with a thermal-hydraulic computer code. The major concern with regard to the system recovery from a bottom main feedwater line break accident was the effectiveness of the recovery operations specified in the plant Emergency Operating Procedures in recovering and maintaining control of the plant. The automatic actions

performed by the plant safety systems (SCRAM, SI initiation, MSIV closure)were effective in mitigating the consequence. The stabilization operation performed by operator actions(PZR internal heater operation, normal charging/letdown operation, and IL SG feed operation) was effective in stabilizing the system at conditions that would permit natural circulation cooldown and depressurization. The voided secondary refill operations verified the effectiveness of the operations for maintaining stable condition while recovering the inventory in a voided SG. The EOP-specified operation was very effective in maintaining control of the Semiscale Mod-2C system during these experiments.

ACKNOWLEDGEMENTS

This report was completed under the sponsorship of Korean Ministry of Science and Technology. Dr. Sang-Hoon Lee, President of the Korea Institute of Nuclear Safety, contributed significantly to the administration of the project. Authors would like to express their gratitude to Mr. Dick Schultz and Mr. Hershall Hardy at INEL for managing the ICAP project and for providing the related documents and test data.

1. Introduction

The RELAP5/MOD3 code [1] has been developed by the Idaho National Engineering Laboratory (INEL) under the sponsorship of US Nuclear Regulatory Commission (USNRC) and its frozen version 5m5 was release at the end of 1990. The code has been assessed against various experimental data to provide input to code improvement and user guideline enhancement [2][3]. However, no assessment has been made against the steam generator (SG) bottom main feed line break (FLB) due to the limited data base and the recent release of the code.

One of the objectives from this assessment using the bottom main feed water line break test is to provide data to assist the USNRC in addressing the various concerns regarding this kind of events. The major concerns are the code applicability, conservatisms or assumptions used in FASR calculation, and the effectiveness of Emergency Operating Procedure (EOP) specified for recovering and cooling down the plant [4]. Specific objectives of this study are:

- to provide data base and applicable range of RELAP5/MOD3 5m5 for simulating 50 % feed line bottom break test, S-FS-11
- to evaluate the accuracy and the discrepancy of the code in predicting the TH behavior of the PCS (Primary Coolnat System) and SCS (Secondary Coolant System) during the test, especially focusing on
  - * Two phase break flow
  - * SG secondary pressure and heat transfer rate
  - * PCS pressurization/depressurization and cooldown

- to evaluate conservatisms used in the C-E System 80 FSAR App 15 B FLB calculations such as:
  * SG 100 % heat transfer degradation with 100 % inventory depletion
  * Failed main steam isolation valve(MSIV) check valve assumption
  * Saturation state of the break flow
  * 110 % of design primary pressure
- to validate the effectiveness of EOP during
  * blowdown phase (0-600 s)
  * stabilization phase (600-4000 s)
  * refill phase (4000-8000 s)

This report was prepared to address the above questions. Descriptions of the Semiscale Mod-2C system and test S-FS-11 are given in Chapter 2. The code description, the input modelling and initial and boundary conditions are given in Chapter 3. The results of calculation are discussed in Chapter 4 and the run statistics given in Chapter 5. The conclusions obtained from the present assessment are summarized in Chapter 6.

2.1 Facility Description

The Semiscale Mod-2C system configuration is illustrated in Fig. 1. The system is scaled from a reference four-loop PWR system based on the core power ratio, 2 MW/3411 MW [4]. Component elevations, dynamic pressure heads, and liquid distribution were maintained as similar as practical. The two-loop test configuration consisted of the vessel with a 25-rod electrically heated core with external downcomer, tube-and-shell steam generators and associated loop piping with circulation pumps. The affected loop (the loop in which the feed line break occurs) is scaled to represent one loop of a four-loop PWR. The Semiscale feedwater and feed line break Experiment Operating Specification contains more detailed information about specific components.

The facility configuration required for the FS Test Series is the Semiscale Mod-2C system. The Mod-2C system consists of the Mod-2B system with several modifications. A new "Type III" AL SG, new main steam line and feedwater line break assemblies, break effluent catch tank, and refined SG control systems have been incorporated into the system for this test series. A letdown line has been added to provide better control of primary system inventory. Scaling criteria specific to Test S-FS-11 are contained in the EOS Appendix [6]. The Type III AL SG design incorporates a downcomer which is external to the tube bundle and riser section (Fig. 2).

The bottom feedwater line break assembly for the AL SG consists of a break

flow nozzle and instrumentation to measure single-phase and two-phase break mass flows as well as fluid density, pressure and temperature. The break nozzle is interchangeable to allow simulation of a wide range of break sizes. For S-FS-11 a nozzle size of 0.609 cm was used to simulate the 50 % break size. Simulation of the MSIV closure will be realized by closing a valve in the connecting "crossoverline" between the SG's. Letdown simulation consists of a valve line connected to the AL cold leg, in which the flow rate is 0.01081 kg/s. Heat loss makeup is accomplished by using external heaters distributed fairly uniformly throughout the Semiscale system. Pressurizer internal heater simulation for Test S-FS-11 consisted of the system warmup heaters supplying 7.10 kW to maintain a primary system subcooling.

2.2 Test Description

Test S-FS-11 simulated a pressurized water reactor transient initiated by a 50 % break in a steam generator bottom feedwater line [5]. The accuracy of the measured parameters was summarized in the Appendix S-FS-11 of the experiment operating specification for the Seimscale Mod-2C feedwater and steam line break experiment series [6]. With the exception of primary pressure, the initial conditions represented those used for the C-E System 80 [7]. The reactor and turbine trip signals (SCRAM) were assumed to be generated by a high pressure signal. Loss-of-offsite power (LOP) was simulated to occur concurrently with SCRAM. The safety injection (SIS) and MSIV closure signals were assumed to be generated by a low steam generator pressure signal. SIS initiated the high pressure injection sytem (HPIS) and

auxiliary feedwater injection signals. The test was designed in three parts:(1)blowdown phase (0-600 s), (2) stabilization phase (600-4000 s), and (3) refill phase (4000-8000 s).

The test was initiated at t=0 s by opening the valve in the break assembly in the affected loop (AL) steam generator (SG). The simulated bottom feedwater line break (FLB), in conjunction with the simulated AL SG main steam line check valve failure, produced pressure drops and inventory losses in both SG secondary sides. Table 3 contains a sequence of events listing for S-FS-11. The first 600 s of the transient consisted of automatically occurring events such as main feedwater termination, core power decay initiation, normal steam flow control valve closure initiation, and HPIS flow initiation. The main feedwater was terminated at break initiation. The initiating event for the core power decay, normal steam flow control valve closure, and main coolant pump trip actions was a reactor and turbin trip (SCRAM) signal, due to a high pressurizer pressure of 15.86 MPa (2300.00 psia), compounded by a simulated LOP concurrent with the SCRAM signal. The initiating event for the MSIV closure action, and the auxiliary feedwater and HPIS initiation (SIS) actions was a low AL SG steam dome pressure of 4.47 MPa (648 psia). The recovery procedures for Test S-FS-11 consisted of: a) stabilization of the plant at the specified pressures, temperatures, and levels, using normal charging/letdown operations, pressurizer heater operation, and intact loop (IL) SG feed operation, and b) AL SG refill with auxiliary feedwater, while maintaining pressurizer level.

The plant stabilization procedure started at 600 s, the simulated time required for operator identification of the feed water line break event. The

AL SG auxiliary feedwater flow was terminated at 600 s. The pressurizer warm-up heaters, supplying 7.10 kw were cycled for 322 s at 120 s after the AL SG auxiliary feedwater termination to reestablish and maintain the primary system subcooling between 27.8 and 33.3 K. Safety injection (HPIS) flow termination criteria were satisfied at about 900 s with the primary system subcooled margin at 27.8 K and the pressurizer level at 250 cm. Since the primary system pressure remained above the 12.32 MPa HPIS shutoff head prior to HPIS flow termination, no HPIS flow injection occurred during the test. Charging flow was cycled, beginning at about 1062 s, to maintain the pressurizer level at 245 cm. Auxiliary feedwater flow was used to re-establish and maintain the IL SG secondary level between 910 and 1000 cm. The IL SG simulated atmospheric dump valve (ADV) was available to maintain the secondary pressure at < 6.98 MPa but was not needed. The plant was considered to be stabilized at 4055 s when the IL SG level reached 910 cm with all other stabilization criteria satisfied. No primary system voiding was produced during the stabilization phase of the test and all external heaters remained at full power throughout this part of the transient.

Following plant stabilization (4055 s) the AL SG refill was initiated by isolating the feedwater line break (4100 s) and commencing AL auxiliary feedwater (4100 s). The AL primary coolant pump was run at minimum speed starting at 4450 s to provide measurable primary tube flow rates for use in evaluating primary-to-secondary heat transfer during the refill phase. IL auxiliary feedwater was terminated at 5038 s when the IL SG secondary level had increased to 1000 cm. Normal charing flow was cycled throughout the refill phase to maintain the pressurizer level. AL auxiliary feedwater was

terminated upon meeting the refill criterion of 1036 cm at 7675 s. The test was terminated at 7700 s.

3. Code and Modelling Description

3.1 Code Description

RELAP5/MOD3 Version 5m5 [1], released by USNRC, was used in the present assessment calculation with Test S-FS-11. The features changed from the RELAP5/MOD2 were described in Reference [2].

3.2 Input Modelling

A standard input deck of Semiscale SBLOCA Test S-LH-1 for RELAP5/MOD2 was received from INEL in January 1991. The deck was modified for RELAP5/MOD3 to simulate the Semiscale SBLOCA Test S-NH-1 [8]. The conversion principle was based on the philosophy applied to model ROSA SBLOCA Test SB-CL-18 in Japan[9]. Some modifications were made as follows:

- Modeling options related to volume, junction, heat structure were properly modified to work with RELAP5/MOD3 [1].
- For steady state run, the following set points were changed:
  * IL feed/steam flowrate control to keep the inventory (103 kg) constant
  * BL feed/steam flowrate control to keep the inventory (26 kg) constant
  * PZR inlet/outlet flowrate control to keep the level (484 cm) constant
  * RCP speed control to keep flowrate (9.4 kg/s for IL and 3.3 kg/s for AL)
- For steady state run, the test specific trips were deleted out.
- A restart transient input data was developed by deleting steady state controllers and changing the test specific trips to be activated.

As in the nodalization diagram of Fig. 3, the Semiscale system was nodalized by 181 volumes, 174 junctions and 256 heat structures after implementing the items stated above. A steady state input deck and a transient input deck were provided in Apperdice A and B of this report.

3.2.1 Primary Coolant System Modelling

The PCS composed of an intact loop and a broken loop, the former included a hot leg, a loop seal, a pump suction tee, two PCPs and a cold leg. The intact loop was modelled by 13 hydrodynamic volumes. All piping metal structures exposed to environmental atmosphere were simulated by the heat structure to consider the associated heat loss. The detailed information can be found in Fig. 3. The volume and junction modelling options were set with default options.

3.2.2 Reactor Vessel Modelling

The Semiscale vessel was modelled by a downcomer annulus, a lower plenum, an active core, a core-bypass flow path, an upper plenum, an upper head. The active core and the downcomer were modeled by 6 volumes and 10 volumes stacked vertically, respectively. The rod bundle interphase friction model option was selected for the active core volumes. The axial power shape was described according to the reference [8]. The ANS-79 model was used for a decay heat simulation, which was changed from ANS-73 model in the posttest calculation.

3.2.3 Pressurizer Modelling

The pressurizer system was modelled by a surgeline, a pressurizer vessel, a spray line from the cold leg, a spray valve and an experiment PORV. Three volumes for the surge line, eight volumes for the vessel and one volume for the spray line were used, respectively. The spray valve and the PORV were simulated by the trip valves. The associated trip logics were prepared according to the experimental specification [5]. To consider the environmental heat loss from the pressurizer vessel wall, the vessel wall was modelled by nine heat structures.

3.2.4 Steam Generator Modelling

The steam generator consisted of a SG inlet plenum, U-tubes, an outlet plenum, a main feedwater tank and feed line, auxiliary feedwater tank and feed line, a feedwater inlet annulus, a SG secondary side downcomer, a boiler section, a separator inlet annulus, a separator, a steam dome, a steamline, a MSIV, MSCV, a MSCV downstream piping and a air-cooled condenser. The number of volumes used for each flow path is given in Fig. 3. The separator section in SG was modelled by a branch component with dead end in outlet side and a SEPARATOR component with inlet junction from the adjacent branch component.

The heat transfer area of U-tube heat structure in the intact loop SG generally affects the initial conditions in the SG secondary side. According to the previous Semiscale calculations using RELAP5/MOD2 [8], the predicted

pressure in SG secondary side were generally underpredicted by 0.4 MPa. This discrepancy may be due to the underestimation of heat transfer area in the SG U-tube.

3.2.5 Others

The emergency core cooling system (ECCS) in Semiscale was also modeled. Fig 3 and Appendix A provide a detailed information of ECCS. The containment was also modeled by a time-dependent volume with a constant pressure.

3.3 Initial and Boundary conditions

To obtain all initial conditions of the whole system prior to the transient, a steady state run was made with three steady state controllers as stated above. The result obtained from the steady state run was compared with the measured initial conditions in Table 1. The agreement between the measured and the predicted values for initial conditions is fairly good.

4. Calculation and Discussion

A transient calculation using the input modellings, initial conditions and boundary conditions stated in Chapter 3 was made with the RELAP5/MOD3 5m5 code. This chapter presents the results obtained from the transient calculation and compare the results with the measured data to assess the code applicability. Table 2 shows the predicted sequence of event along with the measured values. The detailed discussion of the comparison is provided for the following three phases:

1) blowdown phase (0-600 s)
2) stabilization phase (600-4000 s)
3) refill phase (4000-8000 s)

4.1 Blowdown Phase (0-600 s)

The blowdown phase is defined as the time interval between break initiation to a time when all automatic actions are completed and operator action is prepared. The measured and calculated break flow rates are compared in Fig. 4. The code underestimates the break flow rate for the first 20 s following the break initiation and also underestimates the maximum break flow rate. The code, however, overestimates the break flow rate from 20 s to 250 s because of the overestimated AL SG liquid inventory. The subcooled break flow rate is quite underestimated but the two-phase break flow rate is overestimated with this modeling. Fig. 5 shows the transient of the density

before break in the AL SG. The density decreases rapidly and increases again as the auxiliary feeding flow is injected. The code predicts the trends of the density properly so that the deficiency of the two-phase break flow model is not related to the poor prediction of the density. The crossover line valve is closed at 240 s, which simulates the failed MSIV failure allowing the intersecondary communicating flow rates between the SG's. The closure of the valve causes the AL SG steam dome pressure to decrease to zero (Fig. 9) and the IL SG steam dome pressure to increase again to its initial value (Fig. 19). The outgoing flow from the AL SG is increased by this flow in the crossover line. Fig. 6 shows the AL SG feed flow rate, which is terminated at 30 s and the trend is predicted fairly well. Fig. 7 shows the AL SG auxiliary feed flow rate, which is actuated by the AL SG secondary low pressure (4.47 MPa). The code predicts an earlier initiation time due to an overestimation of the AL SG steam flow rate (Fig. 8) and the rapid decrease of the AL SG secondary pressure (Fig. 9). Fig. 10 shows the AL SG secondary liquid mass inventory. The code predicts it closely during the first 20 s but overpredicts afterwards because of the early injected auxiliary feed flow rate and earlier closure of the steam valve. Fig. 11 shows the trend of the AL SG downcommer liquid level and the code underestimates the level as the pressure does. Fig. 12 shows that the AL SG heat transfer rate predicted by the code is fairly good. Fig. 13 shows the IL SG heat transfer rate, which is overpredicted due to the overestimated steam flow rate during the first 20 s. The AL SG secondary pressure decreases more quickly due to the steam flow rate. The lower decay power (Fig. 14) also caused not to repressurize and the crossoverline valve

closure affects the AL SG pressure to approach zero. Fig. 18 shows the trend of the IL SG secondary downcommer level. The code follows the trends of the measured values except for the timing due to the auxiliary feed initiation. Fig. 19 also shows the trend of the IL SG secondary pressure, which is underestimated by 1 MPa due to the earlier injection of the IL auxfeed flow (Fig. 16). The pressure ,however, becomes be stable after the crossoverline valve is closed at 200 s. The code underestimates, during the first 20 s, the IL SG secondary pressure probably due to the overestimated steam flow (Fig. 17). The overestimated steam flow causes to increase the IL SG heat transfer rate during the first 20 s. The failed main steam control line check valve assumption is not conservative since the communicating flow between the SG's increases the cooling capability. Alos, the assumption of saturated state in break flow is not appropriate since the actual break flow experiences all types of the conditions. The value of 110 % primary pressure is found to be quite overestimated resulted from the improper assumptions. Fig. 21 shows the PZR liquid level and the level rises during the first 40 s because the heat sink capability is lost. Again, the level decreases after SCRAM and stays at 235 cm when auxiliary feeding starts. The normal charging set point of the PZR is 235 cm and the normal letdown set point is 255 cm. Fig. 22 shows the PZR pressure and the code predicts them fairly well except for the timing, which is related again to the rapid depressurization of the secondary pressure. The code also underpredicts the pressure due to the earlier injected auxiliary feed water flow rate. The charging contributes to repressurize, around 700 s, and the rate of the repressurization increases due to the internal heater operation

(Fig. 23). Fig. 26 shows the PZR saturation temperature and the code predicts fairly well. Fig. 27 shows the ILHL liquid temperature and the code underpredicts due to the earlier injection of the auxiliary feeding flow rate. The magnitude of the underestimation is about 20 K at around 100 s, which influences the subcooled margin to diverge as shown in Fig. 28. Fig. 29 shows the trend of upper plenum pressure. The trend is almost same as the one of the PZR pressure (Fig. 22). A SI signal is actuated by the SG low pressure but no flow is introduced into the system because the HPIS pump produces no flow at that pressure range. Fig. 30 and 31 show the trend of the AL and IL flow rate and the code predicts the RCP coastdown fairly well as can be seen in Fig. 32 and 33. The upper plenum temperature (Fig. 34) and the lower plenum temperature (Fig. 35) are underestimated by 20 K at around 600 s. Fig. 38 shows the trend of the IL SG secondary liquid void fraction and the upper part still has some liquid which enhances the heat transfer. However, Fig. 39 shows the trend of AL SG liquid void fraction, which decreases rapidly.

4.2 Stabilization Phase (600-4000 s)

The stabilization phase of Test S-FS-11 is defined to extend from 600 s to when criteria for a pressurizer liquid level (235-255 cm), primary subcooling (>27.8 K) and IL SG secondary pressure (<6.98 MPa) and liquid level (910-1000 cm) are met. These criteria are met at 4055 s in the test and predicted at 4000 s by the code.

Fig. 48 shows the PZR liquid level staying at 245 cm and the code predicts

the depressurization and the cooldown as in the trend of the PZR pressure (Fig. 49) and the ILHL liquid temperature (Fig 50). The calculated PZR pressure from 1000 s to 2000 s is overpredicted due to the earlier injection of the charging flow (Fig. 24 and 25). During the stabilization phase, the AL SG auxfeed is not operated so that the AL liquid mass inventory and SG downcommer level stays at zero level. Fig. 41 shows the AL SG secondary pressure staying at 0.1 MPa prior to the following refill phase. Fig. 45 shows the trend of IL SG auxiliary feed water flow rate feeding until 4500 s. Fig. 46 shows the IL SG secondary downcommer level. The level increases to 955 cm due to the feeding. Fig. 47 shows the IL SG secondary pressure approaching 6.98 MPa. The trend of the IL SG secondary downcommer level and the IL SG secondary pressure justifies the effectiveness of the EOP, indicating a safe operation with depressuriztion and cooldown as in Fig. 49 and 50.

4.3 Refill Phase

The refill phase of Test S-FS-11 is defined as the time interval from 4000 s to the end of the test at 8000 s. The refill phase starts with the initiation of the AL SG auxiliary feed water flow rate. This phase ends with the increased AL SG secondary pressure and the liquid level. The liquid level increases rapidly because the calculated aux feed is instated once but not cycled as in the measured. The final primary system pressure (Fig. 49) is underestimated because the secondary heat removal period is presumably extended longer than the measured (Fig. 40). The overestimated heat sink

contributed to the underestimation of the AL SG pressure. The IL SG secondary pressure ,however, is overestimated because the calculated IL SG aux feed is terminated earlier, the level is lower, and vapor is generated as in Fig. 47.

The code underestimates the AL SG secondary pressure (Fig. 41) due to the underestimated AL SG heat transfer rate (Fig. 42). The heat transfer rate is generally function of liquid inventory and void fraction. The IL SG secondary heat transfer rate is well predicted as the void varies (Fig. 57). The code predicts the heat transfer rate to decrease as the void decreases and the liquid inventory increases. This result is contrary to the one in the blowdown phase. The reason for this comes from the fact that the convective heat transfer correlation was developed for a flow inside tube not for a flow around heated tubes in a tube bundle [4]. EOP with the AL SG auxiliary feed water flow operation is validated with a voided SG refill because primary coolant system stably depressurizes and cools down. The trend of primary subcooled margin is properly predicted considering the scale of the plotting and the underestimation of the ILHL liquid temperature (Fig. 50).

5. Run Statistics

The main frame computer used in the present calculation was a CRAY-2S in System Engineering Research Institute (SERI), Korea under UNICOS as a operating system. Fig. 36 and 37 present the plots of the time step size and the CPU time for the transient time in the calculation from 0 to 1000 s. And Fig. 55 and 56 show the time step size and the CPU time used from 1000 s to 8000 s. The grind time can be calculated as follows:

Computer time, CPU = 1754+ 5059 = 6814

Number of time step, DT = 12250+28307 = 40557

Number of volume, C = 181

Transient real time, RT = 8000 (sec)

Grind time = CPU x 1000 / (C * DT) = 0.9080 CPU m sec/vol/step

6. Conclusions

The RELAP5/MOD3 5m5 code was assessed using the Semiscale test S-FS-11 for simulating the 50 % FLB. The assessment was performed in three different phases:(1)blowdown phase, (2)stabilization phase, and (3)refill phase. The calculated results were compared with the measured data to address the following questions:

- Code applicability to Semiscale FLB Test S-FS-11
- Code/Modeling deficiency
- FSAR conservatism evaluation
  - 100 % SG heat transfer degradation
  - failed MSIV
  - saturation state of break flow
  - 110 % of primary peak pressure
- EOP effectiveness

Main conclusions obtained from this assessment are:

- RELAP5/MOD3 5m5 can simulate Test S-FS-11 and the code can predict full scale PWR plant system response.
- The code underestimated the subcooled break flow rate and the maximum break flow rate. The two-phase break flow rate model still has some deficiency
- The SG secondary pressure and heat transfer rate were underestimated due to the fact that the initial phase steam flow was quite overestimated and

the boiling heat transfer correlation was developed for a flow inside tube not for a flow around heated tubes in a tube bundle.

- The modeling technique regarding the IL steam valve and recycled charging/letdown should be improved to match the measured data more closely.
- The assumptions and simplifications made for FSAR accident calculations were evaluated.

First, the assumption made for the bottom main feed water line break calculations regarding the reduction of heat transfer with liquid inventory (i.e., 100 % heat transfer until the liquid inventory is depleted followed by a step change reduction in the heat transfer to 0 %) is not conservative at all for the Semiscale Type III SG FLB case. The assumed heat transfer degradation actually closely simulated the heat transfer rate according to the inventory loss.

Second, the failed affected SG MSIV assumption utilized for the C-E System 80 FSAR was not a conservative assumption because the intersecondary communication, that occurs due to the failure, produces increased steam flow from the IL SG, thereby increasing heat sink capability.

Third, the assumptions regarding the break flow state (i.e., that saturated liquid was discharged until no liquid remained at which time saturated steam was discharged) was not appropriate because the measured break flow did not consist of only saturated liquid and saturated steam flow, but exhibited a transition through the full range of conditions(i.e., subcooled liquid, to saturated liquid, to two-phase liquid, to saturated steam).

Four, the estimated peak primary pressure represent pressures near, but not quite at, 110 % of the design pressure limit. So the need for performing

this best estimate calculation is justified.

- The effectiveness of EOP-specified operation was validated in three phases:

First, the automatic action performed by the plant safety systems (i.e., SCRAM, SI termination, and MSIV closure) was effective in mitigating the consequences.

Second, the stabilization operation performed following operator identification of the transient(i.e., SI termination, PZR internal heater operations, normal charging/letdown operations, and IL SG feed operation) was effective in stabilizing the system at conditions that would permit a natural circulation cooldown and depressurization.

Third, the voided secondary refill operations performed following the stabilization phase were verified to be the effectivenes of the operations for maintaining stable conditions while recovering the inventory in a voided SG with the AL SG auxiliary feed water flow rate

References

1. EG&G, RELAP5 Input Data Requirements, Appendix A to RELAP5/MOD3 Code Manual, January 1990.
2. W. Weaver, Improvement to the RELAP5/MOD3 Choking Model, EGG-EAST-8822, December 1989.
3. Guidelines and Procedures for the International Code Assessment and Applications Program, NUREG-1271, April 1987.
4. T. J. Boucher, Results of Semiscale mod-2C Feedwater and Steam Line Break (S-FS) Experiment Series: Bottom Main Feedwater Line Break Accident Experiments, NUREG/CR-4898, EGG-2503, Feb 1988.
5. M. P. Plessinger, Quick Look Report for Semiscale mod-2C Test S-FS-11, EGG-RTH-7103, November 1985.
6. T. J. Boucher, W. A. Owca, Appendix S-FS-11 of the Experiment Operating Specification for the Semiscale mod-2C Feedwater and Steam Line Break Experiment Series, EGG-SEMI-6909, June 1985.
7. CESSAR-80, Final Safety Analysis Report, Appendix 15B, Combustion Engineering Company.
8. E. J. Lee et al, RELAP5 Assessment Using Semiscale SBLOCA Test S-NH-1, Submitted to INEL and USNRC, Mar 1991.
9. S. H. Lee et al, RELAP5 Assessment Using LSTF SB-CL-18, Submitted to INEL and USNRC, Feb 1991.

Table 1. Initial conditions for Test S-FS-11

Parameter	Measured	RELAP5/MOD3
Pressurzer pressure (MPa)	15.03	15.02
Core power (MW)	2.18	2.18
Core DT (K)	36.7	36.8
PZR liquid level (cm)	484.0	484.0
CL loop temperature difference (K)	4.5	3.8
CL fluid temperature (K)	568	572
IL primary flow rate (L/s)	9.4	9.4
AL primary flow rate (L/s)	3.3	3.3
IL SG secondary pressure (MPa)	6.27	6.24
AL SG secondary pressure (MPa)	6.23	6.22
IL SG secondary inventory (kg)	103	103
AL SG secondary inventory (kg)	26.0	26.3
IL SG feed flow rate (kg/s)	0.86	0.82
AL SG feed flow rate (kg/s)	0.24	0.25
IL SG feed temperature (K)	485.0	485.0
AL SG feed temperature (K)	481.0	481.0

Table 2. Sequence of events for Test S-FS-11

Event	Description	Measured (sec)	Calculated (sec)
Transient initiation		0.0	0.0
PZR pressure = 15.8 MPa	T=Tscram	23.0	24.0
RCP coastdown		25.0	26.0
Power decay		26.5	24.0
MSCV close		26.5	24.0
AL SG steam pressure = 4.47 MPa	T=Tsis	209.0	165.0
Aux feed initiation		211.0	165.0
HPIS initiation		211.0	165.0
Crosover line valve close		214.0	214.0
PZR heater (on/off)		(731/1053)	(731/1053)
AL SG aux feed restart		4100.0	4100.0
AL RCP restart		4450.0	4450.0
IL aux feed termination		5038.0	4500.0
Test termination		7600.0	7600.0

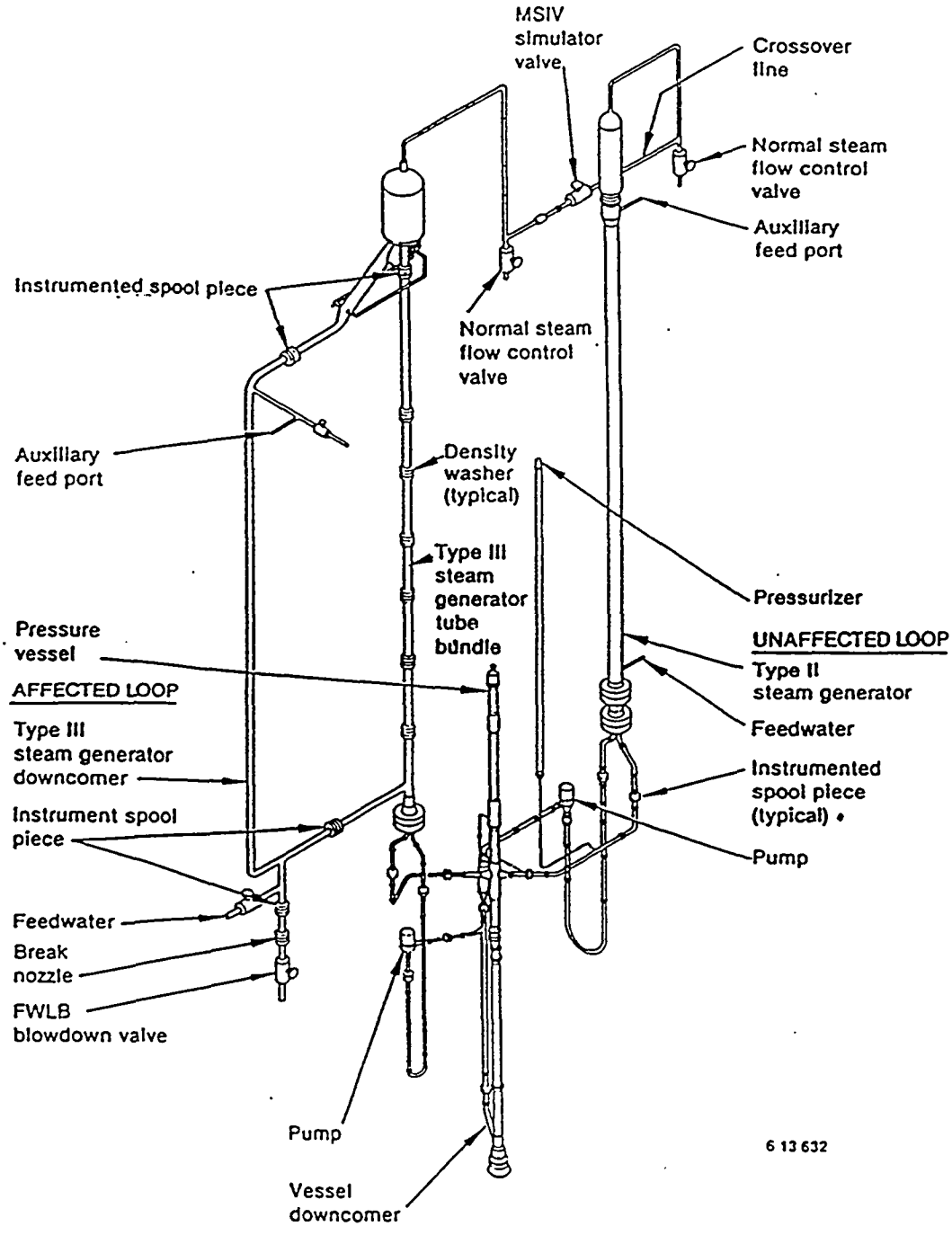


Fig.1 Axonometric configuration of Semiscale Mod-2C

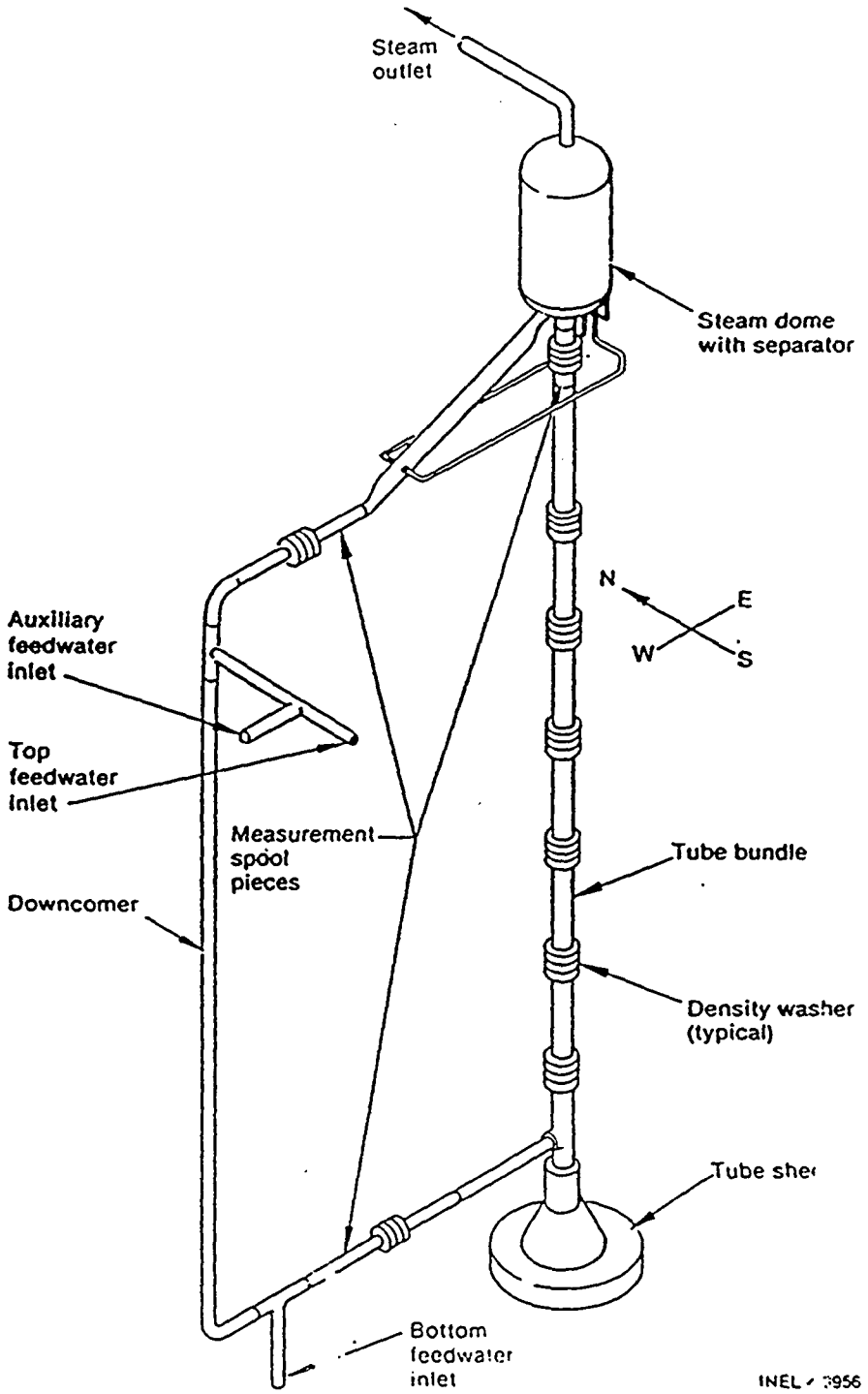


Fig.2 Semiscale Type III Affected Loop (AL) SG Configuration

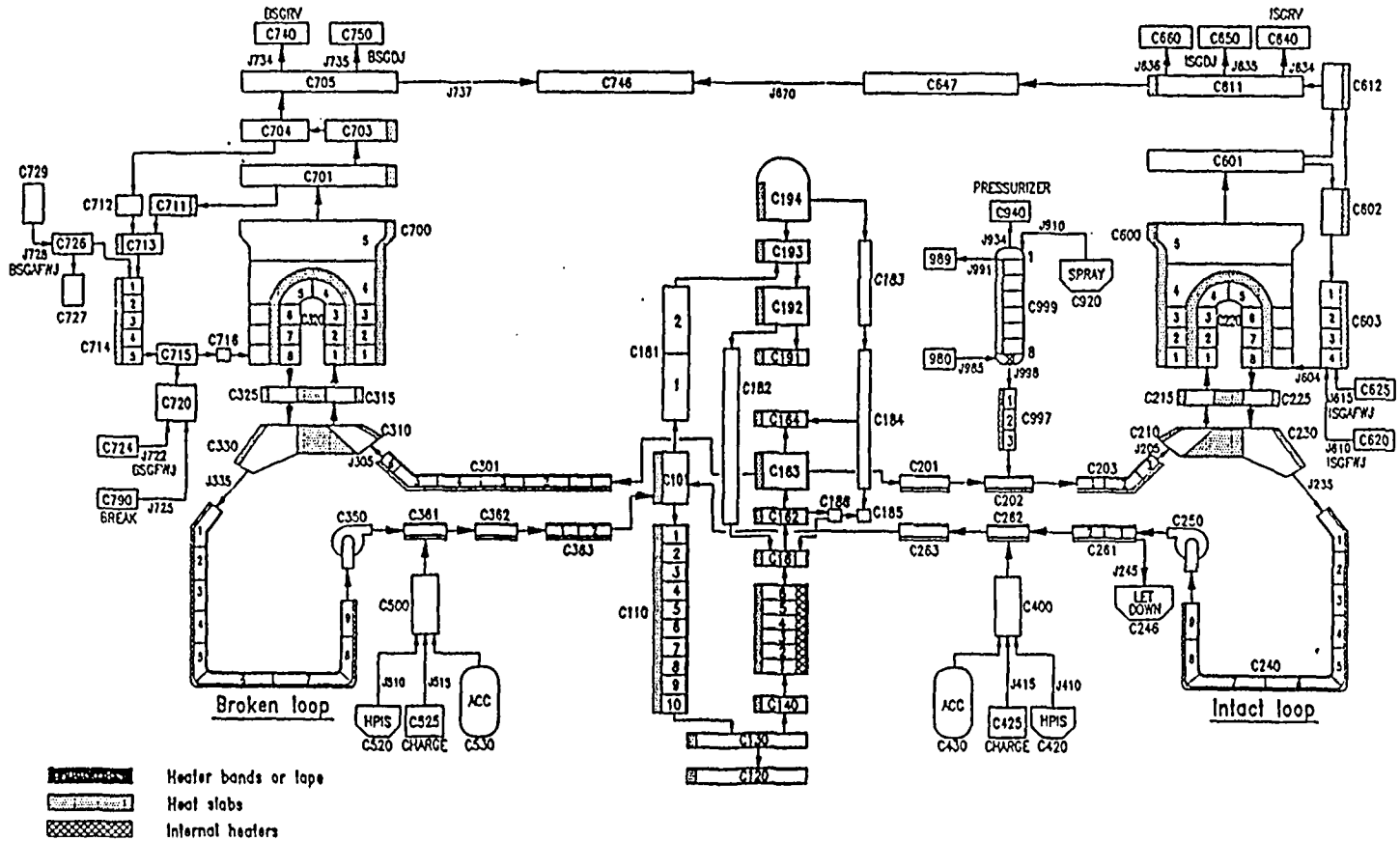


Fig.3 RELAP5 Nodalization for Semiscale Test S-FS-11

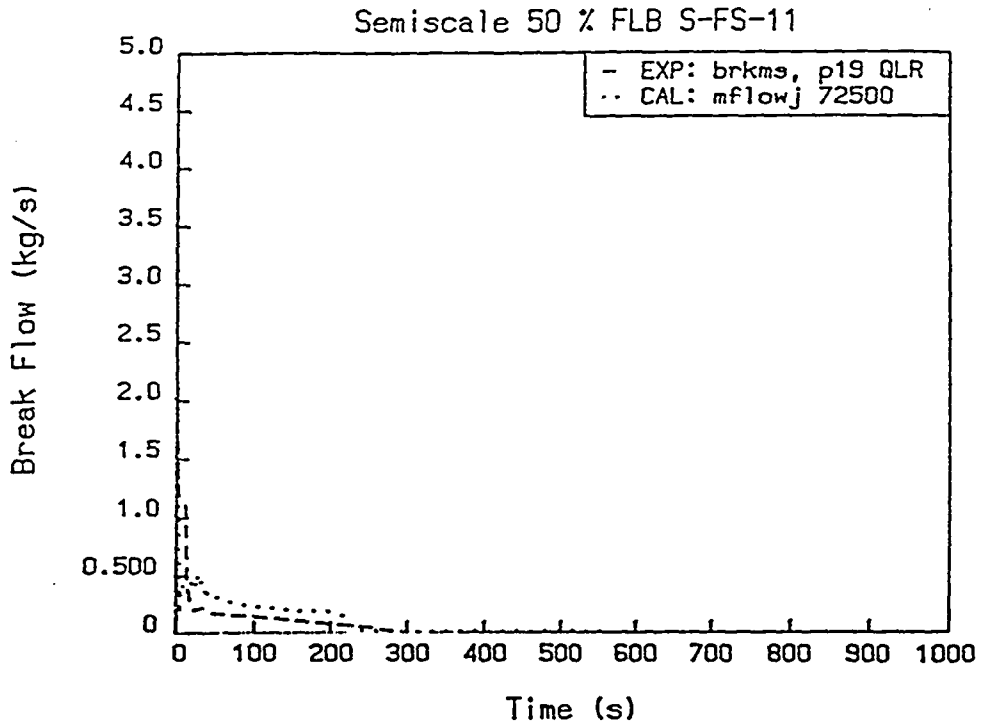


Fig.4 Affected Loop (AL) SG feedline break mass flowrate(0-1000s)

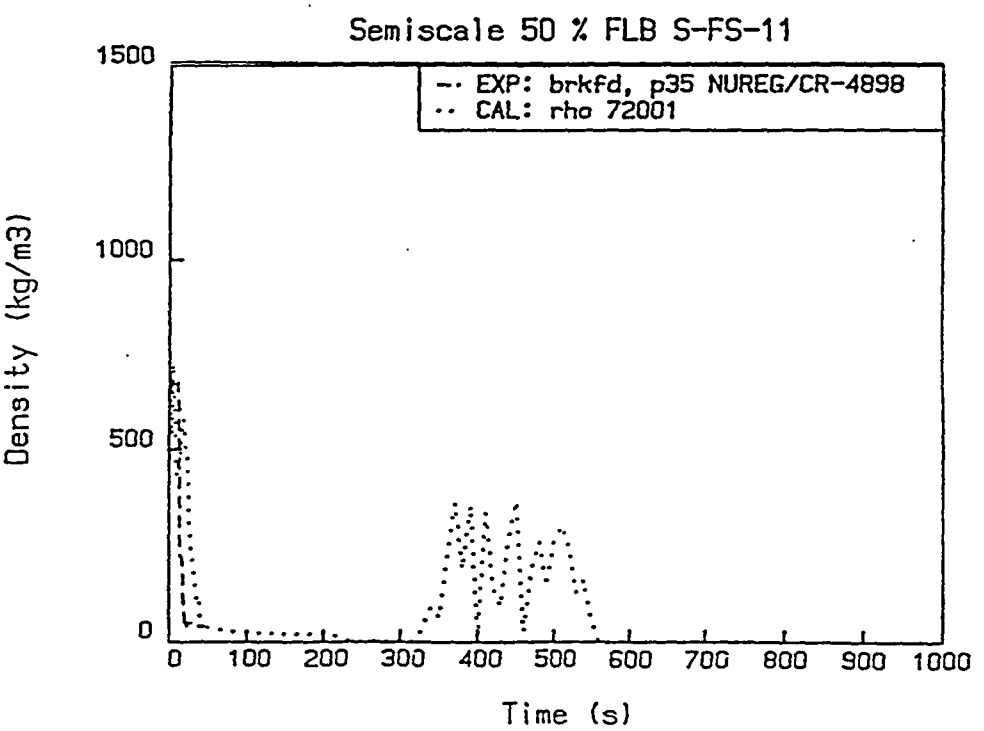


Fig.5 AL SG density before break

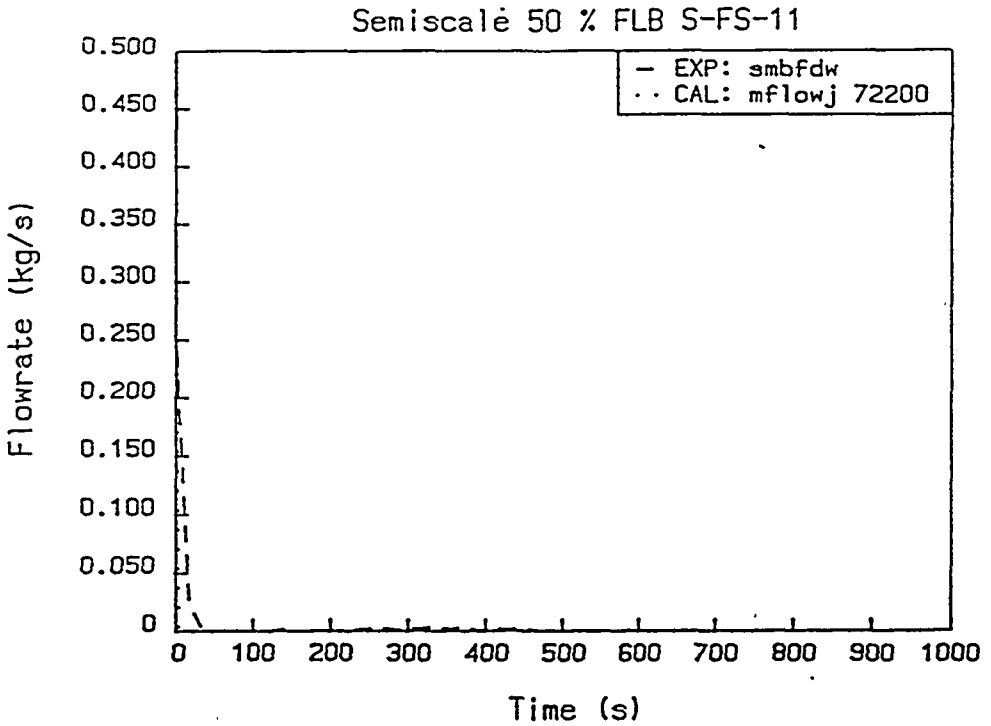


Fig.6 AL SG feed flowrate

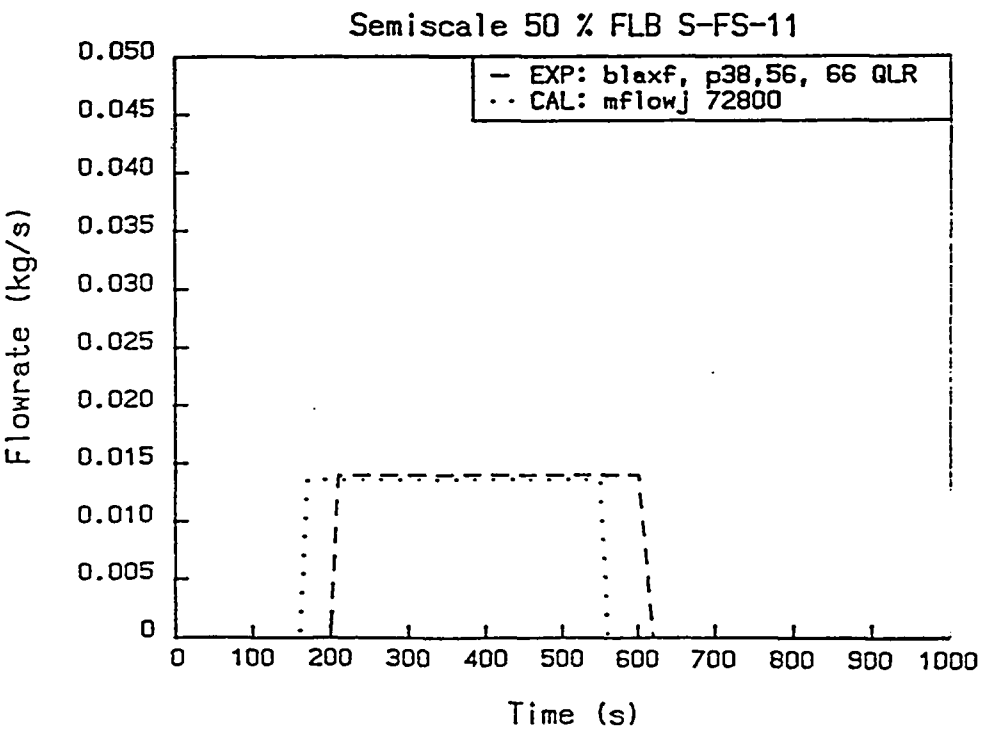


Fig.7 AL SG auxfeed flowrate

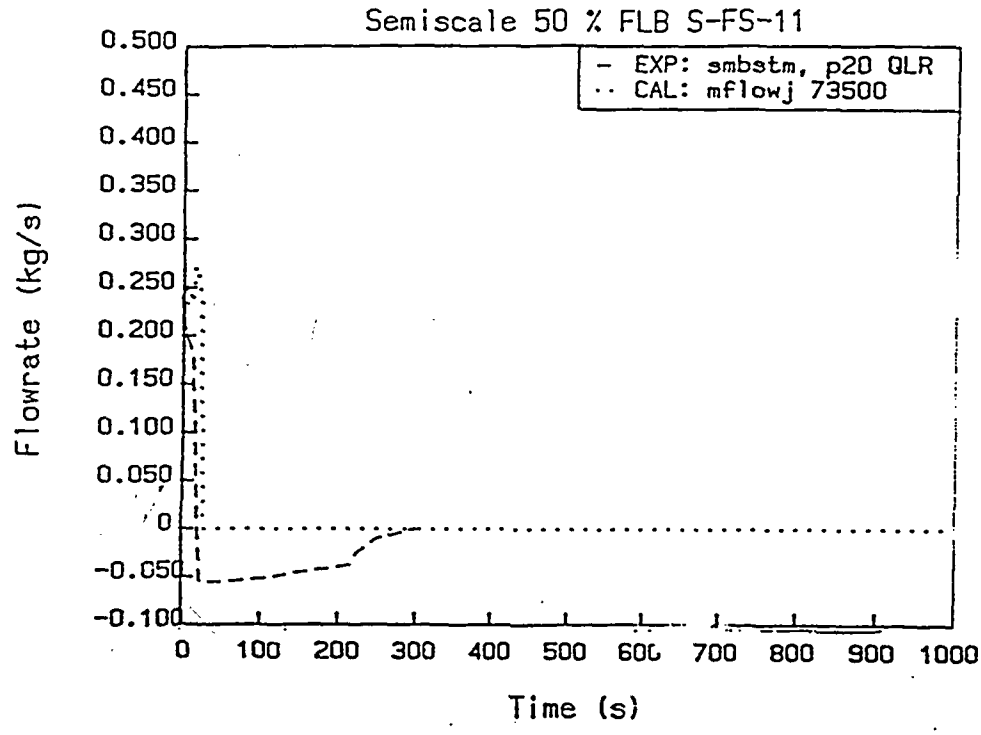


Fig.8 AL SG steam flowrate

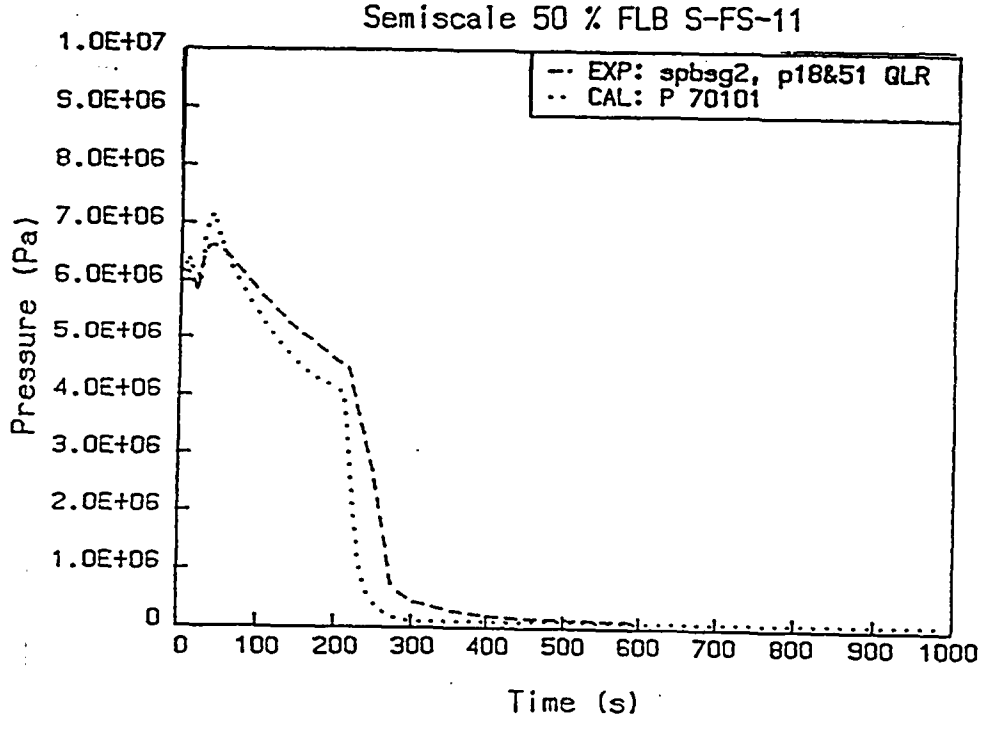


Fig.9 AL SG secondary pressure

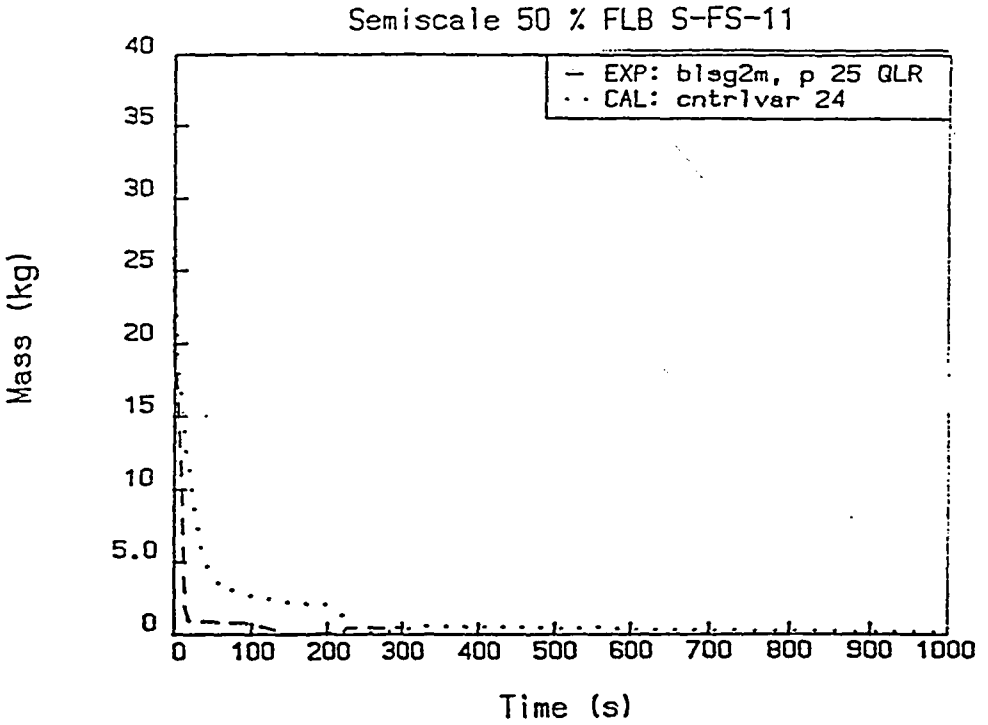


Fig.10 AL SG liquid mass inventory

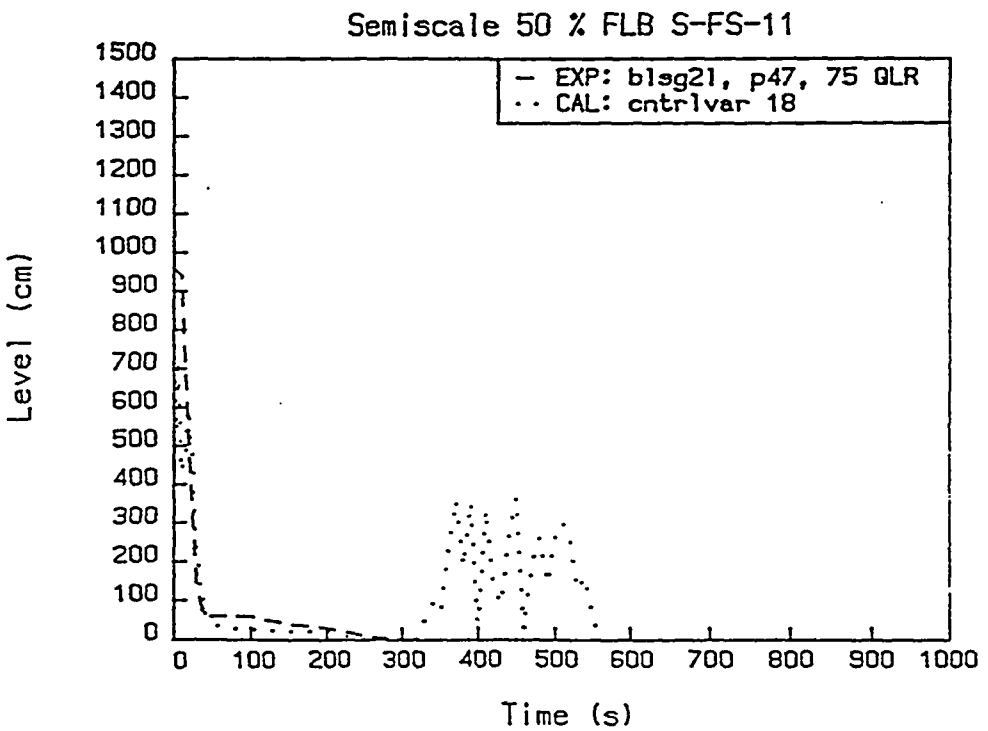


Fig.11 AL SG downcommer liquid level

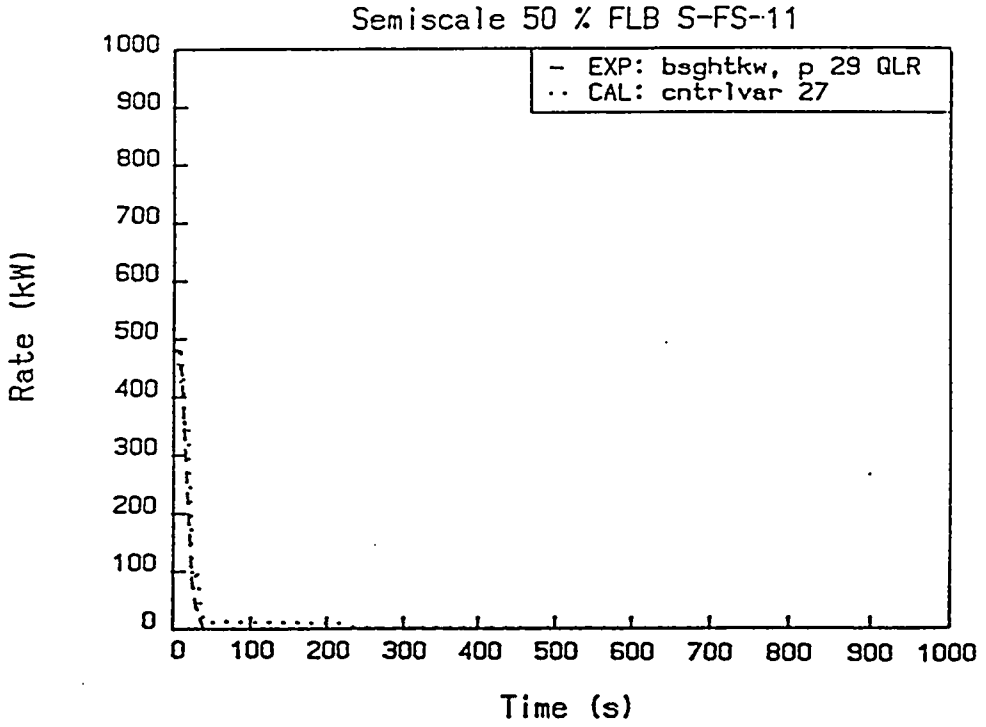


Fig.12 AL SG heat transfer rate

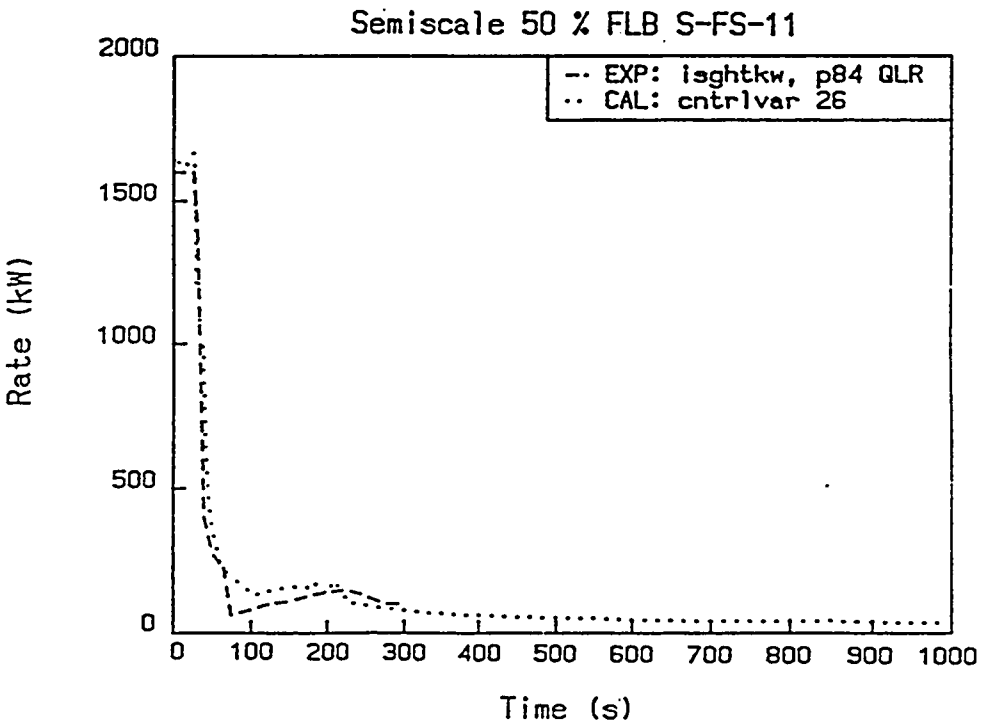


Fig.13 IL SG heat transfer rate

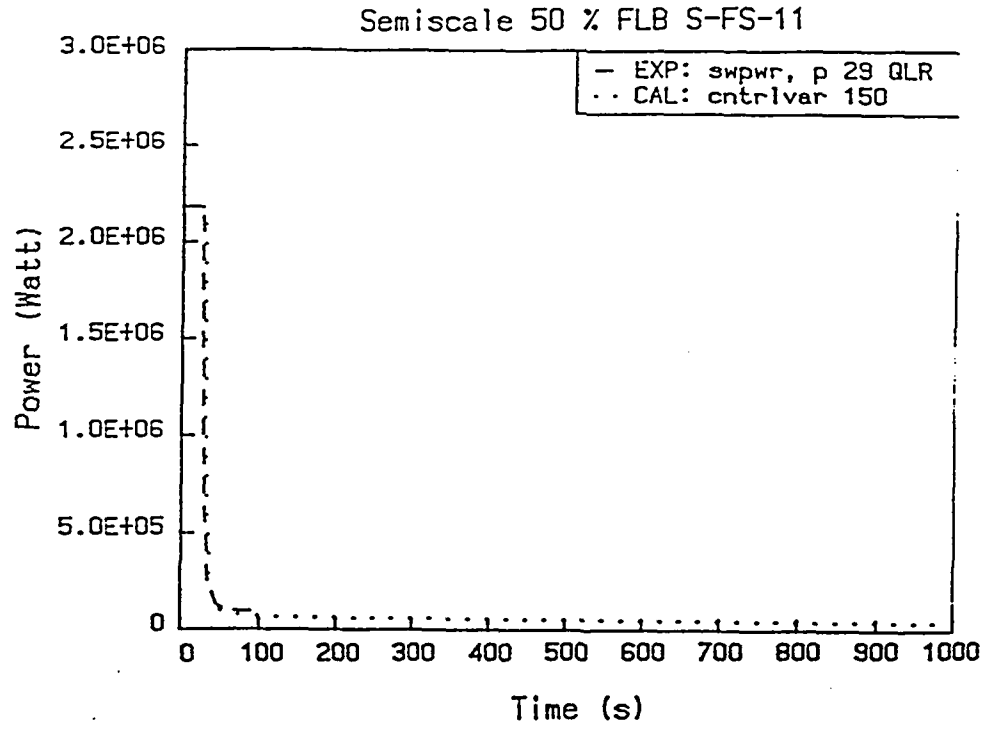


Fig.14 Decay heat power

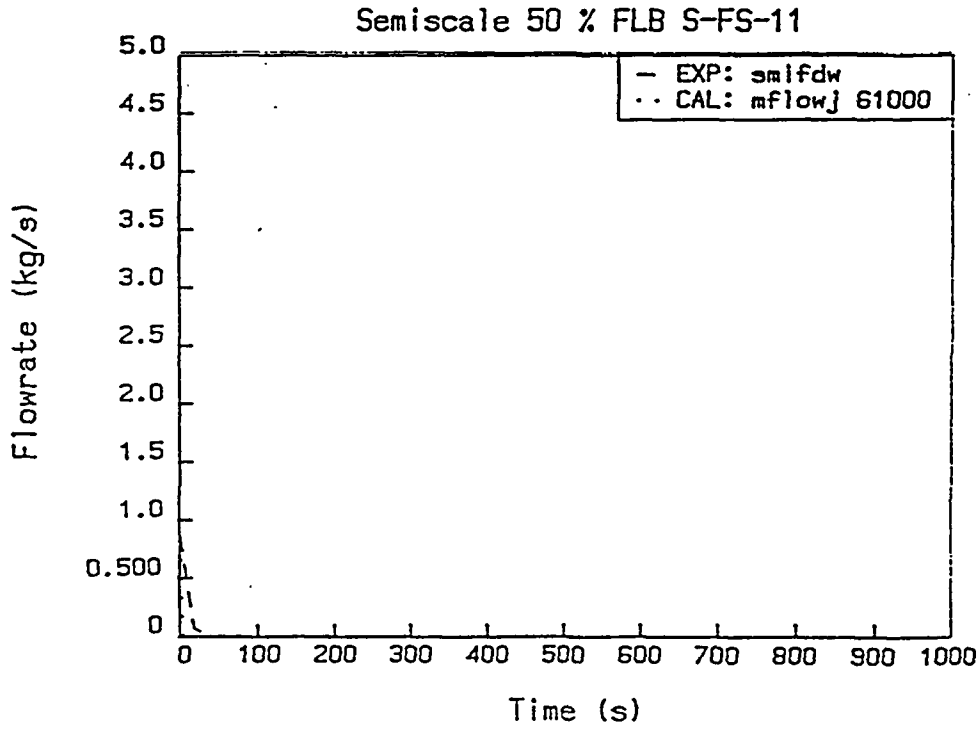


Fig.15 IL SG feed flowrate

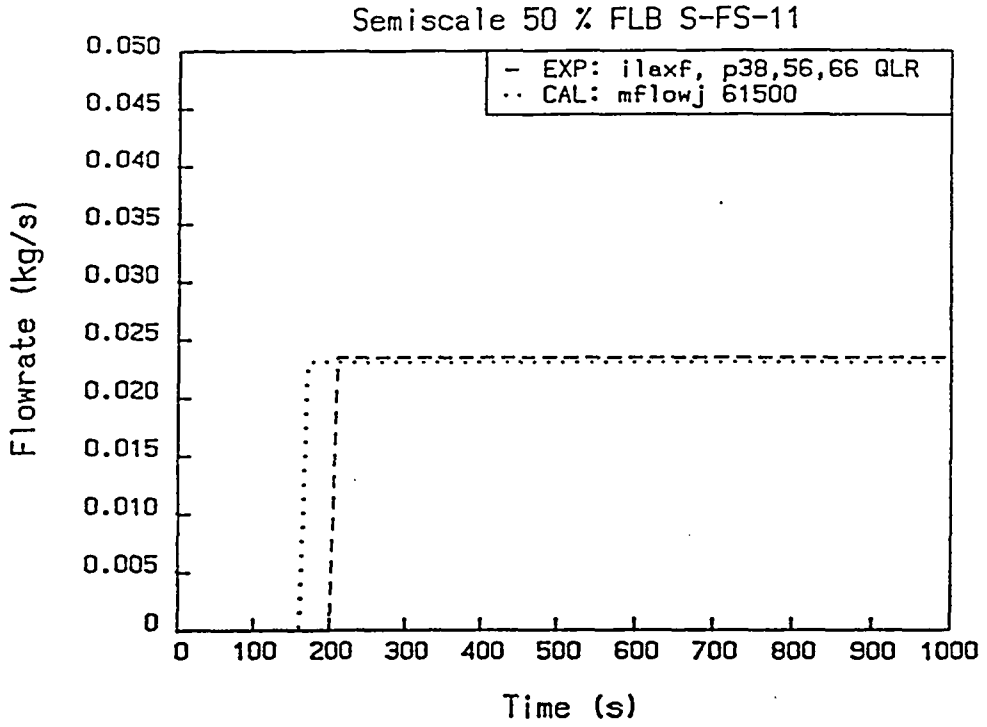


Fig.16 IL SG auxfeed flowrate

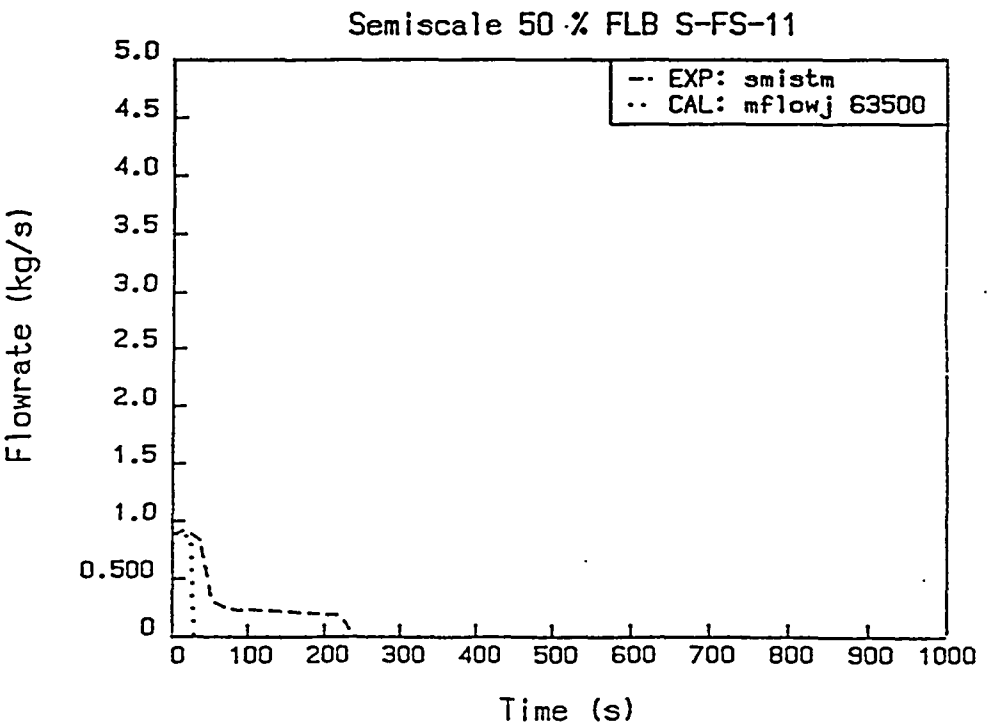


Fig.17 IL SG steam flowrate

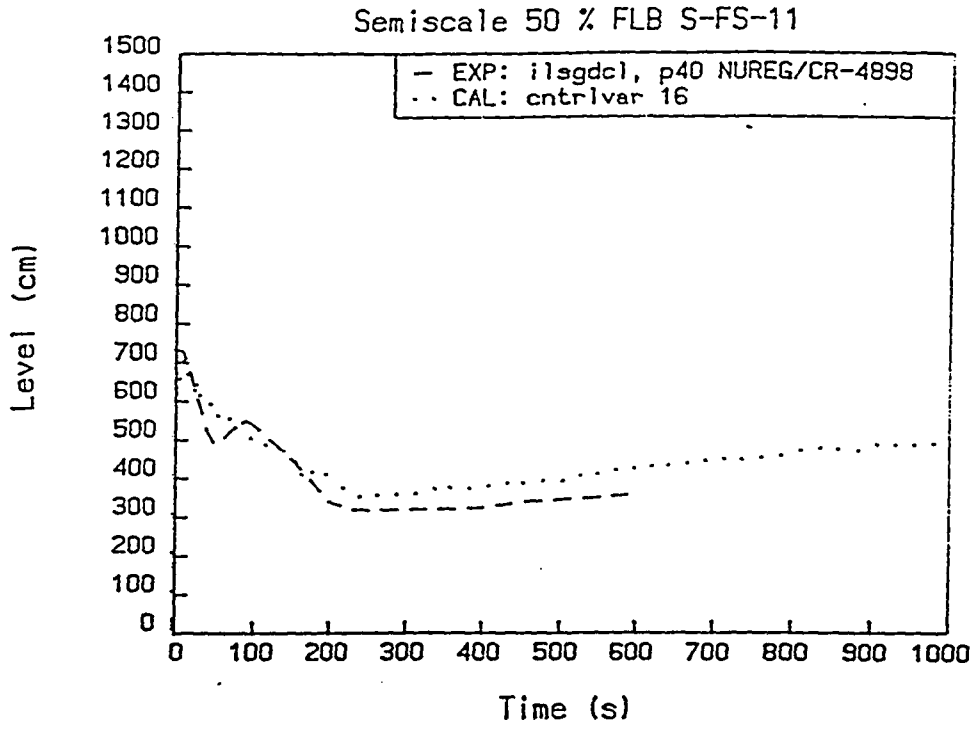


Fig.18 IL SG downcommer liquid level

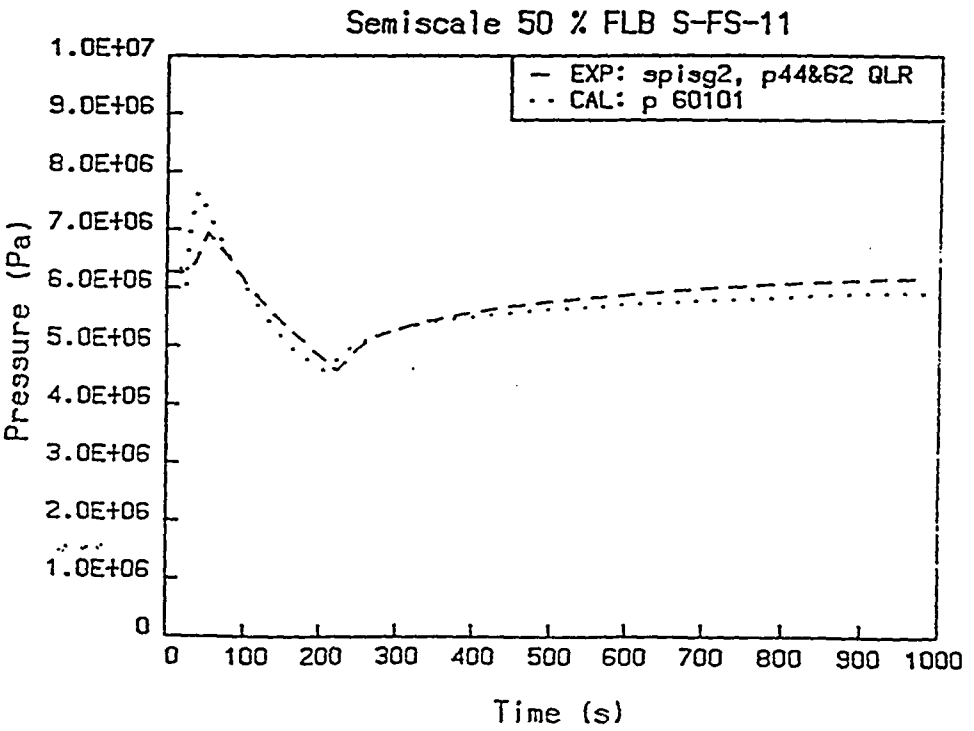


Fig.19 IL SG secondary pressure

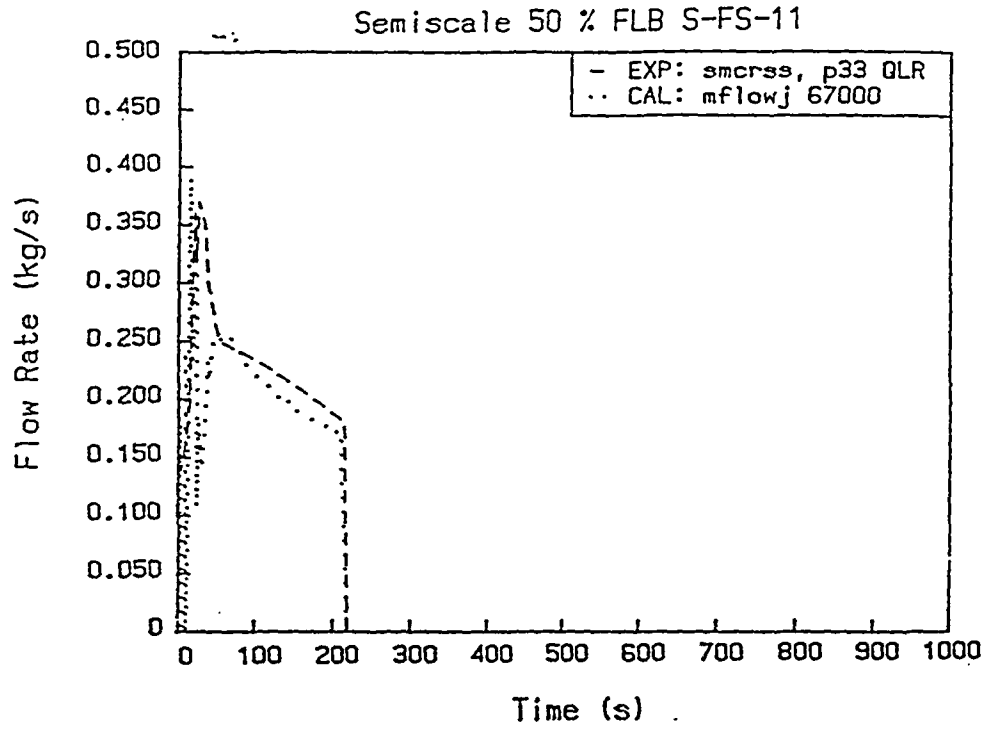


Fig.20 SG crossover line flowrate

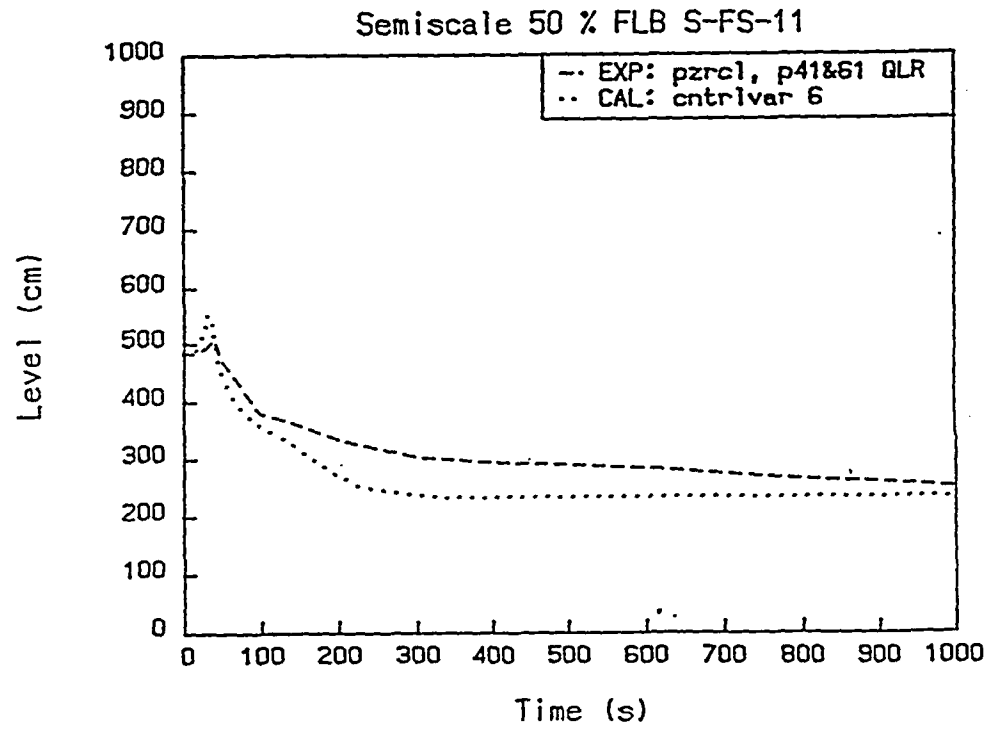


Fig.21 PZR liquid level

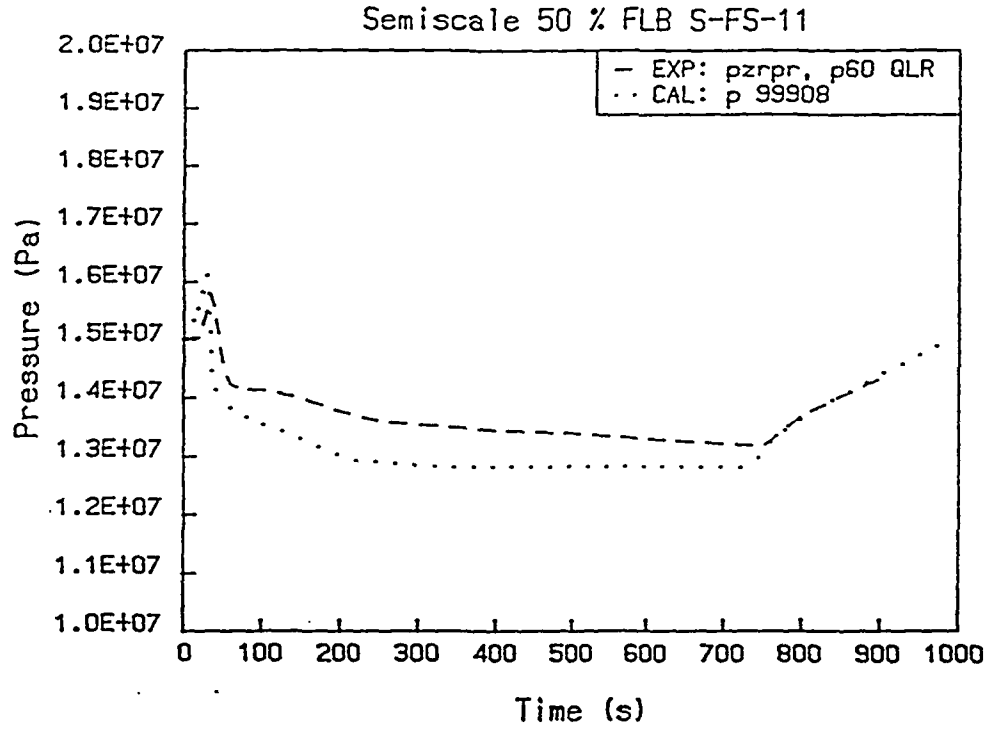


Fig.22 PZR pressure

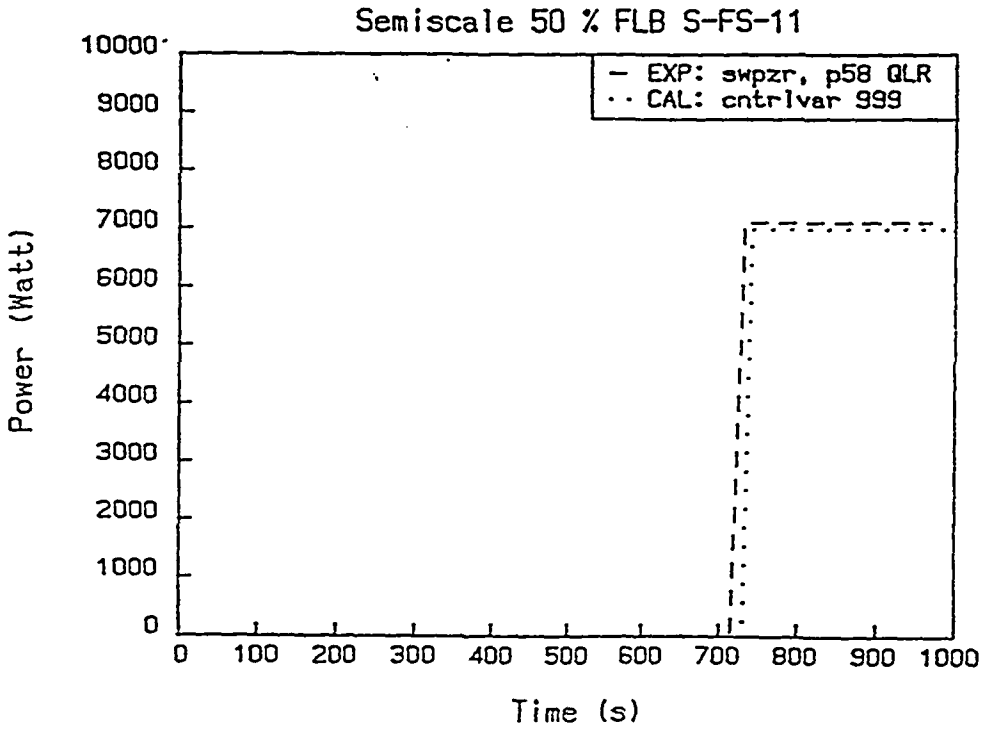


Fig.23 PZR heater power

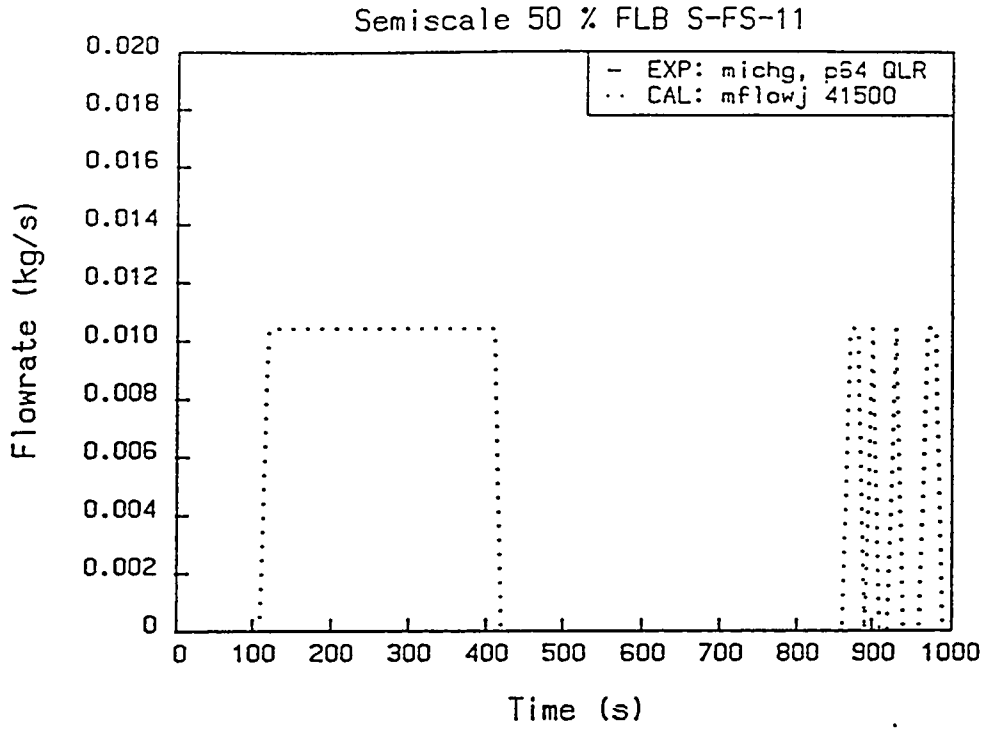


Fig.24 IL charging flowrate

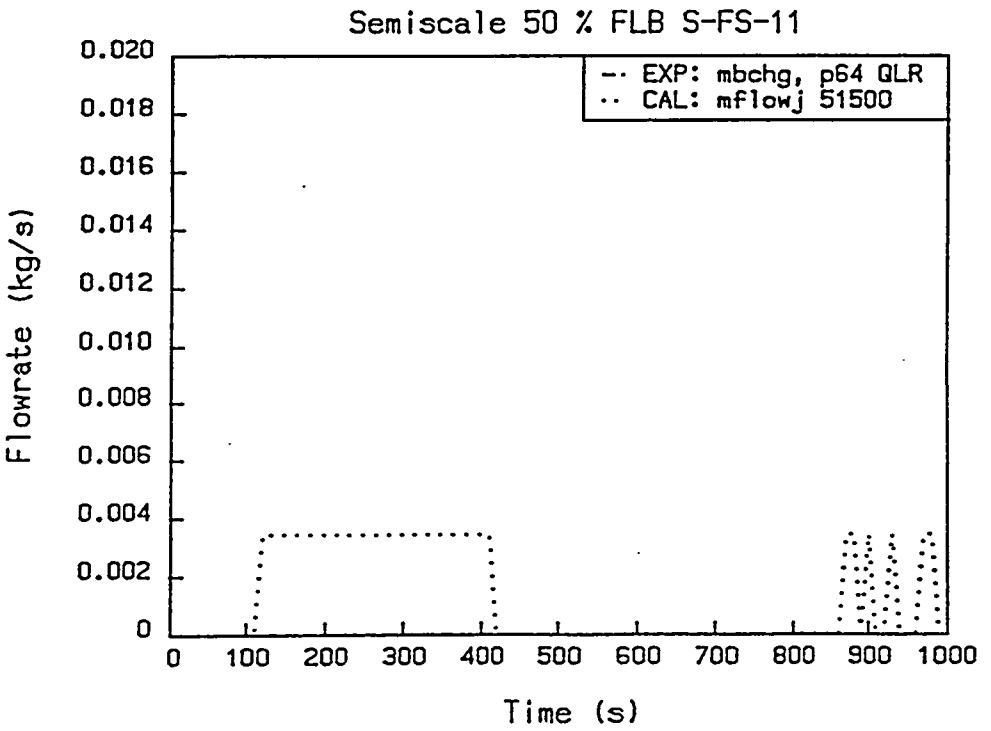


Fig.25 AL charging flowrate

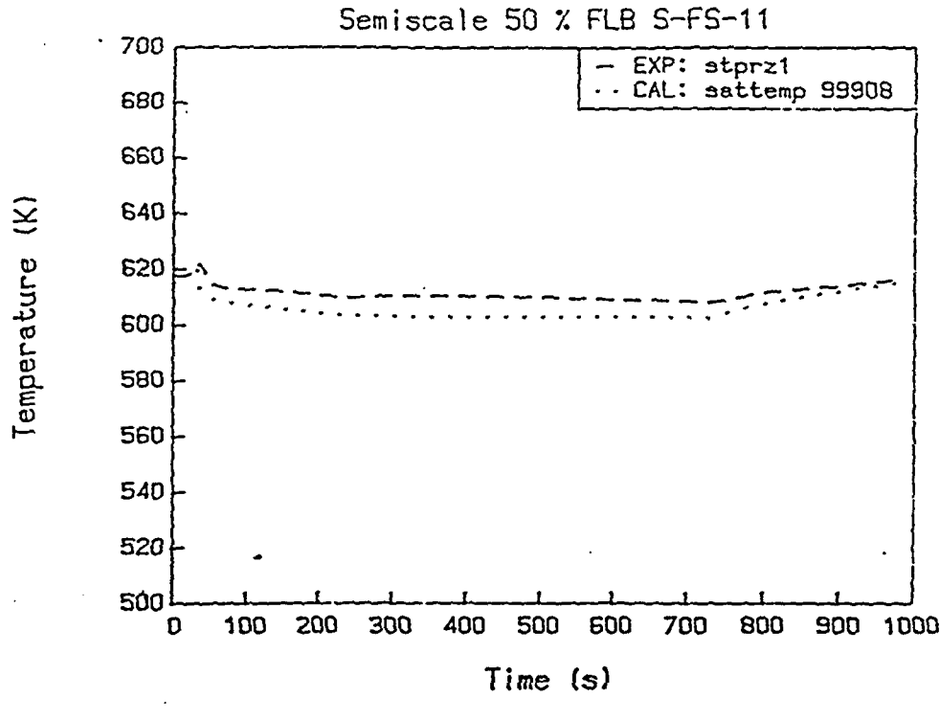


Fig.26 PZR Saturation Temperature

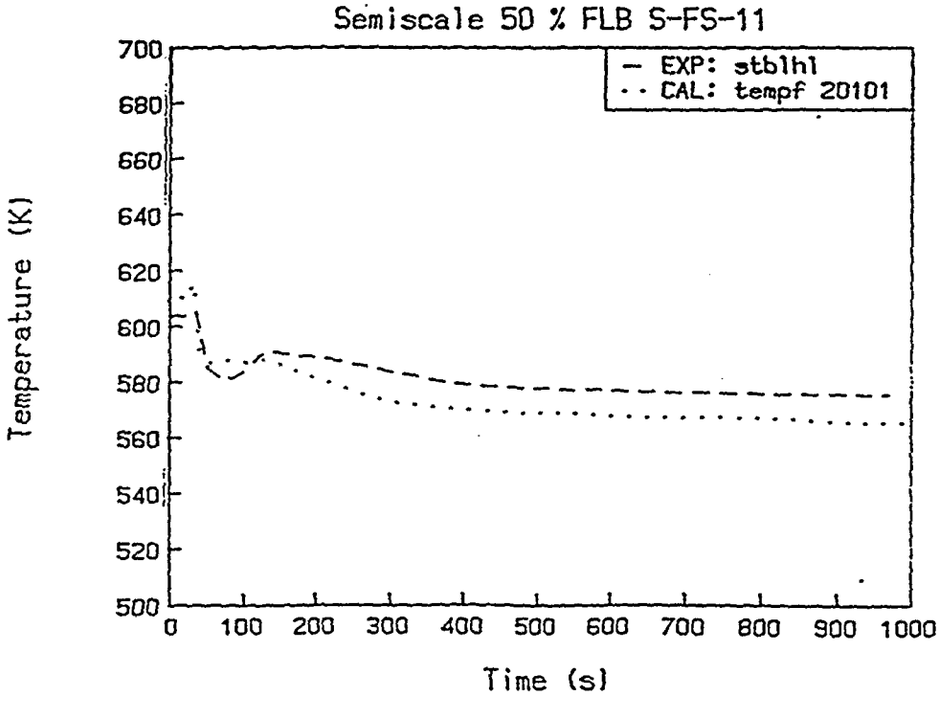


Fig.27 ILHL liquid temperature

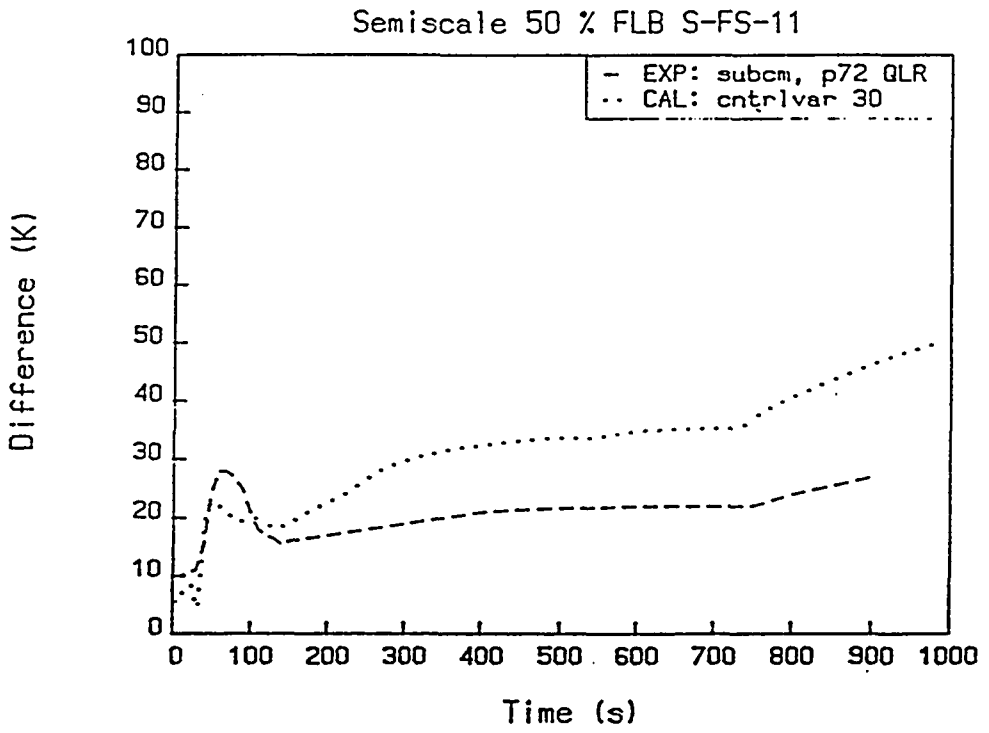


Fig.28 Primary subcooled margin

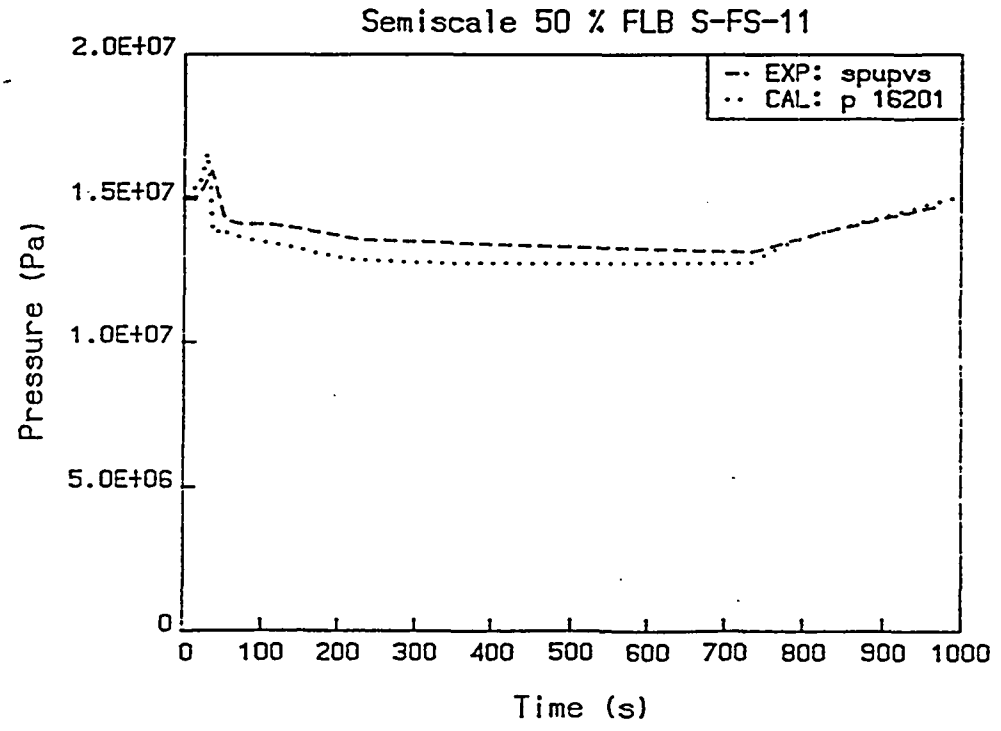


Fig.29 Upper plenum pressure

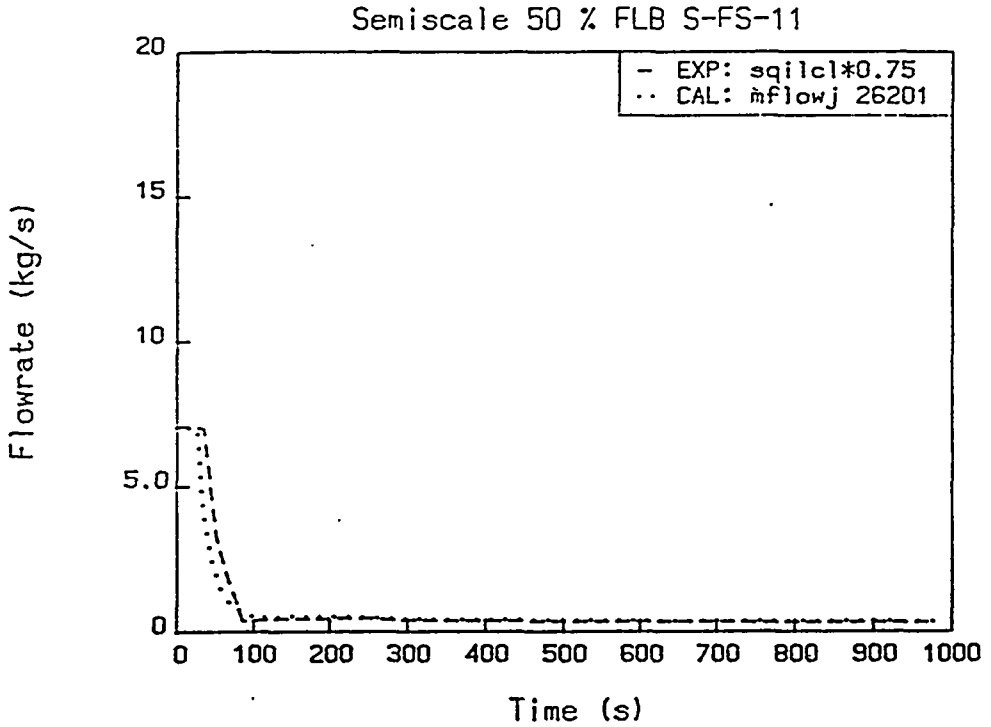


Fig.30 IL flowrate

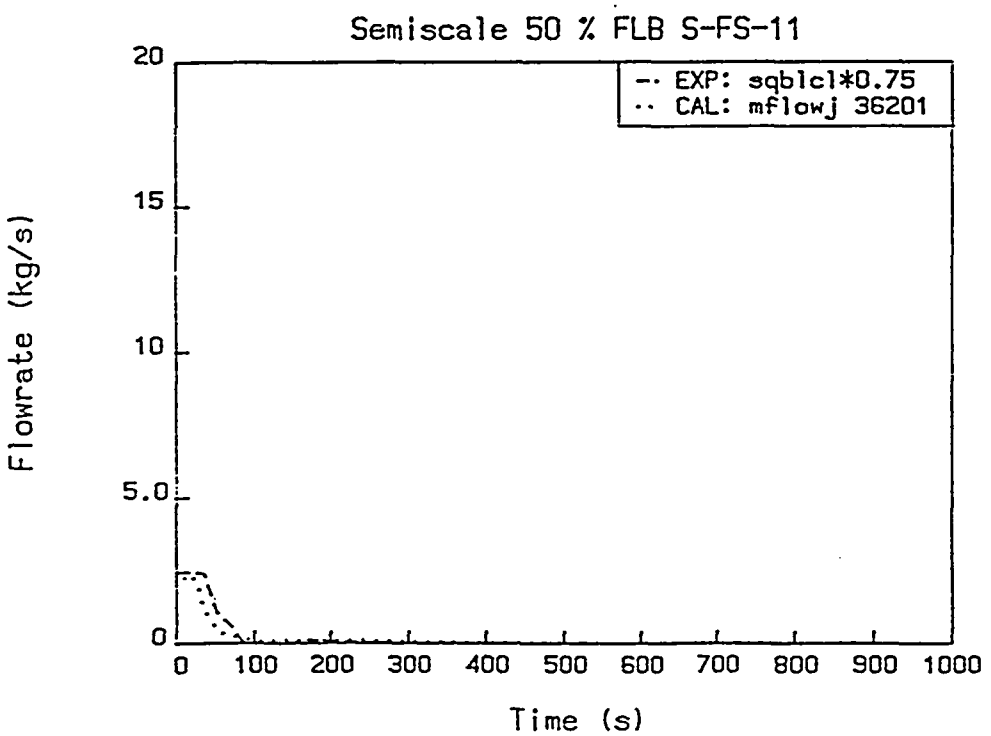


Fig.31 AL flowrate

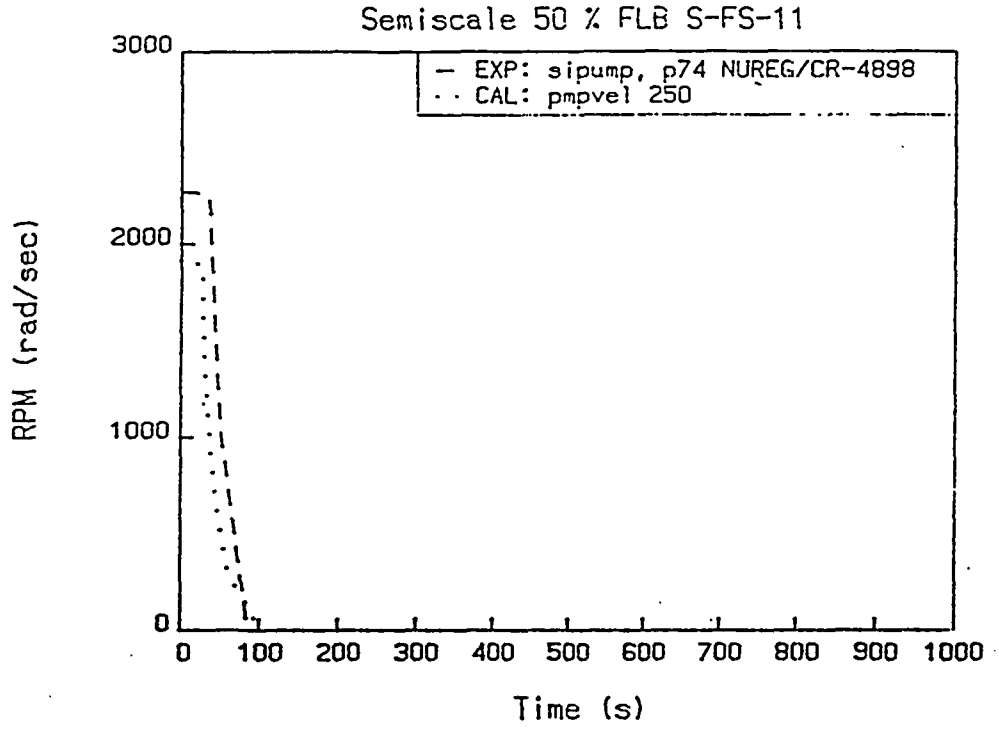


Fig.32 IL pump velocity

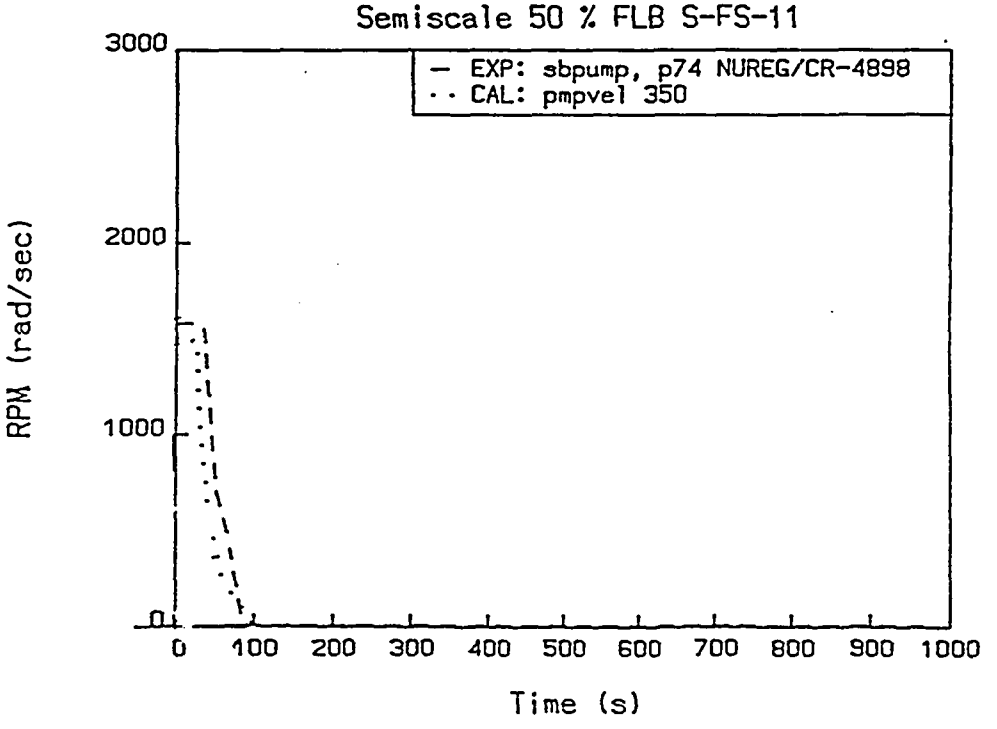


Fig.33 AL pump velocity

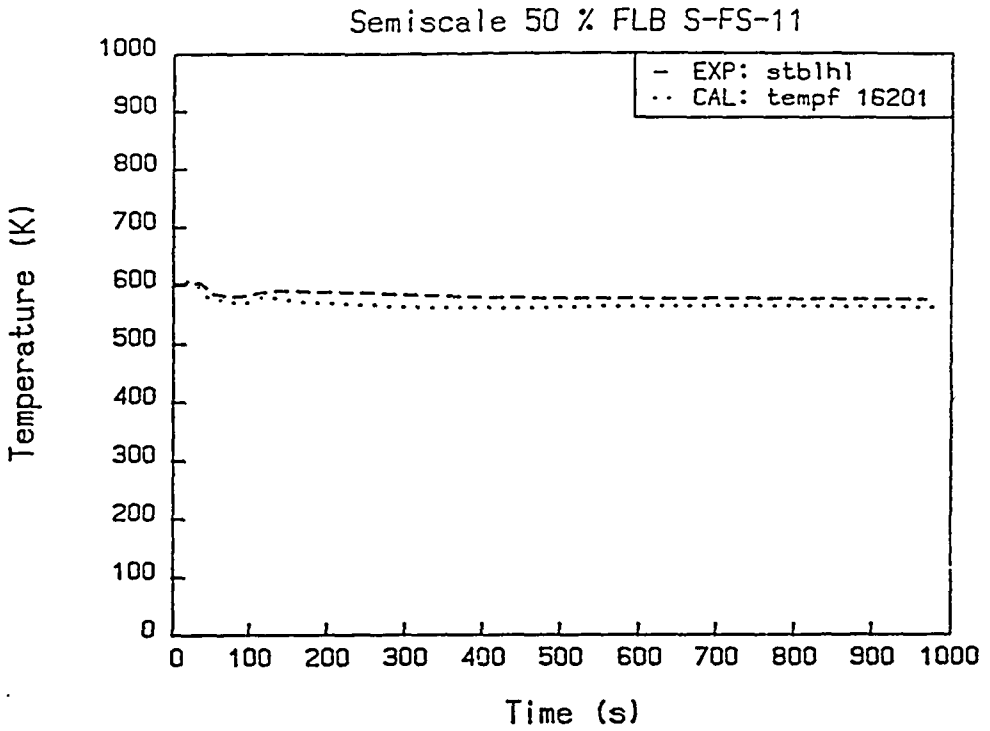


Fig.34 Upper plenum temperature

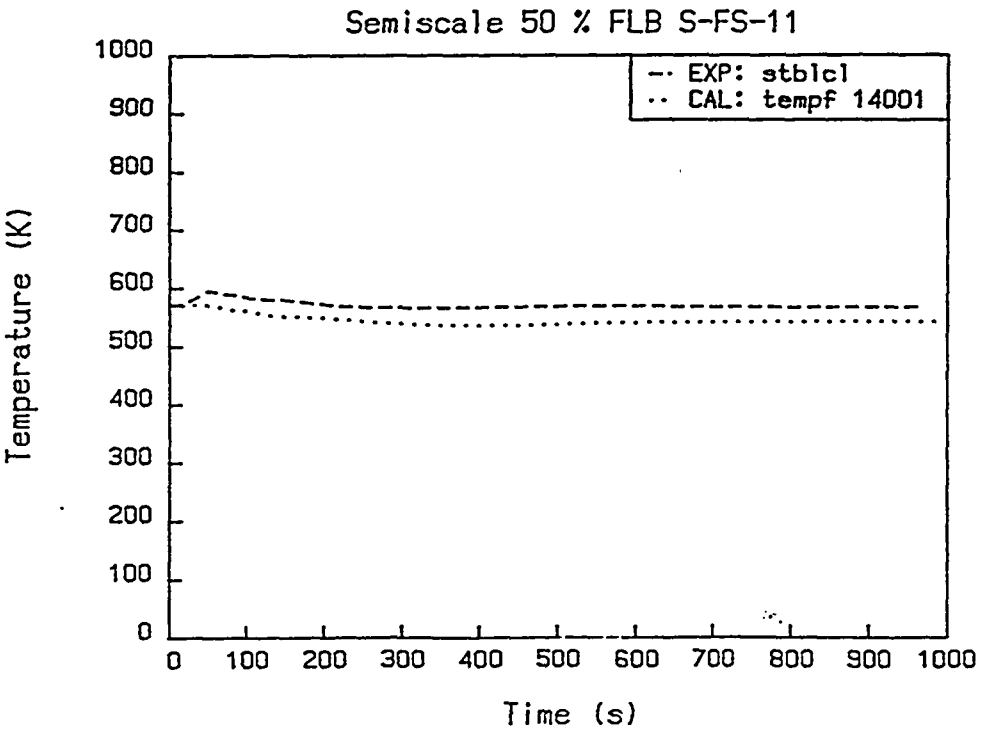


Fig.35 Lower plenum temperature

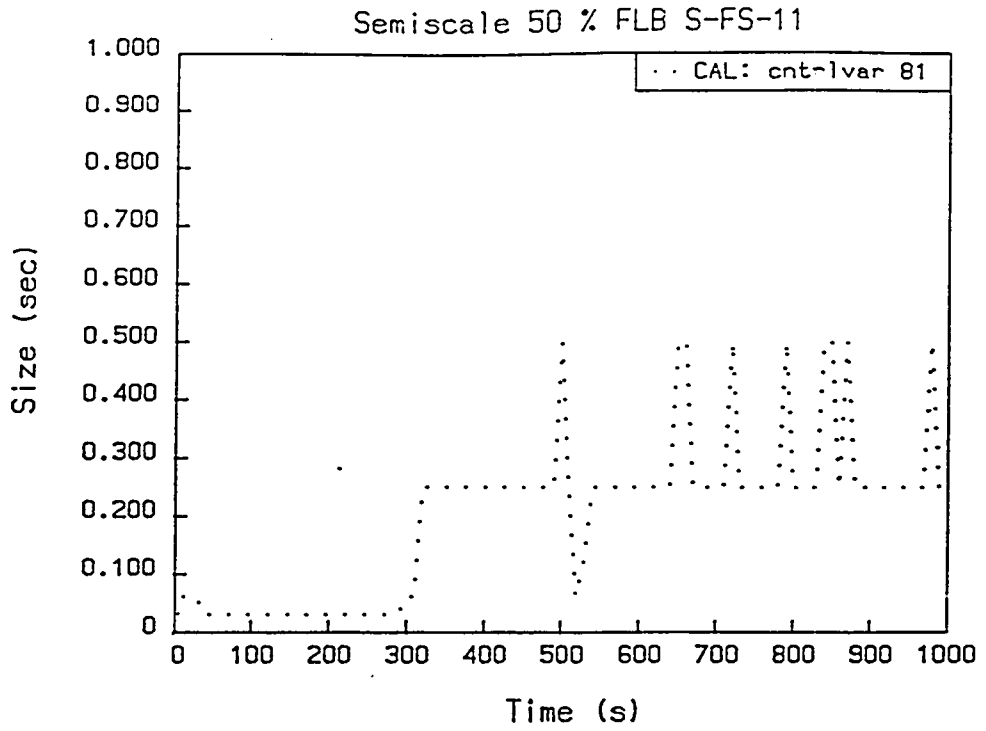


Fig.36 Time step size(0-1000s)

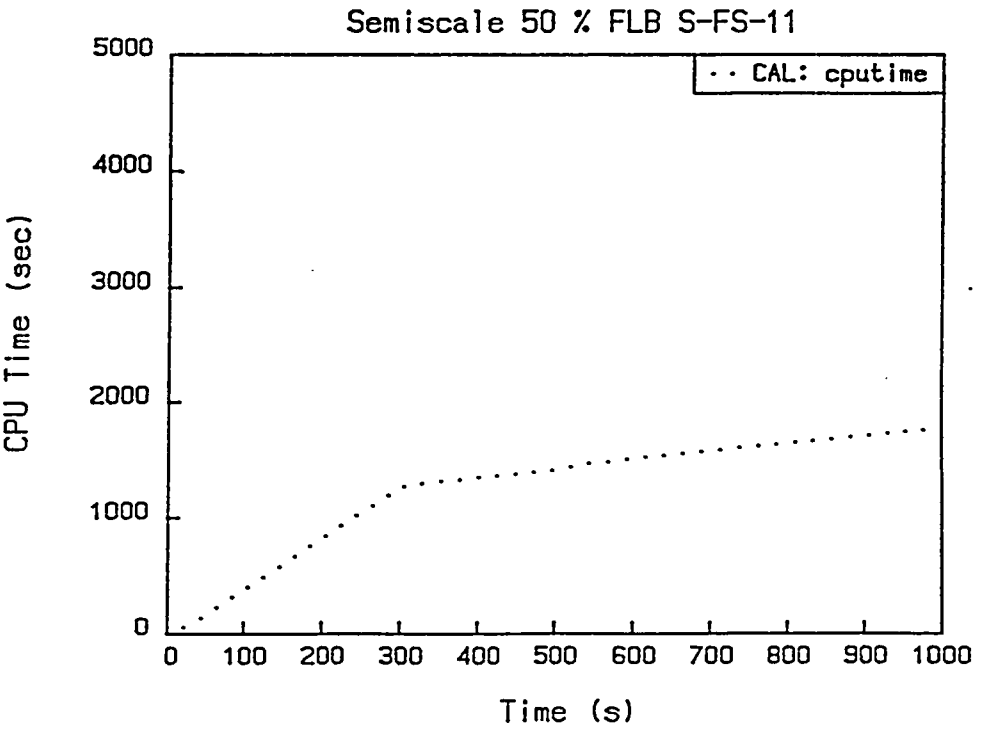


Fig.37 CPU time (0-1000s)

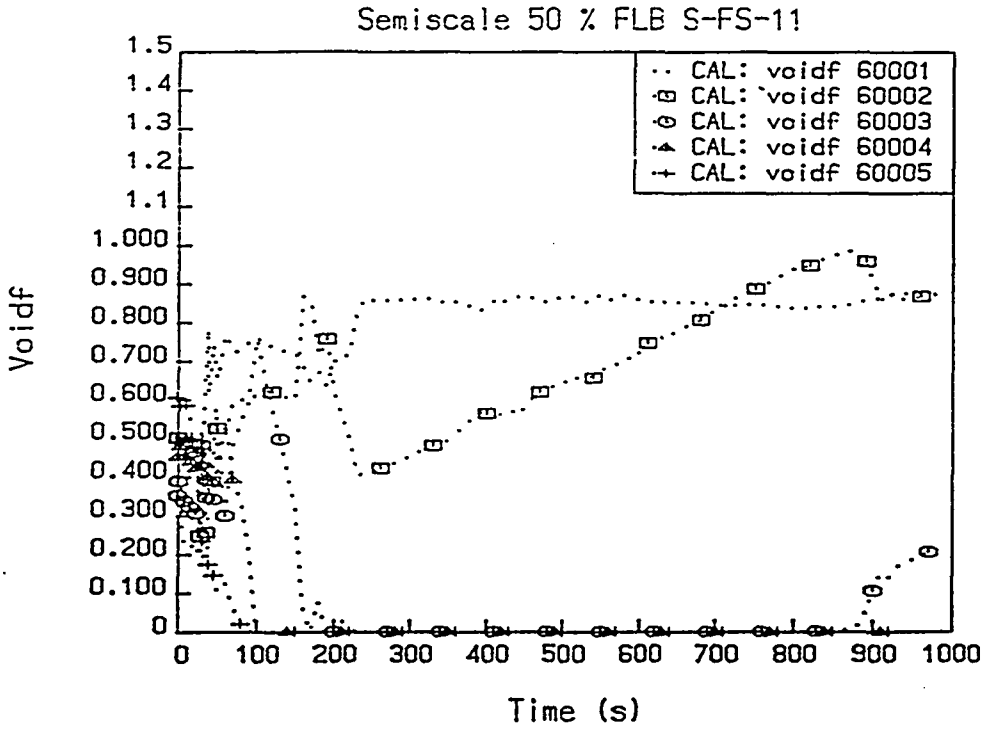


Fig.38 IL SG secondary voidf

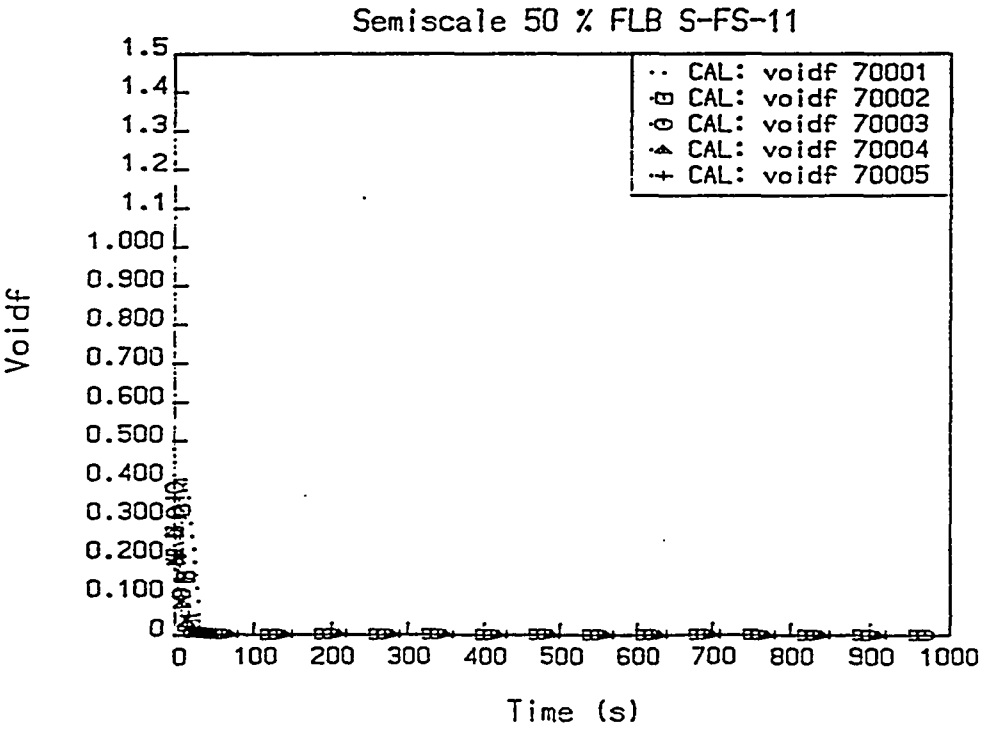


Fig.39 AL SG secondary voidf

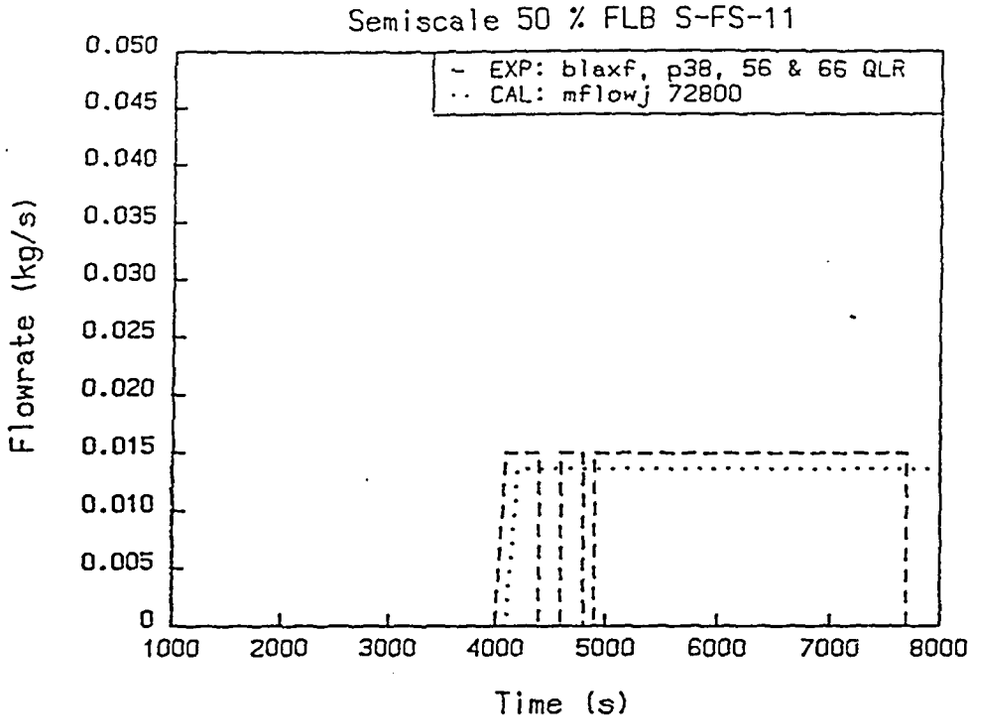


Fig.40 AL SG auxfeed flowrate (1000-8000 s)

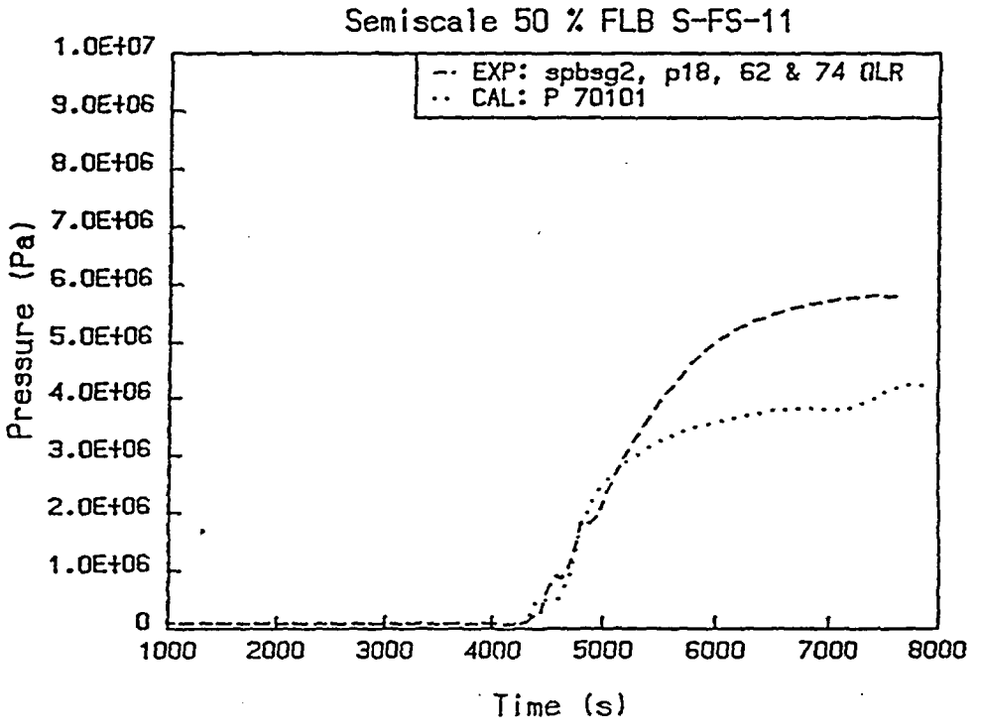


Fig.41 AL SG secondary pressure

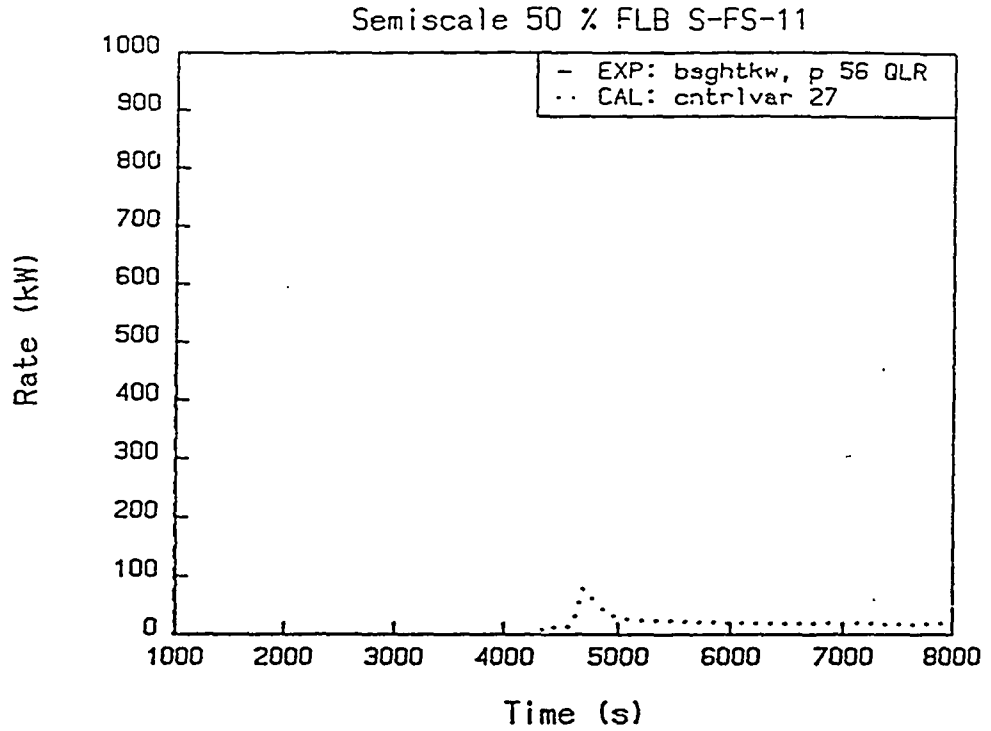


Fig.42 AL SG heat transfer rate

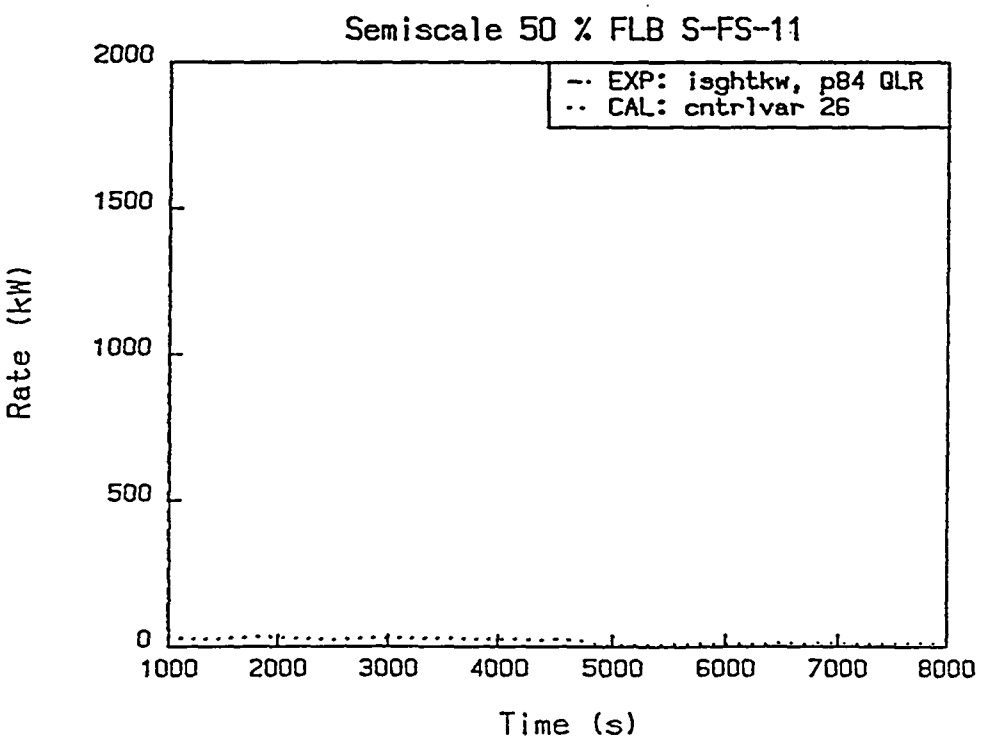


Fig.43 IL SG heat transfer rate

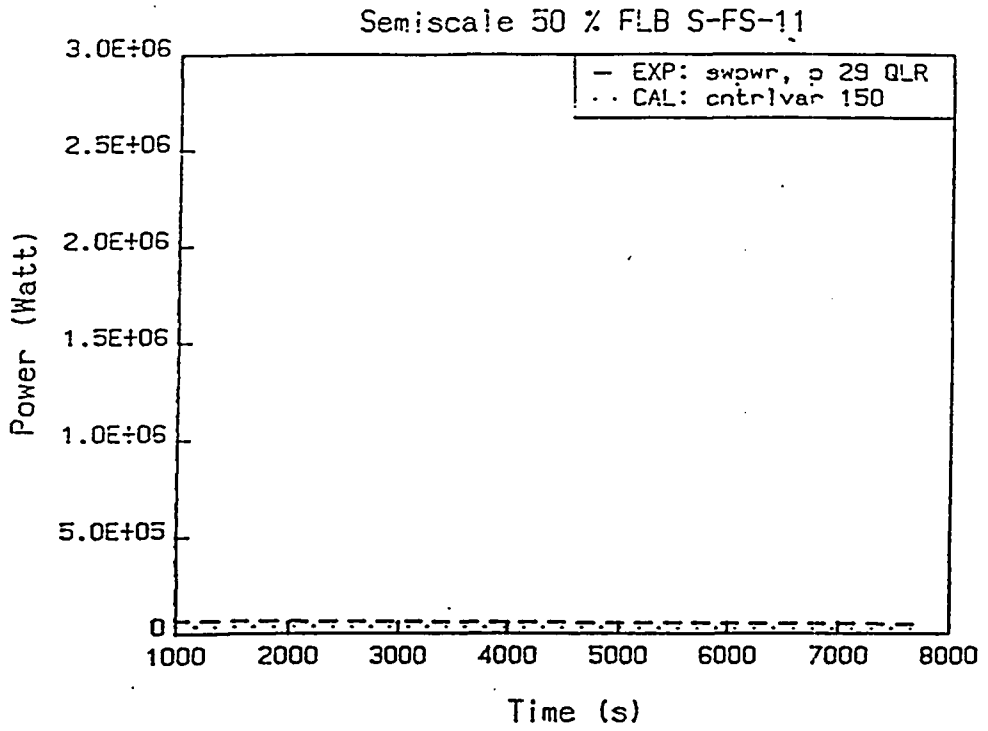


Fig.44 Decay heat power

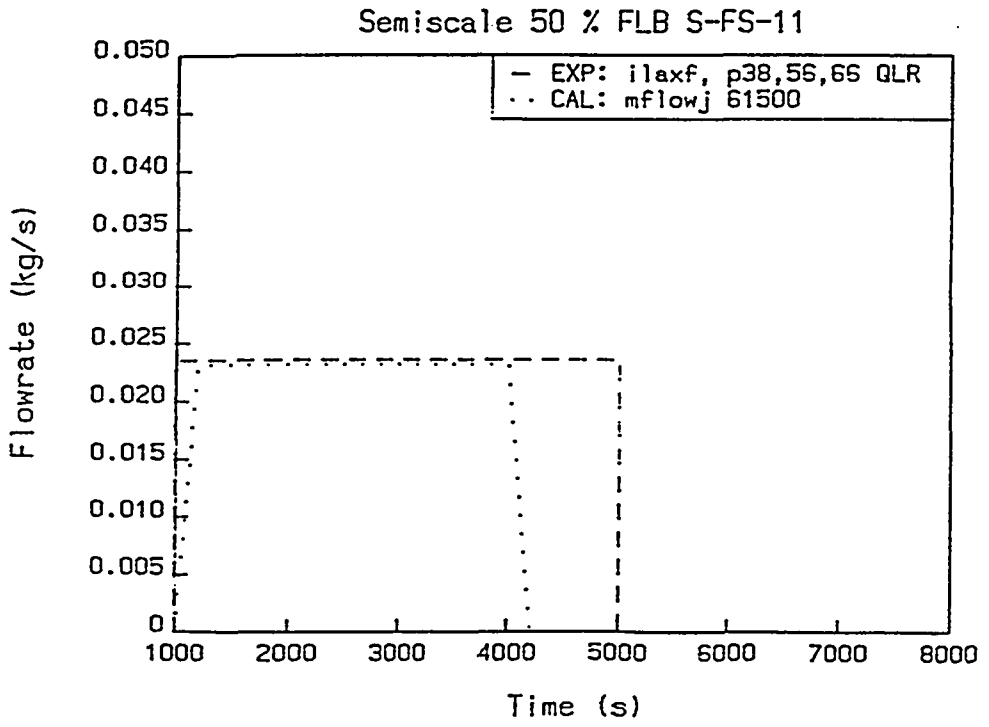


Fig.45 IL SG auxfeed flowrate

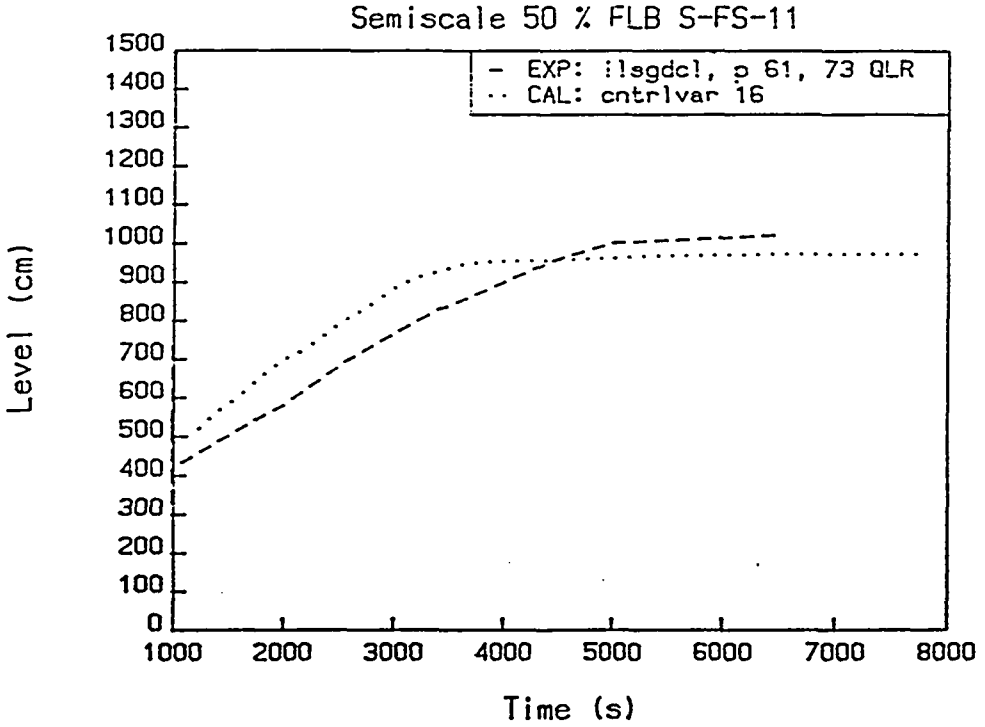


Fig.46 IL SG downcommer liquid level

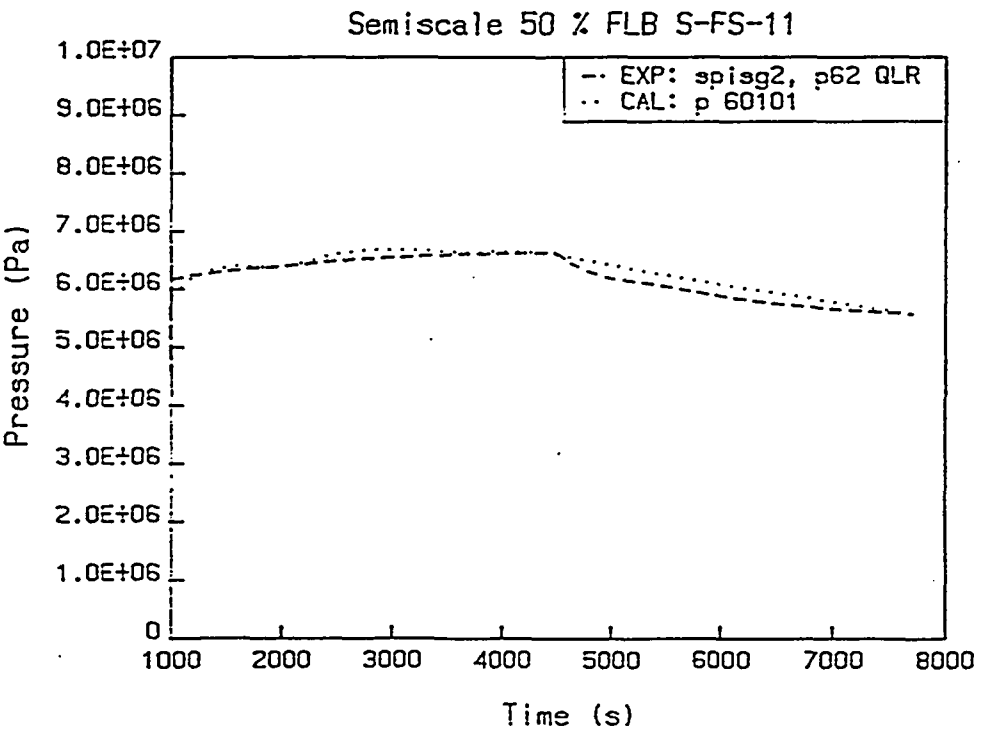


Fig.47 IL SG secondary pressure

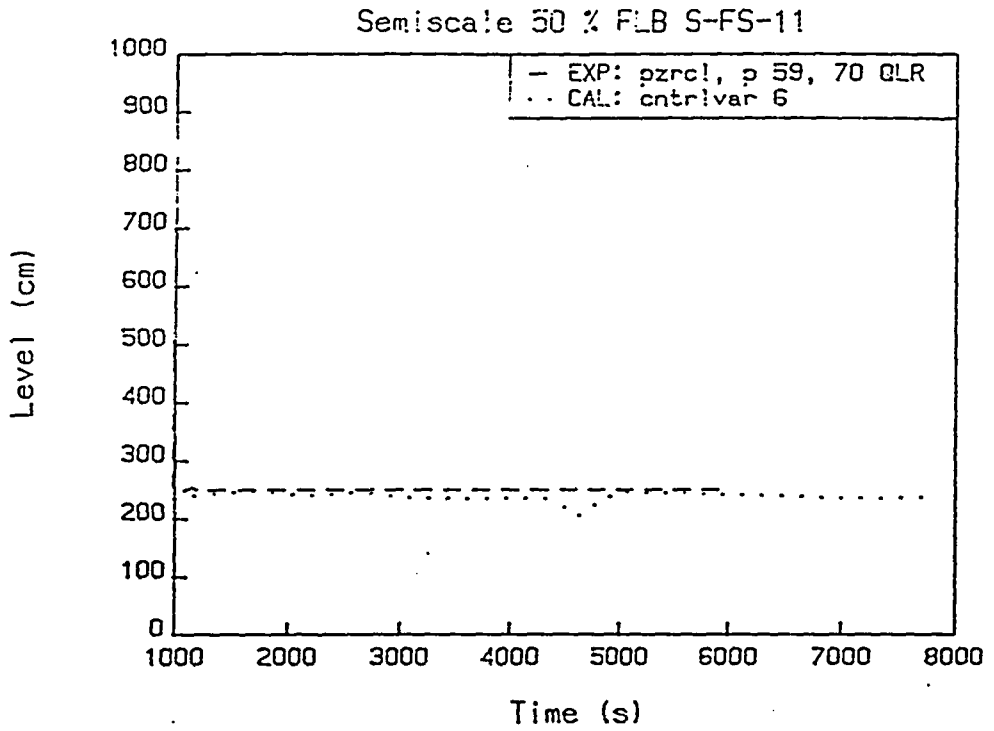


Fig.48 PZR liquid level

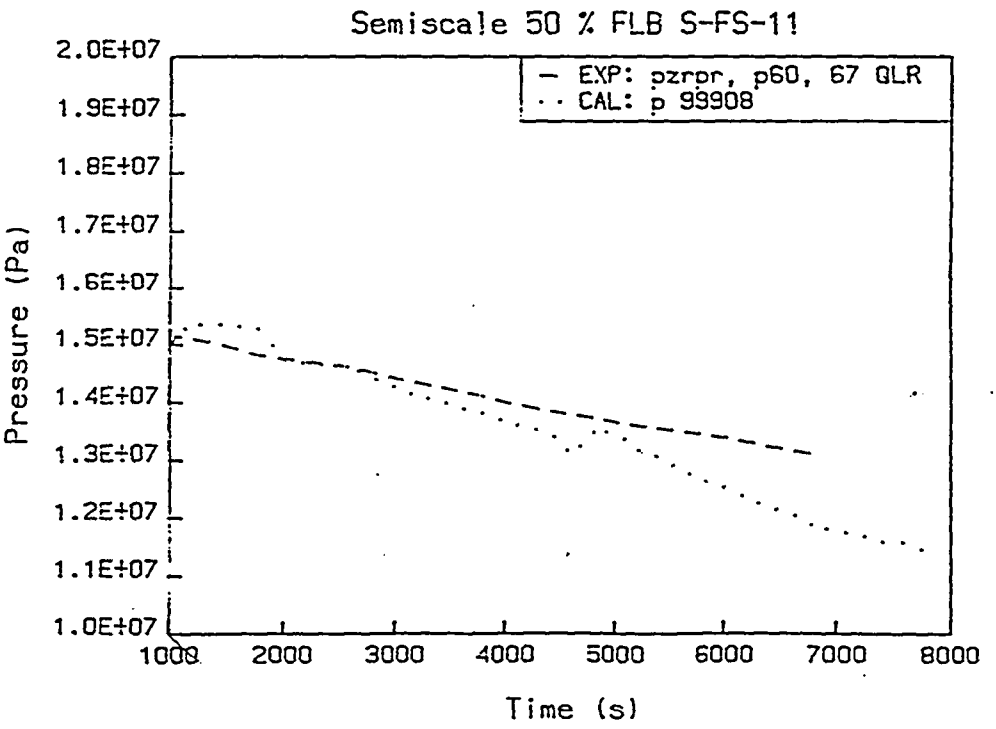


Fig.49 PZR pressure

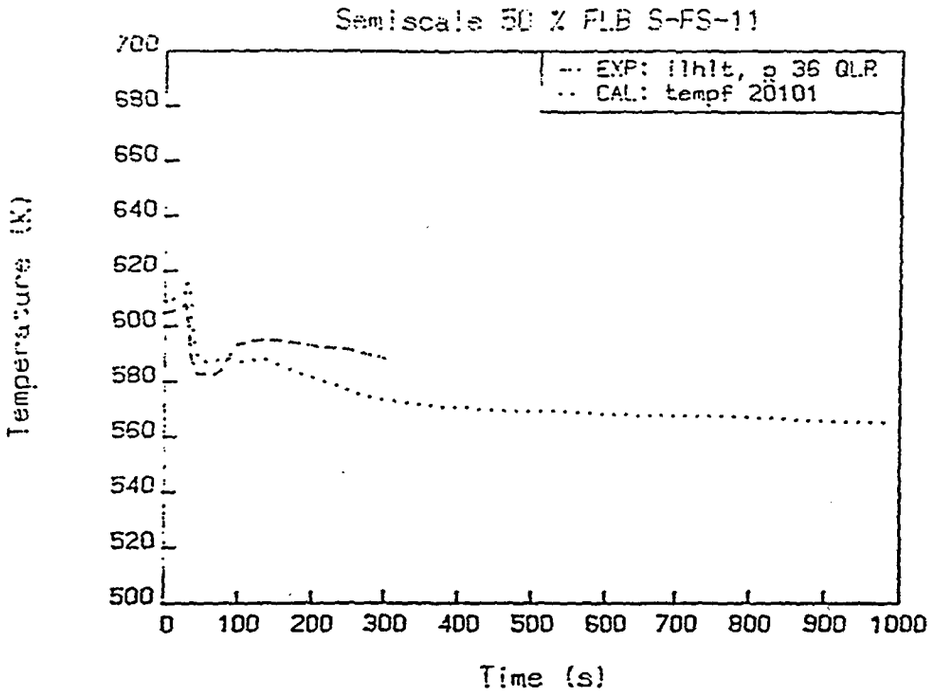


Fig.50 ILHL liquid temperature

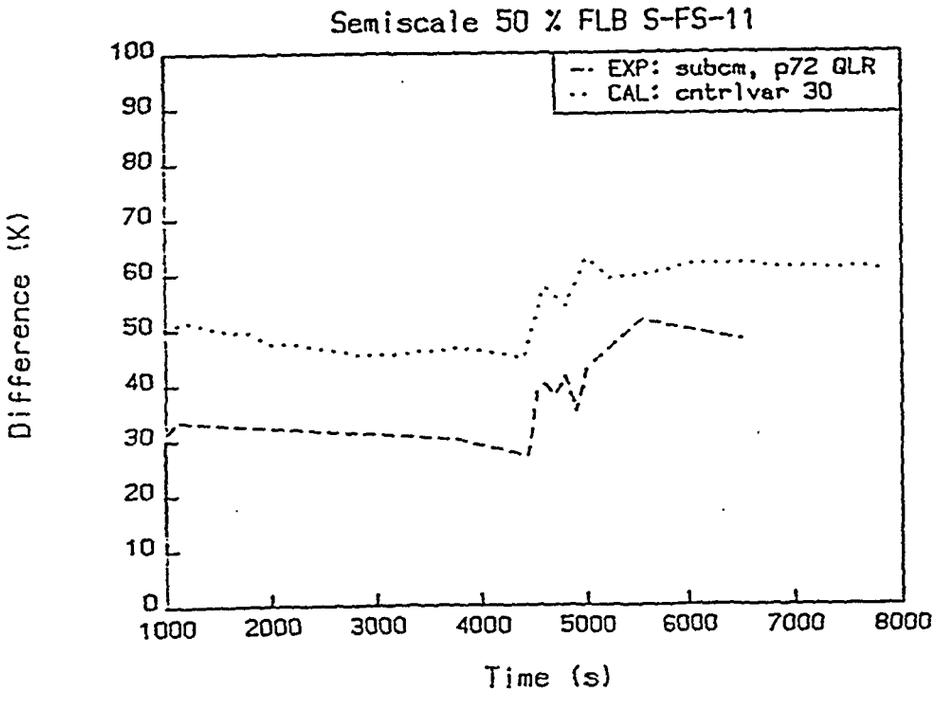


Fig.51 Primary subcooled margin

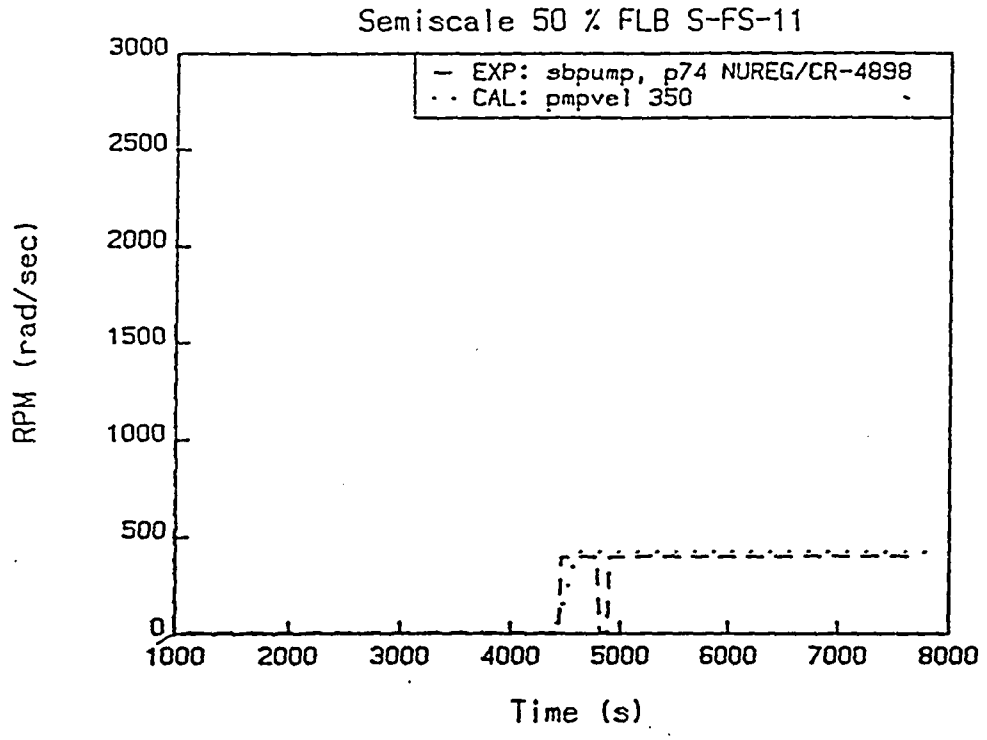


Fig.52 AL pump velocity

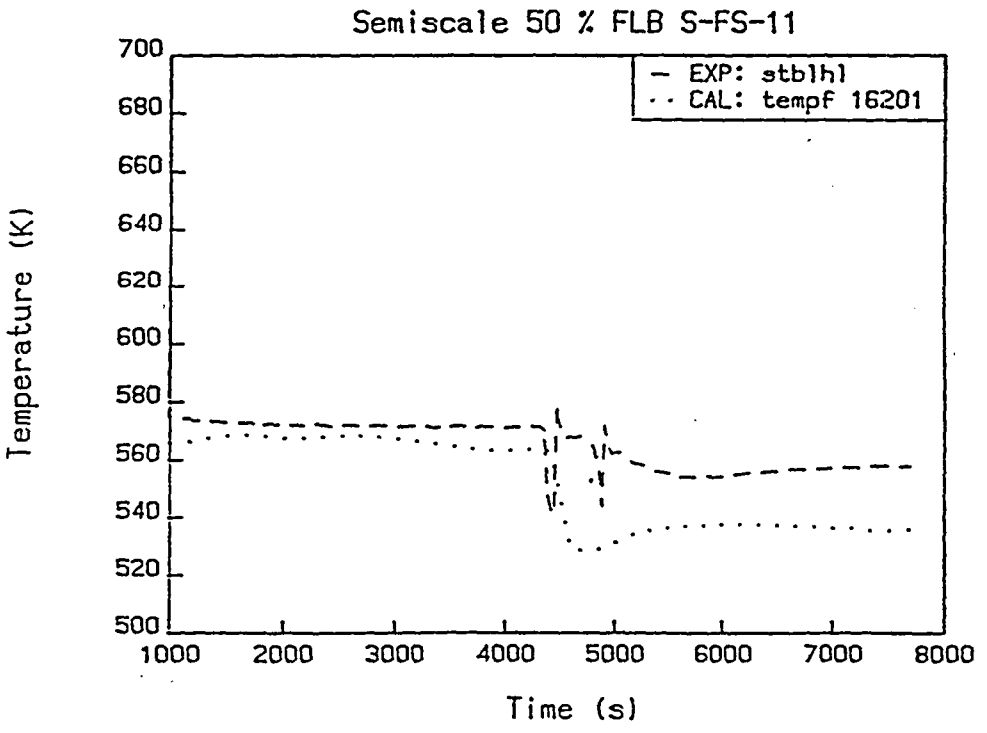


Fig.53 Upper plenum temperature

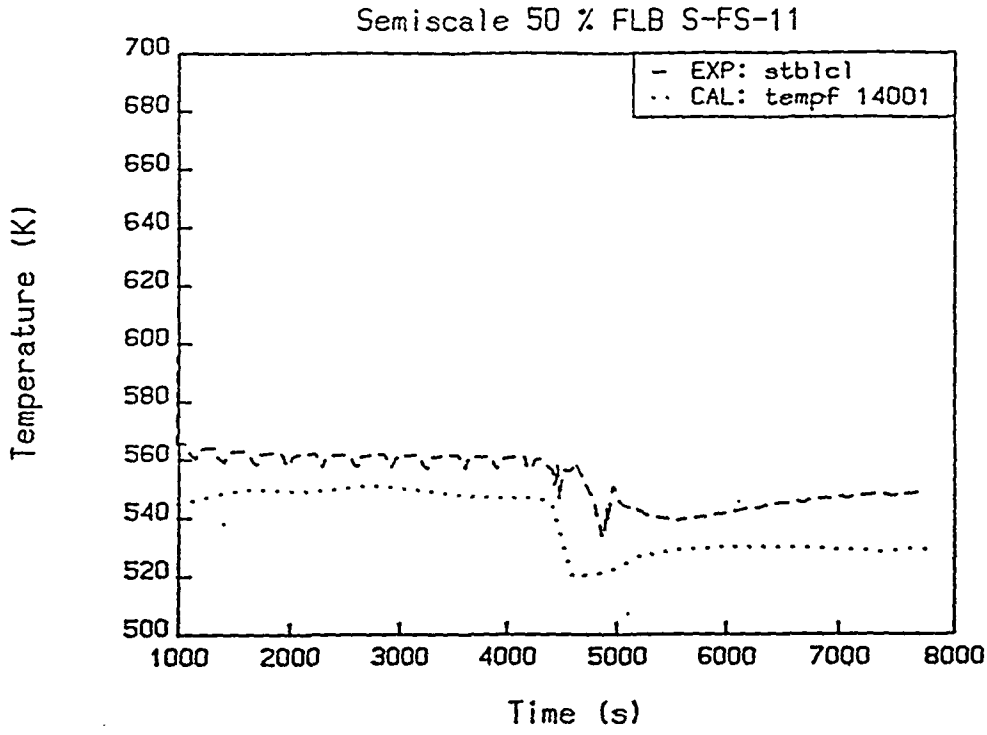


Fig.54 Lower plenum temperature

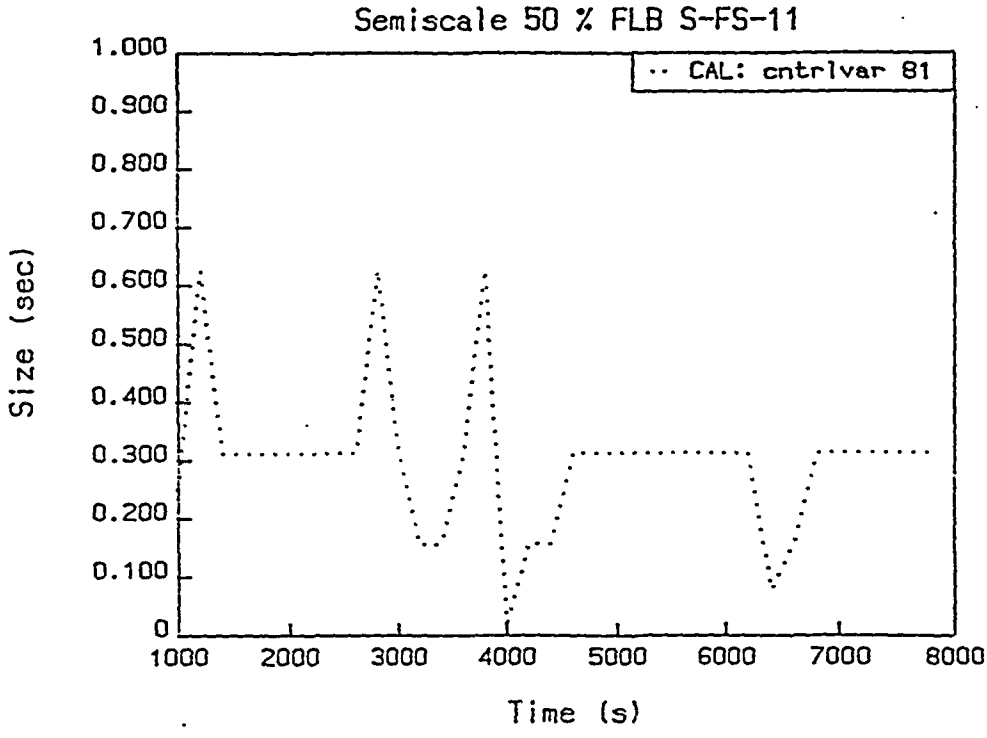


Fig.55 Time step size (1000-8000 s)

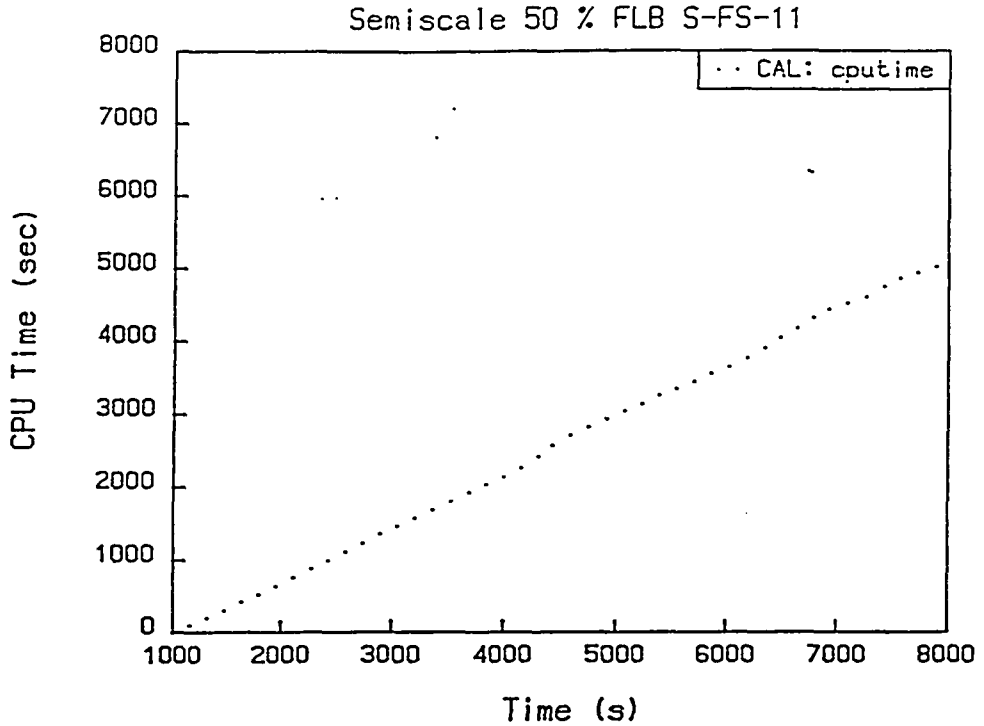


Fig.56 CPU time (1000-8000 s)

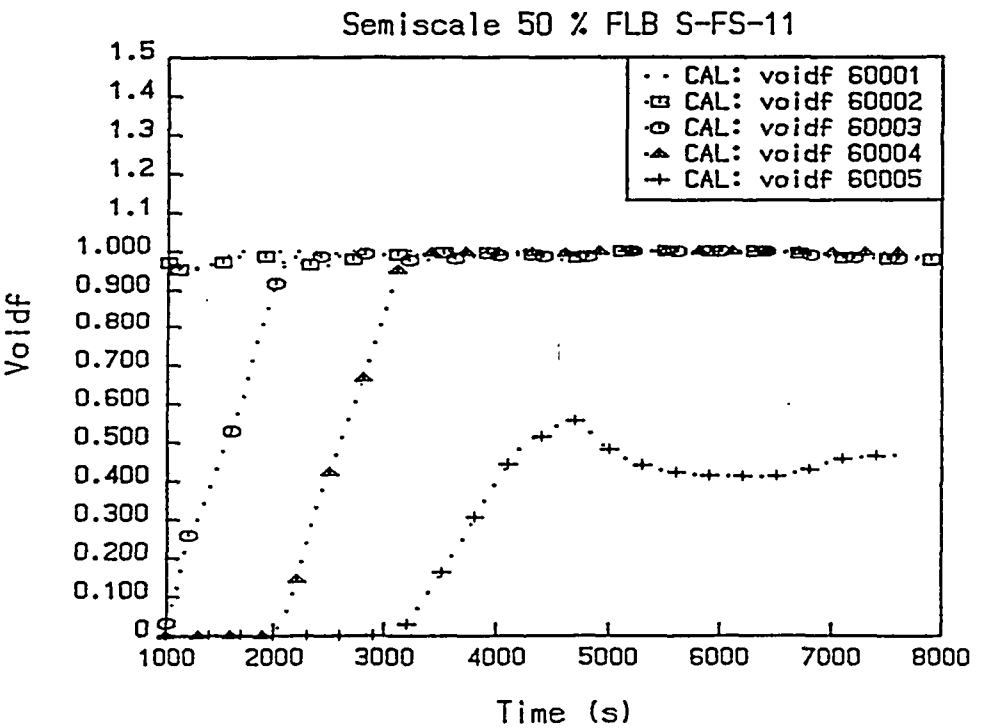


Fig.57 IL SG secondary voidf

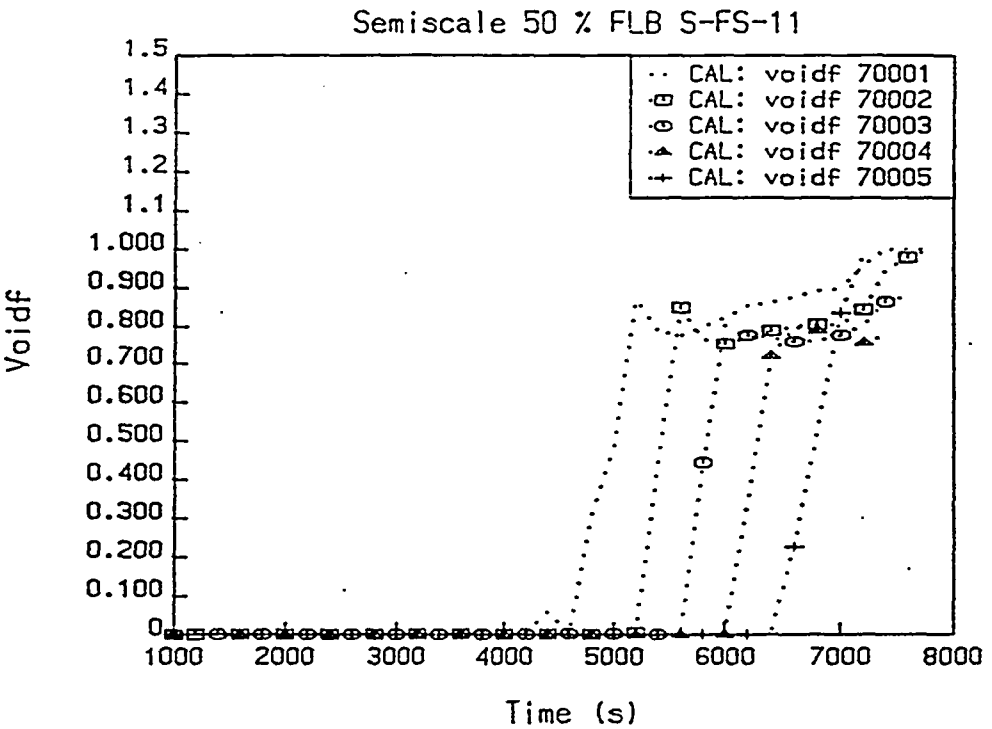


Fig.58 AL SG secondary voidf

```
*****************************************************************
**********************                  **********************
*******************     semiscale mod-2c     *******************
**********************                  **********************
*****************************************************************
*******************   standard transient   *******************
*******************     input deck         *******************
*******************   for relap5/mod2      *******************
*****************************************************************
*****************************************************************
******notes-                                                ******
*****                                                        *****
***** 1. this model is based on the standard mod-2a model    *****
*****    documented in reference 2 below.                    *****
*****                                                        *****
***** 2. steady state runs are made either with the provided *****
*****    control systems package or with additional components*****
*****    for single condition steady state calculations.     *****
*****                                                        *****
***** 3. vessel heater tape to offset vessel heat loss is    *****
*****    included with this model. a control system to shut off*****
*****    the vessel heaters and redistribute the power among *****
*****    the remaining heaters is also included in this model.*****
*****                                                        *****
***** 4. the thermal conductivity of the insulation on the   *****
*****    vessel and piping has been modified to give 56 kw   *****
*****    heat loss. the thermal conductivity of the insulation*****
*****    on the steam generators has been modified to give   *****
*****    14 kw heat loss. an additional 35 kw is lost due to *****
*****    pump seal cooling when pumps are running at full speed.*****
*****    the heater tape is wrapped in the "no break"        *****
*****    configuration from drawing 414220.                  *****
*****                                                        *****
***** 5. the system configuration incorporated in this model is*****
*****    the communicative cold leg break configuration.     *****
*****    all thi system components are removed and upper head*****
*****    internals are modeled as modified to reflect non-thi*****
*****    plant configuration.                                *****
*****                                                        *****
***** 6. steam generator components have been renodalized to *****
*****    reflect the pgcc guidelines as established by caap  *****
*****    letter from c. davis.                               *****
*****                                                        *****
***** 7. steam separator components reflect recommended model*****
*****    changes from j. trapp. (no junctions are abrupt, and*****
*****    inlet is homogeneous)                               *****
*****                                                        *****
***** 8. primary coolant pump discharge junction is homogeneous*****
*****                                                        *****
***** 9. the pressurizer is the 20 foot long pressurizer with*****
*****    heat structure to model the walls and with heater   *****
*****    tape and insulation on the outside.                 *****
*****                                                        *****
***** 10. a leak between the upper head to the upper plenum  *****
*****    through the support columns around the plugs is     *****
*****    included in this model.                             *****
*****                                                        *****
***** 11. the pressurizer spray and associated thermal shock *****
*****    shield are included in this model. normal spray goes*****
*****    from the intact loop cold leg to the pressurizer via*****
*****    time dependent volumes and junctions, matching temp.*****
*****    if auxilary spray is also used the spray temp will not*****
*****    match the cold leg temp. if the thermal shock shield*****
*****    was not included in the test both the hydraulics and*****
*****    heat structure of the pressurizer must be modified. *****
******                                                      ******
*****************************************************************
*                                                               *
*                        references                             *
*                                                               *
*  1. v. h. ransom et al., relap5/mod2 code manual, volume 1 and 2,*
*        egg-saam-6377, september 1983.                         *
*                                                               *
*  2. m. t. leonard, "relap5 standard model for the semiscale mod-2a*
*                                                               *
*  3. system design description for the mod-3 semiscale system, *
*        revision b, december 1980.                             *
*                                                               *
*****************************************************************
*
= relap5 model for the semiscale fs-11 posttest - steady state
*
** for control system steady state runs, make appropriate changes **
** in components -                                              **
**    610, 635, 710, 735, 980, 989, 991, trips, and control systems **
*
*problem       type    option
0000100         new   stdy-st
*
*          inp-chk  or   run
0000101                  run
*
*units        input    output   (si or british)
0000102    british       si
*
*time out      min      max
*0000105  5.0  6.0
*0000106       125.0    150.0
*            noncondensible gas type
0000110      nitrogen
*            mass fraction
0000115      1.0
*
**          vol no     elev    fluid     name
*0000120   101010000     1.0    water   primary
*0000121   600010000     0.0    water     ilsg
*0000122   700010000     0.0    water     olsg
**
*          t end    min st    max st    st cl     mr     mj     mr
*0000201     2.     1.0-7     0.05        3     20     40     40
*0000202    10.     1.0-7     0.05        3     20    160    160
*0000203    25.     1.0-7     0.05        3     40    300    300
*0000204   100.     1.0-7     0.05        3     40   1500   1500
*0000205   200.     1.0-7     0.05        3     40   1000   1000
*0000206  1005.     1.0-7     0.05        3     40   2000   2000
*
```

```
*0000201    35.0  1.0-7  0.5   3   20   200   200
*0000202    40.0  1.0-7  0.01  3   500  5000  5000
0000201    300.0  1.0-7  1.0   3   50   500   500
*************************************************************
** trips -- trip cancellation card 400    variable trip cards 401-599 **
**       -- trip stop card 600             logical trip cards  601-699 **
*************************************************************
**                                                           **
** 401 terminate calculation                                 **
** 402 open break                                            **
** 403 always false - used in motor valves that only close, etc **
** 406 begin transient                                       **
** 407 hpis pressure setpoint                                **
** 408 begin hpis                                           **
** 409 begin core decay - scram                              **
** 410 close main intact loop steam generator steam valve    **
** 411 close main broken loop steam generator steam valve    **
** 412 begin intact loop primary coolant pump coastdown      **
** 413 begin broken loop primary coolant pump coastdown      **
** 414 close main intact loop steam generator feedwater valve **
** 415 close main broken loop steam generator feedwater valve **
** 416 open auxilary intact loop steam generator feedwater valve **
** 417 open auxilary broken loop steam generator feedwater valve **
** 418 open pressurizer spray valve                          **
** 419 turn off steam generator mass controller             **
** 420 always true                                          **
** 421 open pressurizer relief valve                        **
** 423 valve out time dependent volume pressurizer for steady state **
** 424 open steam generator cross-over line valve           **
** 425 close steam generator cross-over line valve          **
** 426 monitor maximum heater rod temp - may want to stop calculation **
** 429 turn off pressurizer level controller                **
** 430 begin using test power for guard heater bank 110 (hot legs) **
** 431 begin using test power for guard heater bank 111 (bl pmp suc) **
** 432 begin using test power for guard heater bank 112 (cold legs) **
** 433 begin using test power for guard heater bank 113 (il pmp suc) **
** 436 begin using test power for vessel external heaters (bank 116) **
** 437 begin using test power for pressurizer ext heaters (bank 117) **
** 439 turn on pressurizer heater rods                        **
** 440 turn off power to upper head heaters                  **
** 441 turn off power to upper vessel heaters                **
** 442 turn off power to middle vessel heaters               **
** 443 turn off power to vessel and downcomer heaters        **
** 460 pressure to open intact loop steam generator relief valve **
** 461 pressure to close intact loop steam generator relief valve **
** 462 upper limit on intact loop secondary pressure for steady state **
** 463 lower limit on intact loop secondary pressure for steady state **
** 464 rate to close main intact loop steam valve for steady state **
** 465 rate to open main intact loop steam valve for steady state **
** 470 pressure to open broken loop steam generator relief valve **
** 471 pressure to close broken loop steam generator relief valve **
** 472 upper limit on broken loop secondary pressure for steady state **
** 473 lower limit on broken loop secondary pressure for steady state **
** 474 rate to close main broken loop steam valve for steady state **
** 475 rate to open main broken loop steam valve for steady state **
** 600 stop calculation                                      **
** 624 open steam generator cross-over line valve           **
** 640 turn off power to upper head heaters                 **
** 641 turn off power to upper vessel heaters               **
** 642 turn off power to middle vessel heaters              **
** 643 turn off power to vessel and downcomer heaters       **
** 660 reset intact loop steam relief valve for hysteresis effects **
** 661 open intact loop steam generator relief valve        **
** 662 used in steady state control to open intact loop steam valve **
** 663 used in steady state control to close intact loop steam valve **
** 670 reset broken loop steam relief valve for hysteresis effects **
** 671 open broken loop steam generator relief valve        **
** 672 used in steady state control to open broken loop steam valve **
** 673 used in steady state control to close broken loop steam valve **
**                                                           **
*************************************************************
*
* trip  vr co   para      rela  va co  para    add     indx  timeof
0000401 time     0        ge    null   0     1000.0    1    -1.
0000402 time     0        ge    null   0     9999.0    1    -1.
0000403 time     0        lt    null   0       0.      1    -1.
0000406 time     0        ge    null   0     9999.0    1    -1.
0000407 p     999010000   le    null   0     1827.5    1    -1.
0000408 time     0        ge    timeof 407     26.3    1    -1.
0000409 time     0        ge    timeof 407      4.6    1    -1.
0000410 time     0        ge    timeof 407      7.3    1    -1.
0000411 time     0        ge    timeof 407      7.3    1    -1.
0000412 time     0        ge    timeof 407      4.7    1    -1.
0000413 time     0        ge    timeof 407      4.35   1    -1.
0000414 time     0        ge    timeof 407      0.0    1    -1.
0000415 time     0        ge    timeof 407      0.0    1    -1.
0000416 time     0        lt    null   0        0.0    1    -1.
0000417 time     0        lt    null   0        0.0    1    -1.
0000418 time     0        lt    null   0        0.     1    -1.
0000419 time     0        le    null   0      500.     n    -1.  *ejl
0000420 time     0        ge    null   0        0.     1     0.
0000421 p     999010000   ge    null   0     2305.     n    -1.
0000422 time     0        ge    timeof 412     64.     1    -1.
0000423 time     0        ge    null   0     9988.     1    -1.
0000424 time     0        lt    null   0        0.     1    -1.
0000425 time     0        lt    null   0        0.     1    -1.
0000426 cntrlvar 29       ge    null   0      922.0    n    -1.
0000429 time     0        le    null   0      340.     n    -1.
0000430 time     0        ge    timeof 406      0.     1    -1.
0000431 time     0        ge    timeof 406      0.     1    -1.
0000432 time     0        ge    timeof 406      0.     1    -1.
0000433 time     0        ge    timeof 406      0.     1    -1.
0000436 time     0        ge    timeof 406      0.     1    -1.
0000437 time     0        ge    timeof 406      0.     1    -1.
0000439 time     0        lt    null   0        0.     1    -1.
0000440 cntrlvar 565      lt    null   0     +184.0    n    -1.
0000441 cntrlvar 564      lt    null   0     +90.0     n    -1.
0000442 cntrlvar 561      lt    null   0     -62.0     n    -1.
0000443 cntrlvar 561      lt    null   0     -423.0    n    -1.
* sfll
*0000600   401   426
0000624   424   and   -425  n   -1.
0000640   422   and   440   1   -1.
0000641   422   and   441   1   -1.
0000642   422   and   442   1   -1.
0000643   422   and   443   n   -1.
```

```
*
* steam generator relief valve trips, including hysteresis effects
*
0000460 p     611010000 gt  null   0     1048.0  n  -1.
0000461 p     611010000 gt  null   0     1045.0  n  -1.
0000470 p     705010000 gt  null   0     1048.0  n  -1.
0000471 p     705010000 gt  null   0     1045.0  n  -1.
*
* steam generator relief valve logic
*
0000660  461   and   661  n  -1.
0000661  460   or    660  n  -1.
0000670  471   and   671  n  -1.
0000671  470   or    670  n  -1.
*
*****************************************************************
* trips used for controlling steam generator pressures in steady-state *
* acceptable pressure bands - trips 462 & 463 (il) and 472 & 473 (bl)  *
* max and min pressure rate changes - trips 464, 465(il), 474, 475(bl) *
* open or close steam valves _ trips 662 & 663 (il) and 672 & 673 (bl) *
*****************************************************************
*
*                        intact loop
0000462 p     611010000 ge  null   0     906.0   n  -1.
0000463 p     611010000 le  null   0     902.0   n  -1.
0000464 cntrlvar 631    gt  null   0    -2500.   n  -1.
0000465 cntrlvar 631    lt  null   0     2500.   n  -1.
0000662  462   and   464  n  -1.
0000663  463   and   465  n  -1.
*
*                        broken loop
0000472 p     705010000 ge  null   0     906.0   n  -1.
0000473 p     705010000 le  null   0     902.0   n  -1.
0000474 cntrlvar 731    gt  null   0    -2500.   n  -1.
0000475 cntrlvar 731    lt  null   0     2500.   n  -1.
0000672  472   and   474  n  -1.
0000673  473   and   475  n  -1.
*
*                                        ****************
*                                        *              *
*                                        *    intact    *
*                                        *     loop     *
*                                        *              *
*****************************************************************
* hot leg, vessel outlet to pressurizer surge line tee          *
*****************************************************************
*
*  ref drawings:  hot leg nozzle  - 407986
*                 3  pc-1b (sp-1) - 414684
*                 2.5pc-1B (sp-2) - 407346
*                 2.5pc-2  (sp-3) - 415155
*
*  inlet elev = outlet elev = + 8.500 in.
*
*          name     type
2010000    c201     pipe
*
*        no vol
2010001       2
*
*          area    vol no
2010101  .0395502      1  * hot vessel nozzle (id = 2.880 in)
2010102  .0314314      2  * 3 in sch 160
*
*        length    vol no
2010301 2.6425000      1
2010302 2.4716667      2  * spool pieces 1 and 2
*
*         hz ang   vol no
2010501    -45.0       1
2010502    -45.0       2
*
*         vr ang   vol no
2010601     0.0        2
*
*         elv ch   vol no
2010701     0.0        2
*
*          rough   hy dia   vol no
2010801 6.667e-5      0.0        2
*
*         f loss   r loss   jun no
2010901     0.05     0.05        1
*
*         ctl flg  vol no
2011001       0        2
*
*          vcahs   jun no
2011101       0        1
*
*     ctl  press    temp     zero     zero   air flg   vol no
2011201   3 2258.30  592.30    0.0      0.0        0        1
2011202   3 2258.30  592.30    0.0      0.0        0        2
*
*        ctl flg
2011300       1
*
*         flow-f   flow-g    velj    jun no
2011301   17.450      0.0     0.0         1
*
*****************************************************************
* hot leg - pressurizer surge line tee                          *
*****************************************************************
*
*  ref drawings:  2.5pc-2 (sp-3) - 415155
*                 2.5pc-6 (sp-4) - 414431
*
*  pressurizer connection is horizontal to the hot leg center line.
*
*  inlet elev = outlet elev = + 8.500 in.
*
*          name     type
2020000    c202     branch
*
*        no jun     ctl
2020001       3       1
```

```
*
*          area    length    volume    hz ang    vr ang    elv ch
2020101   .0246289 2.7433333    0.0       0.0       0.0       0.0
*
*          rough    hy dia      ctl
2020102   6.667e-5    0.0        0
*
*      ctl   press     temp
2020200   3  2258.30   592.30
*
*          from        to      jun area   f loss    r loss    vcahs
2021101  201010000 202000000  .0246289    0.075     0.075       0
2022101  202010000 203000000  .0246289    0.075     0.075       0
2023101  997010000 202000000 7.4667e-4     0.0       0.0       101
*
*          flow-f    flow-g     velj
2021201    17.450      0.0       0.0
2022201    17.450      0.0       0.0
2023201     0.000      0.0       0.0
*
************************************************************
* pressurizer time dependent volume  (for steady state calculations)  *
************************************************************
*
*  elev = +325.875 in.
*
*          name      type
9890000     c989     tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
9890101  .06926263   10.00      0.0       0.0       0.0       0.0
*
*          rough    hy dia      ctl
9890102     0.0       0.0        0
*
*        ctl flg
9890200       2
*
*          time   pressure    quale
9890201     0.0    2243.73     1.0
*
************************************************************
* time dependent pressurizer junction                      *
************************************************************
*
*  elev = +325.875 in.
*
*          name      type
9910000   tmd-prz    valve
*
*          from        to      jun area   f loss    r loss    vcahs
9910101  993000000 999000000  .06926263    0.0       0.0       100
*
*      ctl  flow-f    flow-g     velj
9910201   1   0.0       0.0       0.0
*
*        vlv type
9910300    mtrvlv
*
*        op trip   cl trip     slope    init pos    table
9910301     403       423      0.20       1.0         0
*
************************************************************
* pressurizer desired level  time dependent junction       *
************************************************************
*
*  for steady state - input for getting and maintaining desired level
*  elev = 87.000 in.
*
*          name      type
9850000   pzrlvlj    tmdpjun
*
*          from        to      jun area
9850101  980000000 999010000     .012
*
*        ctl flg     trip    search  variable
9850200       1        0     cntrlvar  985
*
*       table takes into account conversion of kg to lb
*          kg        lb
9850201    -10.0   -22.0462     0.0       0.0
9850202     0.0     0.0         0.0       0.0
9850203     10.0    22.0462     0.0       0.0
*
************************************************************
* pressurizer desired level  time dep volume - temp from bottom pzr  *
************************************************************
*
*  for steady state - input for getting and maintaining desired level
*  elev = 87.000 in.
*
*          name      type
9800000   pzrlvlv    tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
9800101    .012     10.00      0.0       0.0       0.0       0.0
*
*          rough    hy dia      ctl
9800102     0.0       0.0        0
*
*        ctl flg     trip    search  variable
9800200       1        0     tempf  999070000
*
*        temp (f)  temp (f)    quale
9800201     80.0      80.0      0.0
9800202    575.0     575.0      0.0
9800203   1340.0    1340.0      0.0
9800204  17540.0   17540.0      0.0
*
************************************************************
* pressurizer spray  time dependent junction               *
************************************************************
*
*  elev = +325.875 in.
*
*          name      type
```

```
9100000     pzrspry    tmdpjun
*
*            from        to   jun area
9100101   920000000 999000000     .012
*
*         ctl flg     trip
9100200         1      418
*
* check flows for 260 - same if normal spray only
*            time   flow-f   flow-g     velj
9100201      -1.0    0.0       0.0      0.0
9100202       0.0    0.0       0.0      0.0
9100203    2000.0    0.0       0.0      0.0
*
************************************************************
* pressurizer spray time dep volume - temp from intact loop cold leg  *
************************************************************
*
*   elev = +326.875 in.
*
*            name      type
9200000     pzrsprv    tmdpvol
*
*            area    length    volume    hz ang    vr ang    elv ch
9200101      .012     10.00       0.0       0.0       0.0       0.0
*
*           rough    hy dia      ctl
9200102       0.0       0.0        0
*
***** normal spray *****
**         ctl flg      trip    search  variable
*9200200         1         0    tempf 261010000
**
**         temp (f)  temp (f)    quale
*9200201       80.0      80.0      0.0
*9200202      575.0     575.0      0.0
*9200203     1340.0    1340.0      0.0
*9200204    17540.0   17540.0      0.0
**
***** auxilary spray or combination *****
*          ctl flg
9200200          3
*
*            time  pressure      temp
9200201       0.0      12.3      80.0
*
************************************************************
* pressurizer pressure relief valve                        *
************************************************************
*
*   elev = +326.875 in.
*
*            name      type   * simulate
9340000     prsrv     valve   * srv
*
*            from        to  jun area    f loss    r loss     vcahs
9340101   999000000 940000000  1.4748e-5     0.0       0.0       100
*
*             cd1       cd2
9340102       0.7      0.84
*
*       ctl  flow-f    flow-g      velj
9340201    1   0.0       0.0       0.0
*
*         vlv type
9340300      trpvlv
*
*            trip
9340301       421
*
************************************************************
* pressurizer relief valve - time dep discharge volume     *
************************************************************
*
*   elev = +326.875 in.
*
*            name      type
9400000     prsdv     tmdpvol
*
*            area    length    volume    hz ang    vr ang    elv ch
9400101     16.00     10.00       0.0       0.0       0.0       0.0
*
*           rough    hy dia      ctl
9400102       0.0       0.0        0
*
*         ctl flg
9400200         2
*
*            time  pressure     quale
9400201       0.0      12.3       1.0
*
************************************************************
* long pressurizer                                         *
************************************************************
*
*   ref drawings:  416200 - pzr assembly
*                  416199 - prz installation
*                  418126 - pzr thermal slock shield for spray, no liner
*
*   vessel id = 3.631 in, total interior height = 239.875 in
*   bottom of pressurizer model is top of heater rod retainer
*   which is 5.2 inches below the lower pressure tap
*   includes 6 heater rods 0.75 inches dia.
*
*   total volume = 2417.26 in3 without thermal shield
*
*   inlet elev  = top    = +326.875 in.
*   outlet elev = bottom = + 87.000 in.
*
*            name      type
9990000     c999      pipe
*
*          no vol
9990001         8
*
*            area    vol no
```

```
9990101  0.0719084       1
9990102  0.0719084       7
9990103  0.0535067       8 * includes 6 htr rods, grid plate.
*
*          area    jun no
9990201  0.0719084       1
9990202  0.0719084       6
9990203  0.0535067       7
*
*         length   vol no
9990301   2.500000       1
9990302   2.552500       6
9990303   2.583333       7
9990304   2.093750       8
*
*         vr ang   vol no
9990601    -90.0         8
*
*         elv ch   vol no
9990701  -2.500000       1
9990702  -2.552500       6
9990703  -2.583333       7
9990704  -2.093750       8
*
*          rough   hy dia   vol no
9990801  6.667e-5  .2858333       1
9990802  6.667e-5  .3025833       7
9990803  6.667e-5  .1005325       8
*
*         f loss   r loss   jun no
9990901      0.0      0.0        7
*
*         ctl flg  vol no
9991001         0       8
*
*          vcals   jun no
9991103         0       7
*
*     ctl  press    quals     zero     zero  air flg   vol no
9991201   2 2258.30   1.00      0.0      0.0       0        2
9991202   2 2258.30   0.0777    0.0      0.0       0        3
9991203   2 2258.30   0.00      0.0      0.0       0        8
*
*         ctl flg
9991300         1
*
*         flow-f   flow-g     velj   jun no
9991301      0.0      0.0      0.0        7
*
*************************************************************
* pressurizer vessel outlet                                 *
*************************************************************
*
*  ref drawings:  416204 & 416205
*  outlet 6 holes + annulus around grid plate
*  elev = +87.000 in.
*
*           name     type
9980000       j+998   sngljun
*
*            from        to  jun area   f loss   r loss    vcals
9980101  999010000 997000000 6.1762e-3      0.0      0.0      100
*
*      ctl  flow-f   flow-g     velj
9980201    1   0.0       0.0      0.0
*
*************************************************************
* pressurizer surge line                                    *
*************************************************************
*
*  ref drawings:  416119 & 416204
*
*  inlet elev = top    = + 87.000 in.
*  outlet elev = bottom = +  8.500 in.
*
*           name     type
9970000       c+997    pipe
*
*          no vol
9970001         3
*
*          area   vol no
9970101  6.1762e-3       1 * includes heater rod retainer
9970102  7.4667e-4       2
9970103  7.4667e-4       3
*
*         length   vol no
9970301  0.5416667       1
9970302  5.6458333       2
9970303  4.0625000       3
*
*         vr ang   vol no
9970601    -90.0         1
9970602    -90.0         2
9970603    -5.46         3
*
*         elv ch   vol no
9970701 -0.5416667       1
9970702 -5.6458333       2
9970703 -0.3541667       3
*
*          rough   hy dia   vol no
9970801  6.667e-5  .0479447       1
9970802  6.667e-5  .0308333       3
*
*         f loss   r loss   jun no
9970901   7.8434   7.8434        1 * total r' = 1.63e9 m**-4
9970902   7.8434   7.8434        2 * divided equally among
*                                  * the two junctions
*                                  * k = (r')(2e+2)
*         ctl flg  vol no
9971001         0       3
*
*          vcals   jun no
9971101         0       2
*
```

```
*      ctl  press     temp      zero      zero  air flg   vol no
9971201   3 2258.30  592.30       0.0       0.0       0        3
*
*          ctl flg
9971300           1
*          flow-f    flow-g      velj    jun no
9971301       0.0       0.0       0.0         2
*
************************************************************
* hot leg pressurizer surge line tee to steam generator inlet *
************************************************************
*
*  ref drawings:  2.5pc-6 (sp-4) - 414431
*                 2.5pc-7 (sp-5) - 414425
*                 2.5pc-8 (sp-6) - 414426
*                 2.5pc-9 (sp-7) - 414427
*                 inlet plenum   - 414271
*
*  inlet elev  = + 8.500 in. (hot leg centerline)
*  outlet elev = + 73.969 in. (bottom of inlet plenum)
*
*            name      type
2030000       c203      pipe
*
*          no vol
2030001           3
*
*            area    vol no
2030101   .0246289         3  * 2.5 in sch-160
*
*          length    vol no
2030301  2.6542072         1  * spool pieces 4,5,6
2030302  2.3329167         2
2030303  2.1884513         3  * spool piece 7 & inlet plenum connect
*
*          vr ang    vol no
2030601       +45.0         1
2030602       +90.0         2
2030603       +45.0         3
*
*          elv ch    vol no
2030701  1.3941666         1
2030702  2.3329167         2
2030703  1.7286602         3
*
*           rough   hy dia    vol no
2030801  6.667e-5       0.0         3
*
*          f loss    r loss    jun no
2030901       0.075     0.075         1
2030902       0.050     0.050         2
*
*          ctl flg   vol no
2031001           0         3
*
*           vcahs    jun no
*kkt
2031101      100000         2
*
*      ctl  press     temp      zero      zero  air flg   vol no
2031201   3 2258.30  592.30       0.0       0.0       0        1
2031202   3 2258.30  592.30       0.0       0.0       0        2
2031203   3 2258.30  592.30       0.0       0.0       0        3
*
*          ctl flg
2031300           1
*
*          flow-f    flow-g      velj    jun no
2031301      17.450       0.0       0.0         2
*kkt
2031401   0.0  0.0  0.55  0.785  2
*
*                                    ********************
*                                    *  intact loop     *
*                                    *    type-ii       *
*                                    *  steam generator *
************************************************************
* steam generator inlet                                    *
************************************************************
*
*  ref drawing:  414271
*
*  elev = +73.969 in.
*
*            name      type
2050000       j205    sngljun
*
*
*            from        to  jun area    f loss    r loss     vcahs
2050101  203010000 210000000  0.024629       6.0       0.0       000
*
*       ctl  flow-f    flow-g      velj
2050201    1  17.450       0.0       0.0
*
************************************************************
* steam generator inlet plenum                             *
************************************************************
*
*  reference - type-ii (intact loop) steam generator part-leg drwg,
*                    and plenum drwg. 414271 (1,2)
*       note - inlet plenum entrance is circular (dia=2.125 in),
*              plenum tapers outward, nonuniformly, with rise to
*              tube sheet inlet (inlet plenum outlet).
*              outlet is rectangular with radiused corners.
*
*  inlet elev  = bottom = + 73.969 in.
*  outlet elev = top    = + 81.594 in.
*
*            name      type
2100000       c210    snglvol
*
*            area    length    volume    hz ang    vr ang    elv ch
2100101       0.0  0.6354167  0.0478680      +90.0     +90.0  0.6354167
*
*           rough   hy dia       ctl
2100102  6.667e-5  0.2805910         0
```

```
*
*      ctl  press     temp     zero
2100200   3  2258.30   592.30      0.0
*
*************************************************************
* intact loop steam generator tube sheet inlet              *
*************************************************************
*
*  ref drawing:  406416
*
*  inlet elev  = bottom = + 81.594 in. (bottom of tube sheet)
*  outlet elev = top    = +102.594 in. (top of tube sheet)
*
*           name     type
2150000     ilts-in   branch
*
*          no jun   in ctl
2150001         2        1
*
*           area    length    volume   hz ang   vr ang   elv ch
2150101   0.019757   1.7500       0.0      0.0     90.0   1.7500
*
*          rough   hy dia      ctl
2150102   5.000e-6   .06475        0
*
*      ctl  press     temp
2150200   3  2258.30   592.30
*
*           from        to  jun area   f loss   r loss    vcahs
2151101   210010000 215000000  0.019757     1.0      0.0      100
2152101   215010000 220000000  0.019757     0.0      0.0      000
*
*         flow-f   flow-g     velj
2151201     17.450      0.0      0.0
2152201     17.450      0.0      0.0
*kkt
2170000  ilsgin    sngljun
2170101  215010000  220000000  0.019757  0.0  0.0  100100
2170110  0.0  0.0  0.775  1.0
2170201  0.0  0.855  0.855  0.0
*
*************************************************************
* steam generator tube bundle                               *
*************************************************************
*
*  ref drawings:  413415 & 414271
*
*  inlet elev = outlet elev = +102.594 in. (top of tube sheet)
*
*  elev long tube   = 391.24 in. above top of tube sheet
*  elev middle tube = 364.86 in. above top of tube sheet
*  elev short tube  = 336.99 in. above top of tube sheet
*
*  elev model tube  = 364.490 in. above top of tube sheet
*
*           name     type
2200000     isgtub    pipe
*
*          no vol
2200001         8
*
*           area    vol no
2200101   0.019757         8    * 6 tubes, id = 0.777 in
*
*         length    vol no
2200301   7.9525000         1    * 8 volumes around u-tubes: 4 up and
2200302   7.9108334         3    * 4 down.  lengths are equivalent
2200303   6.6920292         5    * to secondary side lengths (c600)
2200304   7.9108334         7
2200305   7.9525000         8
*
*          vr ang   vol no
2200601        +90.0         3
2200602        +88.6         4
2200603        -88.6         5
2200604        -90.0         8
*
*          elv ch   vol no
2200701   +7.9525000         1
2200702   +7.9108334         3
2200703   +6.5999883         4
2200704   -6.5999883         5
2200705   -7.9108334         7
2200706   -7.9525000         8
*
*           rough   hy dia   vol no
2200801   5.000e-6   .06475         8
*
*          f loss   r loss   jun no
2200901         0.0      0.0        3
2200902         0.0      0.0        4
2200903         0.0      0.0        7
*
*          ctl flg   vol no
2201001          0         8
*
*          ctl flg   jun no
2201101          0         7
*
*      ctl  press     temp     zero     zero   air flg   vol no
2201201   3  2258.30   592.30      0.0      0.0         0        1
2201202   3  2258.30   592.30      0.0      0.0         0        2
2201203   3  2258.30   592.30      0.0      0.0         0        3
2201204   3  2258.30   592.30      0.0      0.0         0        4
2201215   3  2258.30   531.30      0.0      0.0         0        5
2201216   3  2258.30   531.30      0.0      0.0         0        6
2201217   3  2258.30   531.30      0.0      0.0         0        7
2201218   3  2258.30   531.30      0.0      0.0         0        8
*
*          ctl flg
2201300          1
*
*         flow-f   flow-g     velj   jun no
2201301     17.450      0.0      0.0        7
*
*************************************************************
```

```
* steam generator secondary volume                                *
*******************************************************************
*
*  ref drawings:  413463 - assembly     406419 - separator
*                 413357 - fillers      413415 - baffle plates
*
*  inlet elev =   0.000 in. above top of tube sheet
*  outlet elev = 436.875 in. above top of tube sheet
*
*           name      type
6000000     isgsec    pipe
*
*          no vol
6000001      5
*
*           area    vol no
6000101     0.0       5
*
*           area    jun no
6000201   .0583799      3 * single baffle plate along flow path
6000202   .0917866      4 * baffle plate which supports tc-tube
*
*          length   vol no
6000301  7.9525000      1 * vol begins above top of tube sheet.
6000302  7.9108334      3 * volumes are separated by junctions
6000303  7.4762500      4 * at baffle plates. (not all plates are
6000304  5.1558333      5 * considered - some are within volumes)
*
*          volume   vol no
6000401  1.0038417      1
6000402  0.9402046      2
6000403  0.8926058      3
6000404  1.0017945      4
6000405  2.2709806      5
*
*          vr ang   vol no
6000601    +90.0      5
*
*          elv ch   vol no
6000701  7.9525000      1
6000702  7.9108334      3
6000703  7.4762500      4
6000704  5.1558333      5
*
*          rough    hy dia   vol no
6000801  6.667e-5  .0884737     3
6000802  6.667e-5  .1058911     4
6000803  6.667e-5  .6378870     5
*
*         ctl flg   vol no
6001001     0         5
*
*          vcahs    jun no
6001101     100       4   * baffle plates
*
*     ctl  press    quals     zero      zero    air flg   vol no
6001201  2 829.600  0.02054    0.0       0.0       0        1
6001202  2 829.600  0.04054    0.0       0.0       0        2
6001203  2 829.600  0.06054    0.0       0.0       0        3
6001204  2 829.600  0.06054    0.0       0.0       0        4
6001205  2 829.600  0.10000    0.0       0.0       0        5
*
*         ctl flg
6001300     0
*
*          vel-f     vel-g     velj    jun no
6001301     2.800     4.500     0.0       1
6001302     4.700     7.400     0.0       2
6001303     5.200     10.500    0.0       3
6001304     4.000     11.700    0.0       4
*kkt
6001401 0.0  1.0  1.0  1.0  3
6001402 0.0  1.0  1.0  1.0  4
*
*******************************************************************
* intact loop steam generator secondary separator                  *
*******************************************************************
*
*  ref drawing:  413463
*
*  inlet elev  = 436.875 in. above top of tube sheet
*  outlet elev = 446.375 in. above top of tube sheet
*
*           name      type
6010000     isgsct    separatr
*
*          no jun     ctl
6010001      3         0
*
*           area    length    volume    lz ang    vr ang    elv ch
6010101     0.0    .7916667  .4508175    0.0       90.0   .7916667
*
*           rough   hy dia     ctl
6010102   6.667e-5    0.0       0
*
*      ctl  press    quals
6010200   2 829.600   0.30
*
*           from       to      jun area  f loss  r loss  cahs  voidgf
6011101   601010000 612000000  .4690572    0.0     0.0  1002   0.50
6012101   601000000 602000000  .4690572    0.0     0.0  1002   0.15
6013101   600010000 601000000  .5353713    0.0     0.0  1000
*
*           vel-f     vel-g     velj
6011201    -2.500     1.600     0.0
6012201     1.000     0.0       0.0
6013201     1.600     1.600     0.0
*
*******************************************************************
* intact loop steam generator secondary steam dome                 *
*******************************************************************
*
*  ref drawing:  413795
*
*  inlet elev  = 446.375 in. above top of tube sheet
*  outlet elev = 455.360 in. above top of tube sheet
```

```
*
*          name     type
6110000    isgsd    snglvol
*
*          area    length    volume    hz ang    vr ang    elv ch
6110101     0.0    .748750   .4249623    0.0       90.0    .748750
*
*          rough    hy dia      ctl
6110102   6.667e-5  .5664365      0
*
*      ctl  press    quals     zero
6110200   2 829.600   1.00      0.0
*
*************************************************************
* intact loop steam generator secondary downcomer (top)     *
*************************************************************
*
*  ref drawing:  413463
*
*  inlet elev  = 441.625 in. above top of tube sheet
*  outlet elev = 375.005 in. above top of tube sheet
*
*          name     type
6020000    isgsd    branch
*
*         no jun      ctl
6020001      1         0
*
*          area    length    volume    hz ang    vr ang    elv ch
6020101     0.0   5.5516667  3.0085308    0.0      -90.0   -5.5516667
*
*          rough    hy dia      ctl
6020102   6.667e-5  .3369291      0
*
*      ctl  press    quals
6020200   2 829.600   0.00
*
*          from        to      jun area    f loss    r loss     vcahs
6021101   602010000  603000000  .0819987      0.0       0.0        0
*
*          vel-f     vel-g      velj
6021201    0.4300   -0.3400      0.0
*
*************************************************************
* intact loop steam generator secondary separator bypass    *
*************************************************************
*
*  ref drawing:  413463
*
*  inlet elev  = 441.625 in. above top of tube sheet
*  outlet elev = 460.110 in. above top of tube sheet
*
*          name     type
6120000    isgby    branch
*
*         no jun      ctl
6120001      2         0
*
*          area    length    volume    hz ang    vr ang    elv ch
6120101     0.0   1.5404167  .7816260    0.0       90.0   1.5404167
*
*          rough    hy dia      ctl
6120102   6.667e-5  .6533449      0
*
*      ctl  press    quals
6120200   2 829.600   1.00
*
*          from        to      jun area    f loss    r loss     vcahs
6121101   612010000  611000000  0.3139546     0.0       0.0        3
6122101   602000000  612000000  0.7880455     0.0       0.0        0
*
*          vel-f     vel-g      velj
6121201     0.0       0.0       0.0
6122201     0.0       0.0       0.0
*
*************************************************************
* intact loop steam generator secondary downcomer (bottom)  *
*************************************************************
*
*  ref drawings:  413363 - assembly
*                 414048 - fillers
*
*  inlet elev  = 375.005 in. above top of tube sheet
*  outlet elev =   0.000 in. above top of tube sheet
*
*          name     type
6030000    isgdcb   pipe
*
*         no vol
6030001      4
*
*          area     vol no
6030101     0.0        4
*
*          area     jun no
6030201  0.0292836     3
*
*          length   vol no
6030301   7.4762500     1
6030302   7.9108334     3
6030303   7.9525000     4
*
*          volume   vol no
6030401   .2211171      1
6030402   .2316581      2
6030403   .2316581      3
6030404   .3322701      4
*
*          vr ang   vol no
6030601     -90.0      4
*
*          elv ch   vol no
6030701   -7.4762500     1
6030702   -7.9108334     3
6030703   -7.9525000     4
*
```

```
*          rough    hy dia    vol no
6030801    6.667e-5  .0128227      1
6030802    6.667e-5  .0126981      3
6030803    6.667e-5  .0201639      4
*
*         ctl flg    vol no
6031001         0         4
*
*          vcahs    jun no
6031101         0         3
*
*      ctl   press    quals     zero     zero   air flg   vol no
6031201   2 829.600      0.0      0.0      0.0         0        1
6031202   2 829.600      0.0      0.0      0.0         0        2
6031203   2 829.600      0.0      0.0      0.0         0        3
6031204   2 829.600      0.0      0.0      0.0         0        4
*
*         ctl flg
6031300         0
*
*          vel-f     vel-g     velj    jun no
6031301      6.450     6.100      0.0         3
*
*************************************************************
* downcomer - riser junction (thru flow divider)            *
*************************************************************
*
*  ref drawing:  413979, flow restrictor, adjustable area
*
*  elev = 0.0 in. above top of tube sheet
*
*           name      type
6040000     isgfs     snqljun
*
*           from        to  jun area    f loss    r loss     vcahs
6040101   603010000 600000000  .0417818       0.0       0.0       100
*
*      ctl   vel-f     vel-g     velj
6040201   0  7.500     7.200      0.0
*
*************************************************************
* steam generator secondary - time dep feedwater junction   *
*************************************************************
*
*  elev = 0.0 in. above top of tube sheet
*
*           name      type
6100000     isgfwj    tmdpjun
*
*           from        to  jun area
6100101   620000000 603010000      .012
*
*         ctl flg     trip
*6100200         1      414
*
*           time    flow-f    flow-g     velj
*6100201     -1.0    5.6034       0.0      0.0
*6100202      0.0    5.6034       0.0      0.0
*6100203     24.0    5.6034       0.0      0.0
*6100204     26.0       0.0       0.0      0.0
*
* for steady state - input for keeping steam generator mass constant,
* put in what goes out steam valve - (constant cntl cards 61002xx above)
*
6100200         1      420      cntrlvar  610
*          table takes into account conversion of kg to lb
6100201     -10.0    0.0  0.0   0.0     * ejl
*6100201     -10.0  -22.0462      0.0       0.0
6100202       0.0    0.0         0.0       0.0
6100203       0.1    0.22046     0.0       0.0
6100204      10.0   22.0462      0.0       0.0
*
*************************************************************
* steam generator secondary - time dep feedwater volume     *
*************************************************************
*
*  elev = 0.0 in. above top of tube sheet
*
*           name      type
6200000     isgfwv    tmdpvol
*
*           area    length    volume    hz ang    vr ang    elv ch
6200101     .012     10.00       0.0       0.0       0.0       0.0
*
*          rough   hy dia      ctl
6200102      0.0      0.0        0
*
*         ctl flg
6200200         3
*
*           time  pressure     temp
6200201      0.0    1250.0    405.0   *ejl
*
*************************************************************
* steam generator secondary - time dep aux feedwater junction*
*************************************************************
*
*  elev = 0.0 in. above top of tube sheet
*
*           name      type
6150000     isgafwj   tmdpjun
*
*           from        to  jun area
6150101   625000000 603010000      .012
*
*         ctl flg     trip
6150200         1      416
*
*           time    flow-f    flow-g     velj
6150201     -1.0       0.0       0.0      0.0
6150202      0.0       0.0       0.0      0.0
6150203   2000.0       0.0       0.0      0.0
*
*************************************************************
* steam generator secondary - time dep aux feedwater volume  *
*************************************************************
```

```
*
*  elev = 0.0 in. above top of tube sheet
*
*           name     type
6250000     isgafwv  tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
6250101      .012    10.00     0.0      0.0      0.0      0.0
*
*          rough   hy dia     ctl
6250102      0.0     0.0       0
*
*         ctl flg
6250200         3
*
*           time  pressure    temp
6250201      0.0    900.0     80.0
*
*************************************************************
* steam generator secondary - relief valve                  *
*************************************************************
*
*  elev = 455.360 in. above top of tube sheet
*
*           name     type
6340000     isgrv    valve  * simulate adv
*
*           from       to  jun area   f loss   r loss    vcahs
6340101   611010000 640000000 .0002892    0.0      0.0      100
*
*      ctl flow-f   flow-g     velj
6340201   1   0.0      0.0      0.0
*
*         vlv type
6340300     trpvlv
*
*           trip
6340301      661
*
*************************************************************
* steam generator secondary - time dep relief discharge volume *
*************************************************************
*
*  elev = 455.360 in. above top of tube sheet
*
*           name     type
6400000     isgrdv   tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
6400101     .70584    10.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia     ctl
6400102      0.0     0.0       0
*
*         ctl flg
6400200         2
*
*           time  pressure    quale
6400201      0.0     12.3      1.0
*
*************************************************************
* steam generator secondary - discharge junction valve      *
*************************************************************
*
*  elev = 455.360 in. above top of tube sheet
*
*           name     type
6350000     isgdj    valve
*
*           from       to  jun area   f loss   r loss    vcahs
6350101   611010000 650000000     .007   204.67   204.67      100
*
*      ctl  flow-f   flow-g     velj
6350201   1   0.0    5.6034     0.0
*
*         vlv type
*6350300     mtrvlv
*
*          op trip   cl trip    slope   init pos   table
*6350301       403       410    .33333  0.294088       0
*
*input for steady state control systems (comment out cards 63503xx)
6350300     srvvlv
6350301       637
*
*************************************************************
* steam generator secondary - time dep discharge volume     *
*************************************************************
*
*  elev = 455.360 in. above top of tube sheet
*
*           name     type
6500000     isgdv    tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
6500101     .70584    10.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia     ctl
6500102      0.0     0.0       0
*
*         ctl flg
6500200         2
*
*           time  pressure    quale
6500201      0.0     12.3      1.0
*
*************************************************************
* cross connection - junction from il steam dome to connection pipe *
*************************************************************
*
*  elev = 455.360 in. above top of tube sheet
*
**          name     type
*6370000     ilcnj    sngljun
**
**          from       to  jun area   f loss   r loss    vcahs
```

```
*6370101   611010000 647000000 0.003003      0.0       0.0       000
**
**       ctl  vel-f     vel-g     velj
*6370201   0    0.0       0.0       0.0
**
*************************************************************
* intact loop steam dome cross connection pipe to bl steam dome     *
*************************************************************
*
*  inlet elev  = 455.360 in. above top of tube sheet
*  outlet elev = 476.125 in. above top of tube sheet
*
*  note - cross-over pipe snakes around:
*         vertically   down    18.000 ft
*         horizontally over     8.000 ft
*         horizontally back     6.000 ft
*         vertically   up      19.730 ft
*         horizontally over     5.000 ft, part of 746
*         horizontally forward  2.000 ft, part of 746
*
**            name      type
*6470000       ilcmp     pipe
**
**          no vol
*6470001         3
**
**            area     vol no
*6470101     .003003       3
**
**          length     vol no
*6470301       18.0        1
*6470302       14.0        2
*6470303    19.7304167     3
**
**          vr ang     vol no
*6470601       -90.0       1
*6470602         0.0       2
*6470603       +90.0       3
**
**          elv ch     vol no
*6470701       -18.0       1
*6470702         0.0       2
*6470703    19.7304167     3
**
**           rough    hy dia    vol no
*6470801    6.667e-5     0.0        3
**
**          ctl flg    vol no
*6471001          0        3
**
**           vcabs     jun no
*6471101          0        2
**
**       ctl  press    quals     zero      zero   air flg   vol no
*6471201  2  829.600     0.0       0.0       0.0       0         1
*6471202  2  829.600     0.0       0.0       0.0       0         2
*6471203  2  829.600     0.0       0.0       0.0       0         3
**
**          ctl flg
*6471300          0
**
**           vel-f     vel-g     velj    jun no
*6471301        0.0       0.0       0.0        2
**
*************************************************************
* steam generator secondary - connection valve to broken loop secondary*
*************************************************************
*
*  elev = 455.360 in. above top of tube sheet
*
**            name      type
*6700000       ilblc     valve
**
**            from        to  jun area    f loss    r loss     vcabs
*6700101   647010000 746010000 0.000661      0.0       0.0       100
**
**       ctl  flow-f    flow-g     velj
*6700201  1    0.0       0.0       0.0
**
**         vlv type
*6700300     mtrvlv
**
**          op trip    cl trip     slope    init pos    table
*6700301        624        425       1.0         0.0        0
**
*                                        ******************
*                                        *     end of       *
*                                        *  steam generator *
*                                        *     secondary    *
*************************************************************
* intact loop steam generator tube sheet outlet                  *
*************************************************************
*
*  ref drawings:  406416 & 414271
*
*  inlet elev  = +102.594 in. (top of tube sheet)
*  outlet elev = + 81.594 in. (bottom of tube sheet)
*
*            name      type
2250000     ilts-ot   branch
*
*          no jun       ctl
2250001         2         1
*
*            area    length    volume    hy ang    vr ang    elv ch
2250101   0.019757    1.7500       0.0       0.0     -90.0   -1.7500
*
*           rough    hy dia       ctl
2250102   5.000e-6    .06475         0
*
*       ctl   press      temp
2250200   3  2258.30    531.30
*
*            from        to  jun area    f loss    r loss     vcabs
2251101   220010000 225000000 0.019757      0.0       0.0       000
2252101   225010000 230000000 0.019757      0.0       1.0       100
```

```
*
*          flow-f    flow-g     velj
2251201     17.450       0.0      0.0
2252201     17.450       0.0      0.0
*
*************************************************************
* steam generator outlet plenum                             *
*************************************************************
*
*  ref drawing:  414271
*
*  see note for steam generator inlet plenum (c210)
*
*  inlet elev  = top    = + 81.594 in.
*  outlet elev = bottom = + 73.969 in.
*
*           name     type
2300000     c230   snglvol
*
*           area   length    volume   hz ang    vr ang    elv ch
2300101      0.0  0.6354167 0.0478680  +90.0     -90.0 -0.6354167
*
*          rough   hy dia      ctl
2300102   6.667e-5  .2809910       0
*
*     ctl  press     temp     zero
2300000   3  2258.30  531.30      0.0
*
*************************************************************
* steam generator outlet                                    *
*************************************************************
*
*  elev = +73.969 in.
*
*           name     type
2350000        j8   sngljun
*
*           from       to  jun area   f loss   r loss    vcahs
2350101  230010000 240000000 0.024629      0.0      6.0      000
*
*     ctl  flow-f    flow-g     velj
2350201   1  17.450       0.0      0.0
*
*************************************************************
* pump suction leg                                          *
*************************************************************
*
*  ref drawings:  inlet plenum     - 414271
*                 2.5pc-10 (sp-8)  - 414428
*                 2.5pc-11 (sp-9)  - 414425-2
*                 2.5pc-12 (sp-10) - 414426-2
*                 2.5pc-13 (sp-11) - 414429
*                 2.5pc-14 (sp-12) - 414025-1
*                 2.5pc-15 (sp-13) - 414026
*                 2.5pc-16 (sp-14) - 414027
*                 2.5pc-17 (sp-15) - 414025-2
*                 2.5pc-18 (sp-16) - 414028
*
*  inlet elev  = + 73.969 in.
*  u-bend bottom elev = -110.750 in.
*  outlet elev =  - 9.850 in.
*
*           name     type
2400000     c240     pipe
*
*          no vol
2400001         9
*
*           area   vol no
2400101  0.024629       9 * 2.5 in sch-160
*
*         length   vol no
2400301 1.5217847       1 * spool piece - 8
2400302 3.6662500       2 *       sp - 8,9,10
2400303 3.4475000       3 *       sp - 11,12
2400304 2.8958333       4 *       sp - 13
2400305 3.5076302       5 *       sp - 14 straight + 30 deg bend
2400306 1.5219271       6 *       sp - 14 60 deg of bend
2400307 1.5219271       7 *       sp - 14 60 deg of bend
2400308 3.5076302       8 *       sp - 14 straight + 30 deg bend
2400309 4.2083333       9 *       sp - 15, 16
*
*          vr ang   vol no
2400601      -45.0       1
2400602      -90.0       4
2400603     -86.79       5
2400604      -30.0       6
2400605      +30.0       7
2400606     +86.79       8
2400607      +90.0       9
*
*          elv ch   vol no
2400701 -1.1836602       1
2400702 -3.6662500       2
2400703 -3.4475000       3
2400704 -2.8958333       4
2400705 -3.4733333       5
2400706 -0.7266667       6
2400707  0.7266667       7
2400708  3.4733333       8
2400709  4.2083333       9
*
*          rough   hy dia   vol no
2400801  6.667e-5        0       9
*
*          f loss   r loss   jun no
2400901       0.0      0.0        1
2400902       0.0      0.0        4
2400903       0.0      0.0        7
2400904       0.3      0.3        8
*
*          ctl flg   vol no
2401001          0        9
*
*          ctl flg   jun no
2401101          0        8
```

```
*
*      ctl   press     temp      zero      zero    air flg    vol no
2401201   3  2258.30   531.30     0.0       0.0       0         1
2401202   3  2258.30   531.30     0.0       0.0       0         2
2401203   3  2258.30   531.30     0.0       0.0       0         3
2401204   3  2258.30   531.30     0.0       0.0       0         4
2401205   3  2258.30   531.30     0.0       0.0       0         5
2401206   3  2258.30   531.30     0.0       0.0       0         6
2401207   3  2258.30   531.30     0.0       0.0       0         7
2401208   3  2258.30   531.30     0.0       0.0       0         8
2401209   3  2258.30   531.30     0.0       0.0       0         9
*
*          ctl flg
2401300          1
*
*          flow-f    flow-g     velj    jun no
2401301     17.450      0.0       0.0       8
*
*****************************************************************
* intact loop pump                                              *
*****************************************************************
*
*  inlet elev = bottom = -9.850 in.
*  outlet elev = top   = 0.000 in. -- elevation = 4773'-9.25"
*
*            name      type
2500000      ilpump     pump
*
*            area     length    volume    hz ang    vr ang    elv ch
2500101       0.0    2.26167  0.05584  +169.102    +90.00  0.8208334
*
*          ctl flg
2500102          0
*
*          vol no  jun area    f loss    r loss    jun flg
2500108   240010000 0.015578      0.0       0.0         0
*
*          vol no  jun area    f loss    r loss    jun flg
2500109   261000000 3.739e-3      0.0       0.0        20 * orifice
*
*      ctl   press     temp      zero
2500200   3  2258.30   531.30      0
*
*      ctl  flow-f    flow-g     velj
2500201   1  17.450      0.0       0.0
*
*      ctl  flow-f    flow-g     velj
2500202   1  17.450      0.0       0.0
*
*index     tab data     phase    dif tab  tor tab  sp tab  trip  rever
2500301          0         0         0       -1       0    0     1
*
*            r-sp    isp/rsp     r-fl      r-hd      r-tor      m-in
2500302     22500.0   0.91843    159.8     397.0      9.34       0.3
*
*           r-den    r-m-tr    fr-tr3    fr-tr1    fr-tr2    fr-tr4
2500303      62.3        0       0.0         0         0         0
*
*stop data    els tm    mx-f-sp    mn-r-sp
2500310         0.0       0.0        0.0
*
*card ccccc00-ccccc99 single phase pump head and torque curve set
*  single phase 4 quadrant head tables (homologous curves)
*
2501100   1     1
2501101  0.000, 1.409    0.174, 1.364    0.343, 1.354    0.495, 1.317
2501102  0.700, 1.224    0.884, 1.093    1.00), 1.000
2501200   1     2
2501201  0.000,-0.650    0.250,-0.475    0.500,-0.194    0.624, 0.000
2501202  0.800, 0.400    0.900, 0.700    1.000, 1.000
2501300   1     3
2501301 -1.000, 2.725   -0.888, 2.470   -0.739, 2.240   -0.492, 1.880
2501302 -0.257, 1.670    0.000, 1.409
2501400   1     4
2501401 -1.000, 2.725   -0.783, 2.050   -0.658, 1.760   -0.434, 1.500
2501402 -0.263, 1.270    0.000, 1.057
2501500   1     5
2501501  0.000, 0.619    0.226, 0.577    0.451, 0.569    0.654, 0.612
2501502  0.875, 0.759    1.000, 1.000
2501600   1     6
2501601  0.000, 1.057    0.190, 0.888    0.375, 0.831    0.689, 0.807
2501602  0.934, 0.921    1.000, 1.000
2501700   1     7
2501701 -1.000,-0.550   -0.879,-0.275   -0.702, 0.000   -0.561, 0.367
2501702 -0.117, 0.642    0.000, 0.619
2501800   1     8
2501801 -1.000,-0.550   -0.500,-0.600    0.000,-0.650
*
*  single phase 4 quadrant torque tables
*
2501900   2     1
2501901  0.000, 0.540    0.200, 0.590    0.400, 0.650    0.600, 0.770
2501902  0.800, 0.950    0.900, 0.980    0.950, 0.960    1.000, 0.870
2502000   2     2
2502001  0.000,-0.150    0.200, 0.020    0.400, 0.220    0.600, 0.460
2502002  0.800, 0.710    0.900, 0.810    0.950, 0.850    1.000, 0.870
2502100   2     3
2502101 -1.000, 0.620   -0.800, 0.680   -0.600, 0.530   -0.400, 0.460
2502102 -0.200, 0.490    0.000, 0.540
2502200   2     4
2502201 -1.000, 0.62    -0.800, 0.530   -0.600, 0.460   -0.400, 0.420
2502202 -0.200, 0.390    0.000, 0.360
2502300   2     5
2502301  0.000,-0.630    0.200,-0.510    0.400,-0.390    0.600,-0.290
2502302  0.800,-0.200    0.900,-0.160    1.000,-0.130
2502400   2     6
2502401  0.000, 0.360    0.200, 0.320    0.400, 0.270    0.600, 0.180
2502402  0.800, 0.050    1.000,-0.130
2502500   2     7
2502501 -1.000,-1.440   -0.800,-1.250   -0.600,-1.080   -0.400,-0.920
2502502 -0.200,-0.770    0.000,-0.630
2502600   2     8
2502601 -1.000,-1.440   -0.800,-1.120   -0.500,-0.790   -0.400,-0.520
2502602 -0.200,-0.310    0.000,-0.150
*
*  two phase head multiplier tables
```

```
*
2503000 0
2503001 0.000, 0.000   0.100, 0.000   0.150, 0.050   0.240, 0.800
2503002 0.300, 0.960   0.400, 0.980   0.600, 0.970   0.800, 0.900
2503003 0.900, 0.800   0.960, 0.500   1.000, 0.000
2503100 0
2503101 0.000,-0.170   .0001,-0.170   0.006, 0.000   0.100, 0.000
2503102 0.150, 0.150   0.240, 0.550   0.800, 0.560   0.960, 0.450
2503103 1.000, 0.000
*
* two phase head difference tables
*
2504100 1      1
2504101 0.000, 0.000   0.100, 0.830   0.200, 1.090   0.500, 1.020
2504102 0.700, 1.010   0.900, 0.940   1.000, 1.000
2504200 1      2
2504201 0.000, 0.000   0.100,-0.040   0.200, 0.000   0.300, 0.100
2504202 0.400, 0.210   0.800, 0.670   0.900, 0.800   1.000, 1.000
2504300 1      3
2504301 -1.000,-1.160  -0.900,-1.240  -0.800,-1.770  -0.700,-2.360
2504302 -0.600,-2.790  -0.500,-2.910  -0.400,-2.670  -0.250,-1.690
2504303 -0.100,-0.500  0.000, 0.000
2504400 1      4
2504401 -1.000,-1.160  -0.900,-0.780  -0.800,-0.500  -0.700,-0.310
2504402 -0.600,-0.170  -0.500,-0.080  -0.350, 0.000  -0.200, 0.050
2504403 -0.100, 0.080  0.000, 0.110
2504500 1      5
2504501 0.000, 0.000   0.200,-0.034   0.400,-0.650   0.600,-0.930
2504502 0.800,-1.190   1.000,-1.470
2504600 1      6
2504601 0.000, 0.110   0.100, 0.130   0.250, 0.150   0.400, 0.130
2504602 0.500, 0.070   0.600,-0.040   0.700,-0.230   0.800,-0.510
2504603 0.900,-0.910   1.000,-1.470
2504700 1      7
2504701 -1.000, 0.000  0.000, 0.000
2504800 1      8
2504801 -1.000, 0.000  0.000, 0.000
*
* two phase torque difference tables
*
2504900 2      1
2504901 0.000, 0.540   0.200, 0.590   0.400, 0.650   0.600, 0.770
2504902 0.800, 0.950   0.900, 0.980   0.950, 0.960   1.000, 0.870
2505000 2      2
2505001 0.000,-0.150   0.200, 0.020   0.400, 0.220   0.600, 0.460
2505002 0.800, 0.710   0.900, 0.810   0.950, 0.850   1.000, 0.870
2505100 2      3
2505101 -1.000, 0.620  -0.800, 0.680  -0.600, 0.530  -0.400, 0.460
2505102 -0.200, 0.490  0.000, 0.540
2505200 2      4
2505201 -1.000, 0.620  -0.800, 0.530  -0.600, 0.460  -0.400, 0.420
2505202 -0.200, 0.390  0.000, 0.360
2505300 2      5
2505301 0.000,-0.630   0.200,-0.510   0.400,-0.390   0.600,-0.290
2505302 0.800,-0.200   0.900,-0.160   1.000,-0.130
2505400 2      6
2505401 0.000, 0.360   0.200, 0.320   0.400, 0.270   0.600, 0.180
2505402 0.800, 0.050   1.000,-0.130
2505500 2      7
2505501 -1.000,-1.440  -0.800,-1.250  -0.600,-1.060  -0.400,-0.920
2505502 -0.200,-0.770  0.000,-0.630
2505600 2      8
2505601 -1.000,-1.440  -0.800,-1.120  -0.600,-0.790  -0.400,-0.520
2505602 -0.200,-0.310  0.000,-0.150
*
* pump coast down table is general table 250
* use control variables 250 and 251 to set pump speed.
*
*            trip      parameter
2506100       420    cntrlvar  251
*table takes into account conversion of rad/sec to rev/min
2506101        -1.0      20665.000
2506102         0.0          0.000
2506103         1.0          9.549
2506104       100.0        954.930
2506105       500.0       4774.297
2506106      1000.0       9549.297
2506107      3000.0      28647.890
*
*************************************************************
* pressurizer spray line tee - time dependent junction      *
*************************************************************
*
*  elev = 0.0 in.
*
*          name     type
2600000    pzrspyt  tmdpjun
*
*          from       to  jun area
2600101  261000000 290000000    .012
*
*        ctl flg     trip
2600200        1      418
*
*          time   flow-f   flow-g     velj
2600201     -1.0     0.0      0.0      0.0
2600202      0.0     0.0      0.0      0.0
2600203   2000.0     0.0      0.0      0.0
*
*************************************************************
* pressurizer spray line - time dependent volume            *
*************************************************************
*
*  elev = 0.0 in.
*
*          name     type
2900000    pzrspyl  tmdpvol
*
*          area   length   volume   hz ang   vr ang   elv ch
2900101     .012    10.00      0.0      0.0      0.0      0.0
*
*         rough   hy dia      ctl
2900102       0.0      0.0        0
*
*        ctl flg
2900200        3
```

```
*
*           time  pressure     temp
2900201      0.0     12.3     80.0
*
*************************************************************
* cold leg...pump outlet to ecc injection point tee         *
*************************************************************
*
*  ref drawings:  3pc-11a (sp-19) - 412544
*                 3pc-12  (sp-20) - 404759
*                 3pc-13  (sp-21) - 404794 or 3pc-1a - 407718
*                 3pc-19a (sp-22) - 414684-3
*
*  inlet elev = outlet elev = 0.000 in.
*
*           name     type
2610000      c261     pipe
*
*         no vol
2610001        2
*
*           area   vol no
2610101   .0375539      2 * 3 in sch-160 (id = 2.624 in)
*
*         length   vol no
2610301  2.0766667      1 * spool piece - 19,20
2610302  2.0766667      2 *         sp - 21 & to ecc tap in sp-22
*
*         vr ang   vol no
2610601      0.0      2
*
*         elv ch   vol no
2610701      0.0      2
*
*          rough   hy dia   vol no
2610801   6.667e-5        0       2
*
*         ctl flg   vol no
2611001         0       2
*
*          vcahs   jun no
2611101       000       1
*
*     ctl   press     temp     zero     zero   air flg   vol no
2611201   3  2258.30  531.30      0.0      0.0         0       2
*
*         ctl flg
2611300         1
*
*         flow-f   flow-g     velj    jun no
2611301     17.450      0.0      0.0         1
*
*************************************************************
* ecc injection tee                                         *
*************************************************************
*
*  ref drawing:  3pc-19a (sp-22) - 414684-3
*
*  inlet elev = outlet elev = 0.000 in.
*
*           name     type
2620000      c262   branch
*
*         no jun     ctl
2620001         3       1
*
*           area   length    volume   bz ang   vr ang   elv ch
2620101   .0375539 2.0766667      0.0    202.5      0.0      0.0
*
*          rough   hy dia     ctl
2620102   6.667e-5      0.0       0
*
*      ctl  press     temp
2620200   3 2258.30  531.30
*
*           from       to  jun area   f loss   r loss    vcahs
2621101  2610100000 2620000000 .0375539     0.30     0.30        0
2622101  2620100000 2630000000 .0375539     0.30     0.30        0
2623101  4000100000 2620000000 .0049952      0.0      0.0    20121
*
*          flow-f   flow-g     velj
2621201     17.450      0.0      0.0
2622201     17.450      0.0      0.0
2623201        0.0      0.0      0.0
*
*************************************************************
* ecc line                                                  *
*************************************************************
*
*  inlet elev = outlet elev = 0.000 in.
*
*           name     type
4000000  ileccpip     pipe
*
*         no vol
4000001        1
*
*           area   vol no
4000101   .0049952        1
*
*         length   vol no
4000301     10.0        1
*
*         vr ang   vol no
4000601      0.0        1
*
*         elv ch   vol no
4000701      0.0        1
*
*          rough   hy dia   vol no
4000801   6.667e-5      0.0        1
*
*         ctl flg   vol no
4001001         0       1
*
*     ctl  press     temp     zero     zero   air flg   vol no
```

```
4001201   3 2258.30  531.30      0.0      0.0        0        1
*
*******************************************************************
* hpis - time dep junction                                        *
*******************************************************************
*
*   elev = 0.0 in.
*
*            name     type
4100000     ilhpisj   tmdpjun
*
*            from       to  jun area
4100101   420000000 400000000 .0049952
*
*         ctl flg     trip    table    volume
4100200         1      498        p 262010000
*
*      pres(psia)   flow-f   flow-g     velj
4100201      -1.0   0.0000      0.0      0.0
4100202       0.0   0.0000      0.0      0.0
4100203      15.0  0.03219      0.0      0.0
4100204    332.25  0.02545      0.0      0.0
4100205    384.51  0.02434      0.0      0.0
4100206    431.70  0.02509      0.0      0.0
4100207    472.88  0.02400      0.0      0.0
4100208    510.39  0.02898      0.0      0.0
4100209    519.09  0.02371      0.0      0.0
4100210    561.93  0.02375      0.0      0.0
4100211    652.46  0.02531      0.0      0.0
4100212    729.93  0.02516      0.0      0.0
4100213    812.43  0.02329      0.0      0.0
4100214    820.29  0.01873      0.0      0.0
4100215   1123.65  0.01480      0.0      0.0
4100216   1158.0   0.01418      0.0      0.0
4100217   1258.0   0.01184      0.0      0.0
4100218   1348.0   0.00968      0.0      0.0
4100219   1407.0   0.00717      0.0      0.0
4100220   1455.0   0.00460      0.0      0.0
4100221   1550.0   0.00         0.0      0.0
4100222   1600.0   0.00         0.0      0.0
*
*******************************************************************
* hpis time dependent volume                                      *
*******************************************************************
*
*   inlet elev = outlet elev = 0.000 in.
*
*            name     type
4200000     ilhpisv   tmdpvol
*
*            area   length   volume   hz ang   vr ang   elv ch
4200101      10.0     10.0      0.0      0.0      0.0      0.0
*
*           rough   hy dia      ctl
4200102  6.667e-5      0.0        0
*
*         ctl flg
4200200         3
*
*            time  pressure     temp
4200201       0.0      12.3     80.0
*
*******************************************************************
* accumulator                                                     *
*******************************************************************
*
*   inlet elev = bottom =   0.000 in.
*   outlet elev = top   = + 43.066 in.
*
*            name     type
4300000      ilacc    accum
*
*            area   length   volume   hz ang   vr ang   elv ch
4300101    0.7085   3.5888      0.0      0.0     90.0   3.5888
*
*           rough   hy dia      ctl
4300102  6.667e-5      0.0       10
*
*        pressure     temp
4300200     615.0     80.0
*
*                    to  jun area    f loss    r loss     vcahs
4301101         400000000  .004995 17227.44  17227.44       000
*
*       vliq  liq lev  lnlen   elev  thick htr-flg tmkrho tmkcp nit-k
4302200 1.582       0   30.0      0  .0574       0      0     0     0
*
*******************************************************************
* cold leg...ecc injection point to downcomer inlet               *
*******************************************************************
*
*   ref drawings:  407986 (downcomer cold leg nozzle)
*
*   inlet elev = outlet elev = 0.000 in.
*
*            name     type
2630000      c263     pipe
*
*          no vol
2630001          1
*
*            area   vol no
2630101   .0396802        1 * 3 in sch-160 (id = 2.624 in)
*
*          length   vol no
2630301    2.1535        1  * cold leg downcomer nozzle
*
*          vr ang   vol no
2630601       0.0        1
*
*          elv ch   vol no
2630701       0.0        1
*
*           rough   hy dia   vol no
2630801  6.667e-5      0.0        1
*
```

```
*         ctl flg   vol no
2631001         0       1
*
*      ctl  press     temp     zero     zero  air flg   vol no
2631201   3 2258.30  531.30      0.0      0.0       0       1
*
*                                    ******************
*                                    *                *
*                                    * reactor vessel *
*                                    *   simulator    *
*                                    *                *
*********************************************************
* cold leg inlet annulus to downcomer tee               *
*********************************************************
*
*  ref drawings: assembly   - 407986
*                inner liner - 407990
*                outer liner - 407991
*
*  inlet elev  = top    = + 12.000 in.
*  outlet elev = bottom = - 12.000 in.
*
*           name     type
1010000    coldtee  branch
*
*         no jun      ctl
1010001         4       1
*
*           area    length    volume   liz ang   vr ang   elv ch
10101101  .1056970  2.0000       0.0       0.0    -90.0  -2.0000
*
*          rough   hy dia      ctl
1010102  6.667e-5  .142750        0
*
*      ctl  press     temp
1010200   3 2258.30  531.30
*
*           from         to  jun area   f loss   r loss    vcahs
1011101  101000000 181000000 7.46674e-4      0.0      0.0      100
1012101  101010000 110000000 0.026039       0.0      0.0        0
1013101  263010000 101000000 0.045082       1.5      1.5      001
1014101  363010000 101000000 0.045082       1.5      1.5      001
*
*          flow-f   flow-g      velj
1011201      0.5908      0.0       0.0
1012201      22.900      0.0       0.0
1013201      17.450      0.0       0.0
1014201      5.840       0.0       0.0
*
*********************************************************
* downcomer                                             *
*********************************************************
*
*  inlet elev  = top    = - 12.000 in.
*  outlet elev = bottom = -214.770 in.
*
*           name     type
1100000    dcomer   pipe
*
*         no vol
1100001        10
*
*           area    vol no
1100101  0.030975        1 * includes reducing section of annulus
1100102  0.026039        8 * downcomer pipe
1100103  0.031502        9 * slanted pipe + entrance half annulus
1100104  0.0762104      10 * distribution annulus
*
*          length   vol no
1100301  2.260833        1
1100302  1.000833        2
1100303  2.000000        7
1100304  1.465667        8
1100305  1.434751        9
1100306  0.962500       10
*
*          vr ang   vol no
1100601     -90.0        8
1100602     -55.75       9
1100603     -90.0       10
*
*          elv ch   vol no
1100701  -2.260833        1
1100702  -1.000833        2
1100703  -2.000000        7
1100704  -1.465667        8
1100705  -1.207667        9
1100706  -0.962500       10
*
*           rough   hy dia   vol no
1100801  6.667e-5  0.195535        1
1100802  6.667e-5  0.0           9
1100803  6.667e-5  0.111833       10
*
*          f loss   r loss   jun no
1100901       0.0      0.0        6
1100902      1.35     1.35        7 * mass flow measurement station
1100903       0.0      0.0        8
1100904       0.0      0.0        9
*
*          ctl flg   vol no
1101001          0       10
*
*           vcahs    jun no
1101101          0        9
*
*      ctl  press     temp     zero     zero  air flg   vol no
1101201   3 2258.30  531.30      0.0      0.0       0       1
1101202   3 2258.30  531.30      0.0      0.0       0       2
1101203   3 2258.30  531.30      0.0      0.0       0       3
1101204   3 2258.30  531.30      0.0      0.0       0       4
1101205   3 2258.30  531.30      0.0      0.0       0       5
1101206   3 2258.30  531.30      0.0      0.0       0       6
1101207   3 2258.30  531.30      0.0      0.0       0       7
1101208   3 2258.30  531.30      0.0      0.0       0       8
1101209   3 2258.30  531.30      0.0      0.0       0       9
```

```
1101210   3 2258.30  531.30      0.0      0.0        0       10
*
*          ctl flg
1101300          1
*
*          flow-f    flow-g     velj    jun no
1101301      22.900       0.0      0.0         9
*
*************************************************************
* lower plenum                                              *
*************************************************************
*
*  inlet elev = top    = -214.770 in.
*  outlet elev = bottom = -223.433 in.
*
*           name     type
1300000     lo-plen  branch
*
*          no jun      ctl
1300001          3        1
*
*           area    length    volume   hz ang   vr ang    elv ch
1300101   0.322478  0.721917     0.0      0.0    -90.0  -0.721917
*
*           rough    hy dia      ctl
1300102   6.667e-5  0.229414        0
*
*      ctl  press     temp
1300200    3 2258.30  531.30
*
*           from        to  jun area   f loss    r loss     vcahs
1301101   110010000 130000000 0.0762184     1.0       1.0       100
1302101   130000000 140000000 0.075189      0.0       0.0       100
1303101   130010000 120000000 0.322478      0.0       0.0       000
*
*          flow-f    flow-g     velj
1301201      22.900       0.0      0.0
1302201      22.900       0.0      0.0
1303201       0.0         0.0      0.0
*kkt
1302110  0.229414  1.0  1.0  1.0
1303110  0.229414  1.0  1.0  1.0
*
*************************************************************
* lower plenum lower volume                                 *
*************************************************************
*
*  inlet elev = top    = -223.433 in.
*  outlet elev = bottom = -229.033 in.
*
*           name     type
1200000     lplovol  snglvol
*
*           area    length    volume   hz ang   vr ang    elv ch
1200101   0.510279  0.466667     0.0      0.0    -90.0  -0.466667
*
*           rough    hy dia      ctl
1200102   6.667e-5  0.381247        0
*
*      ctl  press     temp      zero
1200200    3 2258.30  531.30      0.0
*
*************************************************************
* core inlet                                                *
*************************************************************
*
*  inlet elev = bottom = -214.770 in.
*  outlet elev = top   = -195.140 in.
*
*           name     type
1400000     core-in  snglvol
*
*           area    length    volume   hz ang   vr ang    elv ch
1400101   0.075189  1.635833     0.0      0.0     90.0   1.635833
*
*           rough    hy dia      ctl
1400102   6.667e-5  0.278329        0
*
*      ctl  press     temp      zero
1400200    3 2258.30  531.30      0.0
*kkt
*
*************************************************************
* core inlet junction                                       *
*************************************************************
*
*  elev = -195.140 in.
*
*           name     type
1450000     corein-j  sngljun
*
*           from        to  jun area   f loss    r loss     vcahs
1450101   140010000 150000000 0.026780      0.2       0.1         0
*
*      ctl  flow-f    flow-g     velj
1450201    1  22.900       0.0      0.0
*
*************************************************************
* average channel                                           *
*************************************************************
*
*  inlet elev = bottom = -195.140 in.
*  outlet elev = top   = - 51.140 in.
*
*           name     type
1500000     a-chnel  pipe
*
*          no vol
1500001          6
*
*           area    vol no
1500101   0.030376        6
*
*           area    jun no
1500201   0.026780        5
*
```

```
*          length    vol no
1500301      2.0       6
*
*          vr ang    vol no
1500601      +90.0     6
*
*          elv ch    vol no
1500701      2.0       6
*
*          rough     hy dia    vol no
1500801    6.667e-5  0.032836    6
*
*          f loss    r loss    jun no
1500901      0.10      0.10      5
*
*          ctl flg   vol no
1501001        0       6
*
*          vcahs     jun no
*kkt
1501101      00100     5
*
*      ctl  press     temp      zero      zero   air flg   vol no
1501201   3  2258.30   531.30     0.0       0.0      0        1
1501202   3  2258.30   531.30     0.0       0.0      0        2
1501203   3  2258.30   531.30     0.0       0.0      0        3
1501204   3  2258.30   591.90     0.0       0.0      0        4
1501205   3  2258.30   591.90     0.0       0.0      0        5
1501206   3  2258.30   591.90     0.0       0.0      0        6
*
*          ctl flg
1501300      1
*
*          flow-f    flow-g     velj    jun no
1501301      22.900      0.0      0.0       5
*kkt
1501401 0.032836 1.0  1.0  1.0  5
*
*************************************************************
* upper core                                                 *
*************************************************************
*
*  inlet elv  = bottom = -51.140 in
*  outlet elv = top    = -39.130 in
*
*            name      type
1610000     up-core   branch
*
*          no jun      ctl
1610001        4        1
*
*            area    length    volume    hz ang    vr ang    elv ch
1610101   0.057859  1.000833     0.0       0.0      90.0   1.000833
*
*          rough     hy dia      ctl
1610102   6.667e-5  0.07561       0
*
*      ctl  press     temp
1610200   3  2258.30   591.90
*
*            from        to      jun area   f loss    r loss    vcahs
1611101    150010000 161000000  0.026780     0.8       0.8       000
1612101    161010000 162000000  0.017208     0.0       0.0       100
1613101    162010000 161010000  0.0016085    0.0       0.0       100
1614101    186010000 161010000  0.004606    .43613    .43613     100
*
*          flow-f    flow-g     velj
1611201      22.900      0.0      0.0
1612201      21.000      0.0      0.0
1613201       0.0        0.0      0.0
1614201      -1.900      0.0      0.0
*kkt
1612110 0.07651  1.0  1.0  1.0
1613110 0.07651  1.0  1.0  1.0
*
*************************************************************
* core outlet                                                *
*************************************************************
*
*  inlet elev  = bottom = - 39.130 in.
*  outlet elev = top    = -  6.000 in.
*
*            name      type
1620000     coreout   branch
*
*          no jun      ctl
1620001        1        1
*
*            area    length    volume    hz ang    vr ang    elv ch
1620101   0.045640  2.760833     0.0       0.0      90.0   2.760833
*
*          rough     hy dia      ctl
1620102   6.667e-5  0.120892      0
*
*      ctl  press     temp
1620200   3  2258.30   591.90
*
*            from        to      jun area   f loss    r loss    vcahs
1621101    186000000 162000000  0.075341    .92664    .77720    00003
*
*          flow-f    flow-g     velj
1621201      0.500       0.0      0.0
*kkt
1621110  0.120892  1.0  1.0  1.0
*
*************************************************************
* hot leg outlet tee                                         *
*************************************************************
*
*  inlet elev  = bottom = -  6.000 in.
*  outlet elev = top    = + 23.000 in.
*
*            name      type
1630000     hotout    branch
*
*          no jun      ctl
```

```
1630001        4       1
*
*           area    length    volume   hz ang   vr ang   elv ch
1630101    0.050621  2.416667    0.0      0.0     90.0   2.416667
*
*           rough   hy dia      ctl
1630102    6.667e-5  0.143638     0
*
*      ctl  press     temp
1630200    3  2258.30   592.30
*
*           from        to      jun area   f loss   r loss   vcahs
1631101    163000000 201000000  0.045082     2.5      2.5      002
1632101    163000000 301000000  0.045082     2.5      2.5      002
1633101    162010000 163000000  0.037583     3.0      3.0      000
1634101    163010000 164000000  0.056700     0.0      0.0      000
*
*          flow-f    flow-g      velj
1631201     17.450     0.0        0.0
1632201      5.840     0.0        0.0
1633201     21.500     0.0        0.0
1634201     -2.360     0.0        0.0
*kkt
1632110  0.143638  1.0  1.0  1.0
1633110  0.143638  1.0  1.0  1.0
*
*************************************************************
* top of upper plenum                                       *
*************************************************************
*
*  inlet elev  = bottom = + 23.000 in.
*  outlet elev = top    = + 53.600 in.
*
*           name      type
1640000     upplen    snglvol
*
*           area    length    volume   hz ang   vr ang   elv ch
1640101    0.056700   2.5500     0.0      0.0     90.0   2.5500
*
*           rough   hy dia      ctl
1640102    6.667e-5  0.168707     0
*
*      ctl  press     temp      zero
1640200    3  2258.30   588.00     0.0
*
*************************************************************
* upper head top volume                                     *
*************************************************************
*                                                * geometry with ubi *
*  inlet elev  = top    = +166.760 in.           *  tube removed     *
*  outlet elev = bottom = +132.190 in.           ********************
*
*           name      type
1940000     uptopv    branch
*
*          no jun      ctl
1940001       2         1
*
*           area    length    volume   hz ang   vr ang   elv ch
1940101    0.061635  2.880833    0.0      0.0     -90.0  -2.880833
*
*           rough   hy dia      ctl
1940102    6.667e-5  0.280250     0
*
*      ctl  press     temp
1940200    3  2258.30   531.30     -
*
*           from        to      jun area   f loss   r loss   vcahs
1941101    194010000 183000000  2.19233e-3   0.0      0.0      100
1942101    194010000 193000000  0.053694     0.0      0.0      000
*
*          flow-f    flow-g      velj
1941201     0.5908     0.0        0.0
1942201    -0.5908     0.0        0.0
*
*************************************************************
* upper head - top mid volume                               *
*************************************************************
*                                                * geometry with ubi *
*  inlet elev  = top    = +132.190 in.           *  tube removed     *
*  outlet elev = bottom = + 90.750 in.           ********************
*
*           name      type
1930000     tmphd     branch
*
*          no jun      ctl
1930001       2         1
*
*           area    length    volume   hz ang   vr ang   elv ch
1930101    .053694  3.453333    0.0      0.0     -90.0  -3.453333
*
*           rough   hy dia      ctl
1930102    6.667e-5  0.206333     0
*
*      ctl  press     temp
1930200    3  2258.30   531.30
*
*           from        to      jun area   f loss   r loss   vcahs
1931101    193010000 192000000  0.052330     0.0      0.0      000
1932101    181010000 193010000  7.46674e-4   0.0      0.0      100
*
*          flow-f    flow-g      velj
1931201     0.0        0.0        0.0
1932201     0.5908     0.0        0.0
*
*************************************************************
* upper head middle volume                                  *
*************************************************************
*                                                * geometry with ubi *
*  inlet elev  = top    = + 90.750 in.           *  tube removed     *
*  outlet elev = bottom = + 67.160 in.           ********************
*
*           name      type
1920000     lo-plen   branch
*
*          no jun      ctl
```

```
1920001         2       1
*
*           area    length    volume    hz ang    vr ang    elv ch
1920101    0.052330  1.965833    0.0       0.0     -90.0  -1.965833
*
*           rough    hy dia      ctl
1920102    6.667e-5  0.178830     0
*
*      ctl  press      temp
1920200    3  2258.30   592.30
*
*           from        to  jun area   f loss    r loss     vcahs
1921101    192010000 191000000 0.049603    0.0       0.0       000
1922101    192010000 182000000 0.0016085  5000.0    5000.0     000
*
*          flow-f    flow-g     velj
1921201       0.0       0.0      0.0
1922201       0.0       0.0      0.0
*
*****************************************************************
* upperhead lower volume                                        *
*****************************************************************
*
*  inlet elev = top    = + 67.160 in.
*  outlet elev = bottom = + 61.440 in.
*
*            name      type
1910000      uphlov     pipe
*
*          no vol
1910001         1
*
*            area    vol no
1910101    0.049603      1
*
*          length    vol no
1910301    0.476667      1
*
*          vr ang    vol no
1910601     -90.0        1
*
*          elv ch    vol no
1910701   -0.476667      1
*
*          rough    hy dia    vol no
1910801    6.667e-5  0.138401     1
*
*          ctl flg   vol no
1911001         0       1
*
*      ctl  press      temp      zero      zero   air flg   vol no
1911201    3  2258.30   592.30     0.0       0.0       0       1
*
*****************************************************************
* bypass line from dc upper inlet annulus to upper head         *
*****************************************************************
*
*  inlet elev = bottom = + 12.000 in.
*  outlet elev = top    = + 90.750 in.
*
*            name      type
1810000      bpline     pipe
*
*          no vol
1810001         2
*
*            area    vol no
1810101  7.46674e-4      2
*
*            area    jun no
1810201  1.09978e-4      1
*
*          length    vol no
1810301    3.421917      1
1810302    4.390583      2   * includes horizontal section
*
*          hz ang    vol no
1810501       0.0        2
*
*          vr ang    vol no
1810601       90.0       2
*
*          elv ch    vol no
1810701    3.421917      1
1810702    3.140583      2
*
*          rough    hy dia    vol no
1810801    5.000e-6     0.0       2
*
*           f loss    r loss    jun no
1810901     2.5700    2.5700       1   * adjust to get 0.9%
*
*          ctl flg   vol no
1811001         0       2
*
*          vcahs     jun no
1811101       000       1
*
*      ctl  press      temp      zero      zero   air flg   vol no
1811201    3  2258.30   531.30     0.0       0.0       0       1
1811202    3  2258.30   531.30     0.0       0.0       0       2
*
*          ctl flg
1811300         1
*
*          flow-f    flow-g     velj    jun no
1811301     0.5908      0.0      0.0        1
*
*****************************************************************
* core support column(s) - both modeled as single flow path     *
*****************************************************************
*
*  inlet elev = top    = + 67.160 in.
*  outlet elev = bottom = - 39.130 in.
*
*            name      type
```

```
1820000     septub     pipe
*
*          no vol
1820001         1
*
*            area    vol no
1820101   0.0016085       1
*
*          length    vol no
1820301    8.85750       1
*
*          vr ang    vol no
1820601      -90.0       1
*
*          elv ch    vol no
1820701    -8.85750      1
*
*          rough    hy dia    vol no
1820801    5.000e-6       0        1
*
*          ctl flg    vol no
1821001          0        1
*
*      ctl   press     temp     zero     zero   air flg   vol no
1821201    3  2258.30  592.30     0.0      0.0        0        1
*
*************************************************************
* control rod guide tube (top)                              *
*************************************************************
*
*  inlet elev = top    = +132.190 in.
*  outlet elev = bottom = + 84.200 in.
*
*            name     type
1830000     guitub1    pipe
*
*          no vol
1830001         1
*
*            area    vol no
1830101   2.19233e-3       1
*
*          length    vol no
1830301    3.999167       1
*
*          vr ang    vol no
1830601      -90.0       1
*
*          elv ch    vol no
1830701   -3.999167       1
*
*          rough    hy dia    vol no
1830801    5.000e-6       0.0        1
*
*          ctl flg    vol no
1831001          0        1
*
*      ctl   press     temp     zero     zero   air flg   vol no
1831201    3  2258.30  592.30     0.0      0.0        0        1
*
*************************************************************
* cross-flow volume in guide tube through drill holes to upper plenum *
*************************************************************
*
*  inlet elev = top    = + 84.200 in.
*  outlet elev = bottom = + 23.000 in.
*
*            name     type
1840000     guitub2   branch
*
*          no jun     ctl
1840001         3        1
*
*            area    length    volume    hz ang    vr ang    elv ch
1840101   2.19233e-3   5.1000       0.0       0.0     -90.0   -5.1000
*
*          rough    hy dia     ctl
1840102    5.000e-6       0.0        0
*
*      ctl   press     temp
1840200    3  2258.30  600.00
*
*          from        to  jun area    f loss    r loss    vcals
1841101  183010000 184000000 2.19233e-3       0.0       0.0        0
1842101  184010000 185000000 2.19233e-3       0.0       0.0        0
1843101  184000000 164010000 4.26106e-3    5000.0       0.0        2
* 8 -- 5/16 in. diameter holes connect guide tube to upper plenum (164)
*
*          flow-f    flow-g      velj
1841201       2.3600       0.0       0.0
1842201       2.3600       0.0       0.0
1843201      -1.4000       0.0       0.0
*
*************************************************************
* middle part of guide tube                                 *
*************************************************************
*
*  inlet elev = top    = + 23.000 in.
*  outlet elev = bottom = -  6.000 in.
*
*            name     type
1850000     guitub3    pipe
*
*          no vol
1850001         1
*
*            area    vol no
1850101   2.19233e-3       1
*
*          length    vol no
1850301    2.416667       1
*
*          vr ang    vol no
1850601      -90.0       1
*
*          elv ch    vol no
```

```
1850701    -2.416667       1
*
*           roegh    hy dia    vol no
1850801    5.000e-6      0.0         1
*
*         ctl flg    vol no
1851001           0         1
*
*      ctl   press      temp      zero      zero   air flg    vol no
1851201    3  2258.30    591.90       0.0       0.0         0         1
*
*******************************************************
* lower part of guide tube  (slotted section)         *
*******************************************************
*
*  ref drawing:  408010
*
*  inlet elev  = top    = -  6.000 in.
*  outlet elev = bottom = - 39.130 in.
*
*            name      type
1860000     gnislot   branch
*
*          no jun       ctl
1860001           1         1
*
*            area    length    volume    hz ang    vr ang    elv ch
1860101   0.010809  2.760833       0.0       0.0     -90.0 -2.760833
*
*           rough    hy dia       ctl
1860102   5.000e-6  0.120415         0
*
*      ctl   press      temp
1860200    3  2258.30    591.90
*
*            from        to  jun area    f loss    r loss      vcahs
1861101    185010000 186000000 2.19233e-3    .43613    .43613        100
*
*          flow-f    flow-g      velj
1861201      -1.4000       0.0       0.0
*
*                                                 ************
*                                                 *  broken  *
*                                                 *   loop   *
*******************************************************
* hot leg                                             *
*******************************************************
*  ref drawings:  hot leg nozzle     - 407975
*                 1.5abl-1   (sp-50) - 407670
*                 1.5abl-14a (sp-55) - 414670
*                 1.5abl-30  (sp-56) - 414671
*                 1.5abl-31  (sp-57) - 414672
*                 1.5abl-32  (sp-58) - 414673
*                 1.5abl-33  (sp-59) - 414674
*                 inlet plenum       - 414272
*
*  inlet elev  = + 8.500 in.
*  outlet elev = + 71.969 in.
*
*            name      type
3010000      hl-hl     pipe
*
*          no vol
3010001           6
*
*            area    vol no
3010101   0.0268943         1  * 3 in. sch-160
3010102   0.0097643         6  * 1.5 in sch-160
*
*          length    vol no
3010301   2.1725000         1  * hot leg nozzle
3010302   2.2101267         3  * spool piece - 50
3010303   2.7245243         4  * sp-55
3010304   2.3580833         5  * sp-56,57,58 & 90 bend of 55
3010305   1.9753140         6  * sp-59, and inlet plenum
*
*           hz ang    vol no
3010501         0.0         6
*
*           vr ang    vol no
3010601         0.0         3
3010602        +45.0         4
3010603        +90.0         5
3010604        +45.0         6
*
*           elv ch    vol no
3010701         0.0         3
3010702   1.4025000         4
3010703   2.3580833         5
3010704   1.5284935         6
*
*            rough    hy dia    vol no
3010801   6.667e-5       0.0         6
*
*           f loss    r loss    jun no
3010901         0.3       0.3         1
3010902         0.1       0.1         2
3010903         0.8       0.8         3
3010904         0.8       0.8         5
*
*          ctl flg    vol no
3011001           0         6
*
*            vcahs    jun no
*kkt
3011101      100000         5
*
*      ctl   press      temp      zero      zero   air flg    vol no
3011201    3  2258.30    592.30       0.0       0.0         0         1
3011202    3  2258.30    592.30       0.0       0.0         0         2
3011203    3  2258.30    592.30       0.0       0.0         0         3
3011204    3  2258.30    592.30       0.0       0.0         0         4
3011205    3  2258.30    592.30       0.0       0.0         0         5
3011206    3  2258.30    592.30       0.0       0.0         0         6
*
*         ctl flg
```

```
3011300          1
*
*          flow-f    flow-g      velj    jun no
3011301       5.840       0.0       0.0         5
*kkt
3011401  0.0  0.0  0.55  0.785  5
*
*************************************************************
* steam generator inlet                                     *
*************************************************************
*
*  ref drawing:  414272 sh.2
*
*  elev = +71.969 in.
*
*            name      type
3050000         j305    sngljun
*
*            from        to  jun area    f loss    r loss     vcahs
3050101    301010000 310000000  0.0097643     0.0       0.0       000
*
*       ctl  flow-f    flow-g      velj
3050201    1  5.840       0.0       0.0
*
*************************************************************
* steam generator inlet plenum                              *
*************************************************************
*
*  reference - type-ii (broken loop) steam generator pant-leg drwg,
*                    and plenum drwg. 414272 (1,2)
*       note - inlet plenum entrance is circular (dia=1.388 in),
*              plenum tapers outward, nonuniformly, with rise to
*              tube sheet inlet (inlet plenum outlet).
*              outlet is rectangular with radiused corners.
*
*  inlet elev  = + 71.969 in.
*  outlet elev = + 81.594 in.
*
*            name      type
3100000       blsgip    snglvol
*
*            area    length    volume    hz ang    vr ang    elv ch
3100101         0.0  0.8020833  .0495847       0.0      90.0  0.8020833
*
*           rough    hy dia       ctl
3100102    6.667e-5  0.2500218         0
*
*       ctl   press      temp      zero
3100200    3  2258.30    532.30       0.0
*
*************************************************************
* broken loop steam generator tube sheet                    *
*************************************************************
*
*  ref drawing:  412972
*
*  inlet elev  = + 81.594 in. (bottom of tube sheet)
*  outlet elev = +102.604 in. (top of tube sheet)
*
*            name      type
3150000       blts-in   branch
*
*          no jun      ctl
3150001         2         1
*
*            area    length    volume    hz ang    vr ang    elv ch
3150101   0.0060544  1.751830       0.0       0.0     88.07  1.7508333
*
*           rough    hy dia       ctl
3150102    5.000e-6  .0620833         0
*
*       ctl   press      temp      zero
3150200    3  2250.00    548.00
*
*            from        to  jun area    f loss    r loss     vcahs
3151101    310010000 315000000  0.0060544       0.0       0.0       100
3152101    315010000 320000000  0.0060544       0.0       0.0       000
*
*          flow-f    flow-g      velj
3151201       7.310       0.0       0.0
3152201       7.310       0.0       0.0
*kkt
3170000  blsgin  sngljun
3170101  315010000  320000000  6.0544e-3  0.0  0.0  100100
3170110  0.0  0.0  0.725  1.0
3170201  0  0.855  0.855  0.0
*
*************************************************************
* steam generator tube bundle                               *
*************************************************************
*
*  ref drawings:  412977 & 412980
*
*  inlet elev = outlet elev = +102.604 in. (top of tube sheet)
*
*  elev long tube  = 391.00 in. above top of tube sheet
*  elev short tube = 336.00 in. above top of tube sheet
*
*  elev model tube = 363.50 in. above top of tube sheet
*
*            name      type
3200000       bsgtub    pipe
*
*          no vol
3200001         8
*
*            area    vol no
3200101   6.0544e-3         8
*
*          length    vol no
3200301   7.7916667         1  * volumes 2 & 3, 6 & 7 have lengths
3200302   7.5000000         3  * and elevations equal to their corres-
3200303   7.5428897         5  * ponding secondary side volumes.
3200304   7.5000000         7  * volumes 4 & 5 are each half of the
3200305   7.7916667         8  * 180 degree bend.
*
```

```
*          hz ang    vol no
3200501     -90.0        8
*
*          vr ang    vol no
3200601     +90.0        4
3200602     -90.0        8
*
*          elv ch    vol no
3200701  +7.7916667        1
3200702  +7.5000000        3
3200703  +7.5000000        4
3200704  -7.5000000        5
3200705  -7.5000000        7
3200706  -7.7916667        8
*
*           rough    hy dia   vol no
3200801   5.000e-6  .0620833        8
*
*          f loss    r loss    jun no
3200901      0.34      0.34         7
*
*          ctl flg   vol no
3201001          0        8
*
*          ctl flg   jun no
3201101          0        7
*
*      ctl   press      temp      zero   zero  air flg   vol no
3201201   3  2250.00   568.00       0.0    0.0        0        4
3201202   3  2250.00   568.00       0.0    0.0        0        8
*
*          ctl flg
3201300          1
*
*          flow-f    flow-g      velj    jun no
3201301      7.310       0.0       0.0         7
*
*************************************************************
* steam generator secondary volume                          *
*************************************************************
*
*  ref drawings:  assembly - $$$$$$      baffle plates - $$$$$$
*                 separator - $$$$$$
*
*  inlet elev  =  13.000 in. above top of tube sheet
*  outlet elev = 445.375 in. above top of tube sheet
*
*            name      type
7000000     bsgsec     pipe
*
*          no vol
7000001          5
*
*            area    vol no
7000101       0.0         5
*
*            area    jun no
7000201  0.0242668         3 * baffle plates
7000202  0.0203199         4 * 180 deg return - top of short tube
*
*          length    vol no
7000301   6.7083333         1
7000302   7.5000000         4
7000303   6.8229167         5
*
*          volume    vol no
7000401  0.2213819         1
7000402  0.2476839         2
7000403  0.2461911         3
7000404  0.2649840         4
7000405  0.3268035         5
*
*          vr ang    vol no
7000601     +90.0         5
*
*          elv ch    vol no
7000701   6.7083333         1
7000702   7.5000000         4
7000703   6.8229167         5
*
*           rough    hy dia    vol no
7000802   6.667e-5  0.0658845         3
7000803   6.667e-5  0.0753070         4
7000804   6.667e-5  0.1334227         5
*
*          ctl flg   vol no
7001001          0         5
*
*            abs     jun no
7001101        100         3 * baffle plates
7001102        100         4 * 180 deg return
*
*      ctl   press      quals      zero   zero  air flg   vol no
7001201   2  876.000   0.00880       0.0    0.0        0        5
*
*          ctl flg
7001300          0
*
*           vel-f     vel-g      velj     jun no
7001301      2.4000    3.4000       0.0         1
7001302      3.5000    4.8000       0.0         2
7001303      4.0000    6.4000       0.0         3
7001304      3.4000    7.6000       0.0         4
*kit
7001401  0.0  1.0  1.0  1.0  3
7001402  0.0  1.0  1.0  1.0  4
*
*************************************************************
* broken loop steam generator secondary riser (top) (swirl vane)  *
*************************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  = 445.375 in. above top of tube sheet
*  outlet elev = 461.375 in. above top of tube sheet
*
```

```
*           name     type
7010000     swirl    branch
*
*         no jun     ctl
7010001        2       0
*
*           area   length   volume   hz ang   vr ang   elv ch
7010101      0.0 1.3333333 .5794734      0.0     90.0 1.3333333
*
*          rough   hy dia      ctl
7010102 6.667e-5  .6944443        0
*
*     ctl  press    quals     zero
7010200   2 876.000  1.00
*
*           from       to  jun area  f loss  r loss   vcahs
7011101 7000010000 7010000000 .0458694    50.0    50.0     100
7012101 7010000000 7110000000 .0205061     1.5     1.5   00000
*
*          vel-f    vel-g     velj
7011201     0.3500   0.3300     0.0
7012201     0.0      0.0        0.0
*
*************************************************
* broken loop steam generator preliminary separator *
*************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  = 461.375 in. above top of tube sheet
*  outlet elev = 465.875 in. above top of tube sheet
*
*           name     type
7030000     blsgpsp  branch
*
*         no jun     ctl
7030001        1       0
*
*           area   length   volume   hz ang   vr ang   elv ch
7030101      0.0    0.375  .1534235     0.0     90.0    0.375
*
*          rough   hy dia      ctl
7030102 6.667e-5  .2429779        0
*
*     ctl  press    quals     zero
7030200   2 876.000  1.0
*
*           from       to  jun area  f loss  r loss   vcahs
7031101 7010010000 7030000000 .3477297     0.0     0.0     100
*
*          vel-f    vel-g     velj
7031201     0.3500   0.3500     0.0
*
*************************************************
* broken loop steam generator secondary separator *
*************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  = 461.375 in. above top of tube sheet
*  outlet elev = 465.875 in. above top of tube sheet
*
*           name     type
7040000     bsgsep   separatr
*
*         no jun     ctl
7040001        3       0
*
*           area   length   volume   hz ang   vr ang   elv ch
7040101      0.0    0.375  .1002201     0.0     90.0    0.375
*
*          rough   hy dia      ctl
7040102 6.667e-5      0.0        0
*
*     ctl  press    quals     zero
7040200   2 876.000  1.00
*
*           from       to  jun area  f loss  r loss  cahs  voidgf
7041101 7040010000 7050000000 .0796875     0.0     0.0  1000    1.00
7042101 7040000000 7120000000 .0032519    50.0    50.0  1000    0.15
7043101 7030000000 7040000000 .2672536     0.0     0.0  1003
*
*          vel-f    vel-g     velj
7041201     0.3500   0.3500     0.0
7042201     0.3500   0.3500     0.0
7043201     0.3500   0.3500     0.0
*
*************************************************
* broken loop steam generator steam dome          *
*************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  = 465.875 in. above top of tube sheet
*  outlet elev = 476.125 in. above top of tube sheet
*
*           name     type
7050000     blsgsd   snglvol
*
*           area   length   volume   hz ang   vr ang   elv ch
7050101      0.0  .8541667 .0680664     0.0     90.0  .8541667
*
*          rough   hy dia      ctl
7050102 6.667e-5  .3836702        0
*
*     ctl  press    quals     zero
7050200   2 876.000  1.00      0.0
*
*************************************************
* broken loop steam generator riser to downcomer pipe - muffler *
*************************************************
*
*  ref drawing:  assembly - $$$$$$
*
*  inlet elev  = 445.375 in. above top of tube sheet
*  outlet elev = 411.500 in. above top of tube sheet
```

```
*
*          name     type
7110000    bsgmuf   pipe
*
*          no vol
7110001       1
*
*          area     vol no
7110101     0.0        1
*
*          length   vol no
7110301   5.5088494    1
*
*          volume   vol no
7110401   0.6232431    1
*
*          vr ang   vol no
7110601     -30.0      1
*
*          elv ch   vol no
7110701  -2.8229167    1
*
*          rough    hy dia   vol no
7110801   6.667e-5   .3989363    1
*
*          ctl flg  vol no
7111001       0        1
*
*     ctl  press    quals     zero    zero   air flg   vol no
7111201   2 876.000    0.0      0.0     0.0      0        1
*
*************************************************************
* broken loop steam generator riser to downcomer pipe - drains *
*************************************************************
*
*  ref drawing:  assembly - $$$$$$
*
*  inlet elev  = 461.375 in. above top of tube sheet
*  outlet elev = 411.500 in. above top of tube sheet
*
*          name     type
7120000    bsgdrn   pipe
*
*          no vol
7120001       1
*
*          area     vol no
7120101     0.0        1
*
*          length   vol no
7120301   8.9387346    1
*
*          volume   vol no
7120401   0.0718342    1
*
*          vr ang   vol no
7120601     -30.0      1
*
*          elv ch   vol no
7120701  -4.15625      1
*
*          rough    hy dia   vol no
7120801   6.667e-5   .0751667    1
*
*          ctl flg  vol no
7121001       0        1
*
*     ctl  press    quals     zero    zero   air flg   vol no
7121201   2 876.000    0.0      0.0     0.0      0        1
*
*************************************************************
* broken loop steam generator secondary downcomer (top - horizontal) *
*************************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  = 411.500 in. above top of tube sheet
*  outlet elev = 411.500 in. above top of tube sheet
*
*          name     type
7130000    bsgdn    branch
*
*          no jun     ctl
7130001       3        0
*
*          area     length    volume    hz ang   vr ang   elv ch
7130101     0.0   3.1426389 .0366917     0.0      0.0      0.0
*
*          rough    hy dia     ctl
7130102   6.667e-5   .1316182    0
*
*     ctl  press    quals     zero
7130200   2 876.000   1.00
*
*          from       to      jun area   f loss   r loss   vcahs
7131101  711010000 713000000  .0120117     3.5      3.5      000
7132101  712010000 713000000  .0080362     50.0     50.0     000
7133101  713010000 714000000  .0103869     0.0      0.0      0
*
*          vel-f    vel-g     velj
7131201    0.3500   0.3300    0.0
7132201    0.0      0.0       0.0
7133201    0.3500   0.3300    0.0
*
*************************************************************
* broken loop steam generator secondary downcomer             *
*************************************************************
*
*  ref drawing:  assembly - $$$$$$
*                fillers  - $$$$$$
*
*  inlet elev  = 411.500 in. above top of tube sheet
*  outlet elev =  6.500 in. above top of tube sheet
*
*          name     type
7140000    bsgdnc   pipe
```

```
*
*          no vol
7140001         5
*
*            area    vol no
7140101    .0103869         5
*
*            area    jun no
7140201    .0103869         4
*
*          length    vol no
*
7140301   4.0891869         1
7140302   7.5000010         4
7140303   7.3391869         5
*
*7140401  0.0415476  1
*7140402  0.0779017  4
*7140403  0.0753050  5
*          vr ang    vol no
7140601      -90.0         5
*
*          elv ch    vol no
7140701     -4.0000         1
7140702     -7.5000         4
7140703     -7.2500         5
*
*           rough   hy dia    vol no
7140801    6.667e-5    0.115         5
*
*         ctl flg    vol no
7141001         0         5
*
*             als    jun no
7141101         0         4
*
*      ctl   press    quals     zero     zero   air flg    vol no
7141201   2 876.000      0.0      0.0      0.0         0         5
*
*      ctl flg
7141300         0
*
*           vel-f    vel-g     velj    jun no
7141301      6.9000   6.5900      0.0         4
*
*************************************************************
* broken loop steam generator secondary downcomer (bottom - horizontal)*
*************************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  = 6.500 in. above top of tube sheet
*  outlet elev = 6.500 in. above top of tube sheet
*
*            name     type
7150000     bsgdnb   branch
*
*          no jun      ctl
7150001         3         0
*
*            area    length    volume    bz ang    vr ang    elv ch
7150101       0.0 7.8734167 .0972227       0.0       0.0       0.0
*
*           rough   hy dia      ctl
7150102    6.667e-5  .1302273         0
*
*      ctl   press    quals      zero
7150200   2 876.000     0.00
*
*            from        to  jun area    f loss    r loss    vcahs
7151101   714010000 715000000 .0103869       0.0       0.0      000
7152101   715010000 716000000 .0513379      50.0      50.0    00001
7153101   715000000 720010000 .0103869       0.0       0.0    20002
*
*           vel-f     vel-g      velj
7151201      0.3500    0.3300       0.0
7152201      0.3500    0.3300       0.0
7153201      0.0       0.0          0.0
*
*************************************************************
* broken loop steam generator riser bottom volume below feedwater inlet*
*************************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  =  0.000 in. above top of tube sheet
*  outlet elev = 13.000 in. above top of tube sheet
*
*            name     type
7160000     bsgrsb   branch
*
*          no jun      ctl
7160001         1         0
*
*            area    length    volume    bz ang    vr ang    elv ch
7160101       0.0 1.083333 .0344994       0.0      90.0 1.083333
*
*           rough   hy dia      ctl
7160102    6.667e-5  .0659845         0
*
*      ctl   press    quals      zero
7160200   2 876.000     0.00
*
*            from        to  jun area    f loss    r loss    vcahs
7161101   716010000 700000000 .0242668       0.0       0.0      100
*
*           vel-f     vel-g      velj
7161201      0.3500    0.3300       0.0
*
*************************************************************
* broken loop steam generator bottom feedwater pipe                *
*************************************************************
*
*  ref drawing:  assembly - $$$$$$
*
*  inlet elev  = -3.500 in. above top of tube sheet
```

```
*  outlet elev =  6.500 in. above top of tube sheet
*
*           name     type
7200000     bsgfed   pipe
*
*          no vol
7200001         1
*
*           area   vol no
7200101   .0103869      1
*
*          length   vol no
7200301   .8333333      1
*
*          vr ang   vol no
7200601      90.0      1
*
*          elv ch   vol no
7200701   .8333333      1
*
*          rough   hy dia   vol no
7200801  6.667e-5    0.115      1
*
*         ctl flg   vol no
7201001         0      1
*
*      ctl  press    quals     zero   zero  air flg   vol no
7201201   2 876.000     0.0      0.0    0.0      0       1
*
*************************************************************
* steam generator secondary - main feedwater junction       *
*************************************************************
*
*  elev = 411.5 in. above top of tube sheet - top feed (to 726)
*  elev = 6.5 in. above top of tube sheet - bottom feed (to 720)
*
*           name     type
7220000     bsgfwj   tmdpjun
*
*           from       to  jun area
7220101   724000000 720000000    0.004 * bot feed
*
*         ctl flg     trip
*7220200         1      415
*
*           time   flow-f   flow-g     velj
*7220201     -1.0   0.56119     0.0      0.0
*7220202      0.0   0.56119     0.0      0.0
*7220203     24.0   0.56119     0.0      0.0
*7220204     26.0   0.0         0.0      0.0
*
* for steady state - input for keeping steam generator mass constant,
* put in what goes out steam valve - (comment out cards 71002xx above)
*
7220200         1      420       cntrlvar 710
*          table takes into account conversion of kg to lb
*7220201     -10.0   0.0         0.0      0.0
*7220201     -10.0  -22.046      0.0      0.0
7220201      -0.1   -0.22046     0.0      0.0
7220202       0.0    0.0         0.0      0.0
7220203       0.1    0.22046     0.0      0.0
7220204      10.0   22.046       0.0      0.0
*
*************************************************************
* steam generator secondary - main feedwater volume         *
*************************************************************
*
*           name     type
7240000     bsgfwv   tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
7240101    10.00    10.00      0.0      0.0      0.0      0.0
*
*
*          rough   hy dia     ctl
7240102      0.0     0.0       0
*
*         ctl flg
7240200         3
*
*           time  pressure     temp
7240201      0.0    1250.0    405.0 *ejl
*
*************************************************************
* break valve                                               *
*************************************************************
*
*  top feedline break connects from 727 inlet
*  bottom feedline break connects from 720 inlet
*
**           name     type
7250000     brk-vlv  valve
**
**           from       to  jun area   f loss   r loss   vcahs
7250101   720000000 790000000 0.0097643     0.0      0.0      000
**
**            cd1      cd2
7250102      0.90     0.80
**
**       ctl  flow-f   flow-g     velj
7250201   1    0.0      0.0       0.0
**
**         vlv type
7250300     trpvlv
**
**           trip
7250301      402
**
*************************************************************
* containment                                               *
*************************************************************
*
*  elev = 0.000 in.
*
**           name     type
7900000     feedctm  tmdpvol
```

```
**
**          area    length   volume   hz ang   vr ang   elv ch
7900101     10.0     10.0     0.0      0.0      0.0      0.0
**
**          rough   hy dia     ctl
7900102      0.0     0.0       0
**
**         ctl flg
7900200        2
**
**          time  pressure    quale
7900201      0.0     12.3      1.0
**
*******************************************************
* broken loop steam generator top feedwater pipe      *
*******************************************************
*
*  ref drawing:  $$$$$$
*
*  inlet elev  = 411.500 in. above top of tube sheet
*  outlet elev = 411.500 in. above top of tube sheet
*
*          name     type
7260000   bsgnfd    branch
*
*         no jun     ctl
7260001      2        0
*
*          area    length   volume   hz ang   vr ang   elv ch
7260101   .0103869    2.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia     ctl
7260102   6.667e-5   0.115      0
*
*      ctl  press    quals     zero
7260200   2 876.000   0.00
*
*          from        to   jun area   f loss   r loss   vcahs
7261101   726010000 714000000  .0103869    0.0      0.0      000
7262101   726000000 727010000  .0103869    0.0      0.0     20002
*
*          vel-f     vel-g     velj
7261201     0.0       0.0       0.0
7262201     0.0       0.0       0.0
*
*******************************************************
* broken loop steam generator top feedwater break pipe *
*******************************************************
*
*  ref drawing:  assembly - $$$$$$
*
*  inlet elev  = 411.500 in. above top of tube sheet
*  outlet elev = 401.500 in. above top of tube sheet
*
*          name     type
7270000   bsgtbk    pipe
*
*         no vol
7270001        1
*
*          area    vol no
7270101  0.0103869     1
*
*          length  vol no
7270301  0.8333333     1
*
*          vr ang  vol no
7270601    +90.0       1
*
*          elv ch  vol no
7270701  +0.8333333    1
*
*          rough   hy dia   vol no
7270801   6.667e-5   0.115     1
*
*         ctl flg   vol no
7271001      0        1
*
*      ctl  press    quals     zero     zero   air flg   vol no
7271201   2 876.000    0.0      0.0      0.0      0        1
*
*******************************************************
* steam generator secondary - auxilary feedwater junction *
*******************************************************
*
*  elev = 411.500 in. above top of tube sheet
*
*          name     type
7280000   bsgafvj   tmdpjun
*
*          from        to   jun area
7280101  728000000 726000000    .004
*
*         ctl flg     trip
7280200       1       417
*
*          time    flow-f    flow-g     velj
7280201     -1.0      0.0       0.0       0.0
7280202      0.0      0.0       0.0       0.0
7280206   2000.0      0.0       0.0       0.0
*
*******************************************************
* steam generator secondary - auxilary feedwater volume *
*******************************************************
*
*  elev = 411.500 in. above top of tube sheet
*
*          name     type
7290000   bsgafvv   tmdpvol
*
*          area    length   volume   hz ang   vr ang   elv ch
7290101    10.00    10.00     0.0      0.0      0.0      0.0
*
*          rough   hy dia     ctl
7290102     0.0      0.0       0
*
```

```
*          ctl flg
7290200          3
*
*            time  pressure      temp
7290201         0.0     900.0      80.0
*
*************************************************************
* steam generator secondary - relief valve                  *
*************************************************************
*
*  elev = 476.125 in. above top of tube sheet
*
*             name      type
7340000       bsgrv     valve
*
*             from        to  jun area   f loss   r loss    vcahs
7340101    705010000 740000000     .007      0.0       0.0      100
*
*       ctl  flow-f    flow-g     velj
7340201   1    0.0       0.0      0.0
*
*         vlv type
7340300      trpvlv
*
*            trip
7340301         671
*
*************************************************************
* steam generator secondary - time dep relief discharge volume *
*************************************************************
*
*  elev = 476.125 in. above top of tube sheet
*
*             name      type
7400000       bsgrdv    tmdpvol
*
*             area    length    volume    hz ang    vr ang    elv ch
7400101    10.0          10.00       0.0       0.0       0.0       0.0
*
*            rough    hy dia      ctl
7400102         0.0       0.0        0
*
*          ctl flg
7400200          2
*
*            time  pressure     quals
7400201         0.0      12.3      1.0
*
*************************************************************
* steam generator secondary - discharge junction valve      *
*************************************************************
*
*  elev = 476.125 in. above top of tube sheet
*
*             name      type
7350000       bsgdj     valve
*
*             from        to  jun area   f loss   r loss    vcahs
7350101    705010000 750000000     0.007    1022.36   1022.36      100
*
*       ctl  flow-f    flow-g     velj
7350201   1    0.0    0.56119      0.0
*
*         vlv type
*7350300      mtrvlv
*
*          op trip   cl trip     slope   init pos    table
*7350301         403       411       0.2  .04367422        0
*
*
*input for steady state control systems (comment out cards 73503xx above)
7350300      srvvlv
7350301         737
*
*************************************************************
* steam generator secondary - time dep discharge volume     *
*************************************************************
*
*  elev = 476.125 in. above top of tube sheet
*
*             name      type
7500000       bsgdv     tmdpvol
*
*             area    length    volume    hz ang    vr ang    elv ch
7500101    10.0          10.00       0.0       0.0       0.0       0.0
*
*            rough    hy dia      ctl
7500102         0.0       0.0        0
*
*          ctl flg
7500200          2
*
*            time  pressure     quals
7500201         0.0      12.3      1.0
*
*************************************************************
* cross connection - junction to cross connection pipe from blsg *
*************************************************************
*
*  elev = 476.125 in. above top of tube sheet
*
**            name      type
*7370000       blcnj     sngljun
**
**            from        to  jun area   f loss   r loss    vcahs
*7370101    705010000 746000000 0.003003       0.0       0.0      100
**
**       ctl  vel-f     vel-g     velj
*7370201   0    0.0       0.0      0.0
**
*************************************************************
* broken loop steam dome cross connection pipe to il steam dome *
*************************************************************
*
*  inlet elev = outlet elev = 476.125 in. above top of tube sheet
*
```

```
*  note - cross-over pipe snakes around:
*         horizontally back     2.000 ft
*         horizontally over     5.000 ft
*         vertically   down    18.000 ft, part of 647
*         horizontally forward  6.009 ft, part of 647
*         horizontally over     8.000 ft, part of 647
*         vertically   up      19.730 ft, part of 647
*
**            name      type
*7460000       blcmp     pipe
**
**          no vol
*7460001         1
**
**            area    vol no
*7460101     .003003       1
**
**          length    vol no
*7460301        7.0        1
**
**          vr ang    vol no
*7460601        0.0        1
**
**          elv ch    vol no
*7460701        0.0        1
**
**          rough     hy dia    vol no
*7460801    6.667e-5      0.0        1
**
**         ctl flg    vol no
*7461001          0        1
**
**      ctl  press    quals     zero      zero   air flg    vol no
*7461201   2 675.900     0.0      0.0       0.0        0         1
**
*************************************************************
* broken loop steam generator tube sheet outlet             *
*************************************************************
*
*  ref drawing:  418972
*
*  inlet elev  = +102.604 in. (top of tube sheet)
*  outlet elev = + 81.594 in. (bottom of tube sheet)
*
*            name      type
3250000     blts-ot   branch
*
*          no jun      ctl
3250001          2        1
*
*            area    length    volume    hz ang    vr ang    elv ch
3250101   6.0544e-3  1.751830     0.0       0.0    -88.07  -1.750833
*
*          rough     hy dia      ctl
3250102   5.000e-6   .0620833       0
*
*      ctl  press     temp      zero
3250200   3 2250.00   547.00
*
*           from        to    jun area    f loss    r loss     vcahs
3251101   320010000 325000000 6.0544e-3       0.0       0.0       000
3252101   325010000 330000000 6.0544e-3       0.0       0.0       100
*
*          flow-f    flow-g      velj
3251201      7.310       0.0       0.0
3252201      7.310       0.0      -0.0
*
*************************************************************
* steam generator outlet plenum                             *
*************************************************************
*
*  ref drawing:  414272, sh.2, see note for sg inlet plenum (c310)
*
*  inlet elev  = top    = + 81.594 in.
*  outlet elev = bottom = + 71.969 in.
*
*            name      type
3300000     st-outpl    snglvol
*
*            area    length    volume    hz ang    vr ang    elv ch
3300101       0.0 0.8020833  .0495847       0.0     -90.0 -0.8020833
*
*          rough     hy dia      ctl
3300102   6.667e-5 0.2600218        0
*
*      ctl  press     temp      zero
3300200   3 2258.30   531.30       0.0
*
*************************************************************
* steam generator outlet                                    *
*************************************************************
*
*  elev = +71.969 in.
*
*            name      type
3350000     sg-to-ps    sngljun
*
*           from        to    jun area    f loss    r loss     vcahs
3350101   330010000 340000000 0.00976-03       0.0       0.0       000
*
*      ctl  flow-f    flow-g      velj
3350201   1  5.840       0.0       0.0
*
*************************************************************
* pump suction leg                                          *
*************************************************************
*
*  ref drawings:  inlet plenum      - 414272
*                 1.5ab1-34 (sp-60) - 414675-1
*                 1.5ab1-35 (sp-61) - 414676-1
*                 1.5ab1-36 (sp-62) - 414672-2
*                 1.5ab1-37 (sp-63) - 414673-2
*                 1.5ab1-6a (sp-64) - 414677-1
*                 1.5ab1-7  (sp-65) - 407384-1
*                 1.5ab1-9  (sp-72) - 407380-1
*                 1.5ab1-11 (sp-73) - 407673-1
```

```
*
*  inlet elev  = + 71.969 in.
*  u-tube bottom elev = -110.155 in.
*  outlet elev = - 10.640 in.
*
*           name     type
3400000     bl-ps    pipe
*
*          no vol
3400001        9
*
*           area    vol no
3400101  0.0097643       9  * 1 1/2 in sch-160
*
*         length    vol no
3400301  1.6054810        1  * spool piece-60 and inlet plenum
3400302  2.3333333        2  *        sp-61,62
3400303  1.6437500        3  *        sp-63 & 64 to pressure tap
3400304  4.9431250        4  *        sp-64
3400305  4.2364583        5  *        sp-64 & 65 to bend of u
3400306  1.0157816        6  *        sp-65 1/2 of bend
3400307  1.0157816        7  *        sp-65 1/2 of bend
3400308  5.3495833        8  *        sp-65,72
3400309  2.2966667        9  *        sp-73
*
*          hz ang    vol no
3400501       0.0        9
*
*          vr ang    vol no
3400601       -45.0      1
3400602       -90.0      5
3400603       -45.0      6
3400604       +45.0      7
3400605       +90.0      9
*
*          elv ch    vol no
3400701  -1.3076602        1
3400702  -2.3333333        2
3400703  -1.6437500        3
3400704  -4.9431250        4
3400705  -4.2364583        5
3400706  -0.6466667        6
3400707  +0.6466667        7
3400708  +5.3495833        8
3400709  +2.2966667        9
*
*           rough    hy dia    vol no
3400801  6.667e-5       0.0        9
*
*          f loss    r loss    jun no
3400901       0.0       0.0         1
3400902       0.0       0.0         2
3400903       0.0       0.0         7
3400904       1.3       1.3         8
*
*          ctl flg   vol no
3401001          0        9
*
*          ctl flg   jun no
3401101          0        8
*
*      ctl   press     temp     zero     zero   air flg   vol no
3401201   3  2258.30   531.30      0.0      0.0         0        1
3401202   3  2258.30   531.30      0.0      0.0         0        2
3401203   3  2258.30   531.30      0.0      0.0         0        3
3401204   3  2258.30   531.30      0.0      0.0         0        4
3401205   3  2258.30   531.30      0.0      0.0         0        5
3401206   3  2258.30   531.30      0.0      0.0         0        6
3401207   3  2258.30   531.30      0.0      0.0         0        7
3401208   3  2258.30   531.30      0.0      0.0         0        8
3401209   3  2258.30   531.30      0.0      0.0         0        9
*
*          ctl flg
3401300          1
*
*          flow-f    flow-g      velj    jun no
3401301       5.840      0.0       0.0         8
*
*
*************************************************************
* pump discharge pipe and ecc injection tee                 *
*************************************************************
*
*  ref drawing:  1.5ab1-12 (sp-74) - 407674
*
*  inlet elev = outlet elev = 0.000 in.
*
*           name     type
3610000   pmp-disc   branch
*
*          no jun      ctl
3610001         2        1
*
*           area    length    volume    hz ang    vr ang    elv ch
3610101  0.0097643    1.9700       0.0       0.0       0.0       0.0
*
*           rough    hy dia      ctl
3610102   6.667e-5       0.0        0
*
*      ctl   press     temp
3610200   3  2258.30   531.30
*
*           from        to    jun area    f loss    r loss    vcahs
3611101  361010000 362000000  .0097643       1.2       1.2      000
3612101  500010000 361000000  .002895        0.0       0.0    20121
*
*          flow-f    flow-g      velj
3611201       5.840      0.0       0.0
3612201       0.0        0.0       0.0
*
*************************************************************
* ecc line                                                  *
*************************************************************
*
*  inlet elev = outlet elev = 0.000 in.
*
```

```
*          name     type
5000000   bleccpip    pipe
*
*          no vol
5000001         1
*
*          area   vol no
5000101   0.002695      1    * 0.703 in. id
*
*          length   vol no
5000301      10.0      1
*
*          vr ang   vol no
5000601        0.0      1
*
*          elv ch   vol no
5000701        0.0      1
*
*          rough   hy dia   vol no
5000801   6.667e-5      0.0      1
*
*          ctl flg   vol no
5001001          0      1
*
*      ctl   press     temp     zero     zero   air flg   vol no
5001201   3  2258.30   531.30      0.0      0.0         0        1
*
*************************************************************
* hpis injection junction                                   *
*************************************************************
*
*  elev = 0.000 in.
*
*          name     type
5100000    blhpisj   tmdpjun
*
*          from        to  jun area
5100101  520000000 500000000 0.002695
*
*         ctl flg     trip    table    volume
5100200         1      408        p  361010000
*
*       pres(psia)   flow-f   flow-g     velj
5100201       -1.0     0.00       0.0      0.0
5100202        0.0     0.00       0.0      0.0
5100203       15.0   0.0125       0.0      0.0
5100204     333.57  0.01113       0.0      0.0
5100205     581.36  0.01000       0.0      0.0
5100206     699.77  0.00974       0.0      0.0
5100207      770.0  0.00868       0.0      0.0
5100208      881.0  0.00795       0.0      0.0
5100209    1007.23  0.00705       0.0      0.0
5100210     1024.0  0.00683       0.0      0.0
5100211     1158.0   0.0059       0.0      0.0
5100212     1258.0   0.0051       0.0      0.0
5100213     1348.0   0.0039       0.0      0.0
5100214     1407.0   0.0031       0.0      0.0
5100215     1455.0   0.0019       0.0      0.0
5100216     1550.0     0.00       0.0      0.0
5100217     1600.0     0.00       0.0      0.0
*
*************************************************************
* hpis volume                                               *
*************************************************************
*
*  elev = 0.000 in.
*
*          name     type
5200000    blhpisv   tmdpvol
*
*          area   length   volume   hz ang   vr ang   elv ch
5200101      10.0     10.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia     ctl
5200102        0.0      0.0       0
*
*        ctl flg
5200200         3
*
*          time  pressure     temp
5200201       0.0     12.3     80.0
*
*************************************************************
* accumulator                                               *
*************************************************************
*
*  inlet elev = bottom =    0.000 in.
*  outlet elev = top   = + 13.757 in.
*
*          name     type
5300000     blacc    accum
*
*          area   length   volume   hz ang   vr ang   elv ch
5300101    0.7085   1.1464      0.0      0.0     90.0   1.1464
*
*          rough   hy dia     ctl
5300102        0.0      0.0      10
*
*       pressure     temp
5300200      615.0     80.0
*
*                   to  jun area    f loss    r loss     vcahs
5301101          500000000  0.002695 50149.59  50149.59       000
*
*       vliq  liq lev  lnlen  elev  thick htr-flg tmkrho tmkcp nit-k
5302200 0.555       0 20.00     0  .0417       0      0     0     0
*
*************************************************************
* broken loop cold leg break tee                            *
*************************************************************
*
*  ref drawing:  1.5ab1-17 or 1.5ab126a (sp-76) - 407875
*
*  inlet elev = outlet elev = 0.000 in.
*
*          name     type
```

```
3620000     brk-tee    branch
*
*          no jun      ctl
3620001         1         1
*
*           area     length    volume    hz ang    vr ang    elv ch
3620101  0.0097643  1.647500       0.0       0.0       0.0       0.0
*
*           rough    hy dia       ctl
3620102  6.667e-5       0.0         0
*
*      ctl   press      temp
3620200   3  2258.30   531.30
*
*           from         to  jun area    f loss    r loss     vcahs
3621101  362010000 363000000  .0097643       1.2       1.2       000
*
*         flow-f    flow-g      velj
3621201      5.840       0.0       0.0
*
*************************************************************
* broken loop cold leg  ( downstream of break)              *
*************************************************************
*
*  ref drawings:  1.5ab1-17 (sp-76) - 407875
*                 1.5ab1-15 (sp-79) - 407675
*                 cold leg nozzle   - 407986
*
*           name      type
3630000      bl-cl      pipe
*
*          no vol
3630001         2
*
*           area    vol no
3630101  0.0097643         1  * 1 1/2 in sch-160 pipe
3630102  0.0375539         2  * downcomer inlet annulus nozzle
*
*         length    vol no
3630301  2.3341667         1  * sp-79
3630302  1.2761677         2  * cold leg nozzle
*
*          vr ang    vol no
3630601       0.0         2
*
*          elv ch    vol no
3630701       0.0         2
*
*           rough    hy dia    vol no
3630801   6.667e-5       0.0         2
*
*         ctl flg    vol no
3631001         0         2
*
*           vcahs    jun no
3631101         0         1
*
*      ctl   press      temp      zero      zero   air flg    vol no
3631201   3  2258.30   531.30       0.0       0.0         0         2
*
*          ctl flg
3631300         1
*
*          flow-f    flow-g      velj    jun no
3631301       5.840       0.0       0.0         1
*
*************************************************************
* break junction                                            *
*************************************************************
*
*  elev = 0.000 in.
*
*                          break sizes:
*                            0.5% - 0.00001279  (nominal)  s-nh-1
*                            2.1% - 0.00005116  (nominal)
*                            2.5% - 0.00006175  (nominal)
*                            5.0% - 0.00012979  (nominal)
*                           10.0% - 0.000247    (nominal)
*
*           name      type
*3750000      brk-vlv      valve
*
*           from         to  jun area    f loss    r loss     vcahs
*3750101  362010000 900000000 0.00001279       0.0       0.0       100
*
*            ctl1      ctl2
*3750102       0.90      0.90
*
*      ctl  flow-f    flow-g      velj
*3750201    1   0.0       0.0       0.0
*
*          vlv type
*3751300      trpvlv
*
*            trip
*3750301         402
*
*************************************************************
* containment                                               *
*************************************************************
*
*  elev = 0.000 in.
*
*           name      type
*9000000      contain      tmdpvol
*
*           area    length    volume    hz ang    vr ang    elv ch
*9000101      10.0      10.0       0.0       0.0       0.0       0.0
*
*           rough    hy dia       ctl
*9000102       0.0       0.0         0
*
*          ctl flg
*9000200         2
*
*           time  pressure    quale
```

```
*9000201        0.0     12.3      1.0
*
*****************************************************************
* heat loss ambient volumes                                     *
*****************************************************************
*
*           name     type
8000000     ilsg     tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
8000101     10.0      1.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia      ctl
8000102      0.0      0.0        0
*
*        ctl flg
8000200        1
*
*           time     temp    quale
8000201      0.0     80.0      1.0
*
*****************************************************************
*
*           name     type
8010000     ibbl     tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
8010101     10.0      1.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia      ctl
8010102      0.0      0.0        0
*
*        ctl flg
8010200        1
*
*           time     temp    quale
8010201      0.0     80.0      1.0
*
*****************************************************************
*
*           name     type
8020000     blps     tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
8020101     10.0      1.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia      ctl
8020102      0.0      0.0        0
*
*        ctl flg
8020200        1
*
*           time     temp    quale
8020201      0.0     80.0      1.0
*
*****************************************************************
*
*           name     type
8030000     ibcl     tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
8030101     10.0      1.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia      ctl
8030102      0.0      0.0        0
*
*        ctl flg
8030200        1
*
*           time     temp    quale
8030201      0.0     80.0      1.0
*
*****************************************************************
*
*           name     type
8040000     ilps     tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
8040101     10.0      1.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia      ctl
8040102      0.0      0.0        0
*
*        ctl flg
8040200        1
*
*           time     temp    quale
8040201      0.0     80.0      1.0
*
*****************************************************************
*
*           name     type
8050000     vslduc   tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
8050101     10.0      1.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia      ctl
8050102      0.0      0.0        0
*
*        ctl flg
8050200        1
*
*           time     temp    quale
8050201      0.0     80.0      1.0
*
*****************************************************************
*
*           name     type
8060000     pzrcap   tmdpvol
*
*           area   length   volume   hz ang   vr ang   elv ch
8060101     10.0      1.0      0.0      0.0      0.0      0.0
*
*          rough   hy dia      ctl
8060102      0.0      0.0        0
```

```
*
*          ctl flg
8060200        1
*
*          time     temp     quale
8060201     0.0      80.0      1.0
*
*****************************************************************
*
*          name     type
8070000    pzrsl    tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
8070101    10.0      1.0       0.0       0.0       0.0       0.0
*
*          rough    hy dia     ctl
8070102     0.0       0.0       0
*
*          ctl flg
8070200        1
*
*          time     temp     quale
8070201     0.0      80.0      1.0
*
*****************************************************************
*
*          name     type
8080000    tbsht    tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
8080101    10.0      1.0       0.0       0.0       0.0       0.0
*
*          rough    hy dia     ctl
8080102     0.0       0.0       0
*
*          ctl flg
8080200        1
*
*          time     temp     quale
8080201     0.0      80.0      1.0
*
*****************************************************************
*
*          name     type
8090000    blsg     tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
8090101    10.0      1.0       0.0       0.0       0.0       0.0
*
*          rough    hy dia     ctl
8090102     0.0       0.0       0
*
*          ctl flg
8090200        1
*
*          time     temp     quale
8090201     0.0      80.0      1.0
*
*****************************************************************
*
*          name     type
8110000    ibtlh    tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
8110101    10.0      1.0       0.0       0.0       0.0       0.0
*
*          rough    hy dia     ctl
8110102     0.0       0.0       0
*
*          ctl flg
8110200        1
*
*          time     temp     quale
8110201     0.0      80.0      1.0
*
*****************************************************************
*
*          name     type
8120000    blpsh    tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
8120101    10.0      1.0       0.0       0.0       0.0       0.0
*
*          rough    hy dia     ctl
8120102     0.0       0.0       0
*
*          ctl flg
8120200        1
*
*          time     temp     quale
8120201     0.0      80.0      1.0
*
*****************************************************************
*
*          name     type
8130000    ibclh    tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
8130101    10.0      1.0       0.0       0.0       0.0       0.0
*
*          rough    hy dia     ctl
8130102     0.0       0.0       0
*
*          ctl flg
8130200        1
*
*          time     temp     quale
8130201     0.0      80.0      1.0
*
*****************************************************************
*
*          name     type
8140000    ilpsh    tmdpvol
*
*          area    length    volume    hz ang    vr ang    elv ch
8140101    10.0      1.0       0.0       0.0       0.0       0.0
```

```
*
*          roegh  hy dia      ctl
8140102     0.0    0.0        0
*
*        ctl flg
8140200       1
*
*          time    temp     quale
8140201     0.0    80.0      1.0
*
*****************************************************
*
*          name     type
8150000    vsldmh   tmdpvol
*
*          area    length   volume   hz ang   vr ang   elv ch
8150101    10.0     1.0      0.0      0.0      0.0      0.0
*
*          roegh   hy dia     ctl
8150102     0.0     0.0       0
*
*        ctl flg
8150200       1
*
*          time    temp     quale
8150201     0.0    80.0      1.0
*
*****************************************************
*
*          name     type
8160000    pzrh     tmdpvol
*
*          area    length   volume   hz ang   vr ang   elv ch
8160101    10.0     1.0      0.0      0.0      0.0      0.0
*
*          roegh   hy dia     ctl
8160102     0.0     0.0       0
*
*        ctl flg
8160200       1
*
*          time    temp     quale
8160201     0.0    80.0      1.0
*
*****************************************************
*****************************************            *
*****************************************  heat structure  *
*****************************************  information  *
*****************************************            *
*****************************************************
*
*****************************************************
* downcomer inlet annulus heat loss (above cold leg nozzle)  *
*****************************************************
*
* left boundary  = component 101
* right boundary = ambient volume (805)
*
*gl data        nh      np      type     s-flg    l-cor
110010000        1       8       2        1     0.271375
*
*mesh       loc flg   frm flg
110010100        0       1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
110010101        2    0.279708    -1    0.283850      2    0.353375
110010102        2    0.526042
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
110010201        1       2        2        3        1        5
110010202        8       7
*
*source dis   source    itv no
110010301       0.0        7
*
*init temp      flg
110010400         0
*
*         temp mesh   temp mesh   temp mesh   temp mesh
110010401  542.3   3   301.9   6   232.6   7   175.7   8
*
*l-body      hy-vol      inc    b-cdit   a-code   cy-length   bt-str-no
110010501   101010000       0       1        1     0.875000       1
*
*r-body      hy-vol      inc    b-cdit   a-code   cy-length   bt-str-no
110010601   805010000       0      4100      1     0.875000       1
*
*source       type    is-nplr      l-dr-bt      r-dr-bt      bt-str-no
110010701      0          0            0            0           1
*
*l-h-st     chf-btr    hy-dia     h-eq-dia    ch-length    bt-str-no
*110010801        0       0.0     0.247955     1.875000        1
110010801  0.247955  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-btr    hy-dia     h-eq-dia    ch-length    bt-str-no
*110010901        0       0.0          0.0     1.875000        1
110010901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************
* downcomer inlet annulus hollow center (above cold leg nozzle)  *
*****************************************************
*
* left boundary  = adiabatic
* right boundary = component 101
*
*gl data        nh      np      type     s-flg    l-cor
110110000        1       6       2        1     0.12500
*
*mesh       loc flg   frm flg
110110100        0       1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
110111101        2    0.18750      1    0.191667      2    0.20000
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
110112201        1       2        2        3        1        5
```

```
*
*source dis  source    itv no
11011301       0.0        5
*
*init temp      flg
11011400         0
*
*        temp mesh    temp mesh
11011401 550.0   3  549.7   6
*
*l-bndy      by-vol       inc   b-cdt  a-code  cy-length  bt-str-no
11011501          0         0      0       1     0.87500       1
*
*r-bndy      by-vol       inc   b-cdt  a-code  cy-length  bt-str-no
11011601   101010000         0      1       1     0.87500       1
*
*source        type  is-nplr      l-dr-bt      r-dr-bt     bt-str-no
11011701         0         0            0            0             1
*
*l-h-st     chf-btr   by-dia     h-eq-dia     ch-length    bt-str-no
*11011801          0       0.0          0.0          0.0           1
11011801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-btr   by-dia     h-eq-dia     ch-length    bt-str-no
*11011901          0       0.0     0.336444      1.87500           1
11011901  0.336444  10.0 10.0  0 0 0 0  1.0  1
*
************************************************************
* downcomer inlet annulus heat loss (below cold leg nozzle)  *
************************************************************
*
*  left boundary  = component 102
*  right boundary = ambient volume (805)
*
*gl data        nh        np     type     s-flg     l-cor
11020000         1         8        2         1   0.271375
*
*mesh       loc flg   frm flg
11020100         0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
11020101         2   0.275708         1  0.283850         2  0.359375
11020102         2   0.526042
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
11020201         1         2         2         3         1         5
11020202         8         7
*
*source dis  source    itv no
11020301       0.0        7
*
*init temp      flg
11020400         0
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11020401 549.0   3  308.0   5  299.6   6  234.6   7  176.9   8
*
*l-bndy      by-vol       inc   b-cdt  a-code  cy-length  bt-str-no
11020501   101010000         0      1       1     1.0000       1
*
*r-bndy      by-vol       inc   b-cdt  a-code  cy-length  bt-str-no
11020601   805010000         0   4100       1     1.0000       1
*
*source        type  is-nplr      l-dr-bt      r-dr-bt     bt-str-no
11020701         0         0            0            0             1
*
*l-h-st     chf-btr   by-dia     h-eq-dia     ch-length    bt-str-no
*11020801          0       0.0          0.0          0.0           1
11020801  0.247955  10.0 10.0  0 0 0 0  1.0  1
*
************************************************************
* downcomer inlet annulus hollow center (below cold leg nozzle)  *
************************************************************
*
*  left boundary  = adiabatic
*  right boundary = component 102
*
*gl data        nh        np     type     s-flg     l-cor
11021000         1         6        2         1   0.12500
*
*mesh       loc flg   frm flg
11021100         0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
11021101         2   0.18750         1  0.191667         2  0.20000
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
11021201         1         2         2         3         1         5
*
*source dis  source    itv no
11021301       0.0        5
*
*init temp      flg
11021400         0
*
*        temp mesh    temp mesh
11021401 550.0   3  550.3   6
*
*l-bndy      by-vol       inc   b-cdt  a-code  cy-length  bt-str-no
11021501          0         0      0       1     1.000000       1
*
*r-bndy      by-vol       inc   b-cdt  a-code  cy-length  bt-str-no
11021601   101010000         0      1       1     1.000000       1
*
*source        type  is-nplr      l-dr-bt      r-dr-bt     bt-str-no
11021701         0         0            0            0             1
*
*l-h-st     chf-btr   by-dia     h-eq-dia     ch-length    bt-str-no
*11021801          0       0.0          0.0          0.0           1
11021801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-btr   by-dia     h-eq-dia     ch-length    bt-str-no
*11021901          0       0.0     0.336444      1.87500           1
11021901  0.336444  10.0 10.0  0 0 0 0  1.0  1
*
************************************************************
```

```
* downcomer pipe (heat loss to environment) - unheated                *
************************************************************************
*
*  left boundary  = component 110 (volumes 1,2,3,4,5,6,7,8,9)
*  right boundary = ambient volume (805)
*
*gl data        nh        np      type     s-flg     l-cor
11100000         9        10         2         1  .091041667
*
*mesh       loc flg   frm flg
11100100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11100101         1  .092541667         2  .107825000         1  .10932500
11100102         3  .145833333         2  .312500000
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11100201        10         1        12         3        10         4
11100202         1         7         8         9
*
*source dis   source    itv no
11100301        0.0         9
*
*init temp       flg
11100400         0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11100401 549.9    2  395.0    3  249.3    8  189.7    9  149.3   10
*
*l-body      by-vol       inc    b-cdit   a-code    cy-length   bt-str-no
11100501  110010000         0         1         1    1.715159          1
11100502  110020000         0         1         1    0.273268          2
11100503  110030000         0         1         1    1.272435          3
11100504  110040000         0         1         1    1.272435          4
11100505  110050000         0         1         1    1.272435          5
11100506  110060000         0         1         1    1.272435          6
11100507  110070000         0         1         1    1.272435          7
11100508  110080000         0         1         1    1.465667          8
11100509  110090000         0         1         1    1.434751          9
*
*r-body      by-vol       inc    b-cdit   a-code    cy-length   bt-str-no
11100601  805010000         0      4100         1    1.715159          1
11100602  805010000         0      4100         1    0.273268          2
11100603  805010000         0      4100         1    1.272435          3
11100604  805010000         0      4100         1    1.272435          4
11100605  805010000         0      4100         1    1.272435          5
11100606  805010000         0      4100         1    1.272435          6
11100607  805010000         0      4100         1    1.272435          7
11100608  805010000         0      4100         1    1.465667          8
11100609  805010000         0      4100         1    1.434751          9
*
*source        type    is-mplr     l-dr-bt     r-dr-bt    bt-str-no
11100701         0         0           0           0          9
*
*l-h-st     chf-htr    hy-dia     h-eq-dia    ch-length    bt-str-no
*11100801          0       0.0          0.0       16.244581          9
11100801  0.0  10.0 10.0  0 0 0 0  1.0  9
*
*r-h-st     chf-htr    hy-dia     h-eq-dia    ch-length    bt-str-no
*11100901          0       0.0          0.0          1.0          9
11100901  0.0  10.0 10.0  0 0 0 0  1.0  9
*
************************************************************************
* downcomer pipe (external heaters)                                    *
************************************************************************
*
*  left boundary  = component 110 (volumes 1,2,3,4,5,6,7)
*  right boundary = ambient volume (815)
*
*gl data        nh        np      type     s-flg     l-cor
11101000         7        13         2         1  .091041667
*
*mesh       loc flg   frm flg
11101100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11101101         1  .092541667         2  .107825000         1  .109325000
11101102         3  .145833333         1  .145833333         2  .15635
11101103         2  .3230167
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11101201        10         1        12         3        10         4
11101202         1         7        13         8         9        10
11101203         8        12
*
*source dis   source    itv no    source    itv no    source    itv no
11101301        0.0         8       1.0        10       0.0        12
*
*init temp       flg
11101400         0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11101401 549.6    2  401.5    3  263.9    8  277.5   11  198.5   12
11101402 152.6   13
*
*l-body      by-vol       inc    b-cdit   a-code    cy-length   bt-str-no
11101501  110010000         0         1         1    0.545674          1
11101502  110020000         0         1         1    0.727565          2
11101503  110030000         0         1         1    0.727565          3
11101504  110040000         0         1         1    0.727565          4
11101505  110050000         0         1         1    0.727565          5
11101506  110060000         0         1         1    0.727565          6
11101507  110070000         0         1         1    0.727565          7
*
*r-body      by-vol       inc    b-cdit   a-code    cy-length   bt-str-no
11101601  815010000         0      4100         1    0.545674          1
11101602  815010000         0      4100         1    0.727565          2
11101603  815010000         0      4100         1    0.727565          3
11101604  815010000         0      4100         1    0.727565          4
11101605  815010000         0      4100         1    0.727565          5
11101606  815010000         0      4100         1    0.727565          6
11101607  815010000         0      4100         1    0.727565          7
*
*source        type    is-mplr     l-dr-bt     r-dr-bt    bt-str-no
11101701     10225    .026003           0           0          1
11101702     10225    .035114           0           0          2
```

```
11101703      10225  .035114          0          0      3
11101704      10225  .035114          0          0      4
11101705      10225  .035114          0          0      5
11101706      10225  .035114          0          0      6
11101707      10225  .035114          0          0      7
*
*l-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11101801        0      0.0         0.0    16.244581        7
11101801  0.0  10.0 10.0  0 0 0 0  1.0  7
*
*r-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11101901        0      0.0         0.0    16.244581        7
11101901  0.0  10.0 10.0  0 0 0 0  1.0  7
*
************************************************************
* lower downcomer distribution annulus heat loss (with honeycomb)  *
************************************************************
*
*  left boundary  = component 110 (volume 10)
*  right boundary = ambient volume (805)
*
*gl data        nh       np     type     s-flg     l-cor
11102000         1       10        2         1  0.244875
*
*mesh       loc flg   fin flg
11102100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11102101         1  .246541667        2  .256958333         1  .2586250
11102102         3  .411541667        2  .578208333
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11102201        10         1        11         3        10         4
11102202         1         7         8         9
*
*source dis   source    itv no
11102301        0.0         9
*
*init temp      flg
11102400          0
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11102401  549.3   2  440.6   3  323.7   8  241.6   9  181.1  10
*
*l-body      hy-vol       inc    b-cdt    a-code    cy-length    ht-str-no
11102501  110100000         0        1         1     0.704681            1
*
*r-body      hy-vol       inc    b-cdt    a-code    cy-length    ht-str-no
11102601  805010000         0     4100         1     0.704681            1
*
*source        type    is-mplr      l-dr-ht      r-dr-ht     ht-str-no
11102701         0          0            0            0             1
*
*l-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11102801        0      0.0    0.198130       0.9625            1
11102801  0.198130  10.0 10.0  0 0 0 0 1.0  1
*
*r-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11102901        0      0.0         0.0       0.9625            1
11102901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
************************************************************
* lower downcomer distribution annulus - external heaters  *
************************************************************
*
*  left boundary  = component 110 (volume 10)
*  right boundary = ambient volume (815)
*
*gl data        nh       np     type     s-flg     l-cor
11103000         1       13        2         1  .244875
*
*mesh       loc flg   fin flg
11103100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11103101         1  .246541667        2  .256958333         1  .25862500
11103102         3  .411541667        1  .411641667         2  .42605833
11103103         2  .592725000
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11103201        10         1        11         3        10         4
11103202         1         7        13         8         9        10
11103203         8        12
*
*source dis   source    itv no    source    itv no    source    itv no
11103301        0.0         8       1.0        10       0.0        12
*
*init temp      flg
11103400          0
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11103401  549.3   2  444.1   3  331.6   8  335.1  11  247.6  12
11103402  182.9  13
*
*l-body      hy-vol       inc    b-cdt    a-code    cy-length    ht-str-no
11103501  110100000         0        1         1     0.257819            1
*
*r-body      hy-vol       inc    b-cdt    a-code    cy-length    ht-str-no
11103601  815010000         0     4100         1     0.257819            1
*
*source        type    is-mplr      l-dr-ht      r-dr-ht     ht-str-no
11103701     10225    .035114            0            0             1
*
*l-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11103801        0      0.0    0.198130       0.9625            1
11103801  0.198138  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11103901        0      0.0         0.0       0.9625            1
11103901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
************************************************************
* downcomer distribution annulus to core inlet (thru lower extension)  *
************************************************************
*
*  left boundary  = component 140
```

```
* right boundary = component 110 (volume 10)
*
*gl data        nh      np      type    s-flg   l-cor
11140000        1       3       2       1  0.1796667
*
*mesh      loc flg  frm flg
11140100        0       1
*
*geometry    no itv    r-cor
11140101        2  0.188958
*
*materials   cmp no    itv no
11140201        1       2
*
*source dis  source    itv no
11140301        0.0     2
*
*init temp      flg
11140400        0
*
*       temp mesh
11140401 550.0   3
*
*l-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
11140501  140010000       0     1      1     0.9625      1
*
*r-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
11140601  110100000       0     1      1     0.9625      1
*
*source       type  is-mplr     l-dr-ht      r-dr-ht     ht-str-no
11140701        0       0           0           0        1
*
*l-h-st    chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*11140801        0     0.0          0.0       0.9625        1
11140801 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st    chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*11140901        0     0.0       0.256760     0.9625        1
11140901 0.25676  10.0 10.0  0 0 0 0  1.0  1
*
*************************************************************
* core inlet heat loss  (core bous'g lower ext'n above dwncr an'lus)  *
*************************************************************
*
*  left boundary  = component 140
*  right boundary = ambient volume (805)
*
*gl data        nh      np      type    s-flg   l-cor
11400000        1       6       2       1  .14934039
*
11400100        0       1
*
*geometry    no itv    r-cor    no itv    r-cor
11400101        3  .4826737       2  .64934039
*
*materials   cmp no    itv no    cmp no    itv no
11400201        1       3       8       5
*
*source dis  source    itv no
11400301        0.0     5
*
*init temp      flg
11400400        0
*
*       temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
11400401 547.6   1  494.2   2  459.0   3  432.7   4  328.3   5
11400402 232.4   6
*
*l-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
11400501  140010000       0     1      1     0.6258333     1
*
*r-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
11400601  805010000       0    4100    1     0.6258333     1
*
*source       type  is-mplr     l-dr-ht      r-dr-ht     ht-str-no
11400701        0       0           0           0        1
*
*l-h-st    chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*11400801        0     0.0          0.0         0.0         1
11400801 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st    chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*11400901        0     0.0          0.0         0.0         1
11400901 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*************************************************************
* vessel bottom head  (with honeycomb)                      *
*************************************************************
*
*  left boundary  = component 120
*  right boundary = ambient volume (805)
*
*gl data        nh      np      type    s-flg   l-cor
11200000        1       9       2       1  0.412500
*
*mesh      loc flg  frm flg
11200100        0       1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11200101        1  .414166667       2  .424583333       1  .426250000
11200102        2  .749416666       2  .90708333
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11200201        10      1       11      3       10      4
11200202        1       6       8       8
*
*source dis  source    itv no
11200301        0.0     8
*
*init temp      flg
11200400        0
*
*       temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
11200401 540.1   2  441.3   3  343.5   5  317.0   6  296.6   7
11200402 237.0   8  179.5   9
*
```

```
*l-body     hy-vol      inc   b-cdt   a-code   cy-length   bt-str-no
11200501  120010000     0      1       1      0.466667      1
*
*r-body     hy-vol      inc   b-cdt   a-code   cy-length   bt-str-no
11200601  895010000     0     4100     1      0.466667      1
*
*source       type   is-mplr     l-dr-bt      r-dr-bt     bt-str-no
11200701       0       0           0            0          1
*
*l-h-st    chf-btr   hy-dia    h-eq-dia    ch-length    bt-str-no
*11200801      0      0.0         0.0       0.466667        1
11200801 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st    chf-btr   hy-dia    h-eq-dia    ch-length    bt-str-no
*11200901      0      0.0         0.0       0.466667        1
11200901 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* vessel lower plenum wall  (with honeycomb)                    *
*****************************************************************
*
*  left boundary  = component 130
*  right boundary = ambient volume (805)
*
*gl data        nh       np      type     s-flg     l-cor
11300000         1        9       2        1     .363403395
*
*mesh       loc flg   frm flg
11300100        0        1
*
*geometry    no itv     r-cor     no itv     r-cor     no itv     r-cor
11300101        1     .36907052      2     .37486729      1     .37715339
11300102        2     .69132063      2     .85798730
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11300201        10        1        11        3        10        4
11300202        1         6        8         8
*
*source dis   source    itv no
11300301       0.0         8
*
*init temp      flg
11300400         0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11300401 540.8   2    438.3   3    337.1   5    310.3   6    290.3   7
11300402 232.2   8    176.5   9
*
*l-body     hy-vol      inc   b-cdt   a-code   cy-length   bt-str-no
11300501  130010000     0      1       1      0.721917      1
*
*r-body     hy-vol      inc   b-cdt   a-code   cy-length   bt-str-no
11300601  805010000     0     4100     1      0.721917      1
*
*source       type   is-mplr     l-dr-bt      r-dr-bt     bt-str-no
11300701       0       0           0            0          1
*
*l-h-st    chf-btr   hy-dia    h-eq-dia    ch-length    bt-str-no
*11300801      0      0.0         0.0       0.721917        1
11300801 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st    chf-btr   hy-dia    h-eq-dia    ch-length    bt-str-no
*11300901      0      0.0         0.0       0.721917        1
11300901 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* heated core  (active length)                                  *
*****************************************************************
*
*  left boundary  = adiabatic
*  right boundary = component 150
*
*          note:  the mod-2a core is a 5 x 5 rod matrix with
*                 two (2) unpowered rods in opposing corners.
*                 each rod has an od = 0.422 in.  each power
*                 step (two per hydrodynamic volume) is
*                 modeled individually.
*
*
*gl data        nh       np      type     s-flg     l-cor
11500000        12       18       2        1        0.0
*
*mesh       loc flg   frm flg
11500100        0        1
*
*geometry    no itv     r-cor     no itv     r-cor     no itv     r-cor
11500101        1     0.002917      4     0.009375      4     0.014500
11500102        4     0.015500      4     0.017583
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11500201        3         1        4         5        3         9
11500202        1        13        1        17
*
*source dis   source    itv no    source    itv no    source    itv no
11500301       0.0         1       1.0        5       0.0        17
*
*init temp      flg
11500400         -1
*
*temp distribution
11500401 692.4 692.4 689.8 683.2 673.1 659.6 638.3 619.6 602.9
+        587.8 585.7 583.7 581.7 579.7 575.7 571.7 567.9 564.2
11500402 822.4 822.4 817.5 804.9 785.6 760.1 717.9 681.2 648.7
+        619.6 615.7 611.9 608.1 604.3 596.7 589.3 582.1 575.2
11500403 979.3 979.3 971.9 952.9 923.8 885.2 818.5 760.9 710.4
+        665.5 659.7 654.1 648.5 642.9 631.6 620.7 610.0 599.5
11500404 1143.1 1143.1 1133.1 1107.0 1067.1 1014.2 917.8 835.8 764.6
+        701.8 694.0 686.3 678.8 671.3 656.0 641.1 626.6 612.4
11500405 1275.5 1275.5 1263.7 1232.9 1185.7 1123.4 1004.1 903.7 817.4
+        741.8 732.7 723.8 715.0 706.3 688.5 671.2 654.3 637.7
11500406 1333.6 1333.6 1320.8 1287.7 1236.9 1169.8 1038.8 929.3 835.4
+        753.5 743.8 734.3 724.9 715.5 696.5 677.9 659.7 641.9
11500407 1350.8 1350.8 1338.1 1304.9 1254.2 1187.1 1055.0 944.6 850.1
+        767.7 758.0 748.6 739.2 729.9 711.0 692.5 674.5 656.8
11500408 1293.2 1293.2 1281.4 1250.6 1200.4 1141.1 1020.7 919.6 832.6
+        756.6 747.6 738.7 730.0 721.3 703.7 686.5 669.6 653.2
```

```
11500409 1190.8 1190.8 1180.7 1154.6 1114.7 1061.9  963.3  879.5  806.9
+        743.0  735.4  727.9  720.4  713.1  698.1  683.5  660.2  655.3
11500410 1026.1 1026.1 1018.7  999.7  970.6  932.0  863.9  805.2  753.7
+        707.9  702.3  696.7  691.2  685.8  674.7  663.9  653.5  643.3
11500411  886.2  886.2  881.3  868.7  849.4  823.9  780.6  742.9  709.5
+        679.7  675.9  672.1  668.4  664.8  657.7  650.2  643.2  636.4
11500412  755.6  755.6  753.0  746.4  736.2  722.8  700.9  681.7  664.6
+        649.1  647.1  645.1  643.1  641.2  637.3  633.5  629.8  626.2
*
*l-body     by-vol      inc   b-cdt   a-code   surf-area   bt-str-no
11500501         0        0       0        0         0.0          12
*
*r-body     by-vol      inc   b-cdt   a-code   surf-area   bt-str-no
11500601  150010000        0       1        0   2.5410249           1
11500602  150010000        0       1        0   2.5410249           2
11500603  150020000        0       1        0   2.5410249           3
11500604  150020000        0       1        0   2.5410249           4
11500605  150030000        0       1        0   2.5410249           5
11500606  150030000        0       1        0   2.5410249           6
11500607  150040000        0       1        0   2.5410249           7
11500608  150040000        0       1        0   2.5410249           8
11500609  150050000        0       1        0   2.5410249           9
11500610  150050000        0       1        0   2.5410249          10
11500611  150060000        0       1        0   2.5410249          11
11500612  150060000        0       1        0   2.5410249          12
*
*source      type   is-mplr     l-dr-bt      r-dr-bt    bt-str-no
11500701     10151  0.02584           0            0            1
11500702     10151  0.04917           0            0            2
11500703     10151  0.07416           0            0            3
11500704     10151  0.10166           0            0            4
11500705     10151  0.12001           0            0            5
11500706     10151  0.12916           0            0            6
11500707     10151  0.12916           0            0            7
11500708     10151  0.12001           0            0            8
11500709     10151  0.10166           0            0            9
11500710     10151  0.07416           0            0           10
11500711     10151  0.04917           0            0           11
11500712     10151  0.02584           0            0           12
*
*l-h-st     chf-htr   hy-dia     h-eq-dia     ch-length    bt-str-no
*11500801         0      0.0          0.0          12.0           12
11500801  0.0  10.0 10.0  0 0 0 0  1.0  12
*
*r-h-st     chf-htr   hy-dia     h-eq-dia     ch-length    bt-str-no
*11500901         0      0.0      0.043992         12.0           12
11500901  0.043992  10.0 10.0  0 0 0 0  1.0  12
*
************************************************************
* vessel core barrel wall (mod-3 "steam-gap") - unheated   *
************************************************************
*
*  left boundary  = component 150
*  right boundary = ambient volume (805)
*
*gl data        nh        np      type     s-flg     l-cor
11501000         6        13         2         1  0.132114
*
```

```
*mesh       loc flg   frm flg
11501100         0         1
*
*geometry    no itv     r-cor     no itv     r-cor     no itv     r-cor
11501101         2   .133964          1   .135531          2   .143864
11501102         3   .200256          2   .272256          2   .408956
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11501201         1         2         2         3         1         5
11501202         1         8         1        10         8        12
*
*source dis  source    itv no
11501301        0.0        12
*
*init temp      flg
11501400         -1
*
*temp distribution
11501401 551.6 551.3 551.0 360.7 359.2 357.8 351.9 346.7 342.1
+        334.4 328.0 257.4 186.8
11501402 564.4 564.1 563.7 367.8 366.3 364.8 358.7 353.4 348.6
+        340.7 334.0 261.6 189.2
11501403 581.9 581.5 581.2 377.5 375.5 374.4 368.1 362.5 357.5
+        349.3 342.4 267.4 192.4
11501404 598.5 598.1 597.8 386.9 385.3 383.7 377.1 371.3 366.1
+        357.6 350.5 273.1 195.6
11501405 609.7 609.3 609.0 393.4 391.7 390.0 383.3 377.3 372.0
+        363.3 356.0 276.9 197.8
11501406 614.2 613.8 613.5 395.2 393.5 391.8 384.9 378.9 373.6
+        364.8 357.4 277.9 198.3
*
*l-body     by-vol      inc   b-cdt   a-code   cy-length   bt-str-no
11501501  150010000        0       1        1    0.635984           1
11501502  150020000        0       1        1    0.635984           2
11501503  150030000        0       1        1    0.830843           3
11501504  150040000        0       1        1    0.830843           4
11501505  150050000        0       1        1    0.830843           5
11501506  150060000        0       1        1    0.635984           6
*
*r-body     by-vol      inc   b-cdt   a-code   cy-length   bt-str-no
11501601  805010000        0    4100        1    0.635984           1
11501602  805010000        0    4100        1    0.635984           2
11501603  805010000        0    4100        1    0.830843           3
11501604  805010000        0    4100        1    0.830843           4
11501605  805010000        0    4100        1    0.830843           5
11501606  805010000        0    4100        1    0.635984           6
*
*source      type   is-mplr     l-dr-bt      r-dr-bt    bt-str-no
11501701         0         0           0            0            6
*
*l-h-st     chf-htr   hy-dia     h-eq-dia     ch-length    bt-str-no
*11501801         0      0.0     0.129489         12.0           6
11501801  0.129489  10.0 10.0  0 0 0 0  1.0  6
*
*r-h-st     chf-htr   hy-dia     h-eq-dia     ch-length    bt-str-no
*11501901         0      0.0          0.0          12.0           6
11501901  0.0  10.0 10.0  0 0 0 0  1.0  6
*
```

```
**********************************************************
* vessel core barrel wall - external heaters             *
**********************************************************
*
*  left boundary  = component 150
*  right boundary = ambient volume (815)
*
*gl data        nh       np      type     s-flg    l-cor
11502000         6       16         2         1  0.132114
*
*mesh       loc flg  frm flg
11502100         0        1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11502101         2     .133964        1     .135531        2     .143864
11502102         3     .200256        2     .272256        1     .272356
11502103         2     .2827727       2     .4494394
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11502201         1         2         2         3         1         5
11502202         1         8         1        10        13        11
11502203         9        13         8        15
*
*source dis  source    itv no    source    itv no    source    itv no
11502301        0.0        11       1.0        13       0.0        15
*
*init temp      flg
11502400        -1
*
*temp distribution
11502401  637.7  637.5  637.2  492.3  491.2  490.1  485.7  481.9  478.7
+         473.8  470.2  466.8  461.8  453.4  344.5  235.6
11502402  643.0  642.8  642.6  497.0  495.9  494.8  490.3  486.5  483.3
+         478.3  474.6  471.1  465.9  457.4  347.3  237.1
11502403  648.7  648.5  648.2  503.1  502.0  500.9  496.4  492.6  489.4
+         484.3  480.4  476.8  471.5  462.8  351.0  239.1
11502404  653.2  653.0  652.8  508.3  507.0  506.1  501.7  497.9  494.6
+         489.4  485.5  481.7  476.3  467.4  354.2  240.9
11502405  653.3  653.1  652.9  510.7  509.6  508.6  504.2  500.4  497.2
+         492.0  488.1  484.3  478.7  469.8  355.8  241.8
11502406  653.4  653.1  652.9  511.5  510.4  509.4  505.0  501.3  498.0
+         492.9  488.9  485.1  479.5  470.6  356.4  242.1
*
*l-body      by-vol       inc    b-cdit   a-code    cy-length   ht-str-no
11502501  150010000         0         1         1     1.364016         1
11502502  150020000         0         1         1     1.364016         2
11502503  150030000         0         1         1     1.169157         3
11502504  150040000         0         1         1     1.169157         4
11502505  150050000         0         1         1     1.169157         5
11502506  150060000         0         1         1     1.364016         6
*
*r-body      by-vol       inc    b-cdit   a-code    cy-length   ht-str-no
11502601  815010000         0      4100         1     1.364016         1
11502602  815010000         0      4100         1     1.364016         2
11502603  815010000         0      4100         1     1.169157         3
11502604  815010000         0      4100         1     1.169157         4
11502605  815010000         0      4100         1     1.169157         5
11502606  815010000         0      4100         1     1.364016         6
*
*source       type   is-mplr      l-dr-ht      r-dr-ht    ht-str-no
11502701     10225   .122678            0            0            1
11502702     10225   .122678            0            0            2
11502703     10225   .105342            0            0            3
11502704     10225   .105342            0            0            4
11502705     10225   .105342            0            0            5
11502706     10225   .122678            0            0            6
*
*l-h-st     chf-htr    by-dia    h-eq-dia    ch-length    ht-str-no
*11502801         0       0.0    0.129489         12.0            6
11502801  0.129489  10.0 10.0  0 0 0 0  1.0  6
*
*r-h-st     chf-htr    by-dia    h-eq-dia    ch-length    ht-str-no
*11502901         0       0.0         0.0         12.0            6
11502901  0.0  10.0 10.0  0 0 0 0  1.0  6
*
**********************************************************
* vessel upper core wall (no honeycomb) - unheated       *
**********************************************************
*
*  left boundary  = component 161
*  right boundary = ambient volume (805)
*
*gl data        nh       np      type     s-flg    l-cor
11610000         1       13         2         1  0.132114
*
*mesh       loc flg  frm flg
11610100         0        1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11610101         2     .133964        1     .135531        2     .143864
11610102         3     .200256        2     .560256        2     .7269227
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
11610201         1         2         2         3         1         5
11610202         1         8         1        10         8        12
*
*source dis  source    itv no
11610301        0.0        12
*
*init temp      flg
11610400         0
*
*       temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
11610401  609.7   3  371.4   6  362.1   7  353.0   9  310.4  10
11610402  286.0  11  228.0  12  173.8  13
*
*l-body      by-vol       inc    b-cdit   a-code    cy-length   ht-str-no
11610501 1610010000         0         1         1     0.764104         1
*
*r-body      by-vol       inc    b-cdit   a-code    cy-length   ht-str-no
11610601  805010000         0      4100         1     0.764104         1
*
*source       type   is-mplr      l-dr-ht      r-dr-ht    ht-str-no
11610701         0         0            0            0            1
*
*l-h-st     chf-htr    by-dia    h-eq-dia    ch-length    ht-str-no
```

```
*11610801         0      0.0      0.173513      1.00083        1
11610801 0.173513  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*11610901         0      0.0          0.0       1.00083        1
11610901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
************************************************************
* vessel upper core wall - external heaters                *
************************************************************
*
*  left boundary  = component 161
*  right boundary = ambient volume (815)
*
*gl data         nh        np      type      s-flg    l-cor
11611000          1        16         2          1  0.132114
*
*mesh        loc flg   frn flg
11611100          0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
11611101          2     .133964       1     .135531       2     .143864
11611102          3     .200256       2     .550256       1     .550356
11611103          2     .5707727      2     .7374394
*
*materials    cmp no     itv no     cmp no     itv no     cmp no     itv no
11611201          1          2          2          3          1          5
11611202          1          8          1         10         13         11
11611203          9         13          8         15
*
*source dis   source     itv no     source     itv no     source     itv no
11611301         0.0         11        1.0         13        0.0         15
*
*init temp       flg
11611400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11611401 609.7   3    376.5   6    360.8   9    309.5  11    315.1  13
11611402 313.1  14    238.5  15    178.0  16
*
*l-body       hy-vol       inc     h-cdit   a-code     cy-length   ht-str-no
11611501   1610100000         0          1        1    0.236729         1
*
*r-body       hy-vol       inc     h-cdit   a-code     cy-length   ht-str-no
11611601   8150100000         0        4100        1    0.236729         1
*
*source        type     is-mplr      l-dr-ht      r-dr-ht     ht-str-no
11611701       10225    .043539            0            0             1
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*11611801         0      0.0      0.173513       1.00083        1
11611801 0.173513  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*11611901         0      0.0          0.0       1.00083        1
11611901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
************************************************************
```

```
* vessel upper plenum wall - unheated                     *
************************************************************
*
*  left boundary  = components 162,163,164
*  right boundary = ambient volume (805)
*
*gl data         nh        np      type      s-flg    l-cor
11600000          3        13        -2          1  0.133654
*
*mesh        loc flg   frn flg
11600100          0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
11600101          2     0.142184       1     0.146351       3     .200518
11600102          4     0.422392       2     0.589059
*
*materials    cmp no     itv no     cmp no     itv no     cmp no     itv no
11600201          1          2          2          3          1          6
11600202          1         10          8         12
*
*source dis   source     itv no
11600301         0.0         12
*
*init temp       flg
11600400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11600401 600.0   3    270.0   4    266.0   5    260.0   7    245.0   9
11600402 232.0  11    188.0  12    150.0  13
*
*l-body       hy-vol       inc     h-cdit   a-code     cy-length   ht-str-no
11600501   1620100000         0          1        1    1.755048         1
11600502   1630100000         0          1        1    1.411882         2
11600503   1640100000         0          1        1    1.796411         3
*
*r-body       hy-vol       inc     h-cdit   a-code     cy-length   ht-str-no
11600601   8050100000         0        4100        1    1.755048         1
11600602   8050100000         0        4100        1    1.411882         2
11600603   8050100000         0        4100        1    1.796411         3
*
*source        type     is-mplr      l-dr-ht      r-dr-ht     ht-str-no
11600701         0           0            0            0             3
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*11600801         0      0.0      0.201536       2.760833        1
11600801  0.201536  10.0 10.0  0 0 0 0  1.0  1
*11600802         0      0.0      0.244660       2.416667        2
11600802  0.244660  10.0 10.0  0 0 0 0  1.0  2
*11600803         0      0.0      0.255926       2.550000        3
11600803  0.255926  10.0 10.0  0 0 0 0  1.0  3
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*11600901         0      0.0          0.0          0.0             3
11600901  0.0  10.0 10.0  0 0 0 0  1.0  3
*
************************************************************
* vessel upper plenum wall - external heaters              *
************************************************************
```

```
*
*  left boundary  = components 162,163,164
*  right boundary = ambient volume (815)
*
*gl data        nb       np     type    s-flg    l-cor
11601000         3       16        2        1  0.133854
*
*mesh       loc flg  frm flg
11601100         0        1
*
*geometry    no itv    r-cor   no itv    r-cor   no itv    r-cor
11601101         2  0.142184        1  0.146351        3  0.200518
11601102         4  0.422392        1  0.422492        2  0.4329087
11601103         2  0.5995754
*
*materials   cmp no   itv no   cmp no   itv no   cmp no   itv no
11601201         1        2        2        3        1        6
11601202         1       10       13       11        9       13
11601203         8       15
*
*source dis  source   itv no   source   itv no   source   itv no
11601301        0.0       11      1.0       13      0.0       15
*
*init temp      flg
11601400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
11601401 600.0   3  275.0   4  267.4   7  248.7  10  260.0  13
11601402 264.2  14  200.3  15  155.0  16
*
*l-body      by-vol       inc    b-cdit   a-code   cy-length   bt-str-no
11601501   162010000         0         1        1    1.004785         1
11601502   163010000         0         1        1    1.004785         2
11601503   164010000         0         1        1    0.753589         3
*
*r-body      by-vol       inc    b-cdit   a-code   cy-length   bt-str-no
11601601   815010000         0      4100        1    1.004785         1
11601602   815010000         0      4100        1    1.004785         2
11601603   815010000         0      4100        1    0.753589         3
*
*source        type   is-mplr      l-dr-bt      r-dr-bt    bt-str-no
11601701      10217   .500072            0            0            1
11601702      10217   .499928            0            0            2
11601703      10212       1.0            0            0            3
*
*l-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*11601801          0       0.0     0.201536     2.760833            1
11601801 0.201536  10.0 10.0  0 0 0 0  1.0  1
*11601802          0       0.0     0.244660     2.416667            2
11601802 0.244660  10.0 10.0  0 0 0 0  1.0  2
*11601803          0       0.0     0.255826     2.550000            3
11601803 0.255826  10.0 10.0  0 0 0 0  1.0  3
*
*r-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*11601901          0       0.0          0.0          0.0            3
11601901 0.0  10.0 10.0  0 0 0 0  1.0  3
*
*****************************************************************
```

```
* upper core support plate (separates upper plenum and upper head)    *
*****************************************************************
*
*  left boundary  = component 164
*  right boundary = component 191
*
*gl data        nb       np     type    s-flg    l-cor
11690000         1        4       -1        1      0.0
*
*mesh       loc flg  frm flg
11690100         0        1
*
*geometry    no itv    r-cor
11690101         3    0.654
*
*materials   cmp no   itv no
11690201         1        3
*
*source dis  source   itv no
11690301        0.0        3
*
*init temp      flg
11690400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh
11690401 602.9   1  611.9   2  612.0   3  611.2   4
*
*l-body      by-vol       inc    b-cdit   a-code   surf-area   bt-str-no
11690501   164010000         0         1        1   0.1263155         1
*
*r-body      by-vol       inc    b-cdit   a-code   surf-area   bt-str-no
11690601   191010000         0         1        1   0.1263155         1
*
*source        type   is-mplr      l-dr-bt      r-dr-bt    bt-str-no
11690701         0         0            0            0            1
*
*l-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*11690801          0       0.0          0.0          0.0            1
11690801 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*11690901          0       0.0          0.0          0.0            1
11690901 0.0  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* vessel upper head wall - top & bottom - unheated                *
*****************************************************************
*
*  left boundary  = components 191 & 194
*  right boundary = ambient volume (805)
*
*gl data        nb       np     type    s-flg    l-cor
11901000         2       13        2        1  0.133854
*
*mesh       loc flg  frm flg
11901100         0        1
*
*geometry    no itv    r-cor   no itv    r-cor   no itv    r-cor
```

```
11901101        2  0.142184      1  0.146351      3  0.200518
11901102        4  0.348434      2  0.5151007
*
*materials   cmp no   itv no   cmp no   itv no   cmp no   itv no
11901201         1        2        2        3        1        6
11901202         1       10        8       12
*
*source dis  source   itv no
11901301        0.0       12
*
*init temp      flg
11901400          0
*
*        temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
11901401 577.5   3  276.9   4  271.0   6  263.0   8  250.9  11
11901402 197.7  12  155.3  13
*
*l-body      hy-vol       inc   b-cdit   a-code   cy-length   hit-str-no
11901501  191010000         0        1        1    0.172152          1
11901502  194010000         0        1        1    2.424053          2
*
*r-body      hy-vol       inc   b-cdit   a-code   cy-length   hit-str-no
11901601  805010000         0     4100        1    0.172152          1
11901602  805010000         0     4100        1    2.424053          2
*
*source        type   is-mplr      l-dr-bt      r-dr-bt    bt-str-no
11901701         0         0            0            0            2
*
*l-h-st     chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11901801         0      0.0    0.209097     8.776667            1
11901801 0.209097 10.0 10.0  0 0 0 0  1.0  1
*11901802         0      0.0    0.255470     8.776667            2
11901802 0.255470 10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11901901         0      0.0         0.0     8.776667            2
11901901  0.0  10.0 10.0  0 0 0 0  1.0  2
*
*************************************************************
* vessel upper head wall - middle - unheated               *
*************************************************************
*
*  left boundary  = components 192 & 193
*  right boundary = ambient volume (805)
*
*gl data        nh        np      type     s-flg     l-cor
11902000         2        13         2         1  0.133854
*
*mesh       loc flg   frm flg
11902100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11902101         2  0.142184         1  0.146351         3  0.200518
11902102         4  0.274476         2  0.441143
*
*materials   cmp no   itv no   cmp no   itv no   cmp no   itv no
11902201         1        2        2        3        1        6
11902202         1       10        8       12
*
*source dis  source   itv no
11902301        0.0       12
*
*init temp      flg
11902400          0
*
*        temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
11902401 573.1   3  289.2   4  285.4   5  282.0   6  279.0  7
11902402 272.0  11  211.0  12  162.8  13
*
*l-body      hy-vol       inc   b-cdit   a-code   cy-length   hit-str-no
11902501  192010000         0        1        1    1.579266          1
11902502  193010000         0        1        1    2.486916          2
*
*r-body      hy-vol       inc   b-cdit   a-code   cy-length   hit-str-no
11902601  805010000         0     4100        1    1.579266          1
11902602  805010000         0     4100        1    2.486916          2
*
*source        type   is-mplr      l-dr-bt      r-dr-bt    bt-str-no
11902701         0         0            0            0            2
*
*l-h-st     chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11902801         0      0.0    0.222013     8.776667            1
11902801 0.222013 10.0 10.0  0 0 0 0  1.0  1
*11902802         0      0.0    0.228473     8.776667            2
11902802 0.228473 10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*11902901         0      0.0         0.0         0.0            2
11902901  0.0  10.0 10.0  0 0 0 0  1.0  2
*
*************************************************************
* vessel upper head wall - middle - external heaters       *
*************************************************************
*
*  left boundary  = components 192 & 193
*  right boundary = ambient volume (815)
*
*gl data        nh        np      type     s-flg     l-cor
11903000         2        16         2         1  0.133854
*
*mesh       loc flg   frm flg
11903100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11903101         2  0.142184         1  0.146351         3  0.200518
11903102         4  0.274476         1  0.274576         2  0.2849927
11903103         2  0.4516594
*
*materials   cmp no   itv no   cmp no   itv no   cmp no   itv no
11903201         1        2        2        3        1        6
11903202         1       10       13       11        9       13
11903203         8       15
*
*source dis  source   itv no   source   itv no   source   itv no
11903301        0.0       11      1.0       13      0.0       15
*
```

```
*init temp      flg
11903400         0
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11903401 573.1   3    295.6   4    292.0   5    289.0   6    286.8   7
11903402 284.0  10    288.0  11    297.5  12    301.7  13    299.0  14
11903403 221.6  15    166.4  16
*
*1-body      hy-vol       inc    b-cdt   a-code   cy-length  bt-str-no
11903501  192010000         0        1        1   0.386557          1
11903502  193010000         0        1        1   0.966417          2
*
*r-body      hy-vol       inc    b-cdt   a-code   cy-length  bt-str-no
11903601  815010000         0     4100        1   0.386557          1
11903602  815010000         0     4100        1   0.966417          2
*
*source       type   is-mplr      l-dr-bt      r-dr-bt     bt-str-no
11903701     10208   .166667            0            0             1
11903702     10208   .416667            0            0             2
*
*1-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     bt-str-no
*11903801         0       0.0     0.222013      8.776667             1
11903801 0.222013  10.0 10.0  0 0 0 0  1.0  1
*11903802         0       0.0     0.228473      8.776667             2
11903802 0.228473  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     bt-str-no
*11903901         0       0.0          0.0           0.0             2
11903901 0.0  10.0 10.0  0 0 0 0  1.0  2
*
*****************************************************
* vessel upper head wall - top & bottom - external heaters  *
*****************************************************
*
*  left boundary  = components 191 & 194
*  right boundary = ambient volume (815)
*
*gl data        nh       np     type    s-flg    l-cor
11904000         2       16        2        1  0.133854
*
*mesh       loc flg   fin flg
11904100         0        1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
11904101         2  0.142184         1  0.146351         3  0.200518
11904102         4  0.348434         1  0.348534         2  0.3589507
11904103         2  0.5256174
*
*materials   cmp no    itv no   cmp no    itv no   cmp no    itv no
11904201         1        2        2         3        1         6
11904202         1       10       13        11        9        13
11904203         8       15
*
*source dis  source    itv no   source    itv no   source    itv no
11904301       0.0        11      1.0        13      0.0        15
*
*init temp      flg
11904400         0
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
11904401 577.9   3    282.0   4    278.1   5    274.8   6    271.7  7
11904402 252.0  10    264.6  11    275.4  12    280.4  13    278.4 14
11904403 209.0  15    159.9  16
*
*1-body      hy-vol       inc    b-cdt   a-code   cy-length  bt-str-no
11904501  191010000         0        1        1   0.304515          1
11904502  194010000         0        1        1   0.456772          2
*
*r-body      hy-vol       inc    b-cdt   a-code   cy-length  bt-str-no
11904601  815010000         0     4100        1   0.304515          1
11904602  815010000         0     4100        1   0.456772          2
*
*source       type   is-mplr      l-dr-bt      r-dr-bt     bt-str-no
11904701     10208   .166667            0            0             1
11904702     10208   .250000            0            0             2
*
*1-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     bt-str-no
*11904801         0       0.0     0.209097      8.776667             1
11904801 0.209097  10.0 10.0  0 0 0 0  1.0  1
*11904802         0       0.0     0.255470      8.776667             2
11904802 0.255470  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     bt-str-no
*11904901         0       0.0          0.0      8.776667             2
11904901 0.0  10.0 10.0  0 0 0 0  1.0  2
*
*
*
*****************************************************
* heat slab... steam generator tube bundle   (intact loop)  *
*          (rising primary coolant...first half of u-tube)  *
*****************************************************
*
*  left boundary  = steam generator primary coolant  (component 220)
*  right boundary = steam generator secondary coolant (component 600)
*
*gl data        nh       np     type    s-flg    l-cor
12200000         4        5        2        1  0.032375
*
*mesh       loc flg   fin flg
12200100         0        1
*
*geometry    no itv    r-cor
12200101         4  0.036458333
*
*materials   cmp no    itv no
12200201         5        4
*
*source dis  source    itv no
12200301       0.0        4
*
*init temp      flg
12200400        -1
*
*temp distribution
12200401 575.9  565.1  554.5  544.2  534.2
```

```
12200402  567.9  558.9  550.1  541.6  533.3
12200403  561.0  553.5  546.3  541.6  533.3
12200404  556.5  550.3  544.3  538.4  532.7
*
*1-body     by-vol      inc   b-cdt  a-code  cy-length  bt-str-no
12200501  220010000      0      1       1   47.715000      1
12200502  220020000  10000      1       1   47.465000      3
12200503  220040000      0      1       1   40.152175      4
*
*r-body     by-vol      inc   b-cdt  a-code  cy-length  bt-str-no
12200601  600010000      0      1       1   47.715000      1
12200602  600020000  10000      1       1   47.465000      3
12200603  600040000      0      1       1   40.152175      4
*
*source       type  is-nplr     l-dr-bt     r-dr-bt    bt-str-no
12200701        0        0           0           0            4
*
*1-h-st     chf-btr   hy-dia     h-eq-dia    ch-length    bt-str-no
*12200801         0 0.064750    0.064750         29.5            4
12200801 0.064750  10.0 10.0  0 0 0 0  1.0  4
*
*r-h-st     chf-btr   hy-dia     h-eq-dia    ch-length    bt-str-no
*12200901         0 .0887292    .3115210         29.5            3
12200901 0.3115210  10.0 10.0  0 0 0 0  1.0  3
*12200902         0 .1077433    .4104615         29.5            4
12200902 0.4104615  10.0 10.0  0 0 0 0  1.0  4
*
************************************************************
* heat slab... steam generator tube bundle    (intact loop)        *
*          (decending primary coolant...second half of u-tube)     *
************************************************************
*
*  left boundary  = steam generator primary coolant   (component 220)
*  right boundary = steam generator secondary coolant (component 600)
*
*gl data        nh       np     type    s-flg     l-cor
12201000         4        5        2        1  0.032375
*
*mesh       loc flg   fm flg
12201100         0         1
*
*geometry     no itv     r-cor
12201101          4  0.036458333
*
*materials    cmp no    itv no
12201201          5         4   * inconel  600
*
*source dis   source    itv no
12201301       0.0         4
*
*init temp      flg
12201400         -1
*
*temp distribution
12201401  551.9  546.5  541.2  538.4  532.7
12201402  546.5  541.7  537.0  532.5  528.1
12201403  542.2  538.1  534.1  530.2  526.4
12201404  538.5  535.0  531.5  528.3  525.1
*
*1-body     by-vol      inc   b-cdt  a-code  cy-length  bt-str-no
12201501  220050000      0      1       1   40.152175      1
12201502  220060000  10000      1       1   47.465000      3
12201503  220080000      0      1       1   47.715000      4
*
*r-body     by-vol      inc   b-cdt  a-code  cy-length  bt-str-no
12201601  600040000      0     -1       1   40.152175      1
12201602  600030000      0      1       1   47.465000      2
12201603  600020000      0      1       1   47.465000      3
12201604  600010000      0      1       1   47.715000      4
*
*source       type  is-nplr     l-dr-bt     r-dr-bt    bt-str-no
12201701        0        0           0           0            4
*
*1-h-st     chf-btr   hy-dia     h-eq-dia    ch-length    bt-str-no
*12201801         0 .0647500    .0647500         29.5            4
12201801 0.0647500  10.0 10.0  0 0 0 0  1.0  4
*
*r-h-st     chf-btr   hy-dia     h-eq-dia    ch-length    bt-str-no
*12201901         0 .1077433    .4104615         29.5            1
12201901 0.4104615  10.0 10.0  0 0 0 0  1.0  1
*12201902         0 .0887292    .3115210         29.5            4
12201902 0.3115210  10.0 10.0  0 0 0 0  1.0  4
*
************************************************************
* heat slab... intact loop st. generator heat transfer from       *
*              the riser to the downcomer                          *
************************************************************
*
*  left boundary = component 600
*  right boundary = component 602 & 603
*
*gl data        nh       np     type    s-flg     l-cor
16000000         5        6        2        1  .2680135
*
*mesh       loc flg   fm flg
16000100         0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
16000101          2  .3637826         1  .3665038         2  .3782030
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
16000201         14         2        15         3         1         5
*
*source dis   source    itv no
16000301       0.0         5
*
*init temp      flg
16000400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
16000401  514.0   1  522.3   2  533.2   3  501.8   4  501.7   5
16000402  501.3   6
*
*1-body     by-vol      inc   b-cdt  a-code  cy-length  bt-str-no
16000501  600010000      0      1       1   7.9525000      1
16000502  600020000  10000      1       1   7.9108334      3
```

```
16000503  600040000       0       1       1  7.4762500       4
16000504  600050000       0       1       1  1.4054167       5
*
*r-body     by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
16000601  603040000       0       1       1  7.9525000       1
16000602  603030000       0       1       1  7.9108334       2
16000603  603020000       0       1       1  7.9108334       3
16000604  603010000       0       1       1  7.4762500       4
16000605  602010000       0       1       1  1.4054167       5
*
*source       type  is-mplr     l-dr-ht     r-dr-ht   ht-str-no
16000701        0        0           0           0           5
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length   ht-str-no
*16000801         0  .0884737     .2535283    7.9525000       1
16000801 0.2535283  10.0 10.0  0 0 0 0  1.0  1
*16000802         0  .0884737     .2535283    7.9108334       3
16000802 0.2535283  10.0 10.0  0 0 0 0  1.0  3
*16000803         0  .1058911     .2728816    7.4762500       4
16000803 0.2728816  10.0 10.0  0 0 0 0  1.0  4
*16000804         0  .2145338     .3379099    1.4054167       5
16000804 0.3379099  10.0 10.0  0 0 0 0  1.0  5
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length   ht-str-no
*16000901         0  .0201639     .0732836    7.9525000       1
16000901 0.0732836  10.0 10.0  0 0 0 0  1.0  1
*16000902         0  .0126881     .0518749    7.9108334       3
16000902 0.0518749  10.0 10.0  0 0 0 0  1.0  3
*16000903         0  .0128227     .0523927    7.4762500       4
16000903 0.0523927  10.0 10.0  0 0 0 0  1.0  4
*16000904         0  .3369291     .7902365    1.4054167       5
16000904 0.7902365  10.0 10.0  0 0 0 0  1.0  5
*
************************************************************
* heat slab... steam generator steam dome heat loss to environment *
*            (includes upper section of downcomer)          *
************************************************************
*
*  left boundary  = components 612,611,602
*  right boundary = ambient volume (800)
*
*gl data        nh       np     type    s-flg    l-cor
16100000         3        6        2        1   .5719167
*
*mesh       loc flg   frn flg
16100100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor
16100101         2    0.750         3    1.000
*
*materials   cmp no    itv no   cmp no    itv no
16100201         1         2        17         5
*
*source dis  source    itv no
16100301       0.0         5
*
*init temp      flg
16100400         0
*
*         temp mesh    temp mesh    temp mesh    temp mesh
16100401 516.5   3  376.6   4  239.5   5  96.4   6
*
*l-body     by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
16100501  612010000       0       1       1  1.1334992       1
16100502  611010000       0       1       1  0.1497007       2
16100503  602010000       0       1       1  4.8530686       3
*
*r-body     by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
16100601  800010000       0    4100       1  1.1334992       1
16100602  800010000       0    4100       1  0.1497007       2
16100603  800010000       0    4100       1  4.8530686       3
*
*source       type  is-mplr     l-dr-ht     r-dr-ht   ht-str-no
16100701        0        0           0           0           3
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length   ht-str-no
*16100801         0  .6533499     .6533499    1.5404167       1
16100801 0.6533499  10.0 10.0  0 0 0 0  1.0  1
*16100802         0  .5664365    2.6836228    0.7487500       2
16100802 2.6836228  10.0 10.0  0 0 0 0  1.0  2
*16100803         0  .3369291     .5873578    5.5516667       3
16100803 0.5873578  10.0 10.0  0 0 0 0  1.0  3
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length   ht-str-no
*16100901         0      0.0          0.0          0.0       3
16100901  0.0  10.0 10.0  0 0 0 0  1.0  3
*
************************************************************
* heat slab... broken loop st. generator heat transfer from      *
*            the riser to the downcomer (top)                *
************************************************************
*
*  left boundary  = components 600, 601
*  right boundary = components 602
*
*gl data        nh       np     type    s-flg    l-cor
16001000         2        3        2        1   .4341667
*
*mesh       loc flg   frn flg
16001100         0         1
*
*geometry    no itv    r-cor
16001101         2   .4479167
*
*materials   cmp no    itv no
16001201         1         2
*
*source dis  source    itv no
16001301       0.0         2
*
*init temp      flg
16001400         0
*
*         temp mesh    temp mesh    temp mesh
16001401 519.1   1  501.3   2  488.0   3
*
*l-body     by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
```

```
16001501  600050000       0       1       1  3.5802339       1
16001502  601010000       0       1       1  0.4375000       2
*
*r-body      by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
16001601  602010000       0       1       1  3.5802339       1
16001602  602010000       0       1       1  0.4375000       2
*
*source        type   is-mplr      l-dr-ht      r-dr-ht     ht-str-no
16001701          0         0            0            0             2
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*16001801          0   .7932265    .8251205     3.7504167         1
16001801 0.8251205  10.0 10.0  0 0 0 0   1.0  1
*16001802          0   .8683333    .8683333     0.4375000         2
16001802 0.8683333  10.0 10.0  0 0 0 0   1.0  2
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*16001901          0   .3369291    .7902365     3.7504167         1
16001901 0.7902365  10.0 10.0  0 0 0 0   1.0  1
*16001902          0   .3369291    .7902365     0.4375000         2
16001902 0.7902365  10.0 10.0  0 0 0 0   1.0  2
*
**********************************************************
* heat slab... intact loop steam generator downcomer fillers    *
**********************************************************
*
*  left boundary = component 602, 603
*  right boundary = components 602, 603
*
*gl data         nh       np     type     s-flg     l-cor
16031000          5        3        2         1   .3645833
*
*mesh       loc flg   frm flg
16031100          0         1
*
*geometry     no itv     r-cor
16031101          2    .3958333
*
*materials    cmp no    itv no
16031201          1         2
*
*source dis   source    itv no
16031301         0.0         2
*
*init temp       flg
16031400          0
*
*         temp mesh    temp mesh    temp mesh
16031401  524.5   1   528.7   2   517.9   3
*
*l-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
16031501  602010000         0        1        1  1.1902917         1
16031502  603010000         0        1        1  6.3963472         2
16031503  603020000         0        1        1  6.7681575         3
16031504  603030000         0        1        1  6.7681575         4
16031505  603040000         0        1        1  5.3422315         5
*
*r-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
16031601  602010000         0        1        1  1.1902917         1
16031602  603010000         0        1        1  6.3963472         2
16031603  603020000         0        1        1  6.7681575         3
16031604  603030000         0        1        1  6.7681575         4
16031605  603040000         0        1        1  5.3422315         5
*
*source        type   is-mplr      l-dr-ht      r-dr-ht     ht-str-no
16031701          0         0            0            0             5
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*16031801          0   .3369291    .7902365     1.3912500         1
16031801 0.7902365  10.0 10.0  0 0 0 0   1.0  1
*16031802          0   .0128227    .0523927     7.4762500         2
16031802 0.0523927  10.0 10.0  0 0 0 0   1.0  2
*16031803          0   .0126981    .0518749     7.9108334         3
16031803 0.0518749  10.0 10.0  0 0 0 0   1.0  3
*16031804          0   .0126981    .0518749     7.9108334         4
16031804 0.0518749  10.0 10.0  0 0 0 0   1.0  4
*16031805          0   .0126981    .0518749     6.2441667         5
16031805 0.0518749  10.0 10.0  0 0 0 0   1.0  5
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*16031901          0   .3369291    .7902365     1.3912500         1
16031901 0.7902365  10.0 10.0  0 0 0 0   1.0  1
*16031902          0   .0128227    .0472456     7.4762500         2
16031902 0.0472456  10.0 10.0  0 0 0 0   1.0  2
*16031903          0   .0126981    .0467818     7.9108334         3
16031903 0.0467818  10.0 10.0  0 0 0 0   1.0  3
*16031904          0   .0126981    .0467818     7.9108334         4
16031904 0.0467818  10.0 10.0  0 0 0 0   1.0  4
*16031905          0   .0126981    .0467818     6.2441667         5
16031905 0.0467818  10.0 10.0  0 0 0 0   1.0  5
*
**********************************************************
* heat slab... intact loop steam generator downcomer             *
*           heat transfer to the environment                     *
**********************************************************
*
*  left boundary = components 603
*  right boundary = ambient volume (800)
*
*gl data         nh       np     type     s-flg     l-cor
16030000          4        6        2         1   .3985000
*
*mesh       loc flg   frm flg
16030100          0         1
*
*geometry     no itv     r-cor     no itv     r-cor
16030101          2    .4479167          3    .8979167
*
*materials    cmp no    itv no    cmp no    itv no
16030201          1         2        17         5
*
*source dis   source    itv no
16030301         0.0         5
*
*init temp       flg
16030400          0
```

```
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
16030401 514.1   1    514.0    2   513.9    3   369.0    4   232.0    5
16030402  95.3   6
*
*1-body      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
16030501   603010000         0        1        1   7.4762500           1
16030502   603020000         0        1        1   7.9108334           2
16030503   603030000         0        1        1   7.9108334           3
16030504   603040000         0        1        1   7.9525000           4
*
*r-body      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
16030601   800010000         0     4100        1   7.4762500           1
16030602   800010000         0     4100        1   7.9108334           3
16030603   800010000         0     4100        1   7.9525000           4
*
*source        type    is-mplr     l-dr-bt     r-dr-bt    bt-str-no
16030701         0          0           0           0            4
*
*l-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*16030801          0   .0128227    .0472456    7.4762500            1
16030801 0.0472456  10.0 10.0  0 0 0 0  1.0  1
*16030802          0   .0126981    .0467818    7.9108334            2
16030802 0.0467818  10.0 10.0  0 0 0 0  1.0  2
*16030803          0   .0126981    .0467818    7.9108334            3
16030803 0.0467818  10.0 10.0  0 0 0 0  1.0  3
*16030804          0   .0201639    .0667482    7.9525000            4
16030804 0.0667482  10.0 10.0  0 0 0 0  1.0  4
*
*r-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*16030901          0      0.0          0.0          0.0            4
16030901 0.0  10.0 10.0  0 0 0 0  1.0  4
*
*****************************************************************
* heat slab... steam generator tube bundle     (broken loop)    *
*         (rising primary coolant...first half of u-tubes)      *
*****************************************************************
*
*  left boundary  = steam generator primary coolant   (component 320)
*  right boundary = steam generator secondary coolant (component 700)
*
*gl data         nh         np      type     s-flg     l-cor
13200000          5          5         2         1  0.0310417
*
*mesh        loc flg   frn flg
13200100          0         1
*
*geometry     no itv     r-cor
13200101          4  0.0364583
*
*materials    cmp no    itv no
13200201          5         4   *inconel 600
*
*source dis   source    itv no
13200301        0.0         4
*
*init temp      flg
13200400         -1
```

```
*
*temp distribution
13200401  579.0  569.2  559.6  550.3  541.2
13200402  575.0  566.0  552.3  548.8  540.5
13200403  570.9  562.8  554.9  547.2  539.7
13200404  567.5  560.1  552.9  545.9  539.0
13200405  564.1  557.4  550.9  544.5  538.3
*
*1-body      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
13200501   320010000         0        1        1   2.1666667           1
13200502   320010000         0        1        1   13.4166667          2
13200503   320020000     10000        1        1   15.0000000          4
13200504   320040000         0        1        1   15.0856194          5
*
*r-body      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
13200601   716010000         0        1        1   2.1666667           1
13200602   700010000         0        1        1   13.4166667          2
13200603   700020000     10000        1        1   15.0000000          4
13200604   700040000         0        1        1   15.0856194          5
*
*source        type    is-mplr     l-dr-bt     r-dr-bt    bt-str-no
13200701         0          0           0           0            5
*
*l-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*13200801          0   .0620833    .0620833         0.0            5
13200801 0.0620833  10.0 10.0  0 0 0 0  1.0  5
*
*r-b-st     chf-btr    by-dia     h-eq-dia    ch-length    bt-str-no
*13200901          0   .0659845    .2900678         0.0            4
13200901 0.2900678  10.0 10.0  0 0 0 0  1.0  4
*13200902          0   .0753070    .3067184         0.0            5
13200902 0.3067184  10.0 10.0  0 0 0 0  1.0  5
*
*****************************************************************
* heat slab... steam generator tube bundle     (broken loop)    *
*         (decending primary coolant...second half of u-tubes)  *
*****************************************************************
*
*  left boundary  = steam generator primary coolant   (component 320)
*  right boundary = steam generator secondary coolant (component 700)
*
*gl data         nh         np      type     s-flg     l-cor
13201000          5          5         2         1  0.0310417
*
*mesh        loc flg   frn flg
13201100          0         1
*
*geometry     no itv     r-cor
13201101          4  0.0364583
*
*materials    cmp no    itv no
13201201          5         4   *inconel 600
*
*source dis   source    itv no
13201301        0.0         4
*
*init temp      flg
13201400         -1
```

```
*
*temp distribution
13201401 554.5 549.6 544.9 540.3 535.8
13201402 552.4 547.9 543.6 539.4 535.3
13201403 550.2 545.2 542.2 538.4 534.7
13201404 548.4 544.7 541.1 537.6 534.2
13201405 546.6 543.2 540.0 536.8 533.7
*
*l-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
13201501  320050000        0       1       1  15.0856194          1
13201502  320060000    10000       1       1  15.0000000          3
13201503  320080000        0       1       1  13.4166667          4
13201504  320080000        0       1       1   2.1666667          5
*
*r-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
13201601  700040000        0       1       1  15.0856194          1
13201602  700030000   -10000       1       1  15.0000000          3
13201603  700010000        0       1       1  13.4166667          4
13201604  716010000        0       1       1   2.1666667          5
*
*source       type  is-mplr     l-dr-ht     r-dr-ht   ht-str-no
13201701        0        0           0           0           5
*
*l-h-st    chf-htr   hy-dia    h-eq-dia    ch-length   ht-str-no
*13201801         0  .0620833    .0620833         0.0           5
13201801 0.0620833  10.0 10.0  0 0 0 0   1.0  5
*
*r-h-st    chf-htr   hy-dia    h-eq-dia    ch-length   ht-str-no
*13201901         0  .0753070    .3067184         0.0           1
13201901 0.3067184  10.0 10.0  0 0 0 0   1.0  1
*13201902         0  .0659845    .2900678         0.0           5
13201902 0.2900678  10.0 10.0  0 0 0 0   1.0  5
*
************************************************************
* heat slab... steam generator steam dome heat loss to environment *
*            (includes upper section of riser and separator)       *
************************************************************
*
*  left boundary  = components 701 & 703
*  right boundary = ambient volume (809)
*
*gl data        nh       np     type    s-flg    l-cor
17023000         2        5        2        1  0.3984167
*
*mesh       loc flg   frm flg
17023100         0        1
*
*geometry    no itv    r-cor   no itv    r-cor
17023101         2  .4479167        2  .6145834
*
*materials   cmp no    itv no   cmp no    itv no
17023201         1        2       32        4
*
*source dis  source    itv no
17023301       0.0        4
*
*init temp      flg
17023400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh
17023401 516.5   2  501.3   3  300.5   4   95.4   5
*
*l-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
17023501  701010000        0       1       1  1.3615856          1
17023502  703010000        0       1       1  0.7925179          2
*
*r-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
17023601  809010000        0    4300       1 -1.3615856          1
17023602  809010000        0    4300       1  0.7925179          2
*
*source       type  is-mplr     l-dr-ht     r-dr-ht   ht-str-no
17023701        0        0           0           0           2
*
*l-h-st    chf-htr   hy-dia    h-eq-dia    ch-length   ht-str-no
*17023801         0  .6944443    .6944443         0.0           1
17023801 0.6944443  10.0 10.0  0 0 0 0   1.0  1
*17023802         0  .2429779    .3342205         0.0           2
17023802 0.3342205  10.0 10.0  0 0 0 0   1.0  2
*
*r-h-st    chf-htr   hy-dia    h-eq-dia    ch-length   ht-str-no
*17023901         0       0.0         0.0         0.0           2
17023901 0.0  10.0 10.0  0 0 0 0   1.0  2
*
************************************************************
* heat slab... broken loop st. generator secondary riser heat loss *
*            to the environment                                    *
************************************************************
*
*  left boundary = component 700 & 716
*  right boundary = ambient volume (809)
*
*gl data        nh       np     type    s-flg    l-cor
17000000         6        5        2        1  .1278333
*
*mesh       loc flg   frm flg
17000100         0        1
*
*geometry    no itv    r-cor   no itv    r-cor   no itv    r-cor
17000101         2  .1458333        2  .3135000
*
*materials   cmp no    itv no   cmp no    itv no
17000201         1        2       32        4
*
*source dis  source    itv no
17000301       0.0        4
*
*init temp      flg
17000400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
17000401 519.1   1  501.3   2  488.9   3  320.6   4   94.1   5
*
*l-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
17000501  700010000        0       1       1  6.7083333          1
17000502  700020000    10000       1       1  7.5000000          4
17000503  700050000        0       1       1  6.8229167          5
```

```
17000504  716010000       0      1      1  1.0833333         6
*
*r-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
17000601  809010000       0     4400       1   6.7083333          1
17000602  809010000       0     4400       1   7.5000000          4
17000603  809010000       0     4400       1   6.8229167          5
17000604  809010000       0     4400       1   1.0833333          6
*
*source       type   is-nplr      l-dr-ht      r-dr-ht    ht-str-no
17000701         0         0            0            0            6
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*17000801          0  .0653845     .1654559           0.0            3
17000801 0.1654559  10.0 10.0  0 0 0 0  1.0  3
*17000802          0  .0753070     .1759521           0.0            4
17000802 0.1759521  10.0 10.0  0 0 0 0  1.0  4
*17000803          0  .1934227     .2385353           0.0            5
17000803 0.2385353  10.0 10.0  0 0 0 0  1.0  5
*17000804          0  .0653845     .1654559           0.0            6
17000804 0.1654559  10.0 10.0  0 0 0 0  1.0  6
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*17000901          0       0.0          0.0           0.0            6
17000901 0.0  10.0 10.0  0 0 0 0  1.0  6
*
**************************************************************
* heat slab... broken loop st. generator riser to downcomer  *
*              heat loss to the environment                  *
**************************************************************
*
*  left boundary  = component 711
*  right boundary = ambient volume (809)
*
*gl data         nh        np      type     s-flg     l-cor
17110000          1         5         2         1   .2102917
*
*mesh       loc flg   frm flg
17110100          0         1
*
*geometry     no itv     r-cor     no itv     r-cor
17110101           2   .2317917          2   .3984584
*
*materials    cap no    itv no    cap no    itv no
17110201           1         2        32         4
*
*source dis   source    itv no
17110301        0.0         4
*
*init temp       flg
17110400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
17110401  514.5   1   514.7   2   513.9   3   300.0   4   95.3   5
*
*l-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
17110501  711010000       0     4400       1   4.6776013          1
*
*r-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
17110601  809010000       0     4400       1   4.6776013          1
*
*source       type   is-nplr      l-dr-ht      r-dr-ht    ht-str-no
17110701         0         0            0            0            1
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*17110801          0  .3989363     .3989363           0.0            1
17110801 0.3989363  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*17110901          0       0.0          0.0           0.0            1
17110901 0.0  10.0 10.0  0 0 0 0  1.0  1
*
**************************************************************
* heat slab... broken loop st. generator downcomer           *
*              heat loss to the environment                  *
**************************************************************
*
*  left boundary  = components 713, 714, & 715
*  right boundary = ambient volume (809)
*
*gl data         nh        np      type     s-flg     l-cor
17140000          7         5         2         1   .0575
*
*mesh       loc flg   frm flg
17140100          0         1
*
*geometry     no itv     r-cor     no itv     r-cor
17140101           2   .0691667          2   .2358334
*
*materials    cap no    itv no    cap no    itv no
17140201           1         2        32         4
*
*source dis   source    itv no
17140301        0.0         4
*
*init temp       flg
17140400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
17140401  514.1   1   514.0   2   513.9   3   300.0   4   95.3   5
*
*l-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
17140501  713010000       0     4400       1   3.1426389          1
17140502  714010000       0     4400       1   4.0891869          2
17140503  714020000   10000     4400       1   7.5000000          5
17140504  714050000       0     4400       1   7.4537703          6
17140505  715010000       0     4400       1   7.8734167          7
*
*r-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
17140601  809010000       0     4500       1   3.1426389          1
17140602  809010000       0     4500       1   4.0891869          2
17140603  809010000       0     4500       1   7.5000000          5
17140604  809010000       0     4500       1   7.4537703          6
17140605  809010000       0     4500       1   7.8734167          7
*
*source       type   is-nplr      l-dr-ht      r-dr-ht    ht-str-no
17140701         0         0            0            0            7
```

```
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*17140601         0  .1316182    .1316182          0.0            1
17140601 0.1316182  10.0 10.0  0 0 0 0  1.0  1
*17140602         0  .1150000    .1150000          0.0            6
17140602 0.1150000  10.0 10.0  0 0 0 0  1.0  6
*17140603         0  .1303373    .1303373          0.0            7
17140603 0.1303373  10.0 10.0  0 0 0 0  1.0  7
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*17140901         0     0.0          0.0          0.0            7
17140901  0.0  10.0 10.0  0 0 0 0  1.0  7
*
************************************************************
* heat slab... il sg inlet-outlet plenum - top rectangular section  *
************************************************************
*
*  left boundary  = components 210 & 230
*  right boundary = ambient volume (808)
*
*gl data         nh       np      type     s-flg     l-cor
12100000          2       10         2         1   .329989
*
*mesh        loc flg   fnw flg
12100100          0         1
*
*geometry     no itv    r-cor    no itv    r-cor
12100101          7     .958333       2    1.125
*
*materials    cmp no    itv no    cmp no    itv no
12100201          1         7        26         9
*
*source dis   source    itv no
12100301         0.0         9
*
*init temp       flg
12100400          -1
*
*temp distribution
12100401  606.0  600.0  597.0  594.0  591.0  588.0  585.0  582.0  325.0
+         68.0
12100402  540.0  534.0  531.0  528.0  525.0  522.0  519.0  516.0  292.0
+         68.0
*
*l-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12100501   210010000         0        1        1    0.078125           1
12100502   230010000         0        1        1    0.078125           2
*
*r-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12100601   808010000         0     4100        1    0.078125           1
12100602   808010000         0     4100        1    0.078125           2
*
*source        type   is-nlpr     l-dr-ht     r-dr-ht     ht-str-no
12100701         0         0           0           0             2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12100801         0  .3258603    .5192263     0.156250            2
12100801  0.5192263  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12100901         0     0.0          0.0     0.156250            2
12100901  0.0  10.0 10.0  0 0 0 0  1.0  2
*
************************************************************
* heat slab... il sg inlet-outlet plenum - middle trapizoidal section *
************************************************************
*
*  left boundary  = components 210 & 230
*  right boundary = ambient volume (808)
*
*gl data         nh       np      type     s-flg     l-cor
12101000          2       11         2         1   .243733
*
*mesh        loc flg   fnw flg
12101100          0         1
*
*geometry     no itv    r-cor    no itv    r-cor    no itv    r-cor
12101101          1     .333333       7    .958333       2    1.125
*
*materials    cmp no    itv no    cmp no    itv no
12101201          1         8        26        10
*
*source dis   source    itv no
12101301         0.0        10
*
*init temp       flg
12101400          -1
*
*temp distribution
12101401  606.0  603.0  600.0  597.0  594.0  591.0  588.0  585.0  582.0
+         325.0   68.0
12101402  540.0  537.0  534.0  531.0  528.0  525.0  522.0  519.0  516.0
+         292.0   68.0
*
*l-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12101501   210010000         0        1        1    0.072917           1
12101502   230010000         0        1        1    0.072917           2
*
*r-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12101601   808010000         0     4100        1    0.072917           1
12101602   808010000         0     4100        1    0.072917           2
*
*source        type   is-nlpr     l-dr-ht     r-dr-ht     ht-str-no
12101701         0         0           0           0             2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12101801         0  .2513333    .4800904     0.145834            2
12101801  0.4800904  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12101901         0     0.0          0.0     0.145834            2
12101901  0.0  10.0 10.0  0 0 0 0  1.0  2
*
************************************************************
* heat slab... il sg inlet-outlet plenum - bottom trapizoidal section *
************************************************************
```

```
*
* left boundary  = components 210 & 230
* right boundary = ambient volume (8003)
*
*gl data        nh       np      type     s-flg    l-cor
12102000         2        4         2         1   .243733
*
*mesh       loc flg   frm flg
12102100          0         1
*
*geometry    no itv    r-cor    no itv    r-cor
12102101          1   .333333         2      0.5
*
*materials   cmp no    itv no    cmp no    itv no
12102201          1         1        26         3
*
*source dis  source    itv no
12102301       0.0         3
*
*init temp      flg
12102400         -1
*
*temp distribution
12102401  606.0  582.0  325.0   80.0
12102402  540.0  516.0  292.0   80.0
*
*l-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12102501   210010000         0        1        1    0.166667         1
12102502   230010000         0        1        1    0.166667         2
*
*r-body      by-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12102601   808010000         0     4100        1    0.166667         1
12102602   808010000         0     4100        1    0.166667         2
*
*source        type   is-nlpr      l-dr-ht       r-dr-ht     ht-str-no
12102701         0         0            0             0             2
*
*l-h-st     chf-htr    by-dia     h-eq-dia     ch-length     ht-str-no
*12102801          0   .2513333     .4800904     0.333334             2
12102801  0.4800904  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr    by-dia     h-eq-dia     ch-length     ht-str-no
*12102901          0       0.0          0.0     0.333334             2
12102901  0.0  10.0 10.0  0 0 0 0  1.0  2
*
*************************************************************
* heat slab... il sg plenum between up & dn stream rectangular section *
*************************************************************
*
* left boundary  = component 210
* right boundary = component 230
*
*gl data        nh       np      type     s-flg    l-cor
12103000         1        4         1         1      0.0
*
*mesh       loc flg   frm flg
12103100          0         1
*
*geometry    no itv    r-cor
12103101          3   .095417
*
*materials   cmp no    itv no
12103201          1         3
*
*source dis  source    itv no
12103301       0.0         3
*
*init temp      flg
12103400         -1
*
*temp distribution
12103401  606.0  584.0  562.0  540.0
*
*l-body      by-vol       inc    b-cdt   a-code   surf-area   ht-str-no
12103501   210010000         0        1        0    0.102761         1
*
*r-body      by-vol       inc    b-cdt   a-code   surf-area   ht-str-no
12103601   230010000         0        1        0    0.102761         1
*
*source        type   is-nlpr      l-dr-ht       r-dr-ht     ht-str-no
12103701         0         0            0             0             1
*
*l-h-st     chf-htr    by-dia     h-eq-dia     ch-length     ht-str-no
*12103801          0   .3258603     0.875000     0.156250             1
12103801  0.875000  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    by-dia     h-eq-dia     ch-length     ht-str-no
*12103901          0   .3258603     0.875000     0.156250             1
12103901  0.875000  10.0 10.0  0 0 0 0  1.0  1
*
*************************************************************
* heat slab... il sg plenum between up & dn stream trapizoidal section *
*************************************************************
*
* left boundary  = component 210
* right boundary = component 230
*
*gl data        nh       np      type     s-flg    l-cor
12104000         1        4         1         1      0.0
*
*mesh       loc flg   frm flg
12104100          0         1
*
*geometry    no itv    r-cor
12104101          3   .162938
*
*materials   cmp no    itv no
12104201          1         3
*
*source dis  source    itv no
12104301       0.0         3
*
*init temp      flg
12104400         -1
*
*temp distribution
```

```
12104401 606.0 584.0 562.0 540.0
*
*1-body     hy-vol      inc   b-cdt   a-code  surf-area  ht-str-no
12104501  210010000       0       1       0   0.229152       1
*
*r-body     hy-vol      inc   b-cdt   a-code  surf-area  ht-str-no
12104601  230010000       0       1       0   0.229152       1
*
*source       type  is-alpr     l-dr-ht     r-dr-ht    ht-str-no
12104701        0        0           0           0           1
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12104801         0  .2513333     .5274709    0.479167        1
12104808 0.5274709  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12104901         0  .2513333     .5274709    0.479167        1
12104901 0.5274709  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* heat slabs... il sg tube sheet flanges - up(1) & downstream(2)  *
*****************************************************************
*
*  left boundary  = components 215 & 225
*  right boundary = ambient volume (808)
*
*gl data        nh        np      type     s-flg     l-cor
12150000         2        14         2         1   .212031
*
*mesh       loc flg   fnt flg
12150100         0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
12150101          1   .216114         1   .216406         3   .447917
12150102          1   .528545         5   .958333         2  1.12500
*
*materials    cmp no     itv no     cmp no     itv no     cmp no     itv no
12150201          5          1         13          2         25         11
12150202         26         13
*
*source dis   source     itv no
12150301        0.0         13
*
*init temp       flg
12150400         -1
*
*temp distribution
12150401  606.0  605.5  605.0  604.5  604.0  601.0  600.0  598.0  596.0
+         594.0  592.0  590.0  329.0   80.0
12150402  540.0  539.5  539.0  538.6  538.2  536.4  534.6  532.8  531.0
+         529.2  527.4  526.6  296.6   80.0
*
*l-body     hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
12150501  215010000       0       1       1    0.380208           1
12150502  225010000       0       1       1    0.380208           2
*
*r-body     hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
12150601  808010000       0    4100       1    0.380208           1
12150602  808010000       0    4100       1    0.380208           2
*
*source       type  is-alpr     l-dr-ht     r-dr-ht    ht-str-no
12150701        0        0           0           0           2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12150801         0  0.064750    0.120724    0.769417        2
12150801 0.120724  10.0 10.0  0 0 0 0 -1.0  2
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12150901         0     0.0          0.0    0.769417        2
12150901    0.0  10.0 10.0  0 0 0 0  1.0  2
*
*****************************************************************
* heat slabs... il sg tube sheet conical section - up(1), downstream(2)*
*****************************************************************
*
*  left boundary  = components 215 & 225
*  right boundary = ambient volume (808)
*
*gl data        nh        np      type     s-flg     l-cor
12151000         2         9         2         1   .212031
*
*mesh       loc flg   fnt flg
12151100         0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
12151101          1   .216114         1   .216406         3   .447917
12151102          1   .528545         2   .695211
*
*materials    cmp no     itv no     cmp no     itv no     cmp no     itv no
12151201          5          1         13          2         25          6
12151202         26          8
*
*source dis   source     itv no
12151301        0.0          8
*
*init temp       flg
12151400         -1
*
*temp distribution
12151401  606.0  605.5  605.0  604.0  600.0  595.0  590.0  329.0   80.0
12151402  540.0  539.5  539.0  536.4  534.6  530.8  526.6  296.6   80.0
*
*l-body     hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
12151501  215010000       0       1       1    0.327925           1
12151502  225010000       0       1       1    0.327925           2
*
*r-body     hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
12151601  808010000       0    4100       1    0.327925           1
12151602  808010000       0    4100       1    0.327925           2
*
*source       type  is-alpr     l-dr-ht     r-dr-ht    ht-str-no
12151701        0        0           0           0           2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12151801         0  0.064750    0.120724    0.655849        2
12151801 0.120274  10.0 10.0  0 0 0 0  1.0  2
```

```
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*12151901         0       0.0          0.0      0.739583        2
12151901  0.0  10.0 10.0  0 0 0 0   1.0  2
*
*****************************************************************
* heat slabs... il sg tube sheet center section - up(1) & downstream(2)*
*****************************************************************
*
*  left boundary  = components 215 & 225
*  right boundary = ambient volume (808)
*
*gl data         nh       np     type     s-flg    l-cor
12152000          2        8        2         1    .212031
*
*mesh        loc flg   fnt flg
12152100          0         1
*
*geometry     no itv     r-cor    no itv     r-cor    no itv     r-cor
12152101          1     .216114         1     .216406         3     .447917
12152102          2     .614583
*
*materials    cmp no     itv no    cmp no     itv no    cmp no     itv no
12152201          5          1        13          2        25          5
12152202         26          7
*
*source dis   source     itv no
12152301         0.0          7
*
*init temp       flg
12152400          -1
*
*temp distribution
12152401  606.0  605.5  605.0  604.0  600.0  590.0  329.0   80.0
12152402  540.0  539.5  539.0  536.4  534.6  530.8  296.6   80.0
*
*l-body      hy-vol       inc     b-cdt    a-code     cy-length    ht-str-no
12152501   215010000         0         1         1      0.166867          1
12152502   225010000         0         1         1      0.166867          2
*
*r-body      hy-vol       inc     b-cdt    a-code     cy-length    ht-str-no
12152601   808010000         0      4100         1      0.166867          1
12152602   808010000         0      4100         1      0.166867          2
*
*source         type   is-nlpr      l-dr-ht       r-dr-ht      ht-str-no
12152701          0         0            0             0              2
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*12152801         0  0.064750     0.120724      0.333734        2
12152801  0.120724  10.0 10.0  0 0 0 0   1.0  2
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*12152901         0       0.0          0.0      0.333734        2
12152901  0.0  10.0 10.0  0 0 0 0 1.0  2
*
*****************************************************************
* heat slab... il sg tube sheet between up & dn stream hyd. volumes  *
*****************************************************************
*
*  left boundary  = component 215
*  right boundary = component 225
*
*gl data         nh       np     type     s-flg    l-cor
12153000          1        4        1         1      0.0
*
*mesh        loc flg   fnt flg
12153100          0         1
*
*geometry     no itv     r-cor
12153101          3     .256517
*
*materials    cmp no     itv no
12153201         25          3
*
*source dis   source     itv no
12153301         0.0          3
*
*init temp       flg
12153400          -1
*
*temp distribution
12153401  606.0  584.0  562.0  540.0
*
*l-body      hy-vol       inc     b-cdt    a-code     surf-area    ht-str-no
12153501   215010000         0         1         0      0.693967          1
*
*r-body      hy-vol       inc     b-cdt    a-code     surf-area    ht-str-no
12153601   225010000         0         1         0      0.693967          1
*
*source         type   is-nlpr      l-dr-ht       r-dr-ht      ht-str-no
12153701          0         0            0             0              1
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*12153801         0  0.064750     0.139652          1.75          1
12153801  0.139652  10.0 10.0  0 0 0 0   1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*12153901         0  0.064750     0.139652          1.75          1
12153901  0.139652  10.0 10.0  0 0 0 0   1.0  1
*
*****************************************************************
* heat slab... bl sg inlet-outlet plenum - top rectangular section  *
*****************************************************************
*
*  left boundary  = components 310 & 330
*  right boundary = ambient volume (808)
*
*gl data         nh       np     type     s-flg    l-cor
13100000          2       10        2         1    .329960
*
*mesh        loc flg   fnt flg
13100100          0         1
*
*geometry     no itv     r-cor    no itv     r-cor
13100101          7     .958333         2     1.125
*
```

```
*materials   cmp no   itv no   cmp no   itv no
13100201        1        7       26        9
*
*source dis  source   itv no
13100301        0.0       9
*
*init temp      flg
13100400        -1
*
*temp distribution
13100401 606.0 600.0 597.0 594.0 591.0 588.0 585.0 582.0 325.0
+        68.0
13100402 540.0 534.0 531.0 528.0 525.0 522.0 519.0 516.0 292.0
+        68.0
*
*l-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13100501   310010000       0       1        1    0.078125        1
13100502   330010000       0       1        1    0.078125        2
*
*r-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13100601   808010000       0    4100        1    0.078125        1
13100602   808010000       0    4100        1    0.078125        2
*
*source       type  is-nlpr      l-dr-ht       r-dr-ht     ht-str-no
13100701        0        0            0             0             2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia     ch-length     ht-str-no
*13100801         0  .3258603     .5192263      0.156250             2
13100801 0.5192263  10.0 10.0  0 0 0 0  1.0  2
*r-h-st     chf-htr   hy-dia     h-eq-dia     ch-length     ht-str-no
*13100901         0     0.0          0.0      0.156250             2
13100901 0.0  10.0 10.0  0 0 0 0  1.0  2
*
************************************************************
* heat slab... bl sg inlet-outlet plenum - middle trapizoidal section *
************************************************************
*
*  left boundary  = components 310 & 330
*  right boundary = ambient volume (808)
*
*gl data         nh       np      type     s-flg     l-cor
13101000         2       11         2         1    .247205
*
*mesh       loc flg   fnt flg
13101100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
13101101         1     .333333       7    .958333       2    1.125
*
*materials   cmp no   itv no   cmp no   itv no
13101201         1        8       26       10
*
*source dis  source   itv no
13101301        0.0       10
*
*init temp      flg
13101400        -1
*
*temp distribution
13101401 606.0 603.0 600.0 597.0 594.0 591.0 588.0 585.0 582.0
+        325.0  68.0
13101402 540.0 537.0 534.0 531.0 528.0 525.0 522.0 519.0 516.0
+        292.0  68.0
*
*l-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13101501   310010000       0      -1        1    0.072917        1
13101502   330010000       0       1        1    0.072917        2
*
*r-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13101601   808010000       0    4100        1    0.072917        1
13101602   808010000       0    4100        1    0.072917        2
*
*source       type  is-nlpr      l-dr-ht       r-dr-ht     ht-str-no
13101701        0        0            0             0             2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia     ch-length     ht-str-no
*13101801         0  .2243822     .3974532      0.145834             2
13101801 0.3974532  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia     h-eq-dia     ch-length     ht-str-no
*13101901         0     0.0          0.0      0.145834             2
13101901 0.0  10.0 10.0  0 0 0 0  1.0  2
*
************************************************************
* heat slab... bl sg inlet-outlet plenum - bottom trapizoidal section *
************************************************************
*
*  left boundary  = components 310 & 330
*  right boundary = ambient volume (808)
*
*gl data         nh       np      type     s-flg     l-cor
13102000         2        4         2         1    .247205
*
*mesh       loc flg   fnt flg
13102100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor
13102101         1     .333333       2      0.5
*
*materials   cmp no   itv no   cmp no   itv no
13102201         1        1       26        3
*
*source dis  source   itv no
13102301        0.0       3
*
*init temp      flg
13102400        -1
*
*temp distribution
13102401 606.0  582.0  325.0   80.0
13102402 540.0  516.0  292.0   80.0
*
*l-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13102501   310010000       0       1        1    0.250000        1
13102502   330010000       0       1        1    0.250000        2
*
```

```
*r-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
13102601  808010000     0     4100     1    0.250000     1
13102602  808010000     0     4100     1    0.250000     2
*
*source      type  is-mlpr     l-dr-ht      r-dr-ht     ht-str-no
13102701      0      0           0            0          2
*
*l-h-st    chf-htr  hy-dia    h-eq-dia    ch-length    ht-str-no
*13102801       0  .2243822   .3974532    0.500000       2
13102801  0.3974532 10.0       10.0       0 0 0 0 1.0 2
*
*r-h-st    chf-htr  hy-dia    h-eq-dia    ch-length    ht-str-no
*13102901       0    0.0        0.0      0.500000       2
13102901  0.0 10.0       10.0       0 0 0 0 1.0 2
*
*****************************************************************
* heat slab... bl sg plenum between up & dn stream rectangular section *
*****************************************************************
*
*  left boundary  = component 310
*  right boundary = component 330
*
*gl data       nh      np     type    s-flg    l-cor
13103000        1       4      1       1      0.0
*
*mesh       loc flg  fnw flg
13103100        0       1
*
*geometry    no itv    r-cor
13103101        3     .095333
*
*materials   cmp no    itv no
13103201        1       3
*
*source dis  source    itv no
13103301      0.0       3
*
*init temp     flg
13103400        -1
*
*temp distribution
13103401  606.0  584.0  562.0  540.0
*
*l-body     hy-vol      inc   b-cdt  a-code  surf-area  ht-str-no
13103501  310010000     0       1      0     0.102753     1
*
*r-body     hy-vol      inc   b-cdt  a-code  surf-area  ht-str-no
13103601  330010000     0       1      0     0.102753     1
*
*source      type  is-mlpr     l-dr-ht      r-dr-ht     ht-str-no
13103701      0      0           0            0          1
*
*l-h-st    chf-htr  hy-dia    h-eq-dia    ch-length    ht-str-no
*13103801       0  .3258603   .5192263    0.156250       1
13103801  0.5192263 10.0  10.0  0 0 0 0 1.0 1
*
*r-h-st    chf-htr  hy-dia    h-eq-dia    ch-length    ht-str-no
*13103901       0  .3258603   .5192263    0.156250       1
13103901  0.5192263 10.0  10.0  0 0 0 0 1.0 1
*
*****************************************************************
* heat slab... bl sg plenum between up & dn stream trapizoidal section *
*****************************************************************
*
*  left boundary  = component 310
*  right boundary = component 330
*
*gl data       nh      np     type    s-flg    l-cor
13104000        1       4      1       1      0.0
*
*mesh       loc flg  fnw flg
13104100        0       1
*
*geometry    no itv    r-cor
13104101        3     .222145
*
*materials   cmp no    itv no
13104201        1       3
*
*source dis  source    itv no
13104301      0.0       3
*
*init temp     flg
13104400        -1
*
*temp distribution
13104401  606.0  584.0  562.0  540.0
*
*l-body     hy-vol      inc   b-cdt  a-code  surf-area  ht-str-no
13104501  310010000     0       1      0     0.228673     1
*
*r-body     hy-vol      inc   b-cdt  a-code  surf-area  ht-str-no
13104601  330010000     0       1      0     0.228673     1
*
*source      type  is-mlpr     l-dr-ht      r-dr-ht     ht-str-no
13104701      0      0           0            0          1
*
*l-h-st    chf-htr  hy-dia    h-eq-dia    ch-length    ht-str-no
*13104801       0  .2243822   .5152883    0.479167       1
13104801  0.5152883  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st    chf-htr  hy-dia    h-eq-dia    ch-length    ht-str-no
*13104901       0  .2243822   .5152883    0.479167       1
13104901  0.5152883  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* heat slabs... bl sg tube sheet flanges - up(1) & downstream(2)  *
*****************************************************************
*
*  left boundary  = components 315 & 325
*  right boundary = ambient volume (808)
*
*gl data       nh      np     type    s-flg    l-cor
13150000        2       15     2       1     .1277344
*
*mesh       loc flg  fnw flg
```

```
13150100          0       1
*
*geometry     no itv    r-cor    no itv    r-cor    no itv    r-cor
13150101           1  .1331511         1  .1334427         1  .1958013
13150102           1  .2916667         2  .4634061         6  .9583333
13150103           2 1.1250000
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
13150201           5         1        13         2        25        12
13150202          26        14
*
*source dis   source    itv no
13150301         0.0        14
*
*init temp       flg
13150400          -1
*
*temp distribution
13150401  606.0  605.5  605.0  604.5  604.0  601.0  600.0  598.0  596.0
+         594.0  593.0  592.0  590.0  329.0   80.0
13150402  540.0  539.5  539.0  538.6  538.2  536.4  534.6  532.8  531.0
+         529.2  528.3  527.4  526.2  296.6   80.0
*
*l-body       by-vol       inc    b-cdt    a-code    cy-length   bt-str-no
13150501   315010000         0        1         1     0.203125           1
13150502   325010000         0        1         1     0.203125           2
*
*r-body       by-vol       inc    b-cdt    a-code    cy-length   bt-str-no
13150601   808010000         0     4100         1     0.203125           1
13150602   808010000         0     4100         1     0.203125           2
*
*source         type   is-nlpr      l-dr-bt       r-dr-bt     bt-str-no
13150701          0         0            0             0             2
*
*l-h-st      chf-htr    by-dia      h-eq-dia     ch-length     ht-str-no
*13150801           0  .0620833      .1167128      0.406250             2
13150801  0.1167128  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st      chf-htr    by-dia      h-eq-dia     ch-length     ht-str-no
*13150901           0       0.0           0.0      0.406250             2
13150901  0.0  10.0  10.0  0 0 0 0  1.0  2
*
*************************************************************
* heat slabs... bl sg tube sheet conical section - up(1), downstream(2)*
*************************************************************
*
*  left boundary  = components 315 & 325
*  right boundary = ambient volume (808)
*
*gl data         nh       np     type     s-flg     l-cor
13151000          2        9        2         1  .1277344
*
*mesh       loc flg   fin flg
13151100          0         1
*
*geometry     no itv    r-cor    no itv    r-cor    no itv    r-cor
13151101           1  .1331511         1  .1334427         1  .1958013
13151102           1  .2916667         2  .4634061         2  .6301027
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
13151201           5         1        13         2        25         6
13151202          26         8
*
*source dis   source    itv no
13151301         0.0         8
*
*init temp       flg
13151400          -1
*
*temp distribution
13151401  606.0  605.5  605.0  604.0  600.0  595.0  590.0  329.0   80.0
13151402  540.0  539.5  539.0  536.4  534.6  530.8  526.6  296.6   80.0
*
*l-body       by-vol       inc    b-cdt    a-code    cy-length   bt-str-no
13151501   315010000         0        1         1     .2966746           1
13151502   325010000         0        1         1     .2966746           2
*
*r-body       by-vol       inc    b-cdt    a-code    cy-length   bt-str-no
13151601   808010000         0     4100         1     .2966746           1
13151602   808010000         0     4100         1     .2966746           2
*
*source         type   is-nlpr      l-dr-bt       r-dr-bt     bt-str-no
13151701          0         0            0             0             2
*
*l-h-st      chf-htr    by-dia      h-eq-dia     ch-length     ht-str-no
*13151801           0  .0620833      .1167128      0.6770833            2
13151801  0.1167128  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st      chf-htr    by-dia      h-eq-dia     ch-length     ht-str-no
*13151901           0       0.0           0.0      0.6770833            2
13151901  0.0  10.0  10.0  0 0 0 0  1.0  2
*
*************************************************************
* heat slabs... bl sg tube sheet cylindrical section - up(1) & down(2) *
*************************************************************
*
*  left boundary  = components 315 & 325
*  right boundary = ambient volume (808)
*
*gl data         nh       np     type     s-flg     l-cor
13152000          2        7        2         1  .1277344
*
*mesh       loc flg   fin flg
13152100          0         1
*
*geometry     no itv    r-cor    no itv    r-cor    no itv    r-cor
13152101           1  .1331511         1  .1334427         1  .1958013
13152102           1  .2916667         2  .4583333
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
13152201           5         1        13         2        25         4
13152202          26         6
*
*source dis   source    itv no
13152301         0.0         6
*
```

```
*init temp      flg
13152400        -1
*
*temp distribution
13152401 606.0 605.0 604.0 600.0 590.0 329.0  80.0
13152402 540.0 539.0 536.4 534.6 530.8 296.6  80.0
*
*l-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
13152501  315010000       0       1       1  0.2920754          1
13152502  325010000       0       1       1  0.2920754          2
*
*r-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
13152601  808010000       0    4100       1  0.2920754          1
13152602  808010000       0    4100       1  0.2920754          2
*
*source       type  is-nlpr     l-dr-ht     r-dr-ht    ht-str-no
13152701        0        0           0           0            2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13152801         0  .0620833     .1167128    0.5341508            2
13152801 0.1167128  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st
*13152901         0      0.0         0.0    0.5341508            2
13152901  0.0  10.0  10.0  0 0 0 0  1.0  2
*
*************************************************************
* heat slabs... bl sg tube sheet hub section - up(1) & downstream(2)  *
*************************************************************
*
*  left boundary  = components 315 & 325
*  right boundary = ambient volume (808)
*
*gl data        nh       np     type    s-flg    l-cor
13153000         2        6        2        1  .1277344
*
*mesh       loc flg   frn flg
13153100         0         1
*
*geomerty    no itv    r-cor    no itv    r-cor    no itv    r-cor
13153101         1  .1331511         1  .1334427         1  .1958013
13153102         2  .3624679
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
13153201         5         1        13         2        25         3
13153202        26         5
*
*source dis  source    itv no
13153301       0.0         5
*
*init temp      flg
13153400        -1
*
*temp distribution
13153401 606.0  604.0  600.0  590.0  329.0   80.0
13153402 540.0  536.4  534.6  530.8  296.6   80.0
*
*l-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
13153501  315010000       0       1       1  0.0835417          1
13153502  325010000       0       1       1  0.0835417          2
*
*r-body     hy-vol      inc   b-cdt  a-code  cy-length  ht-str-no
13153601  808010000       0    4100       1  0.0835417          1
13153602  808010000       0    4100       1  0.0835417          2
*
*source       type  is-nlpr     l-dr-ht     r-dr-ht    ht-str-no
13153701        0        0           0           0            2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13153801         0  .0620833     .1167128    0.1670833            2
13153801 0.1167128  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13153901         0      0.0         0.0    0.1670833            2
13153901  0.0  10.0  10.0  0 0 0 0  1.0  2
*
*************************************************************
* heat slab... bl sg tube sheet between up & dn stream hyd. volumes  *
*************************************************************
*
*  left boundary  = component 315
*  right boundary = component 325
*
*gl data        nh       np     type    s-flg    l-cor
13154000         1        3        1        1      0.0
*
*mesh       loc flg   frn flg
13154100         0         1
*
*geomerty    no itv    r-cor
13154101         2  .165750
*
*materials   cmp no    itv no
13154201        25         2
*
*source dis  source    itv no
13154301       0.0         2
*
*init temp      flg
13154400        -1
*
*temp distribution
13154401  606.0  573.0  540.0
*
*l-body     hy-vol      inc   b-cdt  a-code  surf area  ht-str-no
13154501  315010000       0       1       0  0.4135420          1
*
*r-body     hy-vol      inc   b-cdt  a-code  surf area  ht-str-no
13154601  325010000       0       1       0  0.4135420          1
*
*source       type  is-nlpr     l-dr-ht     r-dr-ht    ht-str-no
13154701        0        0           0           0            1
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13154801         0  .6020833     .1326376     1.751830            1
13154801 0.1326376  10.0 10.0  0 0 0 0  1.0  1
```

```
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*1315a901          0 0.064750     0.064750     1.751830            1
13154901 0.064750  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* heat slab... intact & broken loop, 3 in. sch-160 piping       *
*           note - contains only volume lengths which           *
*                  are heated by heater tape.                   *
*****************************************************************
*
*  left boundary  = components 201,261,262,263,301,363
*  right boundary = ambient volumes (811 & 813)
*
*gl data        nh       np     type     s-flg    l-cor
12002000         8        8        2         1  .10933333
*
*mesh       loc flg  fin flg
12002100         0        1
*
*geometry    no itv    r-cor   no itv    r-cor   no itv    r-cor
12002101         2  .14533333        1  .1458333         2  .156350
12002102         2  .32301667
*
*materials   cmp no   itv no   cmp no   itv no   cmp no   itv no
12002201         1        2       13        3        9        5
12002202        16        7
*
*source dis  source   itv no   source   itv no   source   itv no
12002301        0.0        3      1.0        5      0.0        7
*
*init temp      flg
12002400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
12002401 548.9   1  560.4   2  570.4   3  590.2   4  604.8   5
12002402 606.3   6  357.7   7  154.3   8
*
*l-body      hy-vol      inc    b-cdt   a-code   cy-length   ht-str-no
12002501  201010000        0        1        1     0.18189           1
12002502  201020000        0        1        1     0.54567           2
12002503  261010000        0        1        1     1.03188           3
12002504  261020000        0        1        1     0.78704           4
12002505  262010000        0        1        1     0.72757           5
12002506  263010000        0        1        1     0.54567           6
12002507  301010000        0        1        1     0.72757           7
12002508  363020000        0        1        1     0.36378           8
*
*r-body      hy-vol      inc    b-cdt   a-code   cy-length   ht-str-no
12002601  811010000        0     4100        1     0.18189           1
12002602  811010000        0     4100        1     0.54567           2
12002603  813010000        0     4100        1     1.03188           3
12002604  813010000        0     4100        1     0.78704           4
12002605  813010000        0     4100        1     0.72757           5
12002606  813010000        0     4100        1     0.54567           6
12002607  811010000        0     4100        1     0.72757           7
12002608  813010000        0     4100        1     0.36378           8
*
```

```
*source        type   is-mplr     l-dr-ht      r-dr-ht     ht-str-no
12002701        110   .013207           0            0             1
12002702        110   .039077           0            0             2
12002703        112   .246930           0            0             3
12002704        112   .186657           0            0             4
12002705        112   .174759           0            0             5
12002706        112   .129414           0            0             6
12002707        110   .052769           0            0             7
12002708        112   .087280           0            0             8
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12002801         0      0.0          0.0     0.218666             8
12002801  0.0  10.0 10.0  0 0 0 0  1.0  8
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*12002901         0      0.0          0.0     0.218666             8
12002901  0.0  10.0 10.0  0 0 0 0  1.0  8
*
*****************************************************************
* heat slab... intact loop, 3 in. sch-160 piping                *
*           note - heat slab contains only volume lengths which *
*                  are not heated                               *
*****************************************************************
*
*  left boundary  = intact loop primary coolant (201,261,262,263)
*  right boundary = ambient volumes (801 & 803)
*
*gl data        nh       np     type     s-flg    l-cor
12003000         6        5        2         1  0.10933333
*
*mesh       loc flg  fin flg
12003100         0        1
*
*       actual wall thk. mult by 2.0 to account for clamp+hub mass
*geometry    no itv    r-cor   no itv    r-cor
12003101         2  0.182333         2  0.349000
*                                     0.43233  for 3 in. of insul
*
*materials   cmp no   itv no   cmp no   itv no
12003201         1        2       16        4
*
*source dis  source   itv no
12003301        0.0        4
*
*init temp      flg
12003400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh   temp mesh
12003401 550.5   1  544.9   2  540.8   3  328.2   4  147.7   5
*
*l-body      hy-vol      inc    b-cdt   a-code   cy-length   ht-str-no
12003501  201010000        0        1        1     2.46061           1
12003502  201020000        0        1        1     0.75516           2
12003503  261010000        0        1        1     1.04479           3
12003504  261020000        0        1        1     1.28963           4
12003505  262010000        0        1        1     1.34910           5
12003506  263010000        0        1        1     1.60783           6
*
```

```
*r-body     hy-vol      inc   h-cdt  a-code  cy-length  ht-str-no
12003601  801010000      0    4100       1    2.46061       1
12003602  801010000      0    4100       1    0.75516       2
12003603  803010000      0    4100       1    1.04479       3
12003604  803010000      0    4100       1    1.28963       4
12003605  803010000      0    4100       1    1.34910       5
12003606  803010000      0    4100       1    1.60783       6
*
*source      type  is-nlpr     l-dr-ht     r-dr-ht   ht-str-no
12003701       0        0           0           0         6
*
*l-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*          0     0.0          0.0     0.218666         6
12003801 0.0  10.0 10.0  0 0 0 0  1.0  6
*
*r-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*12003901        0     0.0          0.0     0.218666         6
12003901 0.0  10.0 10.0  0 0 0 0  1.0  6
*
************************************************************
* heat slab... intact loop , 2 1/2 in. sch-160 piping      *
*           note - heat slab contains only volume lengths which *
*                  are heated with heater tape.            *
************************************************************
*
* left boundary = intact loop primary coolant (201,202,203,240)
* right boundary = ambient volumes (811 & 814)
*
*gl data       nh       np     type    s-flg    l-cor
12004000       15        8        2        1  0.088542
*
*mesh      loc flg   frn flg
12004100        0         1
*
*geometry    no itv    r-cor    no itv    r-cor    no itv    r-cor
12004101         2  0.119792         1  0.119892         2  0.130309
12004102         2  0.296975
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
12004201         1         2        13         3         9         5
12004202        15         7
*
*source dis  source    itv no    source    itv no    source    itv no
12004301       0.0         3       1.0         5       0.0         7
*
*init temp      flg
12004400         0
*
*          temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
12004401 553.0    4  583.4    5  582.8    6  342.0    7  149.9    8
*
*l-body      hy-vol       inc   h-cdt  a-code  cy-length  ht-str-no
12004501  201020000         0       1       1    0.88573         1
12004502  202010000         0       1       1    1.77146         2
12004503  203010000         0       1       1    1.99290         3
12004504  203020000         0       1       1    0.66430         4
12004505  203030000         0       1       1    0.88573         5
12004506  240010000         0       1       1    0.88573         6
12004507  240020000         0       1       1    1.55003         7
12004508  240030000         0       1       1    0.66430         8
12004509  240030000         0       1       1    1.77146         9
12004510  240040000         0       1       1    2.21433        10
12004511  240050000         0       1       1    3.08856        11
12004512  240060000         0       1       1    1.34009        12
12004513  240070000         0       1       1    1.34009        13
12004514  240080000         0       1       1    3.08856        14
12004515  240090000         0       1       1    2.65719        15
*
*r-body      hy-vol       inc   h-cdt  a-code  cy-length  ht-str-no
12004601  811010000         0    4100       1    0.88573         1
12004602  811010000         0    4100       1    1.77146         2
12004603  811010000         0    4100       1    1.99290         3
12004604  811010000         0    4100       1    0.66430         4
12004605  811010000         0    4100       1    0.88573         5
12004606  811010000         0    4100       1    0.88573         6
12004607  811010000         0    4100       1    1.55003         7
12004608  811010000         0    4100       1    0.66430         8
12004609  814010000         0    4100       1    1.77146         9
12004610  814010000         0    4100       1    2.21433        10
12004611  814010000         0    4100       1    3.08856        11
12004612  814010000         0    4100       1    1.34009        12
12004613  814010000         0    4100       1    1.34009        13
12004614  814010000         0    4100       1    3.08856        14
12004615  814010000         0    4100       1    2.65719        15
*
*source      type  is-nplr     l-dr-ht     r-dr-ht   ht-str-no
12004701       110  .052769           0           0         1
12004702       110  .105537           0           0         2
12004703       110  .118744           0           0         3
12004704       110  .039077           0           0         4
12004705       110  .052769           0           0         5
12004706       110  .052769           0           0         6
12004707       110  .091845           0           0         7
12004708       110  .039077           0           0         8
12004709       113  .114289           0           0         9
12004710       113  .142829           0           0        10
12004711       113  .199265           0           0        11
12004712       113  .086459           0           0        12
12004713       113  .086459           0           0        13
12004714       113  .199265           0           0        14
12004715       113  .171434           0           0        15
*
*l-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*12004801        0     0.0          0.0     0.177084        15
12004801 0.0  10.0 10.0  0 0 0 0  1.0  15
*
*r-h-st    chf-htr   hy-dia    h-eq-dia    ch-length    ht-str-no
*12004901        0     0.0          0.0     0.177084        15
12004901 0.0  10.0 10.0  0 0 0 0  1.0  15
*
************************************************************
* heat slab... intact loop , 2 1/2 in. sch-160 piping      *
*           note - heat slab contains only volume lengths which *
*                  are not heated.                         *
************************************************************
*
```

```
* left boundary = intact loop primary coolant (201,202,203,240)
* right boundary = ambient volumes (801 & 804)
*
*gl data        nh       np      type     s-flg    l-cor
12005000         14        5         2         1  0.068542
*
*mesh       loc flg  frm flg
12005100          0         1
*
*       actual wall thk. mult. by 2.0 to account for clamp + hub mass
*geometry     no itv    r-cor     no itv    r-cor
12005101          2  0.151042          2  0.317709
*
*materials   cmp no    itv no    cmp no    itv no
12005201          1         2        16         4
*
*source dis   source    itv no
12005301         0.0         4
*
*init temp       flg
12005400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
12005401 550.1    1  565.2    2  541.5    3  323.6    4  146.1    5
*
*1-body      by-vol       inc    b-cdit   a-code   cy-length   lit-str-no
12005501  201020000         0         1         1     0.28510          1
12005502  202010000         0         1         1     0.97187          2
12005503  203010000         0         1         1     0.66131          3
12005504  203020000         0         1         1     1.66862          4
12005505  203030000         0         1         1     1.30272          5
12005506  240010000         0         1         1     0.63605          6
12005507  240020000         0         1         1     2.11622          7
12005508  240030000         0         1         1     1.01174          8
12005509  240040000         0         1         1     0.68150          9
12005510  240050000         0         1         1     0.41907         10
12005511  240060000         0         1         1     0.18183         11
12005512  240070000         0         1         1     0.18183         12
12005513  240080000         0         1         1     0.41907         13
12005514  240090000         0         1         1     1.55114         14
*
*r-body      by-vol       inc    b-cdit   a-code   cy-length   lit-str-no
12005601  801010000         0      4100         1     0.28510          1
12005602  801010000         0      4100         1     0.97187          2
12005603  801010000         0      4100         1     0.66131          3
12005604  801010000         0      4100         1     1.66862          4
12005605  801010000         0      4100         1     1.30272          5
12005606  801010000         0      4100         1     0.63605          6
12005607  801010000         0      4100         1     2.11622          7
12005608  804010000         0      4100         1     1.01174          8
12005609  804010000         0      4100         1     0.68150          9
12005610  804010000         0      4100         1     0.41907         10
12005611  804010000         0      4100         1     0.18183         11
12005612  804010000         0      4100         1     0.18183         12
12005613  804010000         0      4100         1     0.41907         13
12005614  804010000         0      4100         1     1.55114         14
*
*source       type  is-mplr      l-dr-lit      r-dr-lit    lit-str-no
12005701          0         0             0             0         14
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    lit-str-no
*12005801          0       0.0          0.0      0.177084         14
12005801  0.0  10.0 10.0  0 0 0 0  1.0  14
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    lit-str-no
*12005901          0       0.0          0.0      0.177084         14
12005901  0.0  10.0 10.0  0 0 0 0  1.0  14
*
**************************************************************
* heat slab... broken loop - 1 1/2 in. sch 160 piping        *
*          note - heat slab contains only volume lengths which *
*                 are heated by heater bands                  *
**************************************************************
*
* left boundary = broken loop primary coolant (340 - volumes 4,5,7)
* right boundary = ambient volume (812)
*
*gl data        nh       np      type     s-flg    l-cor
13001000          3        11         2         1  .0557500
*
*mesh       loc flg  frm flg
13001100          0         1
*
*geometry     no itv    r-cor     no itv    r-cor     no itv    r-cor
13001101          2  .07916667          1  .0792000          1  .061804167
13001102          3  .09222083          1  .094824997        2  .251491663
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
13001201         -1         2        13         3         1         4
13001202          9         7         1         8        16        10
*
*source dis   source    itv no    source    itv no    source    itv no
13001301         0.0         5       1.0         6       0.0        10
*
*init temp       flg
13001400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
13001401 555.0    1  573.4    2  588.8    3  605.0    5  640.0    6
13001402 652.8    7  648.0    9  363.3   10  145.0   11
*
*1-body      by-vol       inc    b-cdit   a-code   cy-length   lit-str-no
13001501  340040000         0         1         1     2.29167          1
13001502  340050000         0         1         1     2.25000          2
13001504  340090000         0         1         1     0.20833          3
*
*r-body      by-vol       inc    b-cdit   a-code   cy-length   lit-str-no
13001601  812010000         0      4100         1     2.29167          1
13001602  812010000         0      4100         1     2.25000          2
13001604  812010000         0      4100         1     0.20833          3
*
*source       type  is-mplr      l-dr-lit      r-dr-lit    lit-str-no
13001701        111  .399475             0             0          1
13001702        111  .392055             0             0          2
13001704        111  .036122             0             0          3
*
```

```
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13001801         0      0.0          0.0     0.111500        3
13001801  0.0  10.0  10.0  0 0 0 0  1.0  3
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13001901         0      0.0          0.0     0.111500        3
13001901  0.0  10.0 10.0  0 0 0 0  1.0  3
*
**********************************************************
* heat slab... broken loop  - 1 1/2 in. sch-160 piping   *
*           note - heat slab contains only volume lengths which *
*                  are heated with heater tape.          *
**********************************************************
*
*  left boundary  = broken loop primary coolant (301,340,361,362,363)
*  right boundary = ambient volumes (811,812,813)
*
*gl data         nh       np      type     s-flg     l-cor
13002000         17        8         2         1   .05575000
*
*mesh       loc flg   frm flg
13002100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor
13002101         2   .07916667      1   .07920000
13002102         2   .0896840       2   .256350
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
13002201         1         2        13         3         9         5
13002202        16         7
*
*source dis  source    itv no    source    itv no    source    itv no
13002301       0.0         3       1.0         5       0.0         7
*
*init temp      flg
13002400         0
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
13002401 548.7   1   545.0   3   542.7   4   536.9   5   531.6   6
13002402 299.4   7   139.1   8
*
*l-bndy      hy-vol       inc     b-cdt   a-code   cy-length   ht-str-no
13002501  301010000         0         1        1      0.33506         1
13002502  301020000         0         1        1      0.67013         2
13002503  301030000         0         1        1      1.34025         3
13002504  301040000         0         1        1      1.34025         4
13002505  301050000         0         1        1      0.67013         5
13002506  301060000         0         1        1      1.00519         6
13002507  340010000         0         1        1      0.67013         7
13002508  340020000         0         1        1      0.67013         8
13002509  340030000         0         1        1      0.67013         9
13002510  340040000         0         1        1      1.34026        10
13002511  340050000         0         1        1      0.33506        11
13002512  340060000         0         1        1      0.67013        12
13002513  340070000         0         1        1      0.67013        13
13002514  340080000         0         1        1      4.35581        14
13002515  361010000         0         1        1      0.33506        15
13002516  362010000         0         1        1      0.67013        16
13002517  363010000         0         1        1      0.33506        17
*
*r-bndy      hy-vol       inc     b-cdt   a-code   cy-length   ht-str-no
13002601  811010000         0      4100        1      0.33506         1
13002602  811010000         0      4100        1      0.67013         2
13002603  811010000         0      4100        1      1.34025         3
13002604  811010000         0      4100        1      1.34025         4
13002605  811010000         0      4100        1      0.67013         5
13002606  811010000         0      4100        1      1.00519         6
13002607  811010000         0      4100        1      0.67013         7
13002608  811010000         0      4100        1      0.67013         8
13002609  811010000         0      4100        1      0.67013         9
13002610  811010000         0      4100        1      1.34026        10
13002611  812010000         0      4100        1      0.33506        11
13002612  812010000         0      4100        1      0.67013        12
13002613  812010000         0      4100        1      0.67013        13
13002614  812010000         0      4100        1      4.35581        14
13002615  813010000         0      4100        1      0.33506        15
13002616  813010000         0      4100        1      0.67013        16
13002617  813010000         0      4100        1      0.33506        17
*
*source       type    is-mplr     l-dr-ht      r-dr-ht     ht-str-no
13002701        110   .013207           0            0             1
13002702        110   .026384           0            0             2
13002703        110   .052769           0            0             3
13002704        110   .052738           0            0             4
13002705        110   .026354           0            0             5
13002706        110   .039077           0            0             6
13002707        110   .026354           0            0             7
13002708        110   .026354           0            0             8
13002709        110   .026354           0            0             9
13002710        110   .052769           0            0            10
13002711        111   .009585           0            0            11
13002712        111   .019147           0            0            12
13002713        111   .019147           0            0            13
13002714        111   .124458           0            0            14
13002715        112   .043740           0            0            15
13002716        112   .087480           0            0            16
13002717        112   .043740           0            0            17
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13002801         0      0.0          0.0     0.111500        17
13002801  0.0  10.0 10.0  0 0 0 0  1.0  17
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*13002901         0      0.0          0.0     0.111500        17
13002901  0.0  10.0 10.0  0 0 0 0  1.0  17
**********************************************************
* heat slab... broken loop - 1 1/2 in. sch-160 piping    *
*           note - heat slab contains only volume lengths which *
*                  are not heated.                       *
**********************************************************
*
*  left boundary  = broken loop primary coolant (301,340,361,362,363)
*  right boundary = ambient volumes (801,802,803)
*
*gl data         nh       np      type     s-flg     l-cor
13003000         18        5         2         1  0.0557500
```

```
*
*mesh       loc flg   frm flg
13003100         0         1
*
*       actual wall thk. mult by 2.0 to acct for clamp-hub mass
*geometry     no itv     r-cor    no itv     r-cor
13003101          2  0.1002584         2  0.2669251
*
*materials   cmp no    itv no    cmp no    itv no
13003201          1         2        16         4
*
*source dis   source    itv no
13003301         0.0         4
*
*init temp       flg
13003400          0
*
*        temp mesh    temp mesh    temp mesh    temp mesh    temp mesh
13003401 549.7    1  544.8    2  541.5    3  306.7    4  140.5    5
*
*l-body      by-vol       inc    b-cdt   a-code    cy-length   bt-str-no
13003501  301010000         0        1        1      0.49827         1
13003502  301020000         0        1        1      1.54000         2
13003503  301030000         0        1        1      0.86987         3
13003504  301040000         0        1        1      1.38427         4
13003505  301050000         0        1        1      1.68796         5
13003506  301060000         0        1        1      0.97012         6
13003507  340010000         0        1        1      0.93535         7
13003508  340020000         0        1        1      1.66920         8
13003509  340030000         0        1        1      0.97362         9
13003510  340040000         0        1        1      1.31120        10
13003511  340050000         0        1        1      1.71140        11
13003512  340060000         0        1        1      0.34555        12
13003513  340070000         0        1        1      0.34555        13
13003514  340080000         0        1        1      0.99377        14
13003515  340090000         0        1        1      2.08834        15
13003516  361010000         0        1        1      1.63494        16
13003517  362010000         0        1        1      0.97737        17
13003518  363010000         0        1        1      1.99911        18
*
*r-body      by-vol       inc    b-cdt   a-code    cy-length   bt-str-no
13003601  801010000         0     4100        1      0.49827         1
13003602  801010000         0     4100        1      1.54000         2
13003603  801010000         0     4100        1      0.86987         3
13003604  801010000         0     4100        1      1.38427         4
13003605  801010000         0     4100        1      1.68796         5
13003606  801010000         0     4100        1      0.97012         6
13003607  801010000         0     4100        1      0.93535         7
13003608  801010000         0     4100        1      1.66920         8
13003609  801010000         0     4100        1      0.97362         9
13003610  801010000         0     4100        1      1.31120        10
13003611  802010000         0     4100        1      1.71140        11
13003612  802010000         0     4100        1      0.34555        12
13003613  802010000         0     4100        1      0.34555        13
13003614  802010000         0     4100        1      0.99377        14
13003615  802010000         0     4100        1      2.08834        15
13003616  803010000         0     4100        1      1.63494        16
13003617  803010000         0     4100        1      0.97737        17
13003618  803010000         0     4100        1      1.99911        18
*
*source       type    is-nlpr     l-dr-bt     r-dr-bt    bt-str-no
13003701         0         0           0           0           18
*
*l-b-st     chf-btr    by-dia    h-eq-dia    ch-length    bt-str-no
*13003801          0       0.0         0.0     0.111500           18
13003801  0.0  10.0 10.0  0 0 0 0  1.0-  18
*
*r-b-st     chf-btr    by-dia    h-eq-dia    ch-length    bt-str-no
*13003901          0       0.0         0.0     0.111500           18
13003901  0.0  10.0 10.0  0 0 0 0  1.0  18
*
*************************************************************
* heat slab... broken loop, vessel nozzles (3 in. sch-160)  *
*           note - heat slab contains only volume lengths which *
*                  are not heated                             *
*************************************************************
*
* left boundary  = broken loop primary coolant vessel nozzles (301,363)
* right boundary = ambient volumes (801,803)
*
*gl data         nh        rp      type     s-flg      l-cor
13004000          2         5         2         1  0.10333333
*
*mesh       loc flg   frm flg
13004100          0         1
*
*geometry     no itv     r-cor    no itv     r-cor
13004101          2  0.145833         2  0.312500
*
*materials   cmp no    itv no    cmp no    itv no
13004201          1         2        16         4
*
*source dis   source    itv no
13004301         0.0         4
*
*init temp       flg
13004400         -1
*
*temp distribution
13004401  610.1  606.8  604.3  352.4  152.5
13004402  546.9  544.1  541.9  318.8  144.8
*
*l-body      by-vol       inc    b-cdt   a-code    cy-length   bt-str-no
13004501  301010000         0        1        1      0.61160         1
13004502  363020000         0        1        1      0.91239         2
*
*
*r-body      by-vol       inc    b-cdt   a-code    cy-length   bt-str-no
13004601  801010000         0     4100        1      0.61160         1
13004602  803010000         0     4100        1      0.91239         2
*
*source       type    is-nlpr     l-dr-bt     r-dr-bt    bt-str-no
13004701         0         0           0           0           2
*
*l-b-st     chf-btr    by-dia    h-eq-dia    ch-length    bt-str-no
*13004801          0       0.0         0.0     0.218666           2
```

```
1300501  0.0  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia     h-eq-dia     ch-length     ht-str-no
*1300501          0      0.0          0.0      0.218666      2
1300501  0.0  10.0 10.0  0 0 0 0  1.0  2
*
*************************************************************
* heat slab... intact loop pump                             *
*     note - heat slab models heat loss due to pump seal cooling    *
*************************************************************
*
*  left boundary  = component 250
*  right boundary = specified in table 251
*
* pump heat loss is tabulated as a linear function of pump angular speed
*
*gl data         nh       np      type     s-flg     l-cor
12500000          1        4         2         1    0.08865
*
*mesh        loc flg   frn flg
12500100          0         1
*
*geometry     no itv     r-cor
12500101          3    0.1500
*
*materials    cmp no     itv no
12500201          1          3
*
*source dis   source     itv no
12500301        0.0          3
*
*init temp       flg
12500400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh
12500401  540.7    1   436.6    2  345.9    3  265.0    4
*
*l-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12500501   250010000         0        1        1     2.26167        1
*
*r-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
12500601           0         0     2251        1     2.26167        1
*
*source         type   is-mplr      l-dr-ht       r-dr-ht     ht-str-no
12500701          0         0            0             0          1
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*12500801          0      0.0          0.0       2.26167          1
12500801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*12500901          0      0.0          0.0       2.26167          1
12500901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*************************************************************
* heat slab... broken loop pump                             *
*     note - heat slab models heat loss due to pump seal cooling    *
*************************************************************
*
*  left boundary  = component 350
*  right boundary = specified in table 351
*
* pump heat loss is tabulated as a linear function of pump angular speed
*
*gl data         nh       np      type     s-flg     l-cor
13500000          1        4        -2         1    0.07014
*
*mesh        loc flg   frn flg
13500100          0         1
*
*geometry     no itv     r-cor
13500101          3    0.12325
*
*materials    cmp no     itv no
13500201          1          3
*
*source dis   source     itv no
13500301        0.0          3
*
*init temp       flg
13500400          0
*
*         temp mesh    temp mesh    temp mesh    temp mesh
13500401  531.1    1   434.0    2  350.8    3  277.4    4
*
*l-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
13500501   350010000         0        1        1     1.9635        1
*
*r-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
13500601           0         0     2251        1     1.9635        1
*
*source         type   is-mplr      l-dr-ht       r-dr-ht     ht-str-no
13500701          0         0            0             0          1
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*13500801          0      0.0          0.0       1.9635          1
13500801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length     ht-str-no
*13500901          0      0.0          0.0       1.9635          1
13500901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*************************************************************
* heat slab... pressurizer heat transfer to pressurizer walls  *
*              without liner - aluminum sheath heated by heater tape  *
*************************************************************
*
*  left boundary  = component 999
*  right boundary = ambient volume (816)
*
*gl data         nh       np      type     s-flg     l-cor
19990000          8       14         2         1    .1512917
*
*mesh        loc flg   frn flg
19990100          0         1
*
```

```
*geometry     no itv    r-cor    no itv    r-cor    no itv    r-cor
19990101         3   .187500         4   .270833         1   .272167
19990102         1   .272267         2   .282683         2   .449350
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
19990201         1         3        19         7        20         8
19990202        13         9         9        11        30        13
*
*source dis   source    itv no    source    itv no    source    itv no
19990301          0.0         9       1.0        11       0.0        13
*
*init temp       flg
19990400           0
*
*          temp mesh    temp mesh    temp mesh
19990401  602.0    2   602.0   12   140.0   14
*
*l-body       by-vol       inc    b-cdt    a-code    cy-length    ht-str-no
19990501    999010000         0        1         1        2.500000         1
19990502    999020000     10000        1         1        2.562500         6
19990503    999070000         0        1         1        2.583333         7
19990504    999080000         0        1         1        2.093750         8
*
*r-body       by-vol       inc    b-cdt    a-code    cy-length    ht-str-no
19990601    816010000         0     4100         1        2.500000         1
19990602    816010000         0     4100         1        2.562500         6
19990603    816010000         0     4100         1        2.583333         7
19990604    816010000         0     4100         1        2.093750         8
*
*source         type    is-mplr      l-dr-ht      r-dr-ht    ht-str-no
19990701          117    .125065            0            0            1
19990702          117    .128192            0            0            6
19990703          117    .129234            0            0            7
19990704          117    .104742            0            0            8
*
*l-h-st      chf-htr    hy-dia      h-eq-dia      ch-length    ht-str-no
*19990801          0    .2858333      .2914500        2.500000         1
19990801  0.29145  10.0 10.0  0 0 0 0  1.0  1
*19990802          0    .3025833      .3025833        2.562500         6
19990802  0.30258  10.0 10.0  0 0 0 0  1.0  6
*19990803          0    .3025833      .3025833        2.583333         7
19990803  0.30258  10.0 10.0  0 0 0 0  1.0  7
*19990804          0    .1005325      .2251253        2.093750         8
19990804  0.22512  10.0 10.0  0 0 0 0  1.0  8
*
*r-h-st      chf-htr    hy-dia      h-eq-dia      ch-length    ht-str-no
*19990801          0       0.0           0.0        2.500000         1
19990901  0.0  10.0 10.0  0 0 0 0  1.0  1
*19990902          0       0.0           0.0        2.562500         6
19990902  0.0  10.0 10.0  0 0 0 0  1.0  6
*19990903          0       0.0           0.0        2.583333         7
19990903  0.0  10.0 10.0  0 0 0 0  1.0  7
*19990904          0       0.0           0.0        2.093750         8
19990904  0.0  10.0 10.0  0 0 0 0  1.0  8
*
**********************************************************************
* heat slab... pressurizer heater rods ---- data from rama corp.,    *
*              heater rod manufacturer                               *
**********************************************************************
*
* left boundary  = adiabatic
* right boundary = component 999
*
*gl data         nh       np      type     s-flg     l-cor
19993000          1        8         2         1       0.0
*
*mesh       loc flg   frm flg
19992100           0         1
*
*geometry     no itv    r-cor    no itv    r-cor    no itv    r-cor
19992101          2  2.1539e-2         1  2.1833e-2         2  2.6953e-2
19992102          2  3.1042e-2
*
*materials    cmp no    itv no    cmp no    itv no    cmp no    itv no
19992201         21         2        22         3        21         5
19992202         23         7
*
*source dis   source    itv no    source    itv no    source    itv no
19992301          0.0         2       1.0         3       0.0         7
*
*init temp       flg
19992400           0
*
*          temp mesh
19992401  631.0    8
*
*l-body       by-vol       inc    b-cdt    a-code    cy-length    ht-str-no
19992501            0         0        0         0          0.0         1
*
*r-body       by-vol       inc    b-cdt    a-code    cy-length    ht-str-no
19992601    999080000         0        1         1         12.0         1
*
*source         type    is-mplr      l-dr-ht      r-dr-ht    ht-str-no
19992701        10999        1.0            0            0            1
*
*l-h-st      chf-htr    hy-dia      h-eq-dia      ch-length    ht-str-no
*19992801          0       0.0           0.0        2.093750         1
19992801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st      chf-htr    hy-dia      h-eq-dia      ch-length    ht-str-no
*19992901          0    .1005325      .1901660        2.093750         1
19992901  0.1901660  10.0 10.0  0 0 0 0  1.0  1
*
**********************************************************************
* heat slab... pressurizer heat transfer out end caps and instrument *
*              ports - thermal conductivity calculated to match test *
**********************************************************************
*
* left boundary  = component 999
* right boundary = ambient volume (806)
*
*gl data         nh       np      type     s-flg     l-cor
19993000          8        3         2         1   .1512917
*
*mesh       loc flg   frm flg
19993100           0         1
```

```
*
*geometry    no itv    r-cor
19993101         2   .449350
*
*materials   cmp no    itv no
19993201        31         2
*
*source dis  source    itv no
19993301       0.0         2
*
*init temp     flg
19993400         0
*
*        temp mesh    temp mesh    temp mesh
19993401 602.0    1  370.0    2  140.0    3
*
*l-bndy      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
19993501   999010000         0        1        1    2.500000       1
19993502   999020000     10000        1        1    2.562500       6
19993503   999070000         0        1        1    2.583333       7
19993504   999080000         0        1        1    2.093750       8
*
*r-bndy      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
19993601   806010000         0     4100        1    2.500000       1
19993602   806010000         0     4100        1    2.562500       6
19993603   806010000         0     4100        1    2.583333       7
19993604   806010000         0     4100        1    2.093750       8
*
*source        type   is-mplr      l-dr-bt      r-dr-bt     bt-str-no
19993701         0         0            0            0             8
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    bt-str-no
*19993801          0   .2858333     .2914500      2.500000        1
19993801 0.29145  10.0 10.0  0 0 0 0  1.0  1
*19993802          0   .3025833     .3025833      2.562500        6
19993802 0.30258  10.0 10.0  0 0 0 0  1.0  6
*19993803          0   .3025833     .3025833      2.583333        7
19993803 0.30258  10.0 10.0  0 0 0 0  1.0  7
*19993804          0   .1005325     .2251253      2.093750        8
19993804 0.22512  10.0 10.0  0 0 0 0  1.0  8
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    bt-str-no
*19993901          0      0.0          0.0      2.500000        1
19993901 0.0  10.0 10.0  0 0 0 0  1.0  1
*19993902          0      0.0          0.0      2.562500        6
19993902 0.0  10.0 10.0  0 0 0 0  1.0  6
*19993903          0      0.0          0.0      2.583333        7
19993903 0.0  10.0 10.0  0 0 0 0  1.0  7
*19993904          0      0.0          0.0      2.093750        8
19993904 0.0  10.0 10.0  0 0 0 0  1.0  8
*
**************************************************************
* heat slab... pressurizer surge line heat loss              *
**************************************************************
*
*  left boundary  = component 997
*  right boundary = ambient volume (807)
*
*gl data        nh        np      type     s-flg     l-cor
19970000         2         5         2         1   .0154167
*
*mesh       loc flg    fra flg
19970100         0         1
*
*geometry    no itv    r-cor    no itv    r-cor
19970101         2   .035000         2   .054450
*
*materials   cmp no    itv no    cmp no    itv no
19970201         1         2        24         4
*
*source dis  source    itv no
19970301       0.0         4
*
*init temp     flg
19970400         0
*
*        temp mesh    temp mesh
19970401 602.0    2  602.0    5
*
*l-bndy      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
19970501   997020000         0        1        1    5.6458333       1
19970502   997030000         0        1        1    4.0625000       2
*
*r-bndy      by-vol       inc    b-cdt   a-code   cy-length   bt-str-no
19970601   807010000         0     4100        1    5.6458333       1
19970602   807010000         0     4100        1    4.0625000       2
*
*source        type   is-mplr      l-dr-bt      r-dr-bt     bt-str-no
19970701         0         0            0            0             2
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    bt-str-no
*19970801          0      0.0          0.0          0.0        2
19970801 0.0  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    bt-str-no
*19970901          0      0.0          0.0          0.0        2
19970901 0.0  10.0 10.0  0 0 0 0  1.0  2
*
**************************************************************
**************************************************************
**********  heat structure thermal property data  ************
**************************************************************
**************************************************************
*
*            type     ca flg    ca flg
*316l stainless steel
20100100    tbl/fctn         1         1
*
*average two phase data
20100200    tbl/fctn         1         1
*
*boron nitride
20100300    tbl/fctn         1         1
*
*constantan
20100400    tbl/fctn         1         1
```

```
*
*inconel 600
20100500    tbl/fctn        1       1
*
*grafoil (grafoil is a trade name of a union carbide product)
20100600    tbl/fctn        1       1
*
*copper ca 102 (oxyen freen copper)
20100700    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for vessel heat loss)
20100800    tbl/fctn        1       1
*
*alumina  (aluminum oxide)
20100900    tbl/fctn        1       1
*
*inconel 718
20101000    tbl/fctn        1       1
*
*honeycomb - hexagonal matrix core
20101100    tbl/fctn        1       1
*
*honeycomb - square matrix core
20101200    tbl/fctn        1       1
*
*contact resistance properties (conductivity of air; storage = 0.0)
20101300    tbl/fctn        1       1
*
*steam generator filler piece construction
20101400    tbl/fctn        1       1
*
*water
20101500    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for piping heat loss)
20101600    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for steam generator heat loss)
20101700    tbl/fctn        1       1
*
*thermal liner - john's manville min-k 2000, 30-35 pcf
20101800    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for pressurizer heat loss)
20101900    tbl/fctn        1       1
*
*aluminum  (used in pressurizer guard heaters)
20102000    tbl/fctn        1       1
*
*magnesium oxide  (used in pressurizer heater rods)
20102100    tbl/fctn        1       1
*
*nichrose v  (used in pressurizer heater rods)
20102200    tbl/fctn        1       1
*
*incoloy 800  (used in pressurizer heater rods)
20102300    tbl/fctn        1       1
*
*cal-temp insulation  (for pressurizer surge line heat loss)
20102400    tbl/fctn        1       1
*
*  0.35% carbon steel used for sg tube sheets
20102500    tbl/fctn        1       1
*
*cal-temp insulation  (for inlet plenum heat loss)
20102600    tbl/fctn        1       1
*
*uo2 used in nuclear core
20102700    tbl/fctn        1       1
*
*zircaloy used in nuclear core
20102800    tbl/fctn        1       1
*
*gap used in nuclear core
20102900    tbl/fctn        1       1
*
*temp-mat insulation  (modified values for pressurizer heat loss)
20103000    tbl/fctn        1       1
*
*pressurizer end cap and instrument heat loss - calculated values
20103100    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for bl steam generator heat loss)
20103200    tbl/fctn        1       1
*
*.....................................................................
*
*thermal conductivity   btu/(s ft f)
*
*           temp    cond    temp    cond    temp    cond
*3161 stainless steel
20100101      32.00  .00215
20100102     100.00  .00215   800.00  .00306  1600.00  .00397
20100103    4000.00  .00397
*
*averge two phase data
20100201      32.00  .000006
20100202     212.00  .000006   572.00  .000008  4000.00  .000008
*
* boron nitride (new curve from c.fineman..in 1/30/79 by dmk)
20100301      32.00  .00255
20100302     200.00  .00241   500.00  .00216  1000.00  .00174
20100303    1500.00  .00133  2000.00  .000909 2500.00  .000491
20100304    3000.00  .000074 3500.00  .000074 4000.00  .000074
*
*constantan
20100401       0.00  .00389  3000.00  .00389  4000.00  .00389
*
*inconel 600
20100501      32.00  .00236
20100502     100.00  .00236   300.00  .00267   500.00  .00294
20100503     700.00  .00322   900.00  .00350  1100.00  .00378
20100504    4000.00  .00378
*
*grafoil
20100601      32.00  .000799
```

```
20100602     250.00   .000799    500.00   .000633    750.00   .000579
20100603    1000.00   .000509   1250.00   .000484   1500.00   .000468
20100604    2000.00   .000463   3000.00   .000456   4000.00   .000456
*
*copper ca 102
20100701      32.00   .0622      212.00   .0606      572.00   .0589
20100702     932.00   .0575     4000.00   .0575
*
*cal-temp insul (increased by factor of 35.0 for vessel heat loss)
20100801       0.00 3.2410e-4   100.00 3.2410e-4   200.00 3.4420e-4
20100802     300.00 3.8500e-4   400.00 4.0540e-4   500.00 4.4530e-4
20100803     600.00 4.8610e-4   700.00 5.3230e-4   800.00 5.8720e-4
*
*alumina  (aluminum oxide)
20100901       0.00 .00034722  3300.00 .00034722
*
*inconel 718
20101001       0.00 .0021667    200.00 .0022778    400.00 .0023333
20101002     600.00 .0025556    800.00 .0028056   1000.00 .0030556
20101003    1200.00 .0033333   1400.00 .0035556   1600.00 .0038333
*
*honeycomb - hexagonal matrix core
20101101       0.00 2.61110e-5  700.00 2.61110e-5
*
*honeycomb - square matrix core
20101201       0.00 2.27780e-5  700.00 2.27780e-5
*
*contact resistance (heaters to piping)     (conductivities of air)
20101301       0.00 3.5750e-6    80.00 4.2110e-6   170.00 4.8190e-6
20101302     260.00 5.4000e-6   350.00 5.9500e-6   440.00 6.4810e-6
20101303     530.00 6.9970e-6   620.00 7.4780e-6   710.00 7.9500e-6
20101304     800.00 8.3940e-6   890.00 8.8420e-6   980.00 9.2750e-6
*
*steam generator filler pieces (conductivities from test grb-14-82)
20101401      80.00 3.0280e-4   260.00 3.3610e-4   440.00 3.6950e-4
20101402     620.00 4.0280e-4   800.00 4.3610e-4
*
*water
20101501      32.0  88.6110e-6  104.0 100.8330e-6  176.0 107.2220e-6
20101502     248.0 110.0000e-6  356.0 108.3370e-6  464.0 101.9440e-6
20101503     500.0  98.0550e-6  572.0  86.6660e-6  700.0  86.6660e-6
*
*cal-temp insul (increased by factor of 7.0 for piping heat loss)
20101601       0.00 6.4810e-5   100.00 6.4810e-5   200.00 6.8830e-5
20101602     300.00 7.7000e-5   400.00 8.1080e-5   500.00 8.9050e-5
20101603     600.00 9.7220e-5   700.00 10.6580e-5  800.00 11.7440e-5
*
*cal-temp insul (increased by factor of 2.6125 for ilsg heat loss)
20101701       0.00 2.4189e-5   100.00 2.4189e-5   200.00 2.5697e-5
20101702     300.00 2.8740e-5   400.00 3.0255e-5   500.00 3.3233e-5
20101703     600.00 3.6596e-5   700.00 3.9784e-5   800.00 4.3987e-5
*
*thermal liner - john's manville min-k 2000, 30-35 pcf
20101801     300.00 1.1110e-5   600.00 1.2730e-5  1000.00 1.4810e-5
*
*cal-temp insul (increased by factor of 1.0 for pressurizer heat loss)
20101901       0.00 9.2600e-6   100.00 9.2600e-6   200.00 9.8330e-6
20101902     300.00 1.1000e-5   400.00 1.1580e-5   500.00 1.2720e-5
20101903     600.00 1.3890e-5   700.00 1.5230e-5   800.00 1.6780e-5
20101904    1000.00 1.9880e-5
*
*aluminum  (used in pressurizer guard heaters)
20102001      32.00 3.2434e-2   212.00 3.3076e-2   392.00 3.4521e-2
20102002     572.00 3.6609e-2   752.00 3.9980e-2  1000.00 4.2668e-2
*
*magnesium oxide  (used in pressurizer heater rods)
20102101     100.00 4.6296e-4  1000.00 3.3796e-4
*
*nichrome v  (used in pressurizer heater rods)
20102201      32.00 1.9749e-3   212.00 2.2158e-3   392.00 2.5048e-3
20102202     572.00 2.7456e-3   752.00 2.8902e-3  1112.00 3.6127e-3
*
*incoloy 800  (used in pressurizer heater rods)
20102301      70.00 1.8519e-3  1000.00 3.2176e-3  1500.00 4.0278e-3
*
*cal-temp insul (increased by factor of 1.0  pzr surge line heat loss)
20102401       0.00 9.2600e-6   100.00 9.2600e-6   200.00 9.8330e-6
20102402     300.00 1.1000e-5   400.00 1.1580e-5   500.00 1.2720e-5
20102403     600.00 1.3890e-5   700.00 1.5230e-5   800.00 1.6780e-5
*
*  0.35% carbon steel used for sg tube sheets
20102501      32.00   .00944     68.00   .00917     212.00   .00889
20102502     392.00   .00817     572.00   .00750     752.00   .00694
20102503    1112.00   .00564    1472.00   .00478
*
*cal-temp insul (increased by factor of 1.0 for inlet plenum heat loss)
20102601       0.00 9.2600e-6   100.00 9.2600e-6   200.00 9.8330e-6
20102602     300.00 1.1000e-5   400.00 1.1580e-5   500.00 1.2720e-5
20102603     600.00 1.3890e-5   700.00 1.5230e-5   800.00 1.6780e-5
20102604    1000.00 1.9880e-5
*
*uo2 used in nuclear core
20102701      32.00   .00152    200.00   .00120    400.00   .00100
20102702     600.00   .00090    800.00   .00074   1000.00   .00065
20102703    1200.00   .00059   1500.00   .00052   2000.00   .00044
20102704    2500.00   .00039   3000.00   .00037   4000.00   .00038
*
*zircaloy used in nuclear core
20102801      32.00   .00197   1099.50   .00320   1199.80   .00330
20102802    1478.80   .00366   1498.60   .00369   1529.20   .00373
20102803    1579.80   .00381   1599.60   .00384   1619.70   .00387
20102804    1639.70   .00391   1759.80   .00411   1999.20   .00458
*
*gap used in nuclear core
20102901      32.00 2.2500e-5   602.30 3.8520e-5   998.33 4.6500e-5
20102902    1502.30 5.7800e-5  2006.30 6.7420e-5  5498.33 1.2040e-5
*
*temp-mat ins (increased by a factor of 1.0 for pressurizer heat loss)
20103001       0.00 4.9770e-6   100.00 5.7870e-6   200.00 6.5970e-6
20103002     300.00 7.6390e-6   400.00 8.7960e-6   500.00 1.0420e-5
20103003     600.00 1.2040e-5   700.00 1.4120e-5   800.00 1.6320e-5
20103004    1000.00 1.6960e-5
*
*pressurizer end cap and instrument heat loss - calculated values
20103101       0.00 1.8334e-6  1000.00 1.8334e-6
*
```

```
*cal-temp insul (increased by factor of 2.2049 for blsg heat loss)
20103201      0.00 2.0340e-5  100.00 2.0340e-5  200.00 2.1671e-5
20103202    300.00 2.4238e-5  400.00 2.5521e-5  500.00 2.8028e-5
20103203    600.00 3.0606e-5  700.00 3.3564e-5  800.00 3.6975e-5
20103204   1000.00 4.3794e-5
*
*.....
*
*volumetric heat capacity data      (btu/cuft-f)
*             temp     cap      temp     cap      temp     cap
*3161 stainless steel
20100151     32.00   61.30    400.00   61.30    600.00   64.60
20100152    800.00   67.10   1000.00   69.35   4000.00   69.35
*
*average two phase
20100251     32.00    1.00    212.00    1.00    572.00   64.00
20100252   4000.00   64.00
*
*boron nitride
20100351     32.00   37.50    400.00   37.50    800.00   48.30
20100352   1200.00   54.60   1600.00   58.30   2000.00   60.00
20100353   2400.00   61.40   3400.00   62.50   4000.00   62.50
*
*constantan
20100451     32.00   56.00    212.00   56.00    572.00   61.00
20100452    932.00   67.00   1472.00   73.00   2192.00   78.00
20100453   2552.00   84.00   3000.00   90.00   4000.00   90.00
*
*inconel 600
20100551     32.00   52.225  4000.00   52.225
*
*grafoil
20100651     32.00   11.90    80.40    11.90    170.40   14.70
20100652    260.40   17.15   350.40    19.60    440.40   21.35
20100653    530.40   22.40   620.40    23.80    710.40   25.20
20100654    800.40   26.32  4000.00    26.32
*
*copper ca 102
20100751     32.00   51.336  4000.00   51.336
*
*cal-temp insulation
20100851      0.00    2.898  1000.00    2.898
*
*alumina   (aluminum oxide)
20100951      0.00   55.20   3300.00   55.20
*
*inconel 718
20101051      0.00   48.5797  200.00   53.7397   400.00   55.458
20101052    600.00   61.5912  800.00   65.1840  1000.00   69.290
20101053   1200.00   74.4227 1400.00   76.9890  1600.00   82.121
*
*honeycomb - hexagonal matrix core
20101151      0.00    2.28969 200.00    2.53081  400.00    2.6512
20101152    600.00    2.89224 800.00    3.06195 1000.00    3.2537
20101153   1200.00    3.49379 1400.00   3.61530 1600.00    3.8563
*
*honeycomb - square matrix core
20101251      0.00    2.15978 200.00    2.38713  400.00    2.5008
20101252    600.00    2.71815 800.00    2.88729 1000.00    3.0691
20101253   1200.00    3.29651 1400.00   3.41018 1600.00    3.6375
*
*contact resistance  (heaters to piping)
20101351      0.00    0.00    3300.00   0.00
*
*steam generator filler piece  (calculation from test grb-14-82)
20101451      0.00   13.00    1000.00   13.00
*
*water  (saturated)
20101551     32.00   63.033   104.00   61.966   176.00   60.950
20101552    248.00   59.895   356.00   58.553   464.00   57.845
20101553    500.00   57.969   572.00   60.999   700.00   62.576
*
*cal-temp insulation
20101651      0.00    2.898  1000.00    2.898
*
*cal-temp insulation
20101751      0.00    2.898  1000.00    2.898
*
*thermal liner - john's manville min-k 2000, 30-35 pcf
20101851    400.00    7.475   800.00    8.125
20101852   1200.00    8.775  1600.00    8.775
*
*cal-temp insulation
20101951      0.00    2.898  1000.00    2.898
*
*aluminum  (used in pressurizer guard heaters)
20102051     32.00   36.177 10000.00   36.177
*
*magnesium oxide  (used in pressurizer heater rods)
20102151     10.00   43.07  10000.00   43.07
*
*nichrome v  (used in pressurizer heater rods)
20102251     10.00   55.07  10000.00   55.07
*
*incoloy 800  (used in pressurizer heater rods)
20102351     10.00   61.00  10000.00   61.00
*
*cal-temp insulation
20102451      0.00    2.898  1000.00    2.898
*
*  0.35% carbon steel
20102551     68.00   51.40   3000.00   51.40
*
*cal-temp insulation
20102651      0.00    2.898  1000.00    2.898
*
*zr02 used in nuclear core
20102751     32.00   43.255   200.00   45.394   400.00   47.459
20102752    600.00   49.072   800.00   50.308  1000.00   51.238
20102753   1200.00   51.939  1500.00   52.721  2000.00   53.920
20102754   2500.00   55.994  3000.00   60.096  4000.00   79.014
*
*zircaloy used in nuclear core
20102851     32.00   27.820  1099.50   33.550  1199.80   35.190
20102852   1478.80   35.190  1498.60   53.180  1529.20   59.330
20102853   1579.80   62.190  1599.60   73.640  1619.70   77.790
```

```
20102654    1639.70   79.780  1759.80   34.790  1999.20   34.790
*
*gap used in nuclear core
20102951      32.00  8.051e-5 5408.30 8.0514e-5
*
*temp-mat insulation
20103051       0.00    2.125  1000.00    2.125
*
*pressurizer end cap and instrument heat loss
20103151       0.00    0.000  1000.00    0.000
*
*cal-temp insulation
20103251       0.00    2.898  1000.00    2.898
*
*
************************************************************
*                        tables                            *
************************************************************
*
*     ********************  core power  ********************
*
*          table     trip     time coef    power coef
20215000     power      409          1.0         1.000  * mw
*
*          time           power   (ans standard decay curve)
20215001      0.0           1.000
20215002      1.1957         .98216
20215003      5.9783         .29432
20215004      7.1739         .22553
20215005     10.7608         .11781
20215006     11.9565         .10006
20215007     21.5217         .05289
20215008     31.0870         .04263
20215009     51.4130         .03880
20215010     81.3048         .03500
20215011    100.4348         .03313
20215012    979.2388         .02080
*
************************************************************
*
*     ************  pressurizer heater rod power  ************
*
*          table     trip     time coef    power coef
20299900     power      499          1.0    10.4200e-3  * mw
*
*          time           power
20299901      0.0           0.000
20299902  10000.0           0.000
*
************************************************************
*              pump speed tables (normalized speed)        *
************************************************************
*
*          table     trip
20225000     reac-t     412   * intact loop pump
*
*          time      norm pump speed
20225001     -1.0           1.0
20225002      0.0           1.0
20225003      1.1956        0.97220
20225004      8.3695        0.55521
20225005      9.5652        0.50440
20225006     19.1304        0.32739
20225007     29.8913        0.23458
20225008     38.2608        0.22025
20225009     59.7826        0.21159
20225010     62.1739        0.19573
20225011     64.5652        0.18887
20225012     66.9565        0.04289
20225013     68.1521        0.0
20225014   4000.0           0.0
*
20235000     reac-t     413   * broken loop pump
20235001     -1.0           1.0
20235002      0.0           1.0
20235003      1.1956        0.98527
20235004      8.3695        0.63678
20235005     10.7608        0.55975
20235006     20.3260        0.42278
20235007     40.6521        0.40220
20235008     59.7826        0.40315
20235009     60.9782        0.32766
20235010     64.5652        0.25842
20235011     65.7608        0.16130
20235012     69.3478        0.0
20235013   4000.0           0.0
*
************************************************************
*                                                          *
*              system heat loss tables                     *
*                                                          *
************************************************************
*
*heat loss due to intact loop pump passive cooling, 20.0 kw at full flow
*     1.0 btu = 1055.056 joules (international table)
**
**          table     trip     time coef     rate coef
*20225100   htrnrate     412          1.0        8.8931   * btu/s)ft2
**
**          time      norm h.t.rate
*20225101     -1.0           1.000
*20225102      0.0           1.000
*20225103     10.4           0.505
*20225104     20.8           0.325
*20225105     32.0           0.227
*20225106     42.4           0.181
*20225107     62.4           0.150
*20225108     64.0           0.000
*20225109   4000.0           0.000
**
*heat loss due to intact loop pump active cooling, 4.3 kw always
*
*          table     trip     time coef     rate coef
20225100   htrnrate     412          1.0        1.9120   * btu/s-ft2
*
*          time      norm h.t.rate
```

```
20225101      0.0          1.000
20225102    20000.0        1.000
*
*****************************************************************
*heat loss due to broken loop pump passive cooling, 14.7 kw at full flow
*    from test so-2b-38, h. s. crapo, hsc-2-84, 3 feb 1984
*    1.0 btu = 1055.056 joules (international table)
**
**          table     trip    time coef     rate coef
*20235100   htrnrate   413         1.0        9.1631   * btu/s-ft2
**
**           time      norm h.t.rate
*20235101     -1.0          1.000
*20235102      0.0          1.000
*20235103      9.6          0.590
*20235104     13.6          0.498
*20235105     20.8          0.407
*20235106     30.4          0.335
*20235107     60.0          0.335
*20235108     64.8          0.000
*20235109   4000.0           0.000
**
*heat loss due to broken loop pump active cooling, 4.3 kw always
*    from test so-2b-38, h. s. crapo, hsc-2-84, 3 feb 1984
*
*          table     trip    time coef     rate coef
20235180   htrnrate   413         1.0        2.6804   * btu/s-ft2
*
*           time      norm h.t.rate
20235101     0.0          1.000
20235102   20000.0        1.000
*
*****************************************************************
*
* specified heat transfer coefficients on piping insulation surface
*  (values calculated for free convecton in air + radiation)
*
*          table
20210000   htc-temp
*
*           temp      h.t.coef   (btu/s-ft2-f)
20210001     100.0      0.00136
20210002     150.0      0.00206
20210003     200.0      0.00247
20210004     300.0      0.00302
20210005     500.0      0.00374
20210006     750.0      0.00438
*
* specified heat transfer coefficients on ilsg insulation surface
*  (values calculated for free convecton in air + radiation)
*
*          table
20220000   htc-temp    0  1.0   0.0   3.5425
*
*           temp      h.t.coef   (btu/s-ft2-f)
20220001     100.0      0.00136
20220002     150.0      0.00206
20220003     200.0      0.00247
20220004     300.0      0.00302
20220005     500.0      0.00374
20220006     750.0      0.00438
*
* specified heat transfer coefficients on olsg steam dome insulation
* surface  (values calculated for free convecton in air + radiation)
*
*          table
20230000   htc-temp    0    1.0    0.0    3.35
*
*           temp      h.t.coef   (btu/s-ft2-f)
20230001     100.0      0.00136
20230002     150.0      0.00206
20230003     200.0      0.00247
20230004     300.0      0.00302
20230005     500.0      0.00374
20230006     750.0      0.00438
*
* specified heat transfer coefficients on olsg riser insulation
* surface  (values calculated for free convecton in air + radiation)
*
*          table
20240000   htc-temp    0    1.0    0.0    3.35
*
*           temp      h.t.coef   (btu/s-ft2-f)
20240001     100.0      0.00136
20240002     150.0      0.00206
20240003     200.0      0.00247
20240004     300.0      0.00302
20240005     500.0      0.00374
20240006     750.0      0.00438
*
* specified heat transfer coefficients on olsg downcomer insulation
* surface  (values calculated for free convecton in air + radiation)
*
*          table
20250000   htc-temp    0    1.0    0.0    3.35
*
*           temp      h.t.coef   (btu/s-ft2-f)
20250001     100.0      0.00136
20250002     150.0      0.00206
20250003     200.0      0.00247
20250004     300.0      0.00302
20250005     500.0      0.00374
20250006     750.0      0.00438
*
*****************************************************************
*              power tables for piping heaters                  *
*****************************************************************
*
*    *****  power table for guard heater power bus 110  *****
*    *****  (power to intact and broken loop hot legs)  *****
*
*          table     trip     time coef    power coef
20211000   power      430          1.0     8.4380e-3   * mw
*
*           time          power
20211001     0.0           1.00
```

```
20211002    10000.0          1.00
*
*******************************************************************
*
*    *****  power table for guard heater power bus 111  *****
*    ********  (power to broken loop pump suction)  ********
*
*          table     trip    time coef    power coef
20211100     power     431          1.0    4.0130e-3  * MW
*
*           time          power
20211101     0.0            1.00
20211102   10000.0           1.00
*
*******************************************************************
*
*    *****  power table for guard heater power bus 112  *****
*    *****  (power to intact and broken loop cold legs)  *****
*
*          table     trip    time coef    power coef
20211200     power     432          1.0    3.1220e-3  * MW
*
*           time          power
20211201     0.0            1.00
20211202   10000.0           1.00
*
*******************************************************************
*
*    *****  power table for guard heater power bus 113  *****
*    ********  (power to intact loop pump suction)  ********
*
*          table     trip    time coef    power coef
20211300     power     433          1.0    8.2610e-3  * MW
*
*           time          power
20211301     0.0            1.00
20211302   10000.0           1.00
*
*******************************************************************
*
*    *****  power table for guard heater power bus 116  *****
*    *  (power to external heaters on vessel and downcomer)  *
*
*          table     trip    time coef    power coef
20211600     power     436          1.0    19.8320e-3  * MW
*
*           time          power
20211601     0.0            1.00
20211602   10000.0           1.00
*
*******************************************************************
*
*    *****  power table for guard heater power bus 117  *****
*    *****  (power to external heaters on pressurizer)  *****
*
*          table     trip    time coef    power coef
20211700     power     437          1.0    1.5930e-3  * MW
*
*           time          power
20211701    -1.0            1.00
20211702     0.0            0.00
20211703   10000.0           0.00
*
*******************************************************************
*                      control variables                          *
*******************************************************************
**                                                                 **
**  1 vessel interface level (-13 -578)                           **
**  2 core interface level (105 -501)                             **
**  3 downcomer interface level (+29 -578)                        **
**  4 upper plenum interface level (+153 -13)                     **
**  5 upper head interface level (+421 +160)                      **
**  6 pressurizer interface level                                 **
**  7 intact loop u-tube up side interface level                  **
**  8 intact loop u-tube down side interface level                **
**  9 intact loop pump suction down side interface level          **
**  10 intact loop pump suction up side interface level           **
**  11 broken loop u-tube up side interface level                 **
**  12 broken loop u-tube down side interface level               **
**  13 broken loop pump suction down side interface level         **
**  14 broken loop pump suction up side interface level           **
**  15 intact loop steam generator riser interface level          **
**  16 intact loop steam generator downcomer interface level      **
**  17 broken loop steam generator riser interface level          **
**  18 broken loop steam generator downcomer interface level      **
**  19 intact loop steam generator secondary riser mass           **
**  20 intact loop steam generator secondary downcomer mass       **
**  21 intact loop steam generator secondary total mass           **
**  22 broken loop steam generator secondary riser mass           **
**  23 broken loop steam generator secondary downcomer mass       **
**  24 broken loop steam generator secondary total mass           **
**  25 total steam generator secondary mass                       **
**  26 energy removed from primary to secondary by intact loop sg **
**  27 energy removed from primary to secondary by broken loop sg **
**  28 energy removed from core heater rods to primary coolant    **
**  29 maximum core heater rod temperature                        **
** 150-151 control system for core heater rod power               **
** 200-221 control system to redistribute power on vessel heaters **
** 250-251 control system to obtain desired intact loop mass flow rate**
** 350-351 control system to obtain desired broken loop mass flow rate**
** 400 fluid mass in downcomer                                    **
** 401 fluid mass in lower plenum                                 **
** 402 fluid mass in core                                         **
** 403 fluid mass in upper plenum                                 **
** 404 fluid mass in upper head                                   **
** 405 fluid mass in bypass line, support columns, guide tubes    **
** 406 fluid mass in pressurizer                                  **
** 407 fluid mass in intact loop hot leg                          **
** 408 fluid mass in intact loop u-tubes                          **
** 409 fluid mass in intact loop cold leg                         **
** 410 fluid mass in broken loop hot leg                          **
** 411 fluid mass in broken loop u-tubes                          **
** 412 fluid mass in broken loop cold leg                         **
** 413 total primary coolant system fluid mass                    **
** 501 vessel delta p -13 to -578 cm                              **
** 502 vessel core delta p -105 to -501 cm                        **
```

```
** 503  vessel downcomer delta p 29 to -578 cm                    **
** 504  vessel upper plenum delta p 135 to -13 cm                  **
** 505  vessel upper head delta p 421 to 160 cm                    **
** 506  pressurizer delta p 632 to 30 cm                           **
** 507  intact loop steam generator u-tube upside delta p 926 to -57e **
** 508  intact loop steam generator u-tube dnside delta p 926 to -57x **
** 509  intact loop pump suction downside delta p -57x to il14     **
** 510  intact loop pump suction upside delta p il14 to il6        **
** 511  broken loop steam generator u-tube upside delta p 925 to -57e **
** 512  broken loop steam generator u-tube dnside delta p 925 to -57x **
** 513  broken loop pump suction downside delta p -57x to b65      **
** 514  broken loop pump suction upside delta p b65 to b73         **
** 515  intact loop steam generator riser delta p 1117 to 89 cm    **
** 516  intact loop steam generator downcomer delta p 1117 to 51 cm **
** 517  broken loop steam generator riser delta p 1186 to -7 cm    **
** 518  broken loop steam generator downcomer delta p 1186 to 18 cm **
** 519  broken loop steam generator downcomer delta p between horizs **
** 531  vessel collapsed level -13 to -578(ref) cm                 **
** 532  vessel core collapsed level -105 to -501(ref) cm           **
** 533  vessel downcomer collapsed level 29 to -578(ref) cm        **
** 534  vessel upper plenum collapsed level 135 to -13(ref) cm     **
** 535  vessel upper head collapsed level 421 to 160(ref) cm       **
** 536  pressurizer collapsed level 632 to 30(ref) cm              **
** 537  ilsg u-tube upside collapsed level 926 to -57e(ref) cm     **
** 538  ilsg u-tube downside collapsed level 926 to -57x(ref) cm   **
** 539  intact loop pump suction downside collapsed level ref il6 cm **
** 540  intact loop pump suction upside collapsed level ref il6 cm **
** 541  blsg u-tube upside collapsed level 925 to -57e(ref) cm     **
** 542  blsg u-tube downside collapsed level 925 to -57x(ref) cm   **
** 543  broken loop pump suction downside collapsed level ref b65 cm **
** 544  broken loop pump suction upside collapsed level ref b65 cm **
** 545  intact loop steam generator riser collapsed level ref 89 cm **
** 546  intact loop steam generator downcomer collapsed level ref 51cm**
** 547  broken loop steam generator riser collapsed level ref -7 cm **
** 548  broken loop steam generator downcomer collapsed level ref 18cm**
** 549  broken loop steam generator dncmr hor collapsed level ref 18cm**
** 561  vessel collapsed level -13 to -578  ref cold leg          **
** 562  vessel core collapsed level -105 to -501 ref cold leg     **
** 563  vessel downcomer collapsed level 29 to -578 ref cold leg  **
** 564  vessel upper plenum collapsed level 135 to -13 ref cold leg **
** 565  vessel upper head collapsed level 421 to 160 ref cold leg **
** 566  pressurizer collapsed level 632 to 30 ref zero cm          **
** 567  ilsg u-tube upside collapsed level 926 to -57e ref tube sheet **
** 568  ilsg u-tube downside collapsed level 926 to -57x ref tub sht **
** 569  intact loop pump suction downside collapsed level ref cold leg**
** 570  intact loop pump suction upside collapsed level ref cold leg **
** 571  blsg u-tube upside collapsed level 925 to -57e ref tube sheet **
** 572  blsg u-tube downside collapsed level 925 to -57x ref tub sht **
** 573  broken loop pump suction downside collapsed level ref cold leg**
** 574  broken loop pump suction upside collapsed level ref cold leg **
** 575  intact loop steam generator riser collapsed level ref tub sht **
** 576  intact loop steam generator downcomer collpsd lvl ref tub sht **
** 577  broken loop steam generator riser collapsed level ref tub sht **
** 578  broken loop steam generator downcomer collpsd lvl ref tub sht **
** 579  broken loop steam generator dncmr hor collpsd lvl ref tub sht **
** 606-610 control system to obtain desired mass in intact loop sg **
** 620  intact loop steam generator recirculation ratio           **
** 625  intact loop steam generator circulation ratio             **
** 630-637 control system to hold il steam dome pressure within band **
** 706-710 control system to obtain desired mass in broken loop sg **
** 720  broken loop steam generator recirculation ratio           **
** 725  broken loop steam generator circulation ratio             **
** 730-737 control system to hold bl steam dome pressure within band **
** 800  total heat loss monitoring system                         **
** 960-965 control system to obtain desired pressurizer liquid level **
** 990-999 control system for pressurizer internal heater rods    **
**                                                                **
*****************************************************************
*
*    control variables for comparison to equivalent semiscale data
*     ******************** liquid levels **********************
*
*          name  type   coef    init val  flg
*
20500100   vsllvl   sum  30.48    -13.000    1  * vessel level (cm)
*                                              * (-13 to -578)
20500101 -19.05608 0.073491      voidf  163010000
20500102           2.750833      voidf  162010000
20500103           1.000833      voidf  161010000
20500104           2.0           voidf  150060000
20500105           2.0           voidf  150050000
20500106           2.0           voidf  150040000
20500107           2.0           voidf  150030000
20500108           2.0           voidf  150020000
20500109           2.0           voidf  150010000
20500110           1.635833      voidf  140010000
20500111           0.721917      voidf  130010000
20500112           0.466667      voidf  120010000
*
20500200   corelvl   sum  30.48   -105.092    1  * core level (cm)
*                                              * (-105. to -501.)
20500201 -16.42833 0.16667       voidf  140010000
20500202           2.00000       voidf  150010000
20500203           2.00000       voidf  150020000
20500204           2.00000       voidf  150030000
20500205           2.00000       voidf  150040000
20500206           2.00000       voidf  150050000
20500207           2.00000       voidf  150060000
20500208           0.81375       voidf  161010000
*
20500300   dncrlvl   sum  30.48    30.480    1  * downcomer lvl (cm)
*                                              * (+29 to -578)
20500301 -19.08608 2.0           voidf  101010000
20500302           2.260833      voidf  110010000
20500303           1.000833      voidf  110020000
20500304           2.0           voidf  110030000
20500305           2.0           voidf  110040000
20500306           2.0           voidf  110050000
20500307           2.0           voidf  110060000
20500308           2.0           voidf  110070000
20500309           1.465667      voidf  110080000
20500310           1.207667      voidf  110090000
20500311           0.962500      voidf  110100000
20500312           0.721917      voidf  130010000
20500313           0.466667      voidf  120010000
*
```

```
20500400  uplnlvl   sum  30.48   136.144   1  * up plenum lvl (cm)
*                                            * (+135 to -13)
20500401 -0.426509 2.550000    voidf 164010000
20500402           2.343175    voidf 163010000
*
20500500   uhlvl    sum  30.48   423.570   1  * up. head lvl (cm)
*                                            * (+421 to +160)
20500501 +5.120    2.888833    voidf 194010000
20500502           3.453333    voidf 193010000
20500503           1.965833    voidf 192010000
20500504           0.476667    voidf 191010000
*
20500600   pzrlvl   sum  30.48   625.793   1  * pzr level (cm)
*
20500601  0.0      2.50        voidf 999010000
20500602           2.5625      voidf 999020000
20500603           2.5625      voidf 999030000
20500604           2.5625      voidf 999040000
20500605           2.5625      voidf 999050000
20500606           2.5625      voidf 999060000
20500607           2.583333    voidf 999070000
20500608           2.09375     voidf 999080000
20500609           0.541667    voidf 997010000
*
*
20500700   ilutu    sum  30.48   925.830   1  * il u-tube up
*                                            * (cm) - from
20500701 -1.75     1.7500000   voidf 215010000 * -57 cm below
20500702           7.9525000   voidf 220010000 * top of tube sheet
20500703           7.9108334   voidf 220020000 * to top of model
20500704           7.9108334   voidf 220030000 * u-tube
20500705           6.5999883   voidf 220040000
*
20500800   ilutd    sum  30.48   925.830   1  * il -tube down
*                                            * (cm) - from
20500801 -1.75     1.7500000   voidf 225010000 * -57 cm below
20500802           6.5999883   voidf 220050000 * top of tube sheet
20500803           7.9108334   voidf 220060000 * to top of model
20500804           7.9108334   voidf 220070000 * u-tube
20500805           7.9525000   voidf 220080000
*
20500900   ilpsd    sum  30.48   151.803   1  * il p-s down (cm)
*                                            * (dpi-57x14)
20500901 -9.229167 0.6354167   voidf 230010000
*
*****************************************************************
* heat slab... broken loop, vessel nozzles (3 in. sch-160)      *
*          note - heat slab contains only volume lengths which  *
*                 are not heated                                *
*****************************************************************
*
* left boundary  = broken loop primary coolant vessel nozzles (301,363)
* right boundary = ambient volumes (801,803)
*
*gl data       nh      np     type    s-flg    l-cor
13004000       2       5      2       1     0.10933333
*
*mesh      loc flg   frm flg
13004100       0       1
*
*geometry    no itv    r-cor    no itv    r-cor
13004101       2      0.145833    2      0.312500
*
*materials   cmp no    itv no    cmp no    itv no
13004201       1       2        16        4
*
*source dis  source    itv no
13004301      0.0       4
*
*init temp     flg
13004400       -1
*
*temp distribution
13004401 610.1 606.8 604.3 352.4 152.5
13004402 546.9 544.1 541.9 318.8 144.8
*
*l-body     hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13004501  301010000      0      1       1      0.61160       1
13004502  363020000      0      1       1      0.91239       2
*
*
*r-body     hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13004601  801010000      0     4100     1      0.61160       1
13004602  803010000      0     4100     1      0.91239       2
*
*source       type   is-mlpr     l-dr-ht      r-dr-ht     ht-str-no
13004701       0       0           0            0          2
*
*l-h-st     chf-htr    hy-dia     h-eq-dia    ch-length    ht-str-no
*13004801       0       0.0         0.0       0.218666       2
13004801 0.0  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr    hy-dia     h-eq-dia    ch-length    ht-str-no
*13004901       0       0.0         0.0       0.218666       2
13004901 0.0  10.0 10.0  0 0 0 0  1.0  2
*
*****************************************************************
* heat slab... intact loop pump                                 *
*      note - heat slab models heat loss due to pump seal cooling *
*****************************************************************
*
*  left boundary  = component 250
*  right boundary = specified in table 251
*
* pump heat loss is tabulated as a linear function of pump angular speed
*
*gl data       nh      np     type    s-flg    l-cor
12500000       1       4      2       1     0.08865
*
*mesh      loc flg   frm flg
12500100       0       1
*
*geometry    no itv    r-cor
12500101       3      0.1500
*
*materials   cmp no    itv no
```

```
12500201         1       3
*
*source dis  source    itv no
12500301       0.0       3
*
*init temp      flg
12500400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh
12500401 540.7   1  436.6   2  345.9   3  255.0   4
*
*l-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
12500501  250010000        0       1        1     2.26167        1
*
*r-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
12500601         0        0    2251        1     2.26167        1
*
*source        type   is-mplr      l-dr-ht      r-dr-ht    ht-str-no
12500701         0         0            0            0            1
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*12500801          0       0.0          0.0        2.26167          1
12500801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*12500901          0       0.0          0.0        2.26167          1
12500901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* heat slab... broken loop pump                                 *
*     note - heat slab models heat loss due to pump seal cooling *
*****************************************************************
*
*  left boundary  = component 350
*  right boundary = specified in table 351
*
* pump heat loss is tabulated as a linear function of pump angular speed
*
*gl data        nh       np     type    s-flg    l-cor
13500000         1        4        2        1  0.07014
*
*mesh       loc flg   frm flg
13500100         0         1
*
*geometry    no itv    r-cor
13500101         3  0.12325
*
*materials   cmp no    itv no
13500201         1         3
*
*source dis  source    itv no
13500301       0.0         3
*
*init temp      flg
13500400         0
*
*        temp mesh   temp mesh   temp mesh   temp mesh
13500401 531.1   1  434.0   2  350.8   3  277.4   4
*
*l-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13500501  350010000        0       1        1      1.9635        1
*
*r-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
13500601         0        0    2351        1      1.9635        1
*
*source        type   is-mplr      l-dr-ht      r-dr-ht    ht-str-no
13500701         0         0            0            0            1
*
*l-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*13500801          0       0.0          0.0        1.9635          1
13500801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr    hy-dia     h-eq-dia     ch-length    ht-str-no
*13500901          0       0.0          0.0        1.9635          1
13500901  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* heat slab... pressurizer heat transfer to pressurizer walls   *
*              without liner - aluminum sheath heated by heater tape *
*****************************************************************
*
*  left boundary  = component 999
*  right boundary = ambient volume (816)
*
*gl data        nh       np     type    s-flg    l-cor
19990000         8       14        2        1  .1512917
*
*mesh       loc flg   frm flg
19990100         0         1
*
*geometry    no itv    r-cor   no itv    r-cor   no itv    r-cor
19990101         3  .187500        4  .270833        1  .272167
19990102         1  .272267        2  .282683        2  .449359
*
*materials   cmp no    itv no   cmp no    itv no   cmp no    itv no
19990201         1         3       19         7       20         8
19990202        13         9        9        11       30        13
*
*source dis  source    itv no   source    itv no   source    itv no
19990301       0.0         9      1.0        11      0.0        13
*
*init temp      flg
19990400         0
*
*        temp mesh   temp mesh   temp mesh
19990401 602.0   2  602.0  12  140.0  14
*
*l-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
19990501  999010000        0       1        1     2.500000        1
19990502  999020000    10000       1        1     2.562500        6
19990503  999070000        0       1        1     2.583333        7
19990504  999080000        0       1        1     2.083750        8
*
*r-body      hy-vol      inc   b-cdt   a-code   cy-length   ht-str-no
19990601  816010000        0    4100        1     2.500000        1
19990602  816010000        0    4100        1     2.562500        6
```

```
19990603  816010000        0    4100       1   2.583333      7
19990604  816010000        0    4100       1   2.093750      8
*
*source        type  is-mplr      l-dr-ht      r-dr-ht    ht-str-no
19990701        117  .125065            0            0            1
19990702        117  .128192            0            0            6
19990703        117  .129234            0            0            7
19990704        117  .104742            0            0            8
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19990801         0  .2858333    .2914500     2.500000            1
19990801 0.29145  10.0 10.0  0 0 0 0  1.0  1
*19990802         0  .3025833    .3025833     2.562500            6
19990802 0.30258  10.0 10.0  0 0 0 0  1.0  6
*19990803         0  .3025833    .3025833     2.583333            7
19990803 0.30258  10.0 10.0  0 0 0 0  1.0  7
*19990804         0  .1005325    .2251253     2.093750            8
19990804 0.22512  10.0 10.0  0 0 0 0  1.0  8
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19990901         0      0.0          0.0     2.500000            1
19990901 0.0  10.0 10.0  0 0 0 0  1.0  1
*19990902         0      0.0          0.0     2.562500            6
19990902 0.0  10.0 10.0  0 0 0 0  1.0  6
*19990903         0      0.0          0.0     2.583333            7
19990903 0.0  10.0 10.0  0 0 0 0  1.0  7
*19990904         0      0.0          0.0     2.093750            8
19990904 0.0  10.0 10.0  0 0 0 0  1.0  8
*
*****************************************************************
* heat slab... pressurizer heater rods ---- data from rama corp.,  *
*              heater rod manufacturer                            *
*****************************************************************
*
*  left boundary = adiabatic
*  right boundary = component 999
*
*gl data        nh       np     type    s-flg    l-cor
19992000         1        8        2        1      0.0
*
*mesh       loc flg   frn flg
19992100         0         1
*
*geometry    no itv     r-cor    no itv     r-cor    no itv     r-cor
19992101         2  2.1539e-2         1  2.1833e-2         2  2.6958e-2
19992102         2  3.1042e-2
*
*materials   cmp no    itv no    cmp no    itv no    cmp no    itv no
19992201         21         2        22         3        21         5
19992202         23         7
*
*source dis  source    itv no    source    itv no    source    itv no
19992301        0.0         2       1.0         3       0.0         7
*
*init temp      flg
19992400         0
*
*         temp mesh
19992401 631.0   8
*
*l-body      by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
19992501         0        0        0        0        0.0           1
*
*r-body      by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
19992601  999060000        0        1        1       12.0           1
*
*source        type  is-mplr      l-dr-ht      r-dr-ht    ht-str-no
19992701       10999      1.0            0            0            1
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19992801         0      0.0          0.0     2.093750            1
19992801  0.0  10.0 10.0  0 0 0 0  1.0  1
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19992901         0  .1005325    .1901660     2.093750            1
19992901 0.1901660  10.0 10.0  0 0 0 0  1.0  1
*
*****************************************************************
* heat slab... pressurizer heat transfer out end caps and instrument  *
*              ports - thermal conductivity calculated to match test  *
*****************************************************************
*
*  left boundary = component 999
*  right boundary = ambient volume (806)
*
*gl data        nh       np     type    s-flg    l-cor
19993000         8        3        2        1  .1512917
*
*mesh       loc flg   frn flg
19993100         0         1
*
*geometry    no itv     r-cor
19993101         2  .449350
*
*materials   cmp no    itv no
19993201         31         2
*
*source dis  source    itv no
19993301        0.0         2
*
*init temp      flg
19993400         0
*
*         temp mesh    temp mesh    temp mesh
19993401 602.0   1  370.0   2  140.0   3
*
*l-body      by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
19993501  999010000        0        1        1    2.500000           1
19993502  999020000    10000        1        1    2.562500           6
19993503  999070000        0        1        1    2.583333           7
19993504  999080000        0        1        1    2.093750           8
*
*r-body      by-vol      inc    b-cdt   a-code   cy-length   ht-str-no
19993601  806010000        0     4100        1    2.500000           1
19993602  806010000        0     4100        1    2.562500           6
19993603  806010000        0     4100        1    2.583333           7
```

```
19993604  806010000       0    4100       1   2.093750      8
*
*source        type  is-aplr      l-dr-ht      r-dr-ht    ht-str-no
19993701          0        0            0            0        8
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19993801         0  .2653333     .2914500     2.500000        1
19993801 0.29145  10.0 10.0  0 0 0 0  1.0  1
*19993802         0  .3025833     .3025833     2.562500        6
19993802 0.30258  10.0 10.0  0 0 0 0  1.0  6
*19993803         0  .3025833     .3025833     2.583333        7
19993803 0.30258  10.0 10.0  0 0 0 0  1.0  7
*19993804         0  .1005325     .2251253     2.093750        8
19993804 0.22512  10.0 10.0  0 0 0 0  1.0  8
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19993901         0      0.0          0.0     2.500000        1
19993901 0.0  10.0 10.0  0 0 0 0  1.0  1
*19993902         0      0.0          0.0     2.562500        6
19993902 0.0  10.0 10.0  0 0 0 0  1.0  6
*19993903         0      0.0          0.0     2.583333        7
19993903 0.0  10.0 10.0  0 0 0 0  1.0  7
*19993904         0      0.0          0.0     2.093750        8
19993904 0.0  10.0 10.0  0 0 0 0  1.0  8
*
**************************************************************
* heat slab... pressurizer surge line heat loss              *
**************************************************************
*
*  left boundary  = component 997
*  right boundary = ambient volume (807)
*
*gl data         nh       np     type     s-flg    l-cor
19970000          2        5        2         1   .0154167
*
*mesh       loc flg   frn flg
19970100          0         1
*
*geometry    no itv    r-cor    no itv    r-cor
19970101          2   .035000         2   .054460
*
*materials   cmp no    itv no    cmp no    itv no
19970201          1         2        24         4
*
*source dis   source    itv no
19970301         0.0         4
*
*init temp       flg
19970400          0
*
*         temp mesh    temp mesh
19970401  602.0    2   602.0    5
*
*l-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
19970501   997020000         0        1        1   5.6458333         1
19970502   997030000         0        1        1   4.0625000         2
*
*r-body      hy-vol       inc    b-cdt   a-code   cy-length   ht-str-no
19970601   807010000         0        1        1   5.6458333         1
19970602   807010000         0        1        1   4.0625000         2
*
*source        type  is-aplr      l-dr-ht      r-dr-ht    ht-str-no
19970701          0        0            0            0        2
*
*l-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19970501         0      0.0          0.0          0.0        2
19970801  0.0  10.0 10.0  0 0 0 0  1.0  2
*
*r-h-st     chf-htr   hy-dia     h-eq-dia    ch-length    ht-str-no
*19970901         0      0.0          0.0          0.0        2
19970901  0.0  10.0 10.0  0 0 0 0  1.0  2
*
**************************************************************
**************************************************************
**********   heat structure thermal property data   **********
**************************************************************
**************************************************************
*
*            type    cm flg    ca flg
*316i stainless steel
20100100    tbl/fctn         1         1
*
*average two phase data
20100200    tbl/fctn         1         1
*
*boron nitride
20100300    tbl/fctn         1         1
*
*constantan
20100400    tbl/fctn         1         1
*
*inconel 600
20100500    tbl/fctn         1         1
*
*grafoil (grafoil is a trade name of a union carbide product)
20100600    tbl/fctn         1         1
*
*copper ca 102 (oxygen freen copper)
20100700    tbl/fctn         1         1
*
*cal-temp insulation  (modified values for vessel heat loss)
20100800    tbl/fctn         1         1
*
*alumina  (aluminum oxide)
20100900    tbl/fctn         1         1
*
*inconel 718
20101000    tbl/fctn         1         1
*
*honeycomb - hexagonal matrix core
20101100    tbl/fctn         1         1
*
*honeycomb - square matrix core
20101200    tbl/fctn         1         1
*
*contact resistance properties (conductivity of air; storage = 0.0)
```

```
20101300    tbl/fctn        1       1
*
*steam generator filler piece construction
20101400    tbl/fctn        1       1
*
*water
20101500    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for piping heat loss)
20101600    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for steam generator heat loss)
20101700    tbl/fctn        1       1
*
*thermal liner - john's manville min-k 2000, 30-35 pcf
20101800    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for pressurizer heat loss)
20101900    tbl/fctn        1       1
*
*aluminum  (used in pressurizer guard heaters)
20102000    tbl/fctn        1       1
*
*magnesium oxide  (used in pressurizer heater rods)
20102100    tbl/fctn        1       1
*
*nichrome v  (used in pressurizer heater rods)
20102200    tbl/fctn        1       1
*
*incoloy 800  (used in pressuizer heater rods)
20102300    tbl/fctn        1       1
*
*cal-temp insulation  (for pressurizer surge line heat loss)
20102400    tbl/fctn        1       1
*
*  0.35% carbon steel used for sg tube sheets
20102500    tbl/fctn        1       1
*
*cal-temp insulation  (for inlet plenum heat loss)
20102600    tbl/fctn        1       1
*
*uo2 used in nuclear core
20102700    tbl/fctn        1       1
*
*zircaloy used in nuclear core
20102800    tbl/fctn        1       1
*
*gap used in nuclear core
20102900    tbl/fctn        1       1
*
*temp-mat insulation  (modified values for pressurizer heat loss)
20103000    tbl/fctn        1       1
*
*pressurizer end cap and instrument heat loss - calculated values
20103100    tbl/fctn        1       1
*
*cal-temp insulation  (modified values for bl steam generator heat loss)
20103200    tbl/fctn        1       1
*
*.....
*
*thermal conductivity    btu/(s ft f)
*
*            temp    cond    temp    cond    temp    cond
*3161 stainless steel
20100101     32.00  .00215
20100102    100.00  .00215   800.00  .00306  1600.00  .00397
20100103   4000.00  .00397
*
*averge two phase data
20100201     32.00  .000006
20100202    212.00  .000006   572.00  .000008  4000.00  .000008
*
* boron nitride (new curve from c.fineman..in 1/30/79 by dmk)
20100301     32.00  .00255
20100302    200.00  .00241   500.00  .00216  1000.00  .00174
20100303   1500.00  .00133  2000.00  .000909 2500.00  .000491
20100304   3000.00  .000074 3500.00  .000074 4000.00  .000074
*
*constantan
20100401      0.00  .00389  3000.00  .00389  4000.00  .00389
*
*inconel 600
20100501     32.00  .00236
20100502    100.00  .00236   300.00  .00267   500.00  .00294
20100503    700.00  .00322   900.00  .00350  1100.00  .00378
20100504   4000.00  .00378
*
*grafoil
20100601     32.00  .000799
20100602    250.00  .000799  500.00  .000683  750.00  .000579
20100603   1000.00  .000509 1250.00  .000484 1500.00  .000468
20100604   2000.00  .000463 3000.00  .000486 4000.00  .000486
*
*copper ca 102
20100701     32.00  .0622    212.00  .0606    572.00  .0589
20100702    932.00  .0575   4000.00  .0575
*
*cal-temp insul (increased by factor of 35.0 for vessel heat loss)
20100801      0.00 3.2410e-4  100.00 3.2410e-4  200.00 3.4420e-4
20100802    300.00 3.8500e-4  400.00 4.0540e-4  500.00 4.4530e-4
20100803    600.00 4.8610e-4  700.00 5.3290e-4  800.00 5.8720e-4
*
*alumina  (aluminum oxide)
20100901      0.00 .0003472  3300.00 .0003472
*
*inconel 718
20101001      0.00 .0021667   200.00 .0022778   400.00 .0023333
20101002    600.00 .0025556   800.00 .0028056  1000.00 .0030556
20101003   1200.00 .0033333  1400.00 .0035556  1600.00 .0038333
*
*honeycomb - hexagonal matrix core
20101101      0.00 2.61110e-5  700.00 2.61110e-5
*
*honeycomb - square matrix core
20101201      0.00 2.27780e-5  700.00 2.27780e-5
```

```
*
*contact resistance (heaters to piping)     (conductivities of air)
20101301      0.00 3.5750e-6   80.00 4.2110e-6  170.00 4.8190e-6
20101302    260.00 5.4000e-6  350.00 5.9500e-6  440.00 6.4810e-6
20101303    530.00 6.9970e-6  620.00 7.4780e-6  710.00 7.9500e-6
20101304    800.00 8.3940e-6  890.00 8.8420e-6  980.00 9.2750e-6
*
*steam generator filler pieces (conductivities from test grb-14-82)
20101401     80.00 3.0280e-4  260.00 3.3610e-4  440.00 3.6950e-4
20101402    620.00 4.0280e-4  800.00 4.3610e-4
*
*water
20101501     32.0  88.6110e-6  104.0 100.8330e-6  176.0 107.2220e-6
20101502    248.0 110.0000e-6  356.0 108.3370e-6  464.0 101.9440e-6
20101503    500.0  98.0550e-6  572.0  86.6660e-6  700.0  86.6660e-6
*
*cal-temp insul (increased by factor of 7.0 for piping heat loss)
20101601      0.00 6.4810e-5  100.00 6.4810e-5  200.00 6.8830e-5
20101602    300.00 7.7000e-5  400.00 8.1080e-5  500.00 8.9050e-5
20101603    600.00 9.7220e-5  700.00 10.6580e-5  800.00 11.7440e-5
*
*cal-temp insul (increased by factor of 2.6125 for ilsg heat loss)
20101701      0.00 2.4189e-5  100.00 2.4189e-5  200.00 2.5697e-5
20101702    300.00 2.8740e-5  400.00 3.0255e-5  500.00 3.3233e-5
20101703    600.00 3.6596e-5  700.00 3.9784e-5  800.00 4.3987e-5
*
*thermal liner - john's manville min-k 2000, 30-35 pcf
20101801    300.00 1.1110e-5  600.00 1.2730e-5 1000.00 1.4810e-5
*
*cal-temp insul (increased by factor of 1.0 for pressurizer heat loss)
20101901      0.00 9.2600e-6  100.00 9.2600e-6  200.00 9.8330e-6
20101902    300.00 1.1000e-5  400.00 1.1580e-5  500.00 1.2720e-5
20101903    600.00 1.3890e-5  700.00 1.5230e-5  800.00 1.6780e-5
20101904   1000.00 1.9880e-5
*
*aluminum (used in pressurizer guard heaters)
20102001     32.00 3.2434e-2  212.00 3.3076e-2  392.00 3.4521e-2
20102002    572.00 3.6609e-2  752.00 3.9980e-2 1000.00 4.2608e-2
*
*magnesium oxide (used in pressurizer heater rods)
20102101    100.00 4.6296e-4 1000.00 3.3796e-4
*
*nichrome v (used in pressurizer heater rods)
20102201     32.00 1.9749e-3  212.00 2.2158e-3  392.00 2.5048e-3
20102202    572.00 2.7456e-3  752.00 2.8902e-3 1112.00 3.6127e-3
*
*inconloy 800 (used in pressurizer heater rods)
20102301     70.00 1.8519e-3 1000.00 3.2176e-3 1500.00 4.0278e-3
*
*cal-temp insul (increased by factor of 1.0 per surge line heat loss)
20102401      0.00 9.2600e-6  100.00 9.2600e-6  200.00 9.8330e-6
20102402    300.00 1.1000e-5  400.00 1.1580e-5  500.00 1.2720e-5
20102403    600.00 1.3890e-5  700.00 1.5230e-5  800.00 1.6780e-5
*
* 0.35% carbon steel used for sg tube sheets
20102501     32.00  .00944   68.00  .00917   212.00  .00889
20102502    392.00  .00817  572.00  .00750   752.00  .00694
20102503   1112.00  .00564 1472.00  .00478
*
*cal-temp insul (increased by factor of 1.0 for inlet plenum heat loss)
20102601      0.00 9.2600e-6  100.00 9.2600e-6  200.00 9.8330e-6
20102602    300.00 1.1000e-5  400.00 1.1580e-5  500.00 1.2720e-5
20102603    600.00 1.3890e-5  700.00 1.5230e-5  800.00 1.6780e-5
20102604   1000.00 1.9880e-5
*
*uo2 used in nuclear core
20102701     32.00  .00152   200.00  .00120   400.00  .00100
20102702    600.00  .00090   800.00  .00074  1000.00  .00066
20102703   1200.00  .00059  1500.00  .00052  2000.00  .00044
20102704   2500.00  .00039  3000.00  .00037  4000.00  .00038
*
*zircaloy used in nuclear core
20102801     32.00  .00197  1099.50  .00320  1199.80  .00330
20102802   1478.80  .00366  1498.60  .00369  1529.20  .00373
20102803   1579.80  .00381  1599.60  .00384  1619.70  .00387
20102804   1639.70  .00391  1759.80  .00411  1999.20  .00458
*
*gap used in nuclear core
20102901     32.00 2.2500e-5  602.30 3.8520e-5  998.33 4.6500e-5
20102902   1592.30 5.7800e-5 2006.30 6.7420e-5 5908.33 1.2040e-5
*
*temp-mat ins (increased by a factor of 1.0 for pressurizer heat loss)
20103001      0.00 4.9770e-6  100.00 5.7870e-6  200.00 6.5970e-6
20103002    300.00 7.6390e-6  400.00 8.7960e-6  500.00 1.0420e-5
20103003    600.00 1.2040e-5  700.00 1.4120e-5  800.00 1.6320e-5
20103004   1000.00 1.6960e-5
*
*pressurizer end cap and instrument heat loss - calculated values
20103101      0.00 1.8334e-6 1000.00 1.8334e-6
*
*cal-temp insul (increased by factor of 2.2040 for blsg heat loss)
20103201      0.00 2.0340e-5  100.00 2.0340e-5  200.00 2.1671e-5
20103202    300.00 2.4238e-5  400.00 2.5521e-5  500.00 2.8028e-5
20103203    600.00 3.0606e-5  700.00 3.3564e-5  800.00 3.6975e-5
20103204   1000.00 4.3794e-5
*
*.....
*
*volumetric heat capacity data     (btu/cuft-f)
*            temp     cap     temp     cap     temp     cap
*316l stainless steel
20100151     32.00   61.30   400.00   61.30   600.00   64.60
20100152    800.00   67.10  1000.00   69.35  4000.00   69.35
*
*average two phase
20100251     32.00    1.00   212.00    1.00   572.00   64.00
20100252   4000.00   64.00
*
*boron nitride
20100351     32.00   37.50   400.00   37.50   800.00   48.30
20100352   1200.00   54.60  1600.00   58.30  2000.00   60.00
20100353   2400.00   61.40  3400.00   62.50  4000.00   62.50
*
*constantan
20100451     32.00   56.00   212.00   56.00   572.00   61.00
20100452    932.00   67.00  1472.00   73.00  2192.00   78.00
```

```
20100453    2552.00    84.00  3000.00    90.00  4000.00    90.00
*
*inconel 600
20100551      32.00    52.225 4000.00    52.225
*
*grafoil
20100651      32.00    11.90   80.40     11.90   170.40    14.70
20100652     260.40    17.15  350.40     19.60   440.40    21.35
20100653     530.40    22.40  620.40     23.80   710.40    25.20
20100654     800.40    26.32 4000.00     26.32
*
*copper ca 102
20100751      32.00    51.336 4000.00    51.336
*
*cal-temp insulation
20100851       0.00     2.898 1000.00     2.898
*
*alumina   (aluminum oxide)
20100951       0.00    55.20  3300.00    55.20
*
*inconel 718
20101051       0.00    48.5797  200.00   53.7597   400.00   56.458
20101052     600.00    61.5912  800.00   65.1849  1000.00   69.290
20101053    1200.00    74.4227 1400.00   76.9890  1600.00   82.121
*
*honeycomb - hexagonal matrix core
20101151       0.00     2.28969 200.00    2.53081  400.00    2.6512
20101152     600.00     2.89224 800.00    3.06095 1000.00    3.2537
20101153    1200.00     3.49379 1400.00   3.61530 1600.00    3.8563
*
*honeycomb - square matrix core
20101251       0.00     2.15978 200.00    2.38713  400.00    2.5008
20101252     600.00     2.71815 800.00    2.88729 1000.00    3.0691
20101253    1200.00     3.29651 1400.00   3.41018 1600.00    3.6375
*
*contact resistance  (heaters to piping)
20101351       0.00     0.00   3300.00    0.00
*
*steam generator filler piece  (calculation from test grb-14-82)
20101451       0.00    13.00   1000.00    13.00
*
*water  (saturated)
20101551      32.00    63.033   104.00    61.966   176.00   60.950
20101552     248.00    59.895   356.00    58.553   464.00   57.845
20101553     500.09    57.989   572.00    60.999   700.00   62.576
*
*cal-temp insulation
20101651       0.00     2.898  1000.00     2.898
*
*cal-temp insulation
20101751       0.00     2.898  1000.00     2.898
*
*thermal liner - john's manville min-k 2000, 30-35 pcf
20101851     400.00     7.475   800.00     8.125
20101852    1200.00     8.775  1600.00     8.775
*
*cal-temp insulation
20101951       0.00     2.898  1000.00     2.898
*
*alumina  (used in pressurizer guard heaters)
20102051      32.00    36.177 10000.00    36.177
*
*magnesium oxide  (used in pressurizer heater rods)
20102151      10.00    43.07  10000.00    43.07
*
*nichrome v  (used in pressurizer heater rods)
20102251      10.00    55.07  10000.00    55.07
*
*incoloy 800  (used in pressurizer heater rods)
20102351      10.00    61.00  10000.00    61.00
*
*cal-temp insulation
20102451       0.00     2.898  1000.00     2.898
*
*  0.35% carbon steel
20102551      65.00    51.40   3000.00    51.40
*
*cal-temp insulation
20102651       0.00     2.898  1000.00     2.898
*
*co2 used in nuclear core
20102751      32.00    43.255   200.00    45.394   400.00   47.459
20102752     600.00    49.072   800.00    50.308  1000.00   51.238
20102753    1200.00    51.939  1500.00    52.721  2000.00   53.920
20102754    2500.00    55.994  3000.00    60.096  4000.00   79.014
*
*zircaloy used in nuclear core
20102851      32.00    27.820  1099.50    33.550  1199.80   35.190
20102852    1478.80    35.190  1498.60    53.180  1529.20   59.330
20102853    1579.80    62.190  1599.60    73.640  1619.70   77.790
20102854    1639.70    79.780  1759.80    34.790  1999.20   34.790
*
*gap used in nuclear core
20102951      32.00  8.051e-5  5408.30  8.0514e-5
*
*temp-mat insulation
20103051       0.00     2.125  1000.00     2.125
*
*pressurizer end cap and instrument heat loss
20103151       0.00     0.000  1000.00     0.000
*
*cal-temp insulation
20103251       0.00     2.898  1000.00     2.898
*
*
*****************************************************************
*                        tables                                 *
*****************************************************************
*
*     ********************  core power  ********************
*
*           table    trip    time coef    power coef
20215000    power     409         1.0         1.000   * mw
*
*           time           power   (ans standard decay curve)
20215001     0.0           1.000
```

```
20215002      1.1957        .98216
20215003      5.9783        .29432
20215004      7.1739        .22553
20215005      10.7608       .11781
20215006      11.9565       .10006
20215007      21.5217       .05289
20215008      31.0870       .04263
20215009      51.4130       .03880
20215010      81.3048       .03500
20215011      100.4348      .03313
20215012      979.2388      .02080
*
*************************************************************
*
*     ***********  pressurizer heater rod power  ***********
*
*           table     trip     time coef     power coef
20299900    power      439          1.0     10.4200e-3   * kw
*
*           time           power
20299901     0.0           0.000
20299902   10000.0         0.000
*
*************************************************************
*                pump speed tables (normalized speed)       *
*************************************************************
*
*           table     trip
20225000    reac-t     412    * intact loop pump
*
*           time      norm pump speed
20225001    -1.0          1.0
20225002     0.0          1.0
20225003     1.1956       0.97220
20225004     8.3695       0.55521
20225005     9.5652       0.50440
20225006     19.1304      0.32739
20225007     29.8913      0.23488
20225008     38.2608      0.22025
20225009     59.7826      0.21159
20225010     62.1739      0.19573
20225011     64.5652      0.16887
20225012     66.9565      0.04289
20225013     68.1521      0.0
20225014    4000.0        0.0
*
20235000    reac-t     413    * broken loop pump
20235001    -1.0          1.0
20235002     0.0          1.0
20235003     1.1956       0.98527
20235004     8.3695       0.63678
20235005     10.7608      0.55975
20235006     20.3260      0.42278
20235007     40.6521      0.40220
20235008     59.7826      0.40315
20235009     60.9782      0.32766
20235010     64.5652      0.25842
20235011     65.7608      0.16130
20235012     69.3478      0.0
20235013    4000.0        0.0
*
*************************************************************
*                                                           *
*                system heat loss tables                    *
*                                                           *
*************************************************************
*
*heat loss due to intact loop pump passive cooling, 20.0 kw at full flow
*     1.0 btu = 1055.056 joules (international table)
**
**          table     trip     time coef     rate coef
*20225100   htrnrate    412          1.0        8.8331   * btu/s)ft2
**
**          time      norm h.t.rate
*20225101    -1.0          1.000
*20225102     0.0          1.000
*20225103     19.4         0.505
*20225104     20.8         0.325
*20225105     32.0         0.227
*20225106     42.4         0.181
*20225107     62.4         0.150
*20225108     64.0         0.000
*20225109    4000.0        0.000
**
*heat loss due to intact loop pump active cooling, 4.3 kw always
*
*           table     trip     time coef     rate coef
20225100    htrnrate    412          1.0        1.9120   * btu/s-ft2
*
*           time      norm h.t.rate
20225101     0.0          1.000
20225102    20000.0       1.000
*
*************************************************************
*heat loss due to broken loop pump passive cooling, 14.7 kw at full flow
*     from test so-2b-38, h. s. crapo, hsc-2-84, 3 feb 1984
*     1.0 btu = 1055.056 joules (international table)
**
**          table     trip     time coef     rate coef
*20235100   htrnrate    413          1.0        9.1631   * btu/s-ft2
**
**          time      norm h.t.rate
*20235101    -1.0          1.000
*20235102     0.0          1.000
*20235103     9.6          0.590
*20235104     13.6         0.498
*20235105     20.8         0.407
*20235106     30.4         0.385
*20235107     60.0         0.385
*20235108     64.8         0.000
*20235109    4000.0        0.000
**
*heat loss due to broken loop pump active cooling, 4.3 kw always
*     from test so-2b-38, h. s. crapo, hsc-2-84, 3 feb 1984
*
*           table     trip     time coef     rate coef
```

```
20235100   htrmrate     413        1.0      2.6894  * btu/s-ft2
*
*          time      mcrm h.t.rate
20235101     0.0          1.000
20235102  20000.0         1.000
*
*****************************************************************
*
* specified heat transfer coefficients on piping insulation surface
*   (values calculated for free convecton in air + radiation)
*
*          table
20210000   htc-temp
*
*           temp      h.t.coef   (btu/s-ft2-f)
20210001     100.0      0.00136
20210002     150.0      0.00206
20210003     200.0      0.00247
20210004     300.0      0.00302
20210005     500.0      0.00374
20210006     750.0      0.00438
*
* specified heat transfer coefficients on ilsg insulation surface
*   (values calculated for free convecton in air + radiation)
*
*          table
20220000   htc-temp    0  1.0   0.0   3.5426
*
*           temp      h.t.coef   (btu/s-ft2-f)
20220001     100.0      0.00136
20220002     150.0      0.00206
20220003     200.0      0.00247
20220004     300.0      0.00302
20220005     500.0      0.00374
20220006     750.0      0.00438
*
* specified heat transfer coefficients on blsg steam dome insulation
* surface  (values calculated for free convecton in air + radiation)
*
*          table
20230000   htc-temp    0    1.0    0.0    3.35
*
*           temp      h.t.coef   (btu/s-ft2-f)
20230001     100.0      0.00136
20230002     150.0      0.00206
20230003     200.0      0.00247
20230004     300.0      0.00302
20230005     500.0      0.00374
20230006     750.0      0.00438
*
* specified heat transfer coefficients on blsg riser insulation
* surface  (values calculated for free convecton in air + radiation)
*
*          table
20240000   htc-temp    0    1.0    0.0    3.35
*
*           temp      h.t.coef   (btu/s-ft2-f)
20240001     100.0      0.00136
20240002     150.0      0.00206
20240003     200.0      0.00247
20240004     300.0      0.00302
20240005     500.0      0.00374
20240006     750.0      0.00438
*
* specified heat transfer coefficients on blsg downcomer insulation
* surface  (values calculated for free convecton in air + radiation)
*
*          table
20250000   htc-temp    0    1.0    0.0    3.35
*
*           temp      h.t.coef   (btu/s-ft2-f)
20250001     100.0      0.00136
20250002     150.0      0.00206
20250003     200.0      0.00247
20250004     300.0      0.00302
20250005     500.0      0.00374
20250006     750.0      0.00438
*
*****************************************************************
*              power tables for piping heaters                  *
*****************************************************************
*
*    *****  power table for guard heater power bus 110  *****
*    *****  (power to intact and broken loop hot legs)  *****
*
*          table     trip     time coef    power coef
20211000    power     430          1.0     8.4380e-3  * mw
*
*          time         power
20211001     0.0          1.00
20211002  10000.0          1.00
*
*****************************************************************
*
*    *****  power table for guard heater power bus 111  *****
*    ********  (power to broken loop pump suction)  ********
*
*          table     trip     time coef    power coef
20211100    power     431          1.0     4.0130e-3  * mw
*
*          time         power
20211101     0.0          1.00
20211102  10000.0          1.00
*
*****************************************************************
*
*    *****  power table for guard heater power bus 112  *****
*    *****  (power to intact and broken loop cold legs)  *****
*
*          table     trip     time coef    power coef
20211200    power     432          1.0     3.1220e-3  * mw
*
*          time         power
20211201     0.0          1.00
20211202  10000.0          1.00
*
```

```
*****************************************************************
*
*     *****  power table for guard heater power bus 113  *****
*     ********  (power to intact loop pump suction)  ********
*
*           table     trip    time coef    power coef
20211300    power      433          1.0    8.2610e-3   * bu
*
*            time          power
20211301      0.0           1.00
20211302  10000.0           1.00
*
*****************************************************************
*
*     *****  power table for guard heater power bus 116  *****
*     *  (power to external heaters on vessel and downcomer)  *
*
*           table     trip    time coef    power coef
20211600    power      436          1.0   19.8320e-3   * bu
*
*            time          power
20211601      0.0           1.00
20211602  10000.0           1.00
*
*****************************************************************
*
*     *****  power table for guard heater power bus 117  *****
*     *****  (power to external heaters on pressurizer)  *****
*
*           table     trip    time coef    power coef
20211700    power      437          1.0    1.5930e-3   * bu
*
*            time          power
20211701     -1.0           1.00
20211702      0.0           0.00
20211703  10000.0           0.00
*
*****************************************************************
*                      control variables                        *
*****************************************************************
**                                                             **
**   1 vessel interface level (-13 -578)                       **
**   2 core interface level (105 -501)                         **
**   3 downcomer interface level (+29 -578)                    **
**   4 upper plenum interface level (+153 -13)                 **
**   5 upper head interface level (+421 +160)                  **
**   6 pressurizer interface level                             **
**   7 intact loop u-tube up side interface level              **
**   8 intact loop u-tube down side interface level            **
**   9 intact loop pump suction down side interface level      **
**  10 intact loop pump suction up side interface level        **
**  11 broken loop u-tube up side interface level              **
**  12 broken loop u-tube down side interface level            **
**  13 broken loop pump suction down side interface level      **
**  14 broken loop pump suction up side interface level        **
**  15 intact loop steam generator riser interface level       **
**  16 intact loop steam generator downcomer interface level   **
**  17 broken loop steam generator riser interface level       **
**  18 broken loop steam generator downcomer interface level   **
**  19 intact loop steam generator secondary riser mass        **
**  20 intact loop steam generator secondary downcomer mass    **
**  21 intact loop steam generator secondary total mass        **
**  22 broken loop steam generator secondary riser mass        **
**  23 broken loop steam generator secondary downcomer mass    **
**  24 broken loop steam generator secondary total mass        **
**  25 total steam generator secondary mass                    **
**  26 energy removed from primary to secondary by intact loop sg  **
**  27 energy removed from primary to secondary by broken loop sg  **
**  28 energy removed from core heater rods to primary coolant **
**  29 maximum core heater rod temperature                     **
** 150-151 control system for core heater rod power            **
** 200-221 control system to redistribute power on vessel heaters  **
** 250-251 control system to obtain desired intact loop mass flow rate**
** 350-351 control system to obtain desired broken loop mass flow rate**
** 400 fluid mass in downcomer                                 **
** 401 fluid mass in lower plenum                              **
** 402 fluid mass in core                                      **
** 403 fluid mass in upper plenum                              **
** 404 fluid mass in upper head                                **
** 405 fluid mass in bypass line, support columns, guide tubes **
** 406 fluid mass in pressurizer                               **
** 407 fluid mass in intact loop hot leg                       **
** 408 fluid mass in intact loop u-tubes                       **
** 409 fluid mass in intact loop cold leg                      **
** 410 fluid mass in broken loop hot leg                       **
** 411 fluid mass in broken loop u-tubes                       **
** 412 fluid mass in broken loop cold leg                      **
** 413 total primary coolant system fluid mass                 **
** 501 vessel delta p -13 to -578 cm                           **
** 502 vessel core delta p -105 to -501 cm                     **
** 503 vessel downcomer delta p 29 to -578 cm                  **
** 504 vessel upper plenum delta p 135 to -13 cm               **
** 505 vessel upper head delta p 421 to 160 cm                 **
** 506 pressurizer delta p 632 to 30 cm                        **
** 507 intact loop steam generator u-tube upside delta p 926 to -57e **
** 508 intact loop steam generator u-tube dnside delta p 926 to -57x **
** 509 intact loop pump suction downside delta p -57x to i14   **
** 510 intact loop pump suction upside delta p i14 to i16      **
** 511 broken loop steam generator u-tube upside delta p 925 to -57e **
** 512 broken loop steam generator u-tube dnside delta p 925 to -57x **
** 513 broken loop pump suction downside delta p -57x to b65   **
** 514 broken loop pump suction upside delta p b65 to b73      **
** 515 intact loop steam generator riser delta p 1117 to 89 cm **
** 516 intact loop steam generator downcomer delta p 1117 to 51 cm **
** 517 broken loop steam generator riser delta p 1186 to -7 cm **
** 518 broken loop steam generator downcomer delta p 1186 to 18 cm **
** 519 broken loop steam generator downcomer delta p between horizs **
** 531 vessel collapsed level -13 to -578(ref) cm              **
** 532 vessel core collapsed level -105 to -501(ref) cm        **
** 533 vessel downcomer collapsed level 29 to -578(ref) cm     **
** 534 vessel upper plenum collapsed level 135 to -13(ref) cm  **
** 535 vessel upper head collapsed level 421 to 160(ref) cm    **
** 536 pressurizer collapsed level 632 to 30(ref) cm           **
** 537 ilsg u-tube upside collapsed level 926 to -57e(ref) cm  **
** 538 ilsg u-tube downside collapsed level 926 to -57x(ref) cm **
** 539 intact loop pump suction downside collapsed level ref i16 cm **
```

```
** 540  intact loop pump suction upside collapsed level ref il6  cm  **
** 541  blsg u-tube upside collapsed level 925 to -57e(ref)  cm      **
** 542  blsg u-tube downside collapsed level 925 to -57x(ref)  cm    **
** 543  broken loop pump suction downside collapsed level ref b65  cm **
** 544  broken loop pump suction upside collapsed level ref b65  cm  **
** 545  intact loop steam generator riser collapsed level ref 89 cm  **
** 546  intact loop steam generator downcomer collapsed level ref 51cm**
** 547  broken loop steam generator riser collapsed level ref -7 cm  **
** 548  broken loop steam generator downcomer collapsed level ref 13cm**
** 549  broken loop steam generator dncmr hor collapsed level ref 18cm**
** 561  vessel collapsed level -13 to -578  ref cold leg            **
** 562  vessel core collapsed level -105 to -501 ref cold leg       **
** 563  vessel downcomer collapsed level 29 to -578 ref cold leg    **
** 564  vessel upper plenum collapsed level 135 to -13 ref cold leg **
** 565  vessel upper head collapsed level 421 to 160 ref cold leg   **
** 566  pressurizer collapsed level 632 to 30 ref zero cm           **
** 567  ilsg u-tube upside collapsed level 926 to -57e ref tube sheet **
** 568  ilsg u-tube downside collapsed level 926 to -57x ref tub sht **
** 569  intact loop pump suction downside collapsed level ref cold leg**
** 570  intact loop pump suction upside collapsed level ref cold leg **
** 571  blsg u-tube upside collapsed level 925 to -57e ref tube sheet **
** 572  blsg u-tube downside collapsed level 925 to -57x ref tub sht  **
** 573  broken loop pump suction downside collapsed level ref cold leg**
** 574  broken loop pump suction upside collapsed level ref cold leg  **
** 575  intact loop steam generator riser collapsed level ref tub sht **
** 576  intact loop steam generator downcomer collpsd lvl ref tub sht **
** 577  broken loop steam generator riser collapsed level ref tub sht **
** 578  broken loop steam generator downcomer collpsd lvl ref tub sht **
** 579  broken loop steam generator dncmr hor collpsd lvl ref tub sht **
** 606-610 control system to obtain desired mass in intact loop sg   **
** 620  intact loop steam generator recirculation ratio              **
** 625  intact loop steam generator circulation ratio                **
** 630-637 control system to hold il steam dome pressure within band **
** 706-710 control system to obtain desired mass in broken loop sg   **
** 720  broken loop steam generator recirculation ratio              **
** 725  broken loop steam generator circulation ratio                **
** 730-737 control system to hold bl steam dome pressure within band **
** 800  total heat loss monitoring system                            **
** 980-985 control system to obtain desired pressurizer liquid level **
** 990-999 control system for pressurizer internal heater rods       **
**                                                                   **
***********************************************************************
*
*    control variables for comparison to equivalent semiscale data
*     ********************  liquid levels  ********************
*
*          name  type   coef   init val  flg
*
20500100   vsllvl   sum  30.48   -13.000    1  * vessel level (cm)
*                                             * (-13 to -578)
20500101 -19.08608 0.073491    voidf  163010000
20500102           2.760833    voidf  162010000
20500103           1.000833    voidf  161010000
20500104           2.0         voidf  150060000
20500105           2.0         voidf  150050000
20500106           2.0         voidf  150040000
20500107           2.0         voidf  150030000
20500108           2.0         voidf  150020000
20500109           2.0         voidf  150010000
20500110           1.635833    voidf  140010000
20500111           0.721917    voidf  130010000
20500112           0.466667    voidf  120010000
*
20500200   corelvl   sum  30.48  -105.092    1  * core level (cm)
*                                             * (-105. to -501.)
20500201 -16.42833 0.16667     voidf  140010000
20500202           2.00000     voidf  150010000
20500203           2.00000     voidf  150020000
20500204           2.00000     voidf  150030000
20500205           2.00000     voidf  150040000
20500206           2.00000     voidf  150050000
20500207           2.00000     voidf  150060000
20500208           0.81375     voidf  161010000
*
20500300   dncrlvl   sum  30.48    30.480    1  * downcomer lvl (cm)
*                                             * (+29 to -578)
20500301 -19.06606 2.0         voidf  101010000
20500302           2.260833    voidf  110010000
20500303           1.000833    voidf  110020000
20500304           2.0         voidf  110030000
20500305           2.0         voidf  110040000
20500306           2.0         voidf  110050000
20500307           2.0         voidf  110060000
20500308           2.0         voidf  110070000
20500309           1.465667    voidf  110080000
20500310           1.207667    voidf  110090000
20500311           0.952500    voidf  110100000
20500312           0.721917    voidf  130010000
20500313           0.466667    voidf  120010000
*
20500400   uplnlvl   sum  30.48   136.144    1  * up plenum lvl (cm)
*                                             * (+135 to -13)
20500401 -0.426509 2.550000    voidf  164010000
20500402           2.343176    voidf  153010000
*
20500500    uhlvl    sum  30.48   423.570    1  * up. head lvl (cm)
*                                             * (+421 to +160)
20500501 +5.120    2.880833    voidf  194010000
20500502           3.453333    voidf  193010000
20500503           1.965833    voidf  192010000
20500504           0.476667    voidf  191010000
*
20500600   pzrlvl   sum  30.48   625.733    1  * pzr level (cm)
*
20500601  0.0      2.50        voidf  999010000
20500602           2.5625      voidf  999020000
20500603           2.5625      voidf  999030000
20500604           2.5625      voidf  999040000
20500605           2.5625      voidf  999050000
20500606           2.5625      voidf  999060000
20500607           2.583333    voidf  999070000
20500608           2.09375     voidf  999080000
20500609           0.541667    voidf  997010000
*
*
20500700    iltn    sum  30.48   925.830    1  * il u-tube up
```

```
*                                                    * (cm) - from
20500701 -1.75      1.7500000   voidf 215010000  * -57 cm below
20500702            7.9525000   voidf 220010000  * top of tube sheet
20500703            7.9108334   voidf 220020000  * to top of model
20500704            7.9108334   voidf 220030000  * u-tube
20500705            6.5999583   voidf 220040000
*
20500800   iluntd   sum 30.48   925.830   1      * il -tube down
*                                                    * (cm) - from
20500801 -1.75      1.7500000   voidf 225010000  * -57 cm below
20500802            6.5999583   voidf 225050000  * top of tube sheet
20500803            7.9108334   voidf 225060000  * to top of model
20500804            7.9108334   voidf 225070000  * u-tube
20500805            7.9525000   voidf 225080000
*
20500900   ilpsd    sum 30.48   151.803   1      * il p-s down (cm)
*                                                    * (dpi-57x+14)
20500901 -9.229167  0.6354167   voidf 230010000
20500902            1.1836602   voidf 240010000
20500903            3.6662500   voidf 240020000
20500904            3.4475000   voidf 240030000
20500905            2.8558333   voidf 240040000
20500906            3.4733333   voidf 240050000
20500907            0.7266667   voidf 240060000
*
20501000   ilpsu    sum 30.48   -25.019   1      * il p-s up  (cm)
*                                                    * (dpi+14x+16)
20501001 -9.229167  0.7266667   voidf 240070000
20501002            3.4733333   voidf 240080000
20501003            4.2083333   voidf 240090000
*
*
20501100   blutu    sum 30.48   923.290   1      * bl u-tube up
*                                                    * (cm) - from
20501101 -1.7508333 1.7508333   voidf 315010000  * -57 cm below
20501102            7.7916667   voidf 320010000  * top of tube sheet
20501103            7.5000000   voidf 320020000  * to top of model
20501104            7.5000000   voidf 320030000  * u-tube
20501105            7.5000000   voidf 320040000
*
20501200   blutd    sum 30.48   923.290   1      * bl -tube down
*                                                    * (cm) - from
20501201 -1.7508333 1.7508333   voidf 325010000  * -57 cm below
20501202            7.5000000   voidf 320050000  * top of tube sheet
20501203            7.5000000   voidf 320060000  * to top of model
20501204            7.5000000   voidf 320070000  * u-tube
20501205            7.7916667   voidf 320080000
*
20501300   blpsd    sum 30.48   142.944   1      * bl p-s down (cm)
*                                                    * (dpb-57x+65a)
20501301 -9.179583  0.8020833   voidf 330010000
20501302            1.3076602   voidf 340010000
20501303            2.3383333   voidf 340020000
20501304            1.6437500   voidf 340030000
20501305            4.9431250   voidf 340040000
20501306            4.2364583   voidf 340050000
20501307            0.6466667   voidf 340060000
*
20501400   blpsu    sum 30.48   -27.026   1      * bl p-s up (cm)
*                                                    * (dpb+65+73a)
20501401 -9.179583  0.6466667   voidf 340070000
20501402            5.3495833   voidf 340080000
20501403            2.2966667   voidf 340090000
*
*
20501500   ilsgrsl  sum 30.48   1130.780   1      * i.l. s.g. lvl (cm)
*                                                    * (top of tube
20501501 0.0        7.9525000   voidf 600010000  * sheet to top of
20501502            7.9108334   voidf 600020000  * cent. separator)
20501503            7.9108334   voidf 600030000  * (0 to +1130)
20501504            7.4762500   voidf 600040000  * riser side
20501505            5.1558333   voidf 600050000
*
20501600   ilsgdcl  sum 30.48   1130.780   1      * i.l. s.g. lvl (cm)
*                                                    * (top of tube
20501601 0.0        7.4762500   voidf 600010000  * sheet to top of
20501602            7.9108334   voidf 603020000  * cent. separator
20501603            7.9108334   voidf 600030000  * (0 to +1130)
20501604            7.9525000   voidf 600040000  * downcomer side
20501605            5.5516667   voidf 600210000
20501606            1.5404167   voidf 612010000
*
20501700   blsgrsl  sum 30.48   1120.150   1      * b.l.s.g. lvl (cm)
*                                                    * (top of tube
20501701 0.0        1.0833333   voidf 715010000  * sheet to top of
20501702            6.7083333   voidf 700010000  * grav. separator)
20501703            7.5000000   voidf 700020000  * (0.0 to 1172)
20501704            7.5000000   voidf 700030000  * riser side
20501705            7.5000000   voidf 700040000
20501706            6.8229167   voidf 700050000
20501707            1.3333333   voidf 701010000
*
20501800   blsgdcl  sum 30.48   1120.140   1      * b.l.s.g. lvl (cm)
*                                                    * (top of tube
20501801 .5416667   4.0000000   voidf 714010000  * sheet to bot of
20501802            7.5000000   voidf 714020000  * grav. separator)
20501803            7.5000000   voidf 714030000  * (0.0 to 1131)
20501804            7.5000000   voidf 714040000  * downcomer side
20501805            7.2500000   voidf 714050000
20501806            2.8229167   voidf 711010000
*
*
*
20501900   ilsgsr   sum .028316846 0.0    1      * il s.g. secondary
*                                                    * riser mass (kg)
20501901 0.0        1.0038417   rho   600010000
20501902            0.9402046   rho   600020000
20501903            0.8926058   rho   600030000
20501904            1.0017945   rho   600040000
20501905            2.2709806   rho   600050000
20501906            0.4508175   rho   601010000
20501907            0.4249623   rho   611010000
*
20502000   ilsgsd   sum .028316846 0.0    1      * il s.g. secondary
*                                                    * downcomer mass(kg)
20502001 0.0        3.0085308   rho   602010000
```

```
20502002          0.7316250   rho   612010000
20502003          0.2211171   rho   603010000
20502004          0.2316581   rho   603020000
20502005          0.2316581   rho   603030000
20502006          0.3322701   rho   603040000
*
20502100   ilsgm  sum   1.0     0.0     1  * il s.g. secondary
*                                           * mass (kg)
20502101  0.0     1.00        cntrlvar   19
20502102          1.00        cntrlvar   20
*
*
20502200   blsgmr sum  .028316846 0.0     1  * bl s.g. secondary
*                                           * riser mass (kg)
20502201  0.0     0.0344994   rho   716010000
20502202          0.2213819   rho   700010000
20502203          0.2476839   rho   700020000
20502204          0.2461911   rho   700030000
20502205          0.26499340  rho   700040000
20502206          0.3268035   rho   700050000
20502207          0.5794734   rho   701010000
20502208          0.1534235   rho   703010000
20502209          0.1002201   rho   704010000
20502210          0.0680664   rho   705010000
*
20502300   blsgmd sum  .028316846 0.0     1  * bl s.g. secondary
*                                           * downcomer mass(kg)
20502301  0.0     0.6232431   rho   711010000
20502302          0.0718342   rho   712010000
20502303          0.0366917   rho   713010000
20502304          0.0424740   rho   714010000
20502305          0.0779018   rho   714020000
20502306          0.0779018   rho   714030000
20502307          0.0779018   rho   714040000
20502308          0.0774216   rho   714050000
20502309          0.0972227   rho   715010000
*
20502400   blsgm  sum   1.0     0.0     1  * bl s.g. secondary
*                                           * liquid mass (kg)
20502401  0.0     1.00        cntrlvar   22
20502402          1.00        cntrlvar   23
*
*
20502500   totsgm sum   1.0     0.0     1  * total secondary
*                                           * liquid mass (kg)
20502501  0.0     1.00        cntrlvar   21
20502502          1.00        cntrlvar   24
*
*
*
20502600   ilsgq  sum  -1.0e-3   0.0     1  * il sg q (kw)
*
20502601  0.0     1.00        q     220010000
20502602          1.00        q     220020000
20502603          1.00        q     220030000
20502604          1.00        q     220040000
20502605          1.00        q     220050000
20502606          1.00        q     220060000
20502607          1.00        q     220070000
20502608          1.00        q     220080000
*
20502700   blsgq  sum  -1.0e-3   0.0     1  * bl sg q (kw)
*
20502701  0.0     1.00        q     320010000
20502702          1.00        q     320020000
20502703          1.00        q     320030000
20502704          1.00        q     320040000
20502705          1.00        q     320050000
20502706          1.00        q     320060000
20502707          1.00        q     320070000
20502708          1.00        q     320080000
*
20502800   corpow sum  .23607e-3   0.0     1  * core power (kw)
*
20502801  0.0     1.00        htrnr 150000101
20502802          1.00        htrnr 150000201
20502803          1.00        htrnr 150000301
20502804          1.00        htrnr 150000401
20502805          1.00        htrnr 150000501
20502806          1.00        htrnr 150000601
20502807          1.00        htrnr 150000701
20502808          1.00        htrnr 150000801
20502809          1.00        htrnr 150000901
20502810          1.00        htrnr 150001001
20502811          1.00        htrnr 150001101
20502812          1.00        htrnr 150001201
*
*
*
20502900   maxrod  stdfactn  1.0     0.0     1  * max rod temp
*
20502901           max        httemp 150000118
20502902                      httemp 150000218
20502903                      httemp 150000318
20502904                      httemp 150000418
20502905                      httemp 150000518
20502906                      httemp 150000618
20502907                      httemp 150000718
20502908                      httemp 150000818
20502909                      httemp 150000918
20502910                      httemp 150001018
20502911                      httemp 150001118
20502912                      httemp 150001218
*
*************************************************************
*          control block for primary coolant system mass    *
*************************************************************
*
20540000   dncrmas sum  .028316846 0.0     1  * downcomer mass
*                                           * (kg)
20540001  0.0     0.2113940   rho   101010000
20540002          0.0700233   rho   110010000
20540003          0.0260607   rho   110020000
20540004          0.0520780   rho   110030000
20540005          0.0520780   rho   110040000
20540006          0.0520780   rho   110050000
```

```
20540007          0.0520780   rho   110060000
20540008          0.0520780   rho   110070000
20540009          0.0381645   rho   110080000
20540010          0.0451975   rho   110090000
20540011          0.0733525   rho   110100000
*
20540100  lplnmas   sum .02831685  0.0     1  * lower plenum
*                                            * mass (kg)
20540101  0.0     0.2381304   rho   120010000
20540102          0.2328024   rho   130010000
20540103          0.1229966   rho   140010000
*
20540200  corenas   sum .02831685  0.0     1  * core mass (kg)
*
20540201  0.0     0.0607520   rho   150010000
20540202          0.0607520   rho   150020000
20540203          0.0607520   rho   150030000
20540204          0.0607520   rho   150040000
20540205          0.0607520   rho   150050000
20540206          0.0607520   rho   150060000
*
20540300  uplnmas   sum .02831685  0.0     1  * upper plenum
*                                            * mass (kg)
20540301  0.0     0.0579072   rho   161010000
20540302          0.1260044   rho   162010000
20540303          0.1223341   rho   163010000
20540304          0.1445850   rho   164010000
*
20540400  uphdmas   sum .02831685  0.0     1  * upper head
*                                            * mass (kg)
20540401  0.0     0.0236441   rho   191010000
20540402          0.1028720   rho   192010000
20540403          0.1854233   rho   193010000
20540404          0.1777042   rho   194010000
*
20540500  byscgt    sum .02831685  0.0     1  * bypass line,
*                                            * support columns,
20540501  0.0     0.0025551   rho   181010000  * and guide tube
20540502          0.0032783   rho   181020000  * mass (kg)
20540503          0.0142473   rho   182010000
20540504          0.0087675   rho   183010000
20540505          0.0111809   rho   184010000
20540506          0.0052981   rho   185010000
20540507          0.0298418   rho   186010000
*
20540600  pzrmass   sum .02831685  0.0     1  * pressurizer
*                                            * mass (kg)
20540601  0.0     0.0033454   rho   997010000
20540602          0.0042156   rho   997020000
20540603          0.0031333   rho   997030000
20540604          0.1731566   rho   999010000
20540605          0.1842654   rho   999020000
20540606          0.1842654   rho   999030000
20540607          0.1842654   rho   999040000
20540608          0.1842654   rho   999050000
20540609          0.1842654   rho   999060000
20540610          0.1857634   rho   999070000
20540611          0.1120170   rho   999080000
*
20540700  ihotmas   sum .02831685  0.0     1  * intact loop
*                                            * hot leg
20540701  0.0     0.1047757   rho   201010000  * mass (kg)
20540702          0.0776879   rho   201020000
20540703          0.0675653   rho   202010000
20540704          0.0653702   rho   203010000
20540705          0.0574572   rho   203020000
20540706          0.0538894   rho   203030000
20540707          0.0478680   rho   210010000
20540708          0.0345748   rho   215010000
*
20540800  itubmas   sum .02831685  0.0     1  * intact loop
*                                            * u-tube
20540801  0.0     0.1571175   rho   220010000  * mass (kg)
20540802          0.1562943   rho   220020000
20540803          0.1562943   rho   220030000
20540804          0.1322144   rho   220040000
20540805          0.1322144   rho   220050000
20540806          0.1562943   rho   220060000
20540807          0.1562943   rho   220070000
20540808          0.1571175   rho   220080000
*
20540900  icldmas   sum .02831685  0.0     1  * intact loop
*                                            * cold leg
20540901  0.0     0.0345748   rho   225010000  * mass (kg)
20540902          0.0478680   rho   230010000
20540903          0.0374799   rho   240010000
20540904          0.0902957   rho   240020000
20540905          0.0849061   rho   240030000
20540906          0.0713212   rho   240040000
20540907          0.0663894   rho   240050000
20540908          0.0374835   rho   240060000
20540909          0.0374835   rho   240070000
20540910          0.0663894   rho   240080000
20540911          0.1036456   rho   240090000
20540912          0.0558400   rho   250010000
20540913          0.0779669   rho   251010000
20540914          0.0779669   rho   251020000
20540915          0.0779669   rho   252010000
20540916          0.0654513   rho   253010000
*
20541000  bhotmas   sum .02831685  0.0     1  * broken loop
*                                            * hot leg
20541001  0.0     0.0584273   rho   301010000  * mass (kg)
20541002          0.0215803   rho   301020000
20541003          0.0215803   rho   301030000
20541004          0.0266031   rho   301040000
20541005          0.0230250   rho   301050000
20541006          0.0192876   rho   301060000
20541007          0.0495847   rho   310010000
20541008          0.0115250   rho   315010000
*
20541100  btubmas   sum .02831685  0.0     1  * broken loop
*                                            * u-tube
20541101  0.0     0.0471739   rho   320010000  * mass (kg)
20541102          0.0454080   rho   320020000
20541103          0.0454080   rho   320030000
```

```
20541104          0.0456672   rho   320040000
20541105          0.0456672   rho   320050000
20541106          0.0454080   rho   320060000
20541107          0.0454080   rho   320070000
20541108          0.0471739   rho   320080000
*
20541200  boldmas   sum .028316245  0.0     1   * broken loop
*                                                * cold leg
20541201  0.0       0.0115250   rho   325010000  * mass (kg)
20541202          0.0495847   rho   330010000
20541203          0.0156764   rho   340010000
20541204          0.0228420   rho   340020000
20541205          0.0160501   rho   340030000
20541206          0.0482662   rho   340040000
20541207          0.0419519   rho   340050000
20541208          0.0099184   rho   340060000
20541209          0.0099184   rho   340070000
20541210          0.0522349   rho   340080000
20541211          0.0224253   rho   340090000
20541212          0.0303500   rho   350010000
20541213          0.0192357   rho   361010000
20541214          0.0160867   rho   362010000
20541215          0.0227915   rho   363010000
20541216          0.0479251   rho   363020000
*
20541300  pcsmass   sum     1.0     0.0     1   * total primary
*                                                * coolant system
20541301  0.0       1.00        cntrlvar    400  * mass (kg)
20541302            1.00        cntrlvar    401
20541303            1.00        cntrlvar    402
20541304            1.00        cntrlvar    403
20541305            1.00        cntrlvar    404
20541306            1.00        cntrlvar    405
20541307            1.00        cntrlvar    406
20541308            1.00        cntrlvar    407
20541309            1.00        cntrlvar    408
20541310            1.00        cntrlvar    409
20541311            1.00        cntrlvar    410
20541312            1.00        cntrlvar    411
20541313            1.00        cntrlvar    412
*
**************************************************************
*                  cntrlvar delta p (kpa)                    *
**************************************************************
*
*         name    type     scale  init val   flg
20550100  vesdp     sum     1.0e-3    100.0     1   * vessel level dp
*                                                  * -13 to -578 cm
20550101  0.0   1.0   p   120010000   0.3303   rho   120010000
20550102      -1.0   p   153010000  -3.3898   rho   153010000
*
*         name    type     scale  init val   flg
20550200  coredp    sum     1.0e-3    100.0     1   * core level dp
*                                                  * -105 to -501 cm
20550201  0.0   1.0   p   140010000  -1.9198   rho   140010000
20550202      -1.0   p   161010000   0.9447   rho   161010000
*
*         name    type     scale  init val   flg
20550300  dwncmdp   sum     1.0e-3    100.0     1   * dwncm level dp
*                                                  * 29 to -578 cm
20550301  0.0   1.0   p   120010000   0.3303   rho   120010000
20550302      -1.0   p   101010000   2.8420   rho   101010000
*
*         name    type     scale  init val   flg
20550400  vescpdp   sum     1.0e-3    100.0     1   * vessel upper
*                                                  * plenum dp
*                                                  * 135 to -13 cm
20550401  0.0   1.0   p   163010000   3.3898   rho   163010000
20550402      -1.0   p   164010000   3.6964   rho   164010000
*
*         name    type     scale  init val   flg
20550500  vesuhdp   sum     1.0e-3    100.0     1   * vessel upper
*                                                  * head dp
*                                                  * 421 to 160 cm
20550501  0.0   1.0   p   191010000   0.3256   rho   191010000
20550502      -1.0   p   194010000   4.0503   rho   194010000
*
*         name    type     scale  init val   flg
20550600  przdp     sum     1.0e-3    100.0     1   * pressurizer
*                                                  * 632 to 30 cm
20550601  0.0   1.0   p   999080000   1.8327   rho   999080000
20550602      -1.0   p   999010000   4.3145   rho   999010000
*
*         name    type     scale  init val   flg
20550700  isgupdp   sum     1.0e-3    100.0     1   * ilsg upside
*                                                  * 926 to -57e cm
20550701  0.0   1.0   p   210010000  -0.5300   rho   210010000
20550702      -1.0   p   220040000   9.8588   rho   220040000
*
*         name    type     scale  init val   flg
20550800  isgdndp   sum     1.0e-3    100.0     1   * ilsg downside
*                                                  * 926 to -57x cm
20550801  0.0   1.0   p   230010000  -0.5300   rho   230010000
20550802      -1.0   p   220050000   9.8588   rho   220050000
*
*         name    type     scale  init val   flg
20550900  ipsdndp   sum     1.0e-3    100.0     1   * il pump suction
*                                                  * downside
*                                                  * -57x to il4
20550901  0.0   0.5   p   240060000   0.5115   rho   240060000
20550902      0.5   p   240070000   0.5115   rho   240070000
20550903      -1.0   p   230010000   0.5300   rho   230010000
*
*         name    type     scale  init val   flg
20551000  ipsupdp   sum     1.0e-3    100.0     1   * il pump suction
*                                                  * upside
*                                                  * il4 to il6
20551001  0.0   0.5   p   240060000   0.5115   rho   240060000
20551002      0.5   p   240070000   0.5115   rho   240070000
20551003      -1.0   p   240090000   4.3006   rho   240090000
*
*         name    type     scale  init val   flg
20551100  bsgupdp   sum     1.0e-3    100.0     1   * blsg upside
*                                                  * 925 to -57e
20551101  0.0   1.0   p   310010000  -0.8393   rho   310010000
20551102      -1.0   p   320040000  10.0822   rho   320040000
```

```
*
*        name   type     scale  init val  flg
20551200 bsgdndp   sum    1.0e-3   100.0    1  * blsg downside
*                                              * 925 to -57x
20551201  0.0   1.0   p  330010000  -0.8393  rho  330010000
20551202       -1.0   p  320050000  10.0822  rho  320050000
*
*        name   type     scale  init val  flg
20551300 bpsdndp   sum    1.0e-3   100.0    1  * bl pump suction
*                                              * downside
*                                              * -57x to b65
20551301  0.0   0.5   p  340060000   0.4829  rho  340060000
20551302       0.5   p  340070000   0.4829  rho  340070000
20551303      -1.0   p  330010000   0.8393  rho  330010000
*
*        name   type     scale  init val  flg
20551400 bpsupdp   sum    1.0e-3   100.0    1  * bl pump suction
*                                              * upside
*                                              * b65 to b73
20551401  0.0   0.5   p  340060000   0.4829  rho  340060000
20551402       0.5   p  340070000   0.4829  rho  340070000
20551403      -1.0   p  340090000   0.6504  rho  340090000
*
*        name   type     scale  init val  flg
20551500 ilsgrndp  sum    1.0e-3   100.0    1  * ilsg riser
*                                              * 1117 to 89 cm
20551501  0.0   1.0   p  600010000   3.1356  rho  600010000
20551502       -1.0   p  602010000   7.8576  rho  602010000
*
*        name   type     scale  init val  flg
20551600 ilsgddp   sum    1.0e-3   100.0    1  * ilsg downcomer
*                                              * 1117 to 51 cm
20551601  0.0   1.0   p  603040000   6.9282  rho  603040000
20551602       -1.0   p  602010000   7.8576  rho  602010000
*
*        name   type     scale  init val  flg
20551700 blsgrdp   sum    1.0e-3   100.0    1  * blsg riser
*                                              * 1186 to -7 cm
20551701  0.0   1.0   p  716010000   2.3049  rho  716010000
20551702       -1.0   p  703010000   0.5601  rho  703010000
*
*        name   type     scale  init val  flg
20551800 blsgddp   sum    1.0e-3   100.0    1  * blsg downcomer
*                                              * 1186 to 18 cm
20551801  0.0   1.0   p  715010000
20551802       -1.0   p  703010000   0.5601  rho  703010000
*
*        name   type     scale  init val  flg
20551900 blsgdhdp  sum    1.0e-3   100.0    1  * blsg dwn horiz
*                                              * 1036 to 18 cm
20551901  0.0   1.0   p  715010000
20551902       -1.0   p  713010000
*
*
*************************************************************
*              cntrlvar collapsed liquid level cm           *
*************************************************************
*
```

```
*        name   type     scale  val0  flg  * vessel clspd
20553100   vescl   div   10204.082   100.   1  * level -13 to
*                                              * -578  ref -578
20553101  rhof  163010000    cntrlvar  501
*
*
*        name   type     scale  val0  flg  * core clspd
20553200   corecl   div   10204.082   100.   1  * level -105 to
*                                              * -501  ref -501
20553201  rhof  161010000    cntrlvar  502
*
*
*        name   type     scale  val0  flg  * dwncm clspd
20553300   dwncmcl   div   10204.082   100.   1  * level 29 to
*                                              * -578  ref -578
20553301  rhof  101010000    cntrlvar  503
*
*
*        name   type     scale  val0  flg  * ves up clspd
20553400   vesupcl   div   10204.082   100.   1  * level 135 to
*                                              * -13  ref -13
20553401  rhof  164010000    cntrlvar  504
*
*
*        name   type     scale  val0  flg  * ves mh clspd
20553500   vesmhcl   div   10204.082   100.   1  * level 421 to
*                                              * 160  ref 160
20553501  rhof  194010000    cntrlvar  505
*
*
*        name   type     scale  val0  flg  * prz clspd
20553600   przcl   div   10204.082   100.   1  * level 632 to
*                                              * 30  ref 30
20553601  rhof  999010000    cntrlvar  506
*
*
*        name   type     scale  val0  flg  * ilsg up clspd
20553700   isgupcl   div   10204.082   100.   1  * level 926 to
*                                              * -57e ref -57
20553701  rhof  2200-0000    cntrlvar  507
*
*
*        name   type     scale  val0  flg  * ilsg dn clspd
20553800   isgdncl   div   10204.082   100.   1  * level 926 to
*                                              * -57x ref -57
20553801  rhof  220050000    cntrlvar  508
*
*
*        name   type     scale  val0  flg  * ilps dn clspd
20553900   ipsdncl   div   10204.082   100.   1  * level -57x to
*                                              * il4  ref il4
20553901  rhof  230010000    cntrlvar  509
*
*
*        name   type     scale  val0  flg  * ilps up clspd
20554000   ipsupcl   div   10204.082   100.   1  * level il4 to
*                                              * il6  ref il4
20554001  rhof  240090000    cntrlvar  510
```

```
*
*
*          name  type      scale   val0 flg  * blsg up clspd
20554100   bsgupcl   div   10204.082   100.   1  * level 925 to
*                                              * -57e  ref -57
20554101   rhof  320040000     cntrlvar  511
*
*
*          name  type      scale   val0 flg  * blsg dn clspd
20554200   bsgdncl   div   10204.082   100.   1  * level 925 to
*                                              * -57x  ref -57
20554201   rhof  320050000     cntrlvar  512
*
*
*          name  type      scale   val0 flg  * blps dn clspd
20554300   bpsdncl   div   10204.082   100.   1  * level -57x to
*                                              * b65  ref b65
20554301   rhof  330010000     cntrlvar  513
*
*
*          name  type      scale   val0 flg  * blps up clspd
20554400   bpsupcl   div   10204.082   100.   1  * level b65 to
*                                              * b73  ref b65
20554401   rhof  340090000     cntrlvar  514
*
*
*          name  type      scale   val0 flg  * ilsg ris clspd
20554500   ilsgrcl   div   10204.082   100.   1  * level 1117 to
*                                              * 89  ref 89
20554501   rhof  611010000     cntrlvar  515
*
*
*          name  type      scale   val0 flg  * ilsg dwn clspd
20554600   ilsgdcl   div   10204.082   100.   1  * level 1117 to
*                                              * 51  ref 51
20554601   rhof  611010000     cntrlvar  516
*
*
*          name  type      scale   val0 flg  * blsg ris clspd
20554700   blsgrcl   div   10204.082   100.   1  * level 1186 to
*                                              * -7  ref -7
20554701   rhof  703010000     cntrlvar  517
*
*
*          name  type      scale   val0 flg  * blsg dwn clspd
20554800   blsgdcl   div   10204.082   100.   1  * level 1186 to
*                                              * 18  ref 18
20554801   rhof  703010000     cntrlvar  518
*
*
*          name  type      scale   val0 flg  * blsg dnhz clspd
20554900   blsgdncl   div   10204.082   100.   1  * level 1036 to
*                                              * 18  ref 18
20554901   rhof  703010000     cntrlvar  519
*
**************************************************************
*
*          name  type      scale   val0 flg  * vessel clspd
20556100   vesclr   scm       1.0   -13.0   1  * level -13 to
*                                              * -578  ref zero
20556101   -578.0  1.0    cntrlvar  531
*
*
*          name  type      scale   val0 flg  * core clspd
20556200   coreclr   scm       1.0   -105.0   1  * level -105 to
*                                              * -501  ref zero
20556201   -501.0  1.0    cntrlvar  532
*
*
*          name  type      scale   val0 flg  * dwncm clspd
20556300   dwncmclr   scm       1.0   +29.0   1  * level 29 to
*                                              * -578  ref zero
20556301   -578.0  1.0    cntrlvar  533
*
*
*          name  type      scale   val0 flg  * ves up clspd
20556400   vesupclr   scm       1.0   +135.0   1  * level 135 to
*                                              * -13  ref zero
20556401   -13.0   1.0    cntrlvar  534
*
*
*          name  type      scale   val0 flg  * ves uh clspd
20556500   vesuhclr   scm       1.0   +421.0   1  * level 421 to
*                                              * 160  ref zero
20556501   160.0   1.0    cntrlvar  535
*
*
*          name  type      scale   val0 flg  * prz clspd
20556600   przclr   scm       1.0   +632.0   1  * level 632 to
*                                              * 30  ref zero
20556601   30.0    1.0    cntrlvar  536
*
*
*          name  type      scale   val0 flg  * ilsg up clspd
20556700   isgupclr   scm       1.0   +926.0   1  * level 926 to
*                                              * -57e ref zero
20556701   -57.0   1.0    cntrlvar  537
*
*
*          name  type      scale   val0 flg  * ilsg dn clspd
20556800   isgdnclr   scm       1.0   +926.0   1  * level 926 to
*                                              * -57x ref zero
20556801   -57.0   1.0    cntrlvar  538
*
*
*          name  type      scale   val0 flg  * ilps dn clspd
20556900   ipsdnclr   scm       1.0   203.6   1  * level -57x to
*                                              * il4  ref zero
20556901   -281.3  1.0    cntrlvar  539
*
*
*          name  type      scale   val0 flg  * ilps up clspd
20557000   ipsupclr   scm       1.0   0.0   1  * level il4 to
*                                              * il6  ref zero
20557001   -281.3  1.0    cntrlvar  540
*
```

```
*
*          name   type       scale    val0  flg  * blsg up clspd
20557100  bsgupclr   sum         1.0  +925.0    1  * level 925 to
*                                                 * -57e  ref zero
20557101    -57.0  1.0    cntrlvar   541
*
*
*          name   type       scale    val0  flg  * blsg dn clspd
20557200  bsgdnclr   sum         1.0  +925.0    1  * level 925 to
*                                                 * -57x  ref zero
20557201    -57.0  1.0    cntrlvar   542
*
*
*          name   type       scale    val0  flg  * blps dn clspd
20557300  bpsdnclr   sum         1.0   203.6    1  * level -57x to
*                                                 * 665  ref zero
20557301   -279.8  1.0    cntrlvar   543
*
*
*          name   type       scale    val0  flg  * blps up clspd
20557400  bpsupclr   sum         1.0     0.0    1  * level 665 to
*                                                 * 673  ref zero
20557401   -279.8  1.0    cntrlvar   544
*
*
*          name   type       scale    val0  flg  * ilsg ris clspd
20557500  ilsgrclr   sum         1.0  +1117.0    1  * level 1117 to
*                                                 * 89  ref zero
20557501    89.2  1.0    cntrlvar   545
*
*
*          name   type       scale    val0  flg  * ilsg dwn clspd
20557600  ilsgdclr   sum         1.0  +1117.0    1  * level 1117 to
*                                                 * 51  ref zero
20557601    50.5  1.0    cntrlvar   546
*
*
*          name   type       scale    val0  flg  * blsg ris clspd
20557700  blsgrclr   sum         1.0  +1186.0    1  * level 1186 to
*                                                 * -7  ref zero
20557701    -7.0  1.0    cntrlvar   547
*
*
*          name   type       scale    val0  flg  * blsg dwn clspd
20557800  blsgdclr   sum         1.0  +1186.0    1  * level 1186 to
*                                                 * 18  ref zero
20557801    16.51  1.0    cntrlvar   548
*
*
*          name   type       scale    val0  flg  * blsg dmhz clspd
20557900  blsghclr   sum         1.0     0.0    1  * level 1036 to
*                                                 * 18  ref zero
20557901    16.51  1.0    cntrlvar   549
*
*****************************************************************
*                control block for core power                   *
*****************************************************************
*
20515000  dcypower  function 2.1800000 0.0      1  * kw
20515001    time          0       150
*
20515100  actpower   sum    1.0     0.0      1
20515101  0.0       1.0          cntrlvar    150  * watts
*
*
*****************************************************************
*           control block for pressurizer heater rods           *
*****************************************************************
*
20599500  varpower  function  1.0     0.0      1  * kw
20599501    time          0       999
*
20599500  pzrpower   sum    1.0     0.0      1
20599501  0.0       1.0          cntrlvar    995  * watts
*
*****************************************************************
* internal pzr heater controls   ( ref  gwj-9-82)               *
*****************************************************************
**
*20599000     t698  tripunit  1.0     0.0      1
*20599001     698
**
*20599100  pooffhtrs   sum   875.0     0.0      1
*20599101  0.0       1.0          cntrlvar    990
**
*20599200     t495  tripunit  1.0     0.0      1
*20599201           495
**
*20599300     t497  tripunit  1.0     0.0      1
*20599301           497
**
*20599400     t699  tripunit  1.0     0.0      1
*20599401     699
**
*20599500  proppwr1   sum   250.0     0.0      1
*20599501  0.0       1.0          cntrlvar    993
**
*20599600  interred   sum  1.25e-3    0.0      1
*20599601    15.6e6   -1.0  p 999010000
**
*20599700  proppwr2   mult    1.0     0.0      1
*20599701    cntrlvar 994    cntrlvar 996    cntrlvar 992
**
*20599800  pzrinhtrs   sum    1.0     0.0      1
*20599801  0.  1.0 cntrlvar 995  1.0 cntrlvar 997  1.0 cntrlvar 991
*
*
*****************************************************************
*           control block for pressurizer level                 *
*****************************************************************
*
* obtain specified and maintain constant mass in the pressurizer
*
20598000     t429  tripunit  1.0     0.0      1
20598001           429
*
```

```
20598100   pzrerr   sum    0.01    0.0     1  * input desired
* ejl
20598101 434.0    -1.0        cntrlvar     6
*20598101 132.3    -1.0        cntrlvar     6  * level in cn
*
20598200   pzrcorr   mult    1.0     0.0     0  * correct level in
20598201    cntrlvar    980    cntrlvar    981  * pzr until t529
*
20598500    pzrfw   mult  .0066805   0.0     0  * pressurizer
20598501    rho    999070000    cntrlvar    982  * feed flow rate
*
************************************************************
*              control block for pumps                     *
************************************************************
*
*              ********** steady state **********
*
*intact loop pump speed --- input desired intact loop flow rate (kg/s)*
20525000   ilperr   sum    1.0     0.0     1
20525001 7.05000  -1.0        mflowj 163010000
*
20525100   ilpspd  integral 20.0   1873.37    1
20525101    cntrlvar    250
*
*
*broken loop pump speed --- input desired broken loop flow rate (kg/s)*
20535000   blperr   sum    1.0     0.0     1
20535001  2.47500  -1.0        mflowj 163020000
*
20535100   blpspd  integral 60.0   1492.32    1
20535101    cntrlvar    350
*
*              ********** transient **********
*
*                        intact loop
*
*20525100 ilpmpspd  function 1873.37   0.0     1  * from cntrlvar 251
*20525101    time          0         250        * in steady-state
*
*                        broken loop
*
*20535100 blpmpspd  function 1492.32   0.0     1  * from cntrlvar 351
*20535101    time          0         350        * in steady state
*
************************************************************
*              control block for steam generators          *
************************************************************
*
* obtain specified and maintain constant mass in the steam generators
*
20560600     t419  tripunit  1.0     0.0     1
20560601              419
*
20560700   ilmerr   sum    1.0     0.0     1  * input desired ilsg
20560701  103.0    -1.0        cntrlvar    21  * liquid mass in kg
*
20560800   ilmcorr   mult    1.0     0.0     0  * correct mass in
20560801    cntrlvar    606    cntrlvar    607  * ilsg until t519
*
20560900   ilsgls   sum    1.0     0.0     0  * mass flow out ilsg
20560901  0.0      1.0        mflowj 635000000
*20560902           1.0        mflowj 637000000
*
20561000   ilsgfw   sum    1.0     0.0     0  * intact loop
20561001  0.0      1.0        cntrlvar    608  * feed flow rate
20561002           1.0        cntrlvar    609
*
20562000   ircrcr   div    1.0     0.0     1  * recirc ratio
20562001   mflowj 601010000    mflowj 601020000
*
20562500   icrcr    div    1.0     0.0     1  * circulation ratio
20562501   mflowj 601010000    mflowj 601030000
*
*
20570600     t419  tripunit  1.0     0.0     1
20570601              419
*
20570700   blmerr   sum    1.0     0.0     1  * input desired blsg
20570701  26.0     -1.0        cntrlvar    24  * liquid mass in kg
*
20570800   blmcorr   mult    1.0     0.0     0  * correct mass in
20570801    cntrlvar    706    cntrlvar    707  * blsg until t519
*
20570900   blsgls   sum    1.0     0.0     0  * mass flow out blsg
20570901  0.0      1.0        mflowj 735000000
*20570902           1.0        mflowj 737000000
*
20571000   blsgfw   sum    1.0     0.0     0  * broken loop
20571001  0.0      1.0        cntrlvar    708  * feed flow rate
20571002           1.0        cntrlvar    709
*
20572000   brcrcr   div    1.0     0.0     1  * recirc ratio
20572001   mflowj 704010000    mflowj 713030000
*
20572500   bcrcr    div    1.0     0.0     1  * circulation ratio
20572501   mflowj 704010000    mflowj 701010000
*
*
* control intact loop steam valve to hold steam dome pressure in
* band given by trips 462 and 463 - open and close steam valve at
* rates given in trips 464 and 465 - open or close depending on
* trips 662 and 663
*
20563000     perr   sum   -1.0     0.0     1  * desired pressure
20563001  6.27e6   -1.0          p     611010000  * pascals - mid band
*
20563100    dperr  diffrend  1.0     0.0     1
20563101    cntrlvar    630
*
20563200   posdpdt  tripunit  1.0     0.0     1
20563201              662
*
20563300   negdpdt  tripunit  1.0     0.0     1
20563301              663
*
20563400    open   mult    1.0     0.0     1
```

```
20563401   cntrlvar   630   cntrlvar   632
*
20563500   close  mult   1.0    0.9    1
20563501   cntrlvar   630   cntrlvar   633
*
20563600    rate   sum    1.e-8  0.0    0
20563601  0.0      1.0        cntrlvar   634
20563602           1.0        cntrlvar   635
*
20563700    posn integral 1.0   0.294668  0
20563701   cntrlvar   636
*
*
* control broken loop steam valve to hold steam dome pressure in
* band given by trips 472 and 473 - open and close steam valve at
* rates given in trips 474 and 475 - open or close depending on
* trips 672 and 673
*
20573000    perr   sum   -1.0     0.0     1  * desired pressure
20573001  6.23e6  -1.0         p      705010000 * pascals - mid band
*
20573100   dperr diffrend 1.0     0.0     1
20573101   cntrlvar   730
*
20573200  posdpdt tripunit 1.0     0.0     1
20573201             672
*
20573300  negdpdt tripunit 1.0     0.0     1
20573301             673
*
20573400   open  mult   1.0     0.0     1
20573401   cntrlvar   730   cntrlvar   732
*
20573500   close  mult   1.0     0.0     1
20573501   cntrlvar   730   cntrlvar   733
*
20573600    rate   sum    4.e-9  0.0     0
20573601  0.0      1.0        cntrlvar   734
20573602           1.0        cntrlvar   735
*
20573700    posn integral 1.0   0.04367422 0
20573701   cntrlvar   736
*
*****************************************************************
*        vessel, downcomer, and upper head external heaters     *
*****************************************************************
*
20520000  pwrbase function 1.0     0.0     0
20520001   time        0         116
*
20520100  vslpwr  mult   1.0     1.0     0
20520101   cntrlvar   200
*
20520200  uhtrip  tripunit 1.0     0.0     1
20520201             640
*
20520300  uvtrip  tripunit 1.0     0.0     1
20520301             641
*
20520400  uvtrip  tripunit 1.0     0.0     1
20520401             642
*
20520500  invuht   sum    1.0     1.0     1
20520501  1.0     -1.0        cntrlvar   202
*
20520600  invuvt   sum    1.0    -1.0     1
20520601  1.0     -1.0        cntrlvar   203
*
20520700  invuvt   sum    1.0     1.0     1
20520701  1.0     -1.0        cntrlvar   204
*
20520800   uhpwr  mult   0.13193 1.0     1
20520801   cntrlvar   201   cntrlvar   205
*
20520900   uvpwra  mult   0.06597 1.0     1
20520901   cntrlvar   201
*
20521000   uvpwrb  mult   0.01003 1.0     1
20521001   cntrlvar   201   cntrlvar   202
*
20521100   uvpwrt   sum    1.0     1.0     1
20521101  0.0      1.0        cntrlvar   209
*20521102           1.0        cntrlvar   210
*
20521200   uvpwr  mult   1.0     1.0     1
20521201   cntrlvar   211   cntrlvar   206
*
20521300   uvpwra  mult   0.17589 1.0     1
20521301   cntrlvar   201
*
20521400   uvpwrb  mult   0.02673 1.0     1
20521401   cntrlvar   201   cntrlvar   202
*
20521500   uvpwrc  mult   0.01667 1.0     1
20521501   cntrlvar   201   cntrlvar   203
*
20521600   uvpwrt   sum    1.0     1.0     1
20521601  0.0      1.0        cntrlvar   213
*20521602           1.0        cntrlvar   214
*20521603           1.0        cntrlvar   215
*
20521700   uvpwr  mult   1.0     1.0     1
20521701   cntrlvar   216   cntrlvar   207
*
20521800   vspwra  mult   0.62621 1.0     1
20521801   cntrlvar   201
*
20521900   vspwrb  mult   0.09517 1.0     1
20521901   cntrlvar   201   cntrlvar   202
*
20522000   vspwrc  mult   0.05933 1.0     1
20522001   cntrlvar   201   cntrlvar   203
*
20522100   vspwrd  mult   0.21929 1.0     1
20522101   cntrlvar   201   cntrlvar   204
*
```

```
20522200   vspwr   sum   1.0    1.0    1
20522201  0.0      1.0       cntrlvar   218
*20522202          1.0       cntrlvar   219
*20522203          1.0       cntrlvar   220
*20522204          1.0       cntrlvar   221
*
*
20522300   vtrip  tripmit 1.0    0.0    1
20522301             643
*
20522400   invvt   sum   1.0    1.0    1
20522401  1.0     -1.0       cntrlvar   223
*
20522500   vspwr   mult  1.0    1.0    1
20522501   cntrlvar  222    cntrlvar   224
*
************************************************************
*                  heat loss monitoring block              *
************************************************************
*
20580000   htloss   sum   1.0    0.0    1
20580001  0.       1.0       q     800010000
20580002           1.0       q     801010000
20580003           1.0       q     802010000
20580004           1.0       q     803010000
20580005           1.0       q     804010000
20580006           1.0       q     805010000
20580007           1.0       q     806010000
20580008           1.0       q     807010000
20580009           1.0       q     808010000
20580010           1.0       q     809010000
20580011           1.0       q     811010000
20580012           1.0       q     812010000
20580013           1.0       q     813010000
20580014           1.0       q     814010000
20580015           1.0       q     815010000
20580016           1.0       q     816010000
*
* int brk
*
20505100 intbrk integral 1.0 0.0 0
20505101 mflowj 725000000
*
* run statistics
*
20507800 oldtime sum 1.0 0.0 0
20507801 0.0 1.0 cntrlvar 79
*
20507900 nextime sum 1.0 0.0 0
20507901 0.0 1.0 time 0.0
*
20508100 tstep sum 1.0 0.0 0
20508101 0.0 -1.0 cntrlvar 78
20508102      1.0 cntrlvar 79
*
* minor edit
*
0000301 mflowj 725000000  * mbrk (kg/s)    (mdot*break)

0000302 p      162010000  * pvsp (MPa)     (pv*sp-13)
0000303 cntrlvar 6        * pzr level      (lprz*process)
0000304 p      999010000  * pzr pressure   (p*prz*632)
0000305 cntrlvar 150      * deacy power    (dcypower)
0000306 mflowj 262010000  * ilhl flowrate  (qi*1)
0000307 mflowj 362010000  * blhl flowrate  (qb*79)
0000308 mflowj 635000000  * il steam rate  (mdot*ilstm)
0000309 mflowj 735000000  * bl steam rate  (mdot*blstm)
0000310 p      601010000  * il sg pressure (pis*1117)
0000311 p      701010000  * bl sg pressure (pbg*1186)
0000312 cntrlvar 15       * il sg level    (lip*971-57e)
0000313 cntrlvar 17       * bl sg level    (lbp1b993-57e)
0000314 mflowj 634000000  * il sg adv rate (mdot*il*adv)
0000315 mflowj 734000000  * bl sg adv rate (mdot*bl*adv)
0000316 mflowj 430010000  * il acc rate    (mdot*il*accm)
0000317 mflowj 530010000  * bl acc rate    (mdot*bl*accm)
0000318 cntrlvar 510      * il pump up dp  (dpi*14b*16)
0000319 cntrlvar 514      * bl pump up dp  (dpb*65*73a)
0000320 rho    363020000  * density blcl   (rb*79m)
0000321 mflowj 110010000  * downcomrer rate (qv*dc-423)
0000322 cntrlvar  1       * core level     (lv-13m-578)
0000323 httemp 150000612  * pct            (thv*peak)
0000324 dt  0             * time step
*0000324 cntrlvar 81      * time step
0000325 cputime           * cputime
0000326 cntrlvar 51       * int brk mass
0000327 mflowj 610000000      * il sg2i
0000328 mflowj 722000000      * bl sg2i
0000329 mflowj 615000000      * il sg2 aux
0000330 mflowj 728000000      * bl sg2 aux
0000331 voidf  220010000  * il sgl
0000332 voidf  220020000
0000333 voidf  220030000
0000334 voidf  220040000
0000335 voidf  320010000  * bl sgl
0000336 voidf  320020000
0000337 voidf  320030000
0000338 voidf  320040000
0000339 voidf  240080000  * il pump up
0000340 voidf  240090000
0000341 voidf  340080000  * bl pump up
0000342 voidf  340090000
0000343 voidf  150010000  * core void
0000344 voidf  150020000
0000345 voidf  150030000
0000346 voidf  150040000
0000347 voidf  150050000
0000348 voidf  150060000
0000349 pmpvel 250        * il pump vel
0000350 pmpvel 350        * bl pump vel
0000351 httemp 150000118  * core btm temp
0000352 httemp 150001218  * core top temp
0000353 tempf  162010000  * core up l temp
0000354 tempf  140010000  * core dn l temp
0000355 httemp 150000618
0000356 httemp 150000718
0000357 httemp 150000818
0000358 httemp 150000918
```

```
0000359  httemp 150001018
0000360  httemp 150001118
0000361  voidf  361010000
0000362  cntrlvar 21  *  il sg total mass
0000363  cntrlvar 24  *  bl
*
. *** end of relap5 mod3 input deck ***
```

```
= relap5 model for the semiscale fs-11 posttest - transient run
*
*problem       type    option
0000100         restart  transnt
*
*          inp-chk  or  run
0000101                 run
*
*units         input    output  (si or british)
0000102     british       si
*
0000103 3592 * sfsb.out & sfsb.rst
*
*           t end    min st    max st  st cl  mr  mj  mr
*
0000201   1000.0  1.0e-7  1.0  3  10 200  800  * blowdown phase
*
* isolate the break valve at 4100 sec
*
0000434   time 0  le  null  0  4100.0  n  -1.0
0000602   434  and  434  n  -1.
*
7250000 brk-vlv  valve
7250101 720000000   790000000   0.000314159  0.0 0.0  0100  * ejl
7250102 0.90 0.80    * ejl
7250201 1  0.0  0.0  0.0
7250300 trpvlv
7250301 602
*
* cross valve
*
6370000 ilcmj  sngljun
6370101 611010000  647000000  0.003003  0.0  0.0  000
6370201 0  0.0  0.0  0.0
*
* il steam dome cross connection pipe to bl steam dome
*
6470000  ilcmp  pipe
6470001  3
6470101  0.003003   3
6470301  18.0        1
6470302  14.0        2
6470303  19.7304167  3
6470601  -90.0   1
6470602   0.0    2
6470603   90.0   3
6470701  -18.0   1
6470702   0.0    2
6470703   19.7304167  3
6470801   6.667e-5   0.0  3
6471001   0      3
6471101   0      2
6471201   2  829.6  0.0  0.0  0.0  0  1
6471202   2  829.6  0.0  0.0  0.0  0  2
6471203   2  829.6  0.0  0.0  0.0  0  3
6471300   0
6471301   0.0  0.0  0.0  2
*
*  close the cross valve at 200 sec
*
0000435  time  0  lt  null  0  200.0  n  -1.0
0000624  492  and  435  n  -1.  * ejl 910423
0000625  -624  or  -624  n  -1.
*
6700000  ilblc  valve
6700101  647010000  746010000  0.000661  0.0  0.0  100
6700201  1  0.0  0.0  0.0
6700300  mtrvlv
6700301  624  625  1.0  0.0  0
*
7370000  blcmj  sngljun
7370101  705010000  745000000  0.003003  0.0  0.0  100
7370201  0  0.0  0.0  0.0
*
7450000  blcmp  pipe
7450001     1
7450101   0.003003  1
7450301   7.0       1
7460601   0.0       1
7460701   0.0       1
7460801   6.667e-5  0.0   1
7461001   0         1
7461201   2  675.9  0.0   0.0  0.0    0   1
*
* phase 1
*   open break valve
0000402  time 0  ge  null  0  0.0  1  -1.
*   scram
0000404  p  999010000  ge  null  0  2287.5  1  -1.
*   msiv close
0000410  time  0  ge  timeof  404   4.0  1  -1.
0000411  time  0  ge  timeof  404   4.0  1  -1.
*   rcp coastdown
0000412  time  0  ge  timeof  404   2.0  1  -1.
0000413  time  0  ge  timeof  404   2.0  1  -1.
*   power decay
0000409  time  0  ge  timeof  404   3.2  1  -1.
*   sis
0000407  p  700010000  le  null  0   635.5  n  -1.
*   hpis
0000450  time  0  ge  timeof  407  25.0  1  -1.
0000451  cntrlvar 6  le  null  0  235.0  n  -1.
0000608  450  or  451  n  -1.  * ejl
*   main feedwater stop
*0000414  time  0  ge  timeof  407  0.0  1  -1.
0000414  time 0  ge  null  0  1.0  1 -1.
*0000415  time  0  ge  timeof  407  0.0  1  -1.
0000415  time 0  ge  null  0  1.0  1 -1.
*   aux feedwater initiated
*0000416  time  0  ge  timeof  407  4.0  1  -1.
0000416  time  0  ge  timeof 407  5.0  1  -1.0
*0000417  time  0  ge  timeof  407  4.0  1  -1.
0000426  cntrlvar 16  lt  null  0  955.  n  -1.   * auxfeed on
0000445  time 0  ge null 0  600.0  n  -1.0
```

```
0000611 445 and 426 n -1.
0000612 416 and 416 n -1.
*
0000616 407 and 407 n -1.
0000617 407 and 407 n -1.
*
* phase 2
*
*  open letdown valve
0000453 cntrlvar 30 ge null 0 33.0  n -1.
0000455 cntrlvar 6 ge null 0 255.0 n -1. * open ldn vv EOS
0000456 cntrlvar 6 le null 0 235.0 n -1. * open chg vv
*
0000651 456 and 456 n -1.
0000657 453 and 455 n -1.
*
4150000 ilchg tmdpjun
4150101 425000000  400000000 0.004995
4150200 1 651
*4150201    0.0 0.0514 0.0 0.0
*4150202 1800.0 0.0514 0.0 0.0
*4150203 2000.0 0.0514 0.0 0.0
*4150204 2500.0 0.0514 0.0 0.0
4150201 -1.0 0.0 0.0 0.0
4150202  0.0 0.023 0.0 0.0
4150203 1000.0 0.023 0.0 0.0
4150204 1001.0 0.0 0.0 0.0
*4150205 300.0 0.0 0.0 0.0
*
4250000 ilchgv tmdpvol
4250101 10.0 10.0 0.0 0.0 0.0 0.0
4250102 0.0 0.0 0
4250200 3
4250201 0.0 2500.0 80.0
*
5150000 blchg tmdpjun
5150101 525000000  500000000 0.004995
*5150200 1 651 p 361010000
*5150201    0.0 0.00758 0.0 0.0
*5150202 1800.0 0.00758 0.0 0.0
*5150203 2000.0 0.00758 0.0 0.0
*5150204 2500.0 0.00758 0.0 0.0
5150200 1 651
5150201 -1.0 0.0 0.0 0.0
5150202  0.0 0.00758 0.0 0.0
5150203 1000.0 0.00758 0.0 0.0
5150204 1001.0 0.0    0.0 0.0
*5150205 300.0 0.0    0.0 0.0
*
5250000 blchgv tmdpvol
5250101 10.0 10.0 0.0 0.0 0.0 0.0
5250102 0.0 0.0 0
5250200 3
5250201 0.0 2500.0 80.0
*
*    subcooled margin control
*
20503000 subcm scm 1.0 0.0 0
20503001 0.0 1.0 satterp 999680000
20503002    -1.0 tempf  201010000
*
2450000 letdown tmdpjun
2450101 261010000 245000000 0.004995
2450200 1 657
2450201 -1.0 0.0 0.0 0.0
2450202  0.0 0.024 0.0 0.0
2450203 1000.0 0.024 0.0 0.0
2450204 1001.0 0.0 0.0 0.0
*
2450000 letdnsk tmdpvol
2450101 1.0 1.0 0.0 0.0 0.0 0.0
2450102 4.0-5 0.0 00
2450200 3
2450201 0.0 18.0 100.0
*  adv control
0000452 p 630010000 ge null 0 1000.0 n -1.
0000454 cntrlvar 16 ge null 0 955.0 n -1.
0000661 452 and 454 n -1.
0000671 452 and 454 n -1.
*
* phase 3  refill
*
*
* change hpis performance data p37, eos
*
4100000    ilhpisj  tmdpjun
*
*          from      to  jun area
4100101  420000000 400000000 .004995 2
*
*        ctl flg    trip    table   volume
4100200        1     608        p 262010000
**
*      pres(psia)   flow-f   flow-g    velj
*4100201      -1.0    0.0000     0.0     0.0
*4100202       0.0    0.058626   0.0     0.0
*4100203      50.0    0.057690   0.0     0.0
*4100204     100.0    0.056986   0.0     0.0
*4100205     150.0    0.055847   0.0     0.0
*4100206     200.0    0.054910   0.0     0.0
*4100207     310.0    0.052758   0.0     0.0
*4100208     605.0    0.046888   0.0     0.0
*4100209     865.0    0.041142   0.0     0.0
*4100210    1095.0    0.035287   0.0     0.0
*4100211    1270.0    0.029422   0.0     0.0
*4100212    1440.0    0.023554   0.0     0.0
*4100213    1650.0    0.011784   0.0     0.0
*4100214    1730.0    0.005893   0.0     0.0
*4100215    1775.0    0.0        0.0     0.0
4100201  -1.0 0.0 0.0 0.0
4100202   0.0 0.0 0.0 0.0
4100203  15.0 0.03219 0.0 0.0
4100204  332.25  0.02545 0.0 0.0
4100205  384.51  0.02434 0.0 0.0
```

```
4100206   431.70   0.02569  0.0  0.0
4100207   471.88   0.024000 0.0  0.0
4100208   510.39   0.02538  0.0  0.0
4100209   519.09   0.02371  0.0  0.0
4100210   561.93   0.02375  0.0  0.0
4100211   652.46   0.02531  0.0  0.0
4100212   729.93   0.02516  0.0  0.0
4100213   812.43   0.02329  0.0  0.0
4100214  820.29  0.01873   0.0  0.0
4100215  1123.66  0.01480  0.0  0.0
4100216  1158.0   0.01418  0.0  0.0
4100217  1158.0  0.01184  0.0  0.0
4100218  1348.0  0.00968   0.0  0.0
4100219  1407.0  0.00717   0.0  0.0
4100220  1455.0  0.00450   0.0  0.0
4100221   1560.0   0.0  0.0  0.0
4100222   1600.0  0.0   0.0  0.0
*
5100000    blbpisj    tmcpjun
*
*           from        to  jun area
5100101   520000000 500000000  0.002695
*
*         ctl flg      trip     table    volume
5100200           1       608         p  361010000
*
*       pres(psia)    flow-f    flow-g      velj
5100201       -1.0    0.00        0.0       0.0
5100202        0.0    0.00        0.0       0.0
5100203       15.0    0.0125      0.0       0.0
5100204      333.57   0.01113     0.0       0.0
5100205      581.36   0.01000     0.0       0.0
5100206      609.77   0.00974     0.0       0.0
5100207      770.0    0.00868     0.0       0.0
5100208      881.0    0.00795     0.0       0.0
5100209     1007.23   0.00705     0.0       0.0
5100210     1024.0    0.00683     0.0       0.0
5100211     1158.0    0.0059      0.0       0.0
5100212     1258.0    0.0051      0.0       0.0
5100213     1348.0    0.0039      0.0       0.0
5100214     1407.0    0.0031      0.0       0.0
5100215     1455.0    0.0019      0.0       0.0
5100216     1560.0    0.00        0.0       0.0
5100217     1600.0    0.00        0.0       0.0
*
6010000 isgdct  separatr
6010001 3   0
6010101 0.0 0.7916667  0.4508175  0.0  90.0  0.7916667
6010102  6.667e-5  0.0  0
6010200 2  829.6   0.3
6011101  601010000  612000000   0.4690572  0.0  0.0  0002  0.5
6012101  601000000  602000000   0.4690572  100.0 100.0  0002  0.15
6013101  600010000  601000000   0.5353713  0.0  0.0  0000
6011201  -2.50  1.60  0.0
6012201  1.00  0.00  0.0
6013201  1.60  1.60  0.0
*
```

```
* sfll trip changes
*
0000401  time  0  ge  null  0  8000.0  1 -1.0
0000406  time  0  ge  null  0     0.0  1 -1.0  * ejl
*
20505100   intbrk   integral  1.0  0.0  0
20505101   mflowj   725000000
*
* add pump transient controller
*
20525100  ilpmpspd  function  1873.37  0.0  1
20525101  time  0  250
20535100  blpmpspd  function  1492.32  0.0  1
20535101  time  0  350
*
* restart pump
*
0000423  time  0  ge  null  0  4400.00   1  -1.0
*
20525200  ilpmprs  function  425.0  0.0  1
20525201  time  0  252
*
20225200  reac-t  423
20225201  -1.0  1.0
20225202   0.0  1.0
20225203  100.0  1.0
20225204  400.0  1.0
20225205  401.0  0.0
20225206  499.0  0.0
20225207  500.0  1.0
20225208 4000.0  1.0
20225209 5000.0  1.0
*
0000439  time  0  ge  null  0  700.0  1  -1.
20599500  varpower  function  6.99  0.0  1
20599501  time  0  999
20599900  pzrpower  sum  1.0  0.0  1
20599901  0.0  1.0  cntrlvar  995
20299900  power  439  1.0  1.0e-3
20299901  0.0  1.0
20299901  -1.0   0.0
20299902   0.0   1.0
20299903  300.0  1.0
20299904  301.0  0.0
*
* delete pzr level controller
*
20598000  l419  delete  0.0 0.0 0.0 0.0 0.0 0.0 0.0
20598100  pzrerr  delete  0.0 0.0 0.0 0.0 0.0 0.0 0.0
20598200  pzrcorr  delete  0.0 0.0 0.0 0.0 0.0 0.0 0.0
20598500  pzrfv  delete  0.0 0.0 0.0 0.0 0.0 0.0
* delete pzr component
+9100000  pzrspry  delete
+9200000  pzrsprv  delete
*
0000418  p  999010000  ge  null  0  2250.0  2  -1.
9100000  pzrspry  tmcpjun
```

```
9100101 920000000  999000000  0.012
9100200 1 413
9100201 -1.0 0.0 0.0 0.0
9100202  0.0 0.0303 0.0 9.0
9100203 3000.0 0.0303 0.0 0.0
9100204 3001.0 0.0 0.0 0.0
*
9200000 pzrswv tmdpvol
9200101 0.012 10.0 0.0 0.0 0.0 0.0
9200102 0.0 0.0 0
9200200 3
9200201 0.0 2400.0 80.0
*
9340000 prsrv delete
9400000 prsdv delete
9500000 pzrlvlv delete
9550000 pzrlvlj delete
9590000 c559 delete
9910000 tmd-prz delete
* delete s/g level controller
20560600  t419   delete 0.0 0.0 0.0 0.0 0.0 0.0
20560700 ilmerr  delete 0.0 0.0 0.0 0.0 0.0 0.0
20560800 ilmcorr delete 0.0 0.0 0.0 0.0 0.0 0.0
20560900 ilsgls  delete 0.0 0.0 0.0 0.0 0.0 0.0
20561000 ilsgfv  delete 0.0 0.0 0.0 0.0 0.0 0.0
20562000 ircrcr  delete 0.0 0.0 0.0 0.0 0.0 0.0
20562500 icrrr   delete 0.0 0.0 0.0 0.0 0.0 0.0
20570600 t419    delete 0.0 0.0 0.0 0.0 0.0 0.0
20570700 blmerr  delete 0.0 0.0 0.0 0.0 0.0 0.0
20570800 blmcorr delete 0.0 0.0 0.0 0.0 0.0 0.0
20570900 blsgls  delete 0.0 0.0 0.0 0.0 0.0 0.0
20571000 blsgfv  delete 0.0 0.0 0.0 0.0 0.0 0.0
20572000 brcrcr  delete 0.0 0.0 0.0 0.0 0.0 0.0
20572500 bcrrr   delete 0.0 0.0 0.0 0.0 0.0 0.0
20553000 perr    delete 0.0 0.0 0.0 0.0 0.0 0.0
20553100 dperr   delete 0.0 0.0 0.0 0.0 0.0 0.0
20553200 posdpdt delete 0.0 0.0 0.0 0.0 0.0 0.0
20553300 negdpdt delete 0.0 0.0 0.0 0.0 0.0 0.0
20553400 open    delete 0.0 0.0 0.0 0.0 0.0 0.0
20553500 close   delete 0.0 0.0 0.0 0.0 0.0 0.0
20553600 rate    delete 0.0 0.0 0.0 0.0 0.0 0.0
20553700 posn    delete 0.0 0.0 0.0 0.0 0.0 0.0
20573000 perr    delete 0.0 0.0 0.0 0.0 0.0 0.0
20573100 dperr   delete 0.0 0.0 0.0 0.0 0.0 0.0
20573200 posdpdt delete 0.0 0.0 0.0 0.0 0.0 0.0
20573300 negdpdt delete 0.0 0.0 0.0 0.0 0.0 0.0
20573400 open    delete 0.0 0.0 0.0 0.0 0.0 0.0
20573500 close   delete 0.0 0.0 0.0 0.0 0.0 0.0
20573600 rate    delete 0.0 0.0 0.0 0.0 0.0 0.0
20573700 posn    delete 0.0 0.0 0.0 0.0 0.0 0.0
*
* run statistics
*
20507800 oldtime sum 1.0 0.0 0
20507801 0.0 1.0 cntrlvar 79
20507900 newtime sum 1.0 0.0 0
20507901 0.0 1.0 time 0.0
20508100 tstep sum 1.0 0.0 0
20508101 0.0 -1.0 cntrlvar 78
20508102      1.0 cntrlvar 79
*
6150000 isgafwj tmdpjun
6150101 625000000 603010000  0.012
6150200 1 616
6150201 -1.0 0.0 0.0 0.0
6150202  0.0 0.0510   0.0 0.0
6150203 4300.0 0.051 0.0 0.0
6150204 4301.0 0.0 0.0 0.0
*
6340000 isgrv valve * simulated adv
6340101 611010000 640000000 0.0002592 0.0 0.0 100
6340201 1 0.0 0.0 0.0
6340300 trpvlv
6340301 661
*
7280000 bsgafwj tmdpjun
7280101 725000000 726000000 0.004
7280200 1 617
7280201 -1.0 0.0 0.0 0.0
7280202  0.0  0.030 0.0 0.0
7280203  390.0 0.030 0.0 0.0
7280204  391.0 0.0  0.0 0.0
7280205 4000.0 0.0  0.0 0.0
7280206 4001.0 0.030 0.0 0.0
7280207 6800.0 0.030 0.0 0.0
*
7340000 bsgrv valve * simulated b adv
7340101 705010000 740000000 0.007   0.0 0.0 100
7340201 1 0.0 0.0 0.0
7340300 trpvlv
7340301 671
*
20225100  htrnrate 412 1.0  8.8931
20225101    -1.0   1.000
20225102     0.0   1.000
20225103    10.4   0.505
20225104    20.8   0.325
20225105    32.0   0.227
20225106    42.4   0.181
20225107    62.4   0.150
20225108    64.0   0.000
20225109  4000.0   0.000
*
20235100  htrnrate 413 1.0 9.1631
20235101    -1.0   1.000
20235102     0.0   1.000
20235103     9.6   0.530
20235104    13.6   0.498
20235105    20.8   0.407
20235106    30.4   0.385
20235107    60.0   0.385
20235108    64.8   0.000
20235109  4000.0   0.000
*
```

```
* lpis set point time
0000499  p  999010000  lt  null  0 200.0 1  -1.
*
* add sg main fw component
*
6100000  isgfwj  tmdpjun
6100101  620000000  603010000   0.012
6100200  1  414
6100201  -1.0  1.80  0.0  0.0  * 91.05.08  ejl
6100202  0.0  1.8078  0.0  0.0
*6100203  24.0  1.8078  0.0  0.0
6100204  26.0  0.0     0.0  0.0
*
7220000  bsgfwj  tmdpjun
7220101  724000000  720000000  0.004
7220200  1  415
7220201  -1.0  0.56  0.0  0.0
7220202  0.0  0.56119  0.0  0.0
*7220203  24.0  0.56119  0.0  0.0
7220204  26.0  0.0     0.0  0.0
*
*6350009  isgdj  tmdpjun
*6350101  611010000  650000000  0.007
*6350200  1  410
*6350201  -1.0  0.0  0.0  0.0
*6350202  0.0  0.0  1.8  0.0
*6350203  50.0  0.0  1.8  0.0
*6350204  51.0  0.0  0.5  0.0
*6350205  230.0  0.0  0.5  0.0
*6350206  231.0  0.0  0.0  0.0
*
6350000  isgdj  valve
6350101  611010000  650000000   0.007  204.67  204.67  100
6350201  1  0.0  1.78476  0.0
6350300  mtrvlv
6350301  403 410  .01  0.24367 0
*
7350000  bsgdj  valve
7350101  705010000  750000000  0.007  1022.36  1022.36  100
7350201  1  0.0  0.51964  0.0
7350300  mtrvlv
7350301  403 411  .2  0.04367  0
*
** trips -- trip cancellation card 400    variable trip cards 401-599 **
**       -- trip stop card 600            logical trip cards  601-699 **
0000462  discard
0000463  discard
0000464  discard
0000465  discard
0000662  409 discard
0000663  409 discard
*
0000472  discard
0000473  discard
0000474  discard
0000475  discard
0000672  409 discard
0000673  409 discard
*
*
* minor edit variables
*
*
0000301  mflowj  725000000   * break flowrate
0000302  p       701010000   * bl sg2 pressure
0000303  p       601010000   * il sg2 pressure
0000304  mflowj  670000000   * sg2 rossoverline flowrate
0000305  cntrlvar  51        *  integrated break flow
0000306  cntrlvar  21        * il sg2 mass
0000307  cntrlvar  24        * bl sg2 mass
0000308  rho     720010000   * density before break
0000309  cntrlvar  16        * il sg2dn level
0000310  cntrlvar  18        * bl sg2dn level
0000311  mflowj  635000000   * misg2 out
0000312  mflowj  735000000   * mbsg2 out
0000313  mflowj  610000000   * misg2 in
0000314  mflowj  720000000   * mbsg2 in
0000315  mflowj  615000000   * il auxfeed
0000316  mflowj  72800000    * bl auxfeed
0000317  mflowj  634000000   * il sg2 adv
0000318  mflowj  734000000   * bl sg2 sdv
0000319  tempf   620010000   * il sg2 fw temp
0000320  tempf   720010000   * bl sg2 fw temp
0000321  voidf   600010000   * il sg2 voidf
0000322  voidf   600020000
0000323  voidf   600030000
0000324  voidf   600040000
0000325  voidf   600050000
0000326  voidf   700010000
0000327  voidf   700020000
0000328  voidf   700030000
0000329  voidf   700040000
0000330  voidf   700050000
0000331  cntrlvar  26        * il  sg heat
0000332  cntrlvar  27        * bl  sg heat
0000333  cntrlvar  150       * decay power
*
0000341  cntrlvar   6        * pzr level
0000342  p       999080000   * pzr pressure
0000343  cntrlvar  999       * pzr  heater power
0000344  mflowj  415000000   * il chg
0000345  mflowj  515000000   * bl chg
0000346  mflowj  245000000   * letdown flowrate
0000347  sattemp 999080000   * pzr sat temp
0000348  tempf   201010000   * ilhl temp
0000349  cntrlvar  30        * subcooled margin
0000350  p       162010000   * upper plenum pressure
0000351  mflowj  410000000   * il hpis
0000352  mflowj  430010000   * il acc
0000353  mflowj  510000000   * bl hpis
0000354  mflowj  530010000   * bl acc
0000355  mflowj  262010000   * il flowrate
0000356  mflowj  362010000   * bl flowrate
0000357  pumpvel  250        * il pump velocity
```

```
0000358 pmpvel  350        * bl pump velocity
0000359 tempf   1620100000 * upper plenum temp
0000360 tempf   1400100000 * lower plenum temp
0000361 cntrlvar  29       * pct
0000362 voidf   1620100000 * upper plenum void
0000363 cntrlvar  81       * time step size
0000364 cpctime   0        * cpu time
0000365 cntrlvar  999      * pwr power
. $$$$$$$$$$ ****** end of relap5 input ****** $$$$$$$$$$
```

```
=  relap5 model for the semiscale mh-1 posttest - restart run
*
*problem       type    option
0000100        restart  transnt
*
*          inp-chk  or   run
0000101                  run
*
*units         input    output   (si or british)
0000102     british       si
*
0000103 12658  * sft1.out & sft1.rst
*
0000200 1000.0
*           t end    min st    max st    st cl     mr     mj     mr
*
0000201   4000.0  1.0e-7  5.0  3  40  800  8000  * recovery
0000202   8000.0  1.0e-7  5.0  3  40  800  8000  * refill
*
0000616   426  and  426  n  -1.  * aux on sgl le 955
0000427   time  0  ge  null  0  4160.0  n  -1.0
0000428   time  0  le  null  0  7760.0  1  -1.0
0000617   427  and  428  n  -1.
*
6150000 isgafvj  tmdpjun
6150101 625000000  603010000  0.012
6150200  1  616
6150201  -1.0  0.0  0.0  0.0
6150202   0.0  0.0510  0.0  0.0
6150203 7000.0  0.0510  0.0  0.0
*
7280000 tsgafvj  tmdpjun
7280101  729000000  726000000  0.004
7280200  1  617
7280201  -1.0  0.0  0.0  0.0
7280202   0.0  0.030  0.0  0.0
7280203 7000.0  0.030  0.0  0.0
*
20535100 blpmpspd  function  425.0  0.0  1
20535101 time  0  252
0000423  time 0  ge  null  0  4400.0  n  -1.
20525200 ilpmprs  function  425.0  0.0  1
20525201 time  0  252
20225200 reac-t  423
20225201  -1.0  0.0
20225202   0.0  1.0
20225203  400.0  1.0
20225204  401.0  0.0
20225205  499.0  0.0
20225206  500.0  1.0
20225207 5000.0  1.0
```

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

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER (Assigned by NRC. Add Vol., Supp., Rev., and Addendum Numbers, if any.)
NUREG/IA-0104

2. TITLE AND SUBTITLE
RELAP5/MOD3 Assessment Using the Semiscale 50% Feed Line Break Test S-FS-11

3. DATE REPORT PUBLISHED
MONTH: June | YEAR: 1993

4. FIN OR GRANT NUMBER
L2245

5. AUTHOR(S)
E. J. Lee, B. D. Chung, H. J. Kim

6. TYPE OF REPORT
Technical

7. PERIOD COVERED *(Inclusive Dates)*

8. PERFORMING ORGANIZATION – NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Korea Institute of Nuclear Safety
P.O. Box 16, Daeduk-Danji
Daejon, Korea 305-353

9. SPONSORING ORGANIZATION – NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

The RELAP5/MOD3 5m5 code was assessed using the 1/1705 volume scaled Semiscale 50% Feed Line Break (FLB) test S-FS-11. Test S-FS-11 was designed in three phases: (a) blowdown phase, (b) stabilization phase, and (c) refill phase. The first objective was to assess the code applicability to 50% FLB situation, the second was to evaluate the FSAR conservatisms regarding SG heat transfer degradation, steam line check valve failure, break flow state, and peak primary system pressure, and the third was to validate the EOP effectiveness. The code was able to simulate the major T/H parameters except for the two-phase break flow and the secondary convective heat transfer rate. The two-phase break flow had still deficiencies. The current boiling heat transfer rate was developed from the data for flow inside of a heated tube, not for flow around heated tubes in a tube bundle. Results indicated that the assumption of 100% heat transfer until the liquid inventory depletion was not conservative, the failed affected steam generator main steam line check valve assumption was not either conservative, the measured break flow experienced all types of flow conditions, the relative proximity to the 110% design pressure limit was conservative. The automatic actions during the blowdown phase were effective in mitigating the consequences. The stabilization operation performed by operator actions were effective to permit natural circulation cooldown and depressurization. The voided secondary refill operations also verified the effectiveness of the operations while recovering the inventory in a voided steam generator.

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

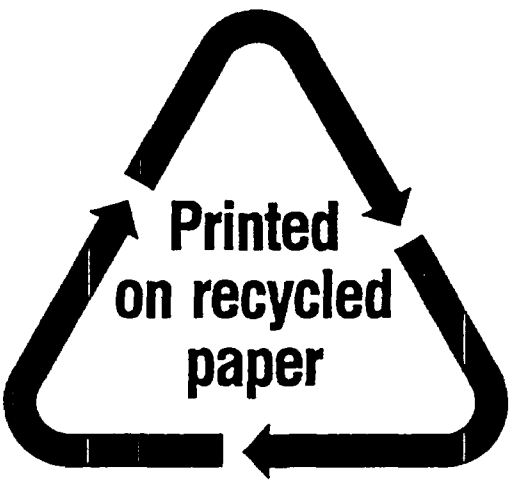
ICAP Program
RELAP5/MOD3
Semiscale S-FS-11

13. AVAILABILITY STATEMENT
Unlimited

14. SECURITY CLASSIFICATION
(This Page)
Unclassified
(This Report)
Unclassified

15. NUMBER OF PAGES

16. PRICE



Federal Recycling Program

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

SPECIAL FOURTH-CLASS RATE
POSTAGE AND FEES PAID
USNRC
PERMIT NO. G-67