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International Agreement Report

Assessment of RELAP5/MOD2 Using Semiscale Intermediate Break Loss-of-Coolant Experiment S-IB-3

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

June 1992

Prepared as part of
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ABSTRACT

This report presents the results of the RELAP5/MOD2 assessment utilizing a Semiscale intermediate break loss-of- coolant experiment S-IB-3. Comprehensive analysis with RELAP5/MOD2 is performed to predict the transient thermal- hydraulic responses of the experiment. Test S-IB-3 is a 21.7%, communicative cold leg break LOCA experiment using Semiscale Mod-2A facility in 1982, for the principal objective to provide reference data for comparison of Semiscale test results to LOBI facility B-R1M test results. Through extensive comparison between test data and best-estimate RELAP5 calculations, the capabilities of RELAP5/MOD2 to predict the intermediate break LOCA accident were assessed. Emphasis was located on the capability of the code to calculate core level depression and break flow rate during system blowdown, pump suction liquid seals phenomena, and temperature excursions behavior etc., throughout the whole experiment. Besides, some sensitivity studies involving the effect of steam generator secondary side pressure boundary, adjustment of two-phase discharge coefficient, intact loop pump coastdown behavior, and some interesting studies regarding break flow etc., were also investigated in this report.

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SUMMARY

This report includes the results and conclusions of the RELAP5/MOD2 code assessment in the analysis of Semiscale intermediate break test S-IB-3. Sensitivity studies of the S-IB-3 simulation with respect to various modelling options are performed as well as to investigate their impacts on the modified calculation results.

Semiscale S-IB-3 is performed to simulate a hypothetical LOCA which results from a 21.7%, communicative cold leg break of a typical pressurized water reactor. Test S-IB-3 was the last of the three-test Intermediate Break series which was conducted from an initial system pressure of 15.5 MPa, with core inlet temperature of 563 K, temperature rise of 33 K, flat radial profile and a total power of 1.45 MW. The principal objective of this test was to provide reference data for comparison of Semiscale test results to Loop Blowdown Investigation (LOBI) facility B-R1M test results.

RELAP5/MOD2 is an advanced, one-dimensional, two fluid, six-equation, thermal nonequilibrium reactor transient and accident analysis program. The objective of this assessment study is to provide systematic assessment of the RELAP5/MOD2 code relative to code development, code improvement, and the enhancement of user guidelines.

In this study, the test simulations using RELAP5/MOD2 begin with break initiation and subsequent blowdown, and continue through primary fluid saturation, loop liquid seals formation and clearance, two temperature excursions, refill/reflood phenomena, and terminate with core quench. Generally speaking, the primary system depressurization and break flow rate are well predicted by the RELAP5/MOD2 model. However, RELAP5/MOD2 fails to predict the pump

suction liquid seal clearing and the observed two temperature excursions phenomena. According to the extensive comparison between the calculated results and the test data, it is found that the time of primary fluid saturation, core bypass line and broken loop hot leg flow reversal, and broken loop steam generator secondary becoming energy source, are predicted with reasonable good agreement in comparison to the measured events. However, the sequence of events after broken loop pump suction liquid seal clearing occurrence in the experiment are presented with significant differences. The major differences between the calculated results and the test data including pump suction liquid seal formation and clearance, heatup phenomena and LPIS injection actuation etc., are discussed in this report.

Sensitivity analyses of the test simulation with respect to several different modellings or options in code input modifications, including the steam generator secondary side pressure boundary, impediment of reverse flow in both broken loop hot leg and upper plenum, adjustment of intact loop pump speed coastdown to a stop, junction options in modelling the loop-pipe connections to the reactor vessel, rearrangement of the connection direction of break junction, and increment of two-phase discharge coefficient are performed to investigate their impacts on overall system response. On the whole, the modified results indicate limited influence to the system thermal- hydraulic responses.

From the results of this scenario study, it is learned that the present RELAP5/MOD2 model fails to simulate the observed temperature excursions of heater rod. It is believed that the improper simulation of pump suction liquid seal formation and clearance, which would be suspected as the possible defect of the present RELAP5/MOD2 code.

1. INTRODUCTION

This report presents the assessment study of RELAP5/MOD2 using Semiscale Mod-2A facility at the U.S. Department of Energy's Idaho National Engineering Laboratory(INEL). Test S-IB-3 was the last of the three-test Intermediate Break series and was conducted on February 23, 1982. This test was a 21.7%, communicative, cold leg break loss-of-coolant experiment. The principal objective of this test was to provide reference data for comparison of Semiscale test results to Loop Blowdown Investigation (LOBI) facility (Ispra, Italy) B-R1M test results. Also, another important objective was to provide reference data for evaluation and assessment of reactor safety code capabilities to predict integral blowdown, refill/reflood experiments for intermediate break sizes. Still another important objective was to expand the break spectrum data base to cover the 10 to 200% range in order to determine if other phenomena are important to core cooling and to evaluate the Mod-2A system response to breaks in this range.

This report includes the results and conclusions of assessment study involving comparisons between data from Semiscale S-IB-3 [1] and RELAP5/MOD2 [2] code calculated (base case results), investigation of pump suction loop seals formation leading to vessel level depression and two temperature excursion occurrence. In addition, some sensitivity studies involving the effect of steam generator secondary side pressure boundary, increment of two-phase discharge coefficient, intact loop pump coastdown behavior, and some interesting studies regarding break flow etc., are also performed in this report.

2. TEST FACILITY AND TRANSIENT DESCRIPTIONS

2.1 Test Facility

Semiscale Mod-2A is a scaled model representation of a four-loop pressurized water reactor (PWR) nuclear generating plant, with a fluid volume of about 1/1705 of a PWR. The scaling philosophy followed in the design of the Mod-2A system (modified volume scaling) preserves most of the important first-order effects thought to be important during loss-of-coolant transient.

The system incorporates the major components of a PWR, including steam generators, vessel, pumps, pressurizer, and loop piping as shown in Figure 2.1. The loop piping consists of an intact loop and a broken loop, the former representing three "unaffected loops" of a four-loop PWR, the latter simulating the single "affected loop" in which a break is postulated to occur in a PWR. Each loop includes an active steam generator and coolant pump. The pressurizer is connected to the intact loop hot leg, and the pressure suppression header and tank are connected via the rupture disk assembly to the broken loop cold leg. Emergency core coolant (ECC) from an accumulator and high or low pressure (low pressure only for S-IB-3) injection system pumps are routed to the loop cold leg (intact loop only for S-IB-3). Feedwater is supplied to the two steam generators from a heated tank and the steam routed through control valves to the atmosphere, i.e., an open loop secondary coolant system is used.

For test S-IB-3, the vessel is multi-sectional consisting of an upper head, upper plenum, heated core region, lower plenum, and an external inlet annulus and downcomer pipe. The core simulator consists of a 5×5 array of electrically heated, 3.66-m-long, 1.072-cm-outside-diameter rods which simulate the fuel rods in a 15×15 type PWR core. Equal power was applied to the 23 heated rods as shown in

Figure 2.2; and two of the rods were unpowered. The peak to average power ratio is 1.55 and the total design power per rod is 116 kW at 380 Vdc. The maximum linear heat generation rate per rod is 36.8 kW/m and the maximum rod design temperature is 1275 K. The number of turns per inch of the electrical heating coil is varied along the rod length to give the staircase approximation of a cosine axial heat flux shape.

The intermediate break S-IB-3 test involved a break at the horizontal mid-plane of the cold leg pipe, between the broken loop pump and downcomer inlet, and at a position relative to that pipe simulating a break in its wall. This was accomplished by utilizing a communicative break assembly, with break oriffice or break nozzle and rupture disk assembly connected to the pressure suppression system. The converging diverging nozzle with throat diameter 0.78867 cm was sized to preserve the ratio of break area to system volume for the LOBI B-R1M test.

Conditions in the system were monitored by an extensive network of metal and fluid thermocouples and differential pressure transducers. In the affected (broken loop) steam generator, both tubes were extensively instrumented with both primary- and secondary- side fluid thermocouples and several primary-side differential pressure transducers. Average fluid density was measured in the loops and vessel with gamma densitometers while volumetric flow was measured with turbine meters. Condensing systems and catch tanks were included to measure effluent from the steam generator atmospheric dump valves and the break assembly (break flow).

2.2 Transient Descriptions [3]

Test S-IB-3 was performed in the Semiscale Mod-2A facility. The experiment simulated intermediate break loss-of-coolant accident involving 21.7% break area of the cold leg in a PWR with inverted top hat, non-UHI upper internals. This test duplicated, as closely as possible, a test of LOBI B-R1M conducted in March of 1981 in the Loop Blowdown Investigation Facility, which was a 25% break test in the LOBI facility in Ispra, Italy.

The test was conducted from initial conditions of 15.5 MPa and 563 K (average of both loops cold leg temperature at downcomer inlet) with a simulated break size (21.7%) of the broken loop cold leg piping at an initial core power level of 1.44 MW, and an initial core inlet flow rate of 7-8 kg/s adjusted to permit achievement of core 33 K temperature rise. After initiation of blowdown, the exact timing of the occurrence of the controlled events can be found in Table 2.1. Immediately after rupture of the pressure boundary, the core power and pump speeds began following controlled transients. Shortly after the pressurizer pressure reached 12.6 MPa, the broken loop steam generator steam valve was closed at 5 s. This was followed by closure of the broken and intact loop steam generator feedwater valves at 2.5 s and 30 s, respectively. Approximately 163 s after the depressurization of the primary system continued, and the accumulator actuation pressure (2.7 MPa) was reached, the accumulator flow was initiated. Upon reaching a primary system pressure of 1 MPa, the intact loop steam generator steam valve was closed, the power to the broken loop pump was tripped and Low-pressure Injection System (LPIS) flow was initiated shortly thereafter. The test were terminated upon reaching the end of available data acquisition space.

The depressurization of the primary system caused the vessel upper plenum fluid to reach saturation conditions within 1 to 2 s after rupture of the pressure boundary. As the vessel coolant was displaced from the core, the heater rod temperatures began to increase. Before the blowdown ends at the system pressure of 1 MPa, the vessel lower plenum was refilled and reflooding of the core was initiated. Thereafter, the reflooding of the core associated with the flow of LPIS liquid led to the eventual quench of the core at 350 s.

3. CODE AND MODEL DESCRIPTIONS

3.1 Computer Code

The RELAP5/MOD2 Cycle 36.04 computer code is used to simulate the transient thermal-hydraulic response of the semiscale Mod-2A system during experiment S-IB-3. RELAP5/MOD2 is based on an one-dimensional, two fluid, six-equation, thermal non-equilibrium non-homogeneous hydrodynamic model and includes thermal-hydraulic and component models, to describe the processes that occur during the blowdown of a PWR. This computer code is developed at the INEL for the U.S. Nuclear Regulatory Commission (USNRC). Specific application of the code to the experiment S-IB-3 simulation is discussed in the following sections.

3.2 Model Descriptions [4]

The RELAP5/MOD2 model of the Semiscale S-IB-3 simulation is shown in Figure 3.1. The nodalization used in this study is based on the nodalization presented in Reference 5. This model consists of 142 hydraulic volumes, 139 junctions and 167 heat structures to describe the Semiscale Mod-2A system including reactor vessel, broken loop, intact loop, pressurizer, steam generator, and ECCS. Brief descriptions of the RELAP5/MOD2 model of the Semiscale Mod-2A facility are presented as follows.

3.2.1 Reactor Vessel

The reactor core is modelled by six control volumes of equal length covering the active length of the heated core (3.66m). The twelve-step axial power profile is modelled within these six volumes (two steps per volume). Equal power was applied to the 23 heated rods; two of the rods were unpowered. In modelling of the reactor vessel, a total of 36 hydraulic volumes and 42 junctions were used to represent the vessel hydraulic space.

The downcomer inlet annulus are branch components which connect the piping cold legs to the downcomer and upper head bypass line. In Semiscale, the annular downcomer of a PWR vessel is replaced with an external pipe to permit extensive instrumenting of both the core and downcomer regions. The downcomer control volume boundaries occur at the same elevations as control volumes in the vessel for ease in liquid level tracking. The lower plenum and upper plenum are divided into several control volumes and simulated by branch or single-volume components in the RELAP5/MOD2 model. Flow resistance and percent bypass flow through the upper head bypass line is adjusted at the junction between the two control volumes of component.

A total of 44 heat structures representing the flow ducts and reactor vessel are modelled to describe the appropriate heat transfer between different flow channels, and ambient. Heat transfer between physical structures and primary coolant is modelled by defining the appropriate geometry and boundary conditions in RELAP5/MOD2 heat structure components. The environmental heat loss components are bounded by a primary coolant volume and an ambient (air) volume. Besides, honeycomb and steam gap insulators were also appropriately modelled.

3.2.2 Broken Loop

Modelling of the broken loop deserves careful attention since the accuracy of the break flow calculation is of major importance in the predictions of the system responses. In this study, the broken loops (hot leg and cold leg) are simulated by a series of branch and pipe components, and the break junction is simulated by a trip valve with $4.885 \times 10^{-5} m^2$ flow area of a converging/diverging nozzle. Downstream of the break junction, the broken loops are connected to time-dependent volume where the pressure boundary condition of the blowdown suppression tank is provided. Flow areas and flow resistances of the junctions along the broken loops are specified to simulate the pump suction, steam generator, and broken loop piping. Choked-flow model is applied to the junctions wherever the junction flow area is restricted.

Determination of the break geometry is also of importance in accurately calculating the break flow. A discharge coefficient is required to account for multi-dimensional effects at the break that cannot be calculated using one-dimensional computer codes. A recommended discharge coefficient of 1.0 and 0.84 are applied in the broken loop cold leg break for subcooled and saturated choked flow, respectively.

3.2.3 Intact Loop

In modelling of the intact loops, the hot leg, steam generator, primary coolant pump (PCP), and cold leg are simulated by branch, single-volume, pipe, and pump components. Control volumes are divided at interfaces of flow area change, branching locations or instrument locations. Pump characteristics (including head curves and torque curves) are provided for single-phase homologous conditions. A set of two-phase multiplier and difference curves are input, in conjunction with the single-phase curves, to calculate the two-phase pump performance. Two major branch locations are the pressurizer in the hot leg and ECC injection in the cold leg.

3.2.4 Pressurizer

In modelling of the pressurizer attached with the intact loop hot leg, five control volumes were used to model the pressurizer vessel. Five control volumes and related single-junction are modelled in the pressurizer surge line nodalization. A total pressurizer liquid mass (including surge line) of 10.1 kg is modelled with the liquid/vapor interface occurring at 85 in. above the hot leg centerline.

3.2.5 Steam Generator

The hydrodynamic model of both the intact and broken loop steam generators is very similar. It was developed to adequately represent the important geometric characteristics of the primary and secondary coolant flow paths. The steam generator primary side is represented by two single-volume components in modelling of the inlet and outlet plena, and an eight-section pipe (with four sections direct vertically upward and four sections direct downward) in simulating the steam generator U-tubes. In the secondary side, it is represented by a series of feedwater system, downcomer, boiler, separator, and riser simulations based on various components available in the RELAP5/MOD2 code. In modelling of the separator, the steam inlet and vapor outlet junction orientations, which can be freely defined in RELAP5/MOD1, were restricted according to the input requirement of RELAP5/MOD2. At the exit of the secondary side, a time-dependent volume is used to provide the pressure boundary conditions of the air-cooled condenser. Cylindrical heat structures representing the tubes are added to permit the heat exchange between the primary and the secondary sides of the steam generator. Additional heat structures are also used to simulate the heat loss to the environment.

3.2.6 ECCS

The emergency core cooling systems, including the accumulator and LPIS are simulated in the RELAP5/MOD2 model. The accumulator is represented as a time-dependent volume. It is actuated at a given time rather than by a specified low pressure of 2.7 MPa. The LPIS is modelled by a time-dependent junction which is activated by a low system pressure of 1 MPa. The LPIS is operated by centrifugal pump, which is controlled to inject coolant at a pre-programmed rate.

In addition to the system modelling, adequate control variables including fuel temperature, collapsed water level, pressure, and volumetric flow rate etc., are generated so that direct comparison with test data could be made. All input data are listed in the Appendix.

3.3 Initialization Process

The RELAP5/MOD2 model of the Semiscale S-IB-3 experiment simulation is initialized to a steady-state corresponding to the test initial conditions before it is utilized for the intermediate break LOCA transient analysis. During initialization, the following processes are taken:

(1) Through reviewing the available documents in hand, no information about feedwater, break flow rate, and steam valve open rate have been provided. Besides, the measured hot leg temperature in broken loop presented in Table 5 (596.9 K) and Appendix (589.6 K) of Report No. EGG-SEMI-6013[6] are not consistent. Consequently, an effort was initiated to simulate feedwater flow rate and steam valve open rate using control system, which should be adjusted to meet the required energy balance and 1:3 loop steam flow ratio criteria. The measured break flow rate is calculated from the summation of

the product of the volumetric flow rate and density of control volume C362 and C363, which is adjacent to break junction near the pump side and vessel side, respectively. The measured hot leg temperature in broken loop is calculated from the mean value of the above two temperatures.

(2) In broken loop pump behavior study according to the primary coolant pump rated parameters in Ref. 4, it is difficult to simulate the desired rated pump flow rate and pump head if initial rated pump speed is used in RELAP5/MOD2 model. To retrieve this situation, utilizing pump flow rate in the model was attempted to calculate a reasonable rated pump speed through using control system methodology.

(3) By inspecting the measured and calculated differential pressure and liquid level in both loops and vessel during initialization process, many discrepancies were found between them. It is believed that the measured data offered in the document (Ref. 1) doesn't represent the actual pressure drop. The actual pressure drop can be obtained by taking into account the effect of gravitational pressure drop associated with the reference leg between them. Thus, the measured data need to be modified before they are compared with the calculated data. The revised differential pressure and liquid level are shown in Tables 3.1~3.3 for intact loop, broken loop and pressure vessel, respectively.

(4) After revising the differential pressure and liquid level, and put them into the initialization model, the forward and reverse form loss coefficients (K factor) were adjusted in order to reach a steady state which is close to the test initial condition during initialization process. The liquid level of the steam generator

secondary side in intact loop (measured data is 732.7 cm) and broken loop (measured data is 713.8 cm) are not consistent with the differential pressure measured at the test's initial condition. Because there is no liquid level data during the transient, the differential pressure data is selected. Consequently, the liquid level of intact and broken loop were revised into 1050.0 cm and 982.0 cm, respectively.

Five hundred seconds of steady-state calculation was proceeded. It was achieved by using some initialization techniques including pressurizer pressure control, S/G steam valve and feed valve closure, pump coastdown, and ECCS actuation control, etc. The calculated initial conditions of the RELAP5/MOD2 model obtained by the initialization process are listed in Table 3.4 in comparison with the specified and measured data. The comparison shows minor differences between measured and calculated results, however, they almost matched quite well and were acceptable.

4. RESULTS AND DISCUSSIONS

In this section, analytical results of the experimental simulation of the thermal-hydraulic responses of S-IB-3 test are assessed through comparison of test data. Besides, effects of several different modellings are also independently investigated as sensitivity studies to compare with base case results and test data.

4.1 Base Case Analysis

4.1.1 General System Response

Test results of approximately 320 seconds of transient time were used to assess the RELAP5/MOD2 code. Following the test procedure in S-IB-3 simulation, the transient calculation initiated by the opening of break valves, has the following major calculated event timings as compared to the test data listed in Table 4.1.

Apparently, there is no significant difference between the calculated transient scenario and the test result during the first 30 seconds except that the upper plenum fluid saturation is delayed by about 14 seconds. However, the major phenomena, such as the formation of pump suction liquid seals, core heat up and refill/reflood phenomena occurrence, are not properly predicted by RELAP5/MOD2.

4.1.2 Reactor Vessel and Loop Hydraulic Response

The break was opened at 0 s and the primary system began a linear depressurization due to steam volume expansion in the pressurizer that was supplying liquid to the loops to compensate for inventory depletion through the break. Figure 4.1 and 4.2 shows the calculated upper plenum and pressurizer pressure, respectively, compared to the test data. It is illustrated that the system pressure response is well predicted and an extremely rapid system depressurization occurs during the first 15 seconds, then decreases gradually thereafter. Figure 4.1 shows that both the calculated and measured pressure drop from 15.5 MPa to 12 MPa immediately after the test initiation. As the pressure decreases, the temperature of the liquid in the vessel reaches saturation and flashing phenomenon occurs. Consequently, the depressurization rate is reduced by the voiding in the vessel as shown in both the calculated result and test data. At the first 130 seconds, the calculated pressure closely follows the test data, while it is slightly overpredicted thereafter by RELAP5/MOD2. The fluid reaches saturation condition and starts to flash by 3.6 seconds in the broken loop hot leg, and shortly afterward by 4.1 seconds in the intact loop hot leg, as shown in Figure 4.3. Figure 4.4 also compares the cold leg temperatures of both loops and saturation and shows that nearly all of the system became saturated by 15 to 20 seconds which is well approached to the experimental results. According to the calculated pressurizer water level response shown in Figure 4.5, the pressurizer empty occurs at 10 s after the test initiation is found to be delayed by 3 seconds in comparison with the test data.

By investigating the overall experimental phenomena, system behavior during the first 130 s of the transient was characterized by continuous voiding from the upper elevations going downward. The phenomena of interest include gravity drain, liquid holdup in the steam generator tubes and pump suction upflow legs due to steam flow, and the formation of liquid seals in the pump suction piping. The calculated differential pressure and liquid level of the broken loop pump suction upflow leg are presented in Figure 4.6 and 4.7, respectively. It shows that RELAP5/MOD2 underpredicts the formation of loop liquid seals from 10 to 25 seconds, whereas it fails to simulate the liquid seal clearance at 25 second. According to the experiment, hydraulic seals are formed in the pump suction loop U-bend piping as a result of the slow gravity dominated depletion of primary coolant inventory. The liquid seals impede the flow of vapor (generated in the core) through the coolant loop piping thus preventing steam venting from the break and this in turn can induce a differential pressure between the reactor vessel and downcomer. As a result of failing to simulate the liquid seal clearance at 25 second, the calculated result is overpredicted by RELAP5/MOD2 during the period of 30 s to 150 s as shown in Figure 4.6. Thereafter, the restriction of vapor flow around the loops is reduced due to the fact that the pump suction liquid seal clears. Figure 4.8 represents the volumetric flow rate in broken loop cold leg. At 25 second, the measured volumetric flow rate increases as the result of vapor flow rate associated with the liquid seal clearance increased. The fact that this phenomena can't be calculated in the simulation provides another evidence which shows that the liquid seal clearance is not properly simulated.

Figure 4.9 represents the calculated mass flow rate from the upper head to the guide tube and shows that no reversed flow occurs in the guide tube while it is observed in the experiment. Since in the calculation, there is no liquid seals that formed in the pump suction legs, the vapor flow around the loops will not be impeded and the vapor in the vessel will not be forced to flow up the guide tube into the upper head. On the other hand, the flow calculated in bypass line reverses at about 14.7 s as shown in Figure 4.10 and starts to flow down the bypass line to the downcomer inlet annulus. The occurrence timing is well predicted as compared to the experimental results. After initiation of blowdown, the flow in the broken loop is being restricted and actually stagnated at about 11.6 s as presented in Figure 4.11. This restricted flow caused the liquid which was being held up in the upflow leg of the steam generator tubes to fall back down the tubes and forced the flow in the broken loop hot leg to reverse.

The broken loop steam generator steam valve was essentially isolated prior to and throughout the blowdown, while the intact loop steam generator steam valve was specified to be left open at their steady state operating position until the system pressure reached 1 MPa, then closed. Thus, this effective isolation of the broken loop steam generator caused the secondary pressure in the broken loop steam generator to remain very near to the initial secondary pressure and consequently the broken loop steam generator became a heat source earlier. In Figure 4.12, it is noted that the time by which the broken loop steam generator becomes a heat source is about 12 s earlier than the test result of 22 s. It is suspected that the condition of broken loop steam generator secondary side (whether it is heat source or heat sink) has a major effect on the prediction of the broken loop hot leg flow reversal. Further discussion will be made in the sensitivity study later. In contrast, the intact loop steam generator became a heat source arisen by 300 s which occurred much later than the test result. This evidence is shown in Figure 4.12.

In Figure 4.13, it is seen that the calculated break flow transition from subcooled to saturated condition occurs at 10 s. That is, single-phase blowdown ends and two-phase blowdown begins at the cold leg break 10 s after the experiment initiation. The comparison between the calculated break mass flow rate and test one is shown in Figure 4.14. It indicates that the flow is characterized by a large peak, followed by a rapid decrease as the homogeneous flow conditions at the break changed quickly from single–phase to two–phase. In general, there is a large drop in critical velocity when the flow changes from a subcooled state to a two–phase state. This sudden change often leads to unrealistic velocity oscillation and unstable flow regime. Therefore, an underrelaxation scheme is implemented in RELAP5/MOD2. The large dip at 10 second indicates that the underrelaxation scheme can be further improved. It is also seen that the subcooled break flow rate is underpredicted during the first 30 s, while a better agreement presents during the blowdown period thereafter. It is shown in Figure 4.15 that this underpredicted result consequently leads to less integrated break flow during the blowdown period in comparison with the experimental result. Additionally, the broken loop cold leg mass flow rate and flow regime adjacent to break junction near pump side and vessel side, respectively, are shown in Figures 4.16 through 4.18. The break junction mass flow rate near pump side is well predicted, however, slightly overpredicted near vessel side. The flow regime adjacent to break junction retains the bubbly flow during single–phase blowdown, but an unstable flow regime transition among the bubbly, slug and horizontal stratified flow during two–phase blowdown.

As discussed earlier, the upper head discharged liquid through the bypass line into the downcomer inlet annulus because of the reversed flow in the bypass line. The flow in the bypass line continued to be reversed from about 15 s until the end of the test (as shown in Fig. 4.10) with transition from liquid to vapor flow at about 60 s (earlier than experimental data) when the top of the bypass line uncovered, as shown in Figure 4.19. It is also noted in both Figures 4.19 and 4.20 that in the calculation the upper head was not completely drained of fluid. The water inventory in the upper head decreased slowly after the transition from liquid to vapor flow till the end of the test. It is different from the test result that the upper head was completely drained of fluid by about 140 s as shown in Figure 4.19.

Figure 4.21 and 4.22 presents the differential pressure in intact loop pump upflow and downflow leg, respectively, which indicates that no liquid seals formation and clearance occurred during the blowdown period. It can also be seen from Figure 4.23 that liquid level in intact loop pump suction upflow retains a monotonous decrease, while no abrupt change in liquid level occurs during the clearout period of liquid seals from 89 to 160 s, which is evidently different from the experimental results. Thus, it is concluded that RELAP5/MOD2 fails to predict the liquid seals phenomena in intact loop pump suction. Furthermore, Figures 4.24 through 4.26 show the mass flow rates of intact loop hot leg, cold leg and vessel downcomer, respectively. It illustrates that intact loop acts as a "liquid slug amplifier" since the liquid slug calculated around 25 second is amplified along the loop downstream due to the condensation resulted from intact loop steam generator cooling and liquid-vapor mixing in the piping. Since this behavior is not observed in the test, it may partially explain the overprediction of intact loop flow rate during the first 150 s. The measured pressurizer volumetric flow rate in Figure 4.27 is shown to rise sharply at 7 s, characteristic of an abrupt transition from liquid to two-phase flow. The occurrence timing and the magnitude of peak flow rate are well predicted during the transition, while the slope change in a drastic reduction is steeper than the test data. In Figure 4.28, it is also noted that the calculated pressurizer surge line mass flow empty occurred at 10 s after the test initiation.

4.1.3 ECC and Core Thermal Response

As described earlier, the calculated accumulator liquid as shown in Figure 4.29 starts flowing into the intact loop cold leg at 163 seconds. It is virtually the same with the test results due to the fact that the accumulator is modelled by a time-dependent volume instead of pressure controlled actuation at 2.7 MPa.

According to the experimental phenomena, because of the condensation of steam at the injection point, a region of lower pressure was formed at the injection point, causing steam to flow up the external, single pipe downcomer. It can be seen in both the calculated and measured data of Figure 4.30. Also, owing to the pressure differential between the vessel and the break, the steam flow up the downcomer was of sufficient magnitude to force the ECC liquid around the downcomer inlet annulus and to the break (as shown in Figure 4.31), bypassing the core between 163 and 190 s. With the blowdown nearly over, the large driving force for flow up the downcomer diminished and the ECC was able to penetrate the downcomer and flow into the core [7]. However, Figure 4.29 also indicates that there is no LPIS injection during the blowdown transient. Since the LPIS pump is specified to inject liquid into the intact loop when the pressurizer pressure reaches 1 MPa, while the system pressure is always above 1 MPa throughout the blowdown.

In general, the accumulator water, the formation of pump suction liquid seals, and the core power are the major factors affecting the core thermal response during blowdown [8]. Before we discuss the calculated core thermal responses of S-IB-3 test, the experimental temperature excursions are described below. A composite core temperature trace for this test consists of a decrease in temperature corresponding to the saturation temperature in the core, followed by a rapid increase in temperature starting at about 50 seconds, to a peak temperature in the range of 740 K, and then followed by another, slower, decrease until the core is rewet at about 133 seconds, when a rapid decrease occurs. This is followed by a reduction in the cooling rate until the temperature levels out and starts to increase again at about 190 seconds. The temperature then peaks, in the range of 630 K, and starts to gradually decrease until the rod is rewet again at about 280 seconds. From this point on the temperature drops close to and follows the saturation temperature until the end of the test.

As a matter of fact, the Semiscale heater rods experienced two temperature excursions during test S–IB–3. The first excursion was due to a severe level depression in the vessel caused by the intact loop liquid seal; the second was due to a loss of steam cooling caused by the boiloff of core coolant to an elevation below the bottom of the heated length. However, Figure 4.32 indicates that the RELAP5/MOD2 fails to predict any of the temperature excursions. The improper simulation of pump suction liquid seal formation and clearout phenomena could be considered as the major reason. Additionally, the other cause of disagreement that RELAP5/MOD2 predicts no heatup is suspected due to the fact that the calculated core coolant inventory is essentially homogeneous whereas core liquid was highly stratified in the experiment[7]; this is probably also responsible for the overprediction of core collapsed liquid level depression as shown in Figure 4.33.

From immediately after rupture until 2 seconds, there was a rapid rise in void fraction in the upper half of the core. Figure 4.34 shows that both the calculated and test data experience this phenomenon. This void formation was caused by boiling due to the release of stored energy from the heater rods and to decay heat transferred to the fluid. When the stored energy in the rod was reduced, some of the voids collapsed in the period from 2 to 3 seconds in the high power region of the core as shown in Figure 4.34. However, according to the experiment after liquid formed seals in the pump suctions, the steam generated in the core was restricted from flowing freely around the loops to the break. Lack of a sufficient relief path for the steam resulted in the depression of the liquid level in the vessel and pump suction upflow legs. The lowered vessel level allowed the void fraction in the entire core to get high enough to cause dryout on all of the heater rods. In contrast, RELAP5/MOD2 cannot give the prediction of the liquid formed seals in the pump suctions, therefore, an unrestricted steam generated in the core can flow freely around the loops to the break, this leads to impediment of heatup. The overpredicted density in vessel during the blowdown as shown in Figure 4.34 can also be accounted for this result.

4.2 Sensitivity Studies

In addition to the base case calculation, sensitivity studies are performed to explore the effects of input modelling and code options. Scenario study and simple model modification, such as the effect of steam generator secondary side pressure boundary, intact loop pump coastdown behavior, and some interesting studies regarding break flow, etc., are also analyzed to elucidate the code capability. The identifications of the cases performed in this study are listed in Table 4.2 with the conditions which are different from that of the base case. The purpose and the results of the sensitivity studies are discussed in the following sections.

4.2.1 PRESSB This case study is used to identify the influences of primary coolant system thermal-hydraulic response predictions resulted from providing pressure boundaries in steam generator secondary sides. The calculated system pressure and break mass flow rate in this case as shown in Figure 4.35 and 4.36, respectively, indicates that results are similar with the base case except the break mass flow rate slightly overpredicts during 70 s to 110 s. In Figure 4.37, calculated cladding temperature in PRESSB case is shown. It is seen that there is still no heatup phenomena in the cladding temperature prediction resulted from no liquid seals formation in the pump suction. Also, there is no significant difference in vessel response, except that less liquid inventory in vessel is seen during the period from 70 s to 110 s because of excess break flow as discussed above. Figure 4.38 and 4.39 shows the calculated density and liquid level in vessel, respectively, and illustrate the above results. Besides, loop flow responses are worthily mentioned. Figure 4.40 and 4.41 presents the intact loop and broken loop hot leg mass flow rate, respectively, and indicates that the calculated loop flow in this case give a better result than that of the base case. In the mean time, the occurrence timing of the broken loop hot leg flow reversal achieves a good agreement in comparison with the test data. As it is discussed in section 4.1.2, it is suspected that the condition in broken loop steam generator secondary side has a major effect on the prediction of broken loop hot leg flow reversal. The well match timing of broken loop flow reversal in PRESSB case confirms this hypothesis. As a whole, it is concluded that providing pressure boundaries in steam generator secondary sides can only give limited influence of primary coolant system thermal-hydraulic responses.

4.2.2 PB – IRFL In this case study, we are interested in impeding the reversed flow both from control volume 301 to 163 and from control volume 164 to 163 on the basis of the pressure boundary study above, to see if the initial liquid slug in the liquid slug amplification phenomena can be eliminated. After adjusting the junction reverse form loss coefficient to almost infinite, it is seen that there is negligible influence in broken loop flow rate as shown in Figure 4.42. Conversely, significant differences are shown in Figure 4.43 and 4.44, the intact loop flow, which results in a better improvement in comparison with the unreasonable overpredicted flow in the base case. Better improvement is also achieved in vessel downcomer mass flow as shown in Figure 4.45. It is concluded that impeding the reversed flow in both broken loop hot leg (C163–C301) and upper plenum (C163–

C164) can only improve the intact loop mass flow, however, there is negligible influence to the system response.

4.2.3 PUMPCD The purpose of this case study illustrates the effect of intact loop pump on intact loop flow rate and core heat up. In the PUMPCD case, intact loop pump speed is adjusted to coast to a stop from 20 s to the end of the test. Minor difference in the calculated break mass flow rate is seen from Figure 4.46 and indicates negligible effect resulted from pump coastdown actuation. The same result can be obtained in heater rod cladding temperature as shown in Figure 4.47. With regard to the influence of intact loop flow, similar results as PB–IRFL case are obtained from Figure 4.48 and 4.49. A better improvement in intact loop flow prediction is appraisable in this case study.

4.2.4 CROSFJ It is recommended that modelling of loop–pipe is connected to the reactor vessel should use the option for cross–flow connections [9]. However, normal junction is specified in RELAP5/MOD2 input as loop–pipe is connected to the reactor vessel in the base case study. Thus, a sensitivity study is needed to investigate the possible impacts of different junction types on the system response. According to the results from Figure 4.50 to 4.53, the hot leg and cold leg junction mass flow rate of both loops indicates that there is no significant influence using either normal or cross–flow junction.

4.2.5 BREAKJ It is interesting to give a sensitivity study in investigating the effects of changing direction of break junction from C362 to C363. It is seen from Figure 4.54 that the calculated break mass flow rate in single–phase blowdown almost approach that of the base case data, whereas a larger difference is presented during the two–phase blowdown period. It is due to the fact that the volume void fraction of control volumes 362 and 363 in BREAKJ case is different from that of the base case. Also, by looking at the broken loop junction mass flow rates from Figure 4.55 through 4.57, it is concluded that changing the direction of break junction cannot improve the prediction of either break mass flow rate or system thermal-hydraulic responses in any way.

4.2.6 <u>**TDC – 1.0**</u> The input of discharge coefficients to RELAP5/MOD2 modifies the flow area of the simulated break by a factor equal to the coefficient. Thus, discharge coefficients other than 1.0 are n representative of the true break area but rather are indicative of possible deficiencies in the break-flow models [9]. A discharge coefficient less than 1.0, however, can be justified as a method of compensating for two-dimensional effect, such as vena contracta, that are not simulated by the one-dimensional RELAP5/MOD2 code. Therefore a two-phase discharge coefficient of 0.84 is recommended as the best selection in the break flow model. In the TDC-1.0 case, the cold leg break two-phase discharge coefficient is increased from 0.84 in the base case to 1.0.

It is seen from Figure 4.58 that the calculated break mass flow rate increases in the two-phase blowdown period by this input change, especially with overpredicted result during 50 s to 110 s from the base case. The other parameters, including the system pressure and cladding temperature responses, shown in Figure 4.59 and 4.60, respectively, are both underpredicted due to the increased break mass flow rate. Additionally, the calculated liquid level and density in vessel as shown in Figure 4.61 and 4.62, respectively, illustrate a better agreement with the base case.

Incidentally, in modelling the junction flag option for ECC injection point, a computational failure occurred with flag 00120 assumption, however, this was removed by using flag 20121 instead. The major differences between the flag options are the selection of centrally located or downward oriented junction and another selection of normal or cross-flow junction.

5. RUN STATISTICS

The computer run statistics of the RELAP5/MOD2 simulations are summarized in Table 5.1. The simulations are conducted on a FACOM M200 computer which is compatible to the IBM MVS system.

6. CONCLUSIONS

In this study, the intermediate break Semiscale test S-IB-3 is analyzed by the RELAP5/MOD2 model. The test simulations begin with break initiation and subsequent blowdown, and continue through primary fluid saturation, loop liquid seals formation and clearout, two temperature excursions, refill/reflood phenomena, and terminate with core quench. Generally speaking, the primary system depressurization and break flow rate are well predicted by the RELAP5/MOD2 model. However, RELAP5/MOD2 fails to predict the pump suction liquid seal clearing and the observed temperature excursions phenomena. Through extensive comparison with measurement and important sensitivity studies elaborated in the previous section, noticed differences and major findings are described in the following:

(1) The calculated system pressure is well predicted and an extremely rapid system depressurization occurs during the first few seconds after the test initiation. All of the fluid in the system nearly becomes saturated by 15 to 20

seconds which is well matched with the experimental results, while a significant difference is calculated in estimating the occurrence timing of the upper plenum saturation.

(2) The loss of primary coolant is predominantly a gravity–dominated drain during which the liquid located in the pump suctions would form hydraulic "seals" [10,11]. These loop seals would impede the flow of steam from passing through the hot legs to the break. One significant consequence during loop seal formation is that the break flow will be primarily liquid; thus, once the loop seal clears, less coolant will be available to mitigate any core heatup which could occur during the boiloff phase. Unfortunately, according to the base case results, it is concluded that RELAP5/MOD2 fails to predict the pump suction liquid seal formation and clearout phenomena. This result indicates a possible deficiency in the interphase drag model and/or flow stratification model of the present RELAP5/MOD2 code.

(3) It is suspected that the condition of broken loop steam generator secondary side (whether it is heat source or heat sink) has a major effect on the prediction of the broken loop hot leg flow reversal. In addition, the occurrence timing prediction of the steam generator secondary side becoming energy source, in comparison with the test data gives an acceptable result in broken loop, whereas an extreme delay in intact loop. The major reason of its postponement may be due to the fact that system depressurization during the blowdown can hardly reach 1 MPa, which is specified as the pressure of the intact loop steam generator steam valve isolation.

(4) RELAP5/MOD2 barely gives an acceptable result in the prediction of the cold leg break flow during the first 30 seconds, while a better agreement presents during the blowdown period thereafter. As a matter of fact, subcooled break flow rate is evidently underpredicted while saturated break flow rate is slightly underestimated. The underpredicted break flow rate results in the excessive water inventory retained in the vessel. In the sensitivity study, the two-phase discharge coefficient of 1.0 (instead of 0.84 in the base case) is used in the broken loop cold leg, it is found that the modified break flow rate is increased in the two-phase blowdown period by this input change, especially with overpredicted result during 50 s to 110 s. A discharge coefficient less than 1.0, however, can be justified as a method of compensating for two-dimensional effect, such as vena contracta, that are not simulated by the one-dimensional RELAP5/MOD2 code. Therefore a two-phase discharge coefficient of 0.84 is recommended as the best selection in the break flow model.

(5) By investigating the intact loop mass flow rate, a "liquid slug amplification phenomena" is calculated and excessive liquid is predicted in intact loop. However, it is not observed in the experiment. In the sensitivity study of PB-IRFL and PUMPCD cases, either impeding the reversed flow in both broken loop hot leg and upper plenum, or adjusting intact loop pump speed coastdown to a stop at 20 s, gives a better agreement in the prediction of intact loop mass flow rate. However, both of them have negligible influence to the system thermal-hydraulic response.

(6) Two observed temperature excursions of heater rod are not predicted. The improper simulation of pump suction liquid seal formation and clearout phe-

nomena could be the major reason. Besides, the other cause of disagreement that RELAP5/MOD2 predicts no heatup is suspected due to the fact that the calculated core coolant inventory is essentially homogeneous whereas core liquid was highly stratified in the experiment. Thus, it indicates that the loop fluid seal and vertical stratified flow modelling employed in this study is quite important in an intermediate break LOCA analyses.

(7) In the sensitivity studies, the influence of providing pressure boundaries to the steam generator secondary sides was shown to be of limited significance relative to the primary coolant system response. Besides, modelling of loop-pipe connections to the reactor vessel with the option of either normal or cross-flow connections, may result in minor difference of overall system response. With regard to the change of the connection direction of break junction, it is found that a larger difference is presented during the two-phase blowdown period because of the different upstream volume void fraction prediction.

(8) Finally, in modelling the junction flag option for ECC injection point, a computational failure occurred with flag 00120 assumption, however, it was removed by using flag 20121 instead. The major differences between the flag options are the selection of centrally located or downward oriented junction and another selection of normal or cross-flow junction.

Table 2.1

Chronology of Events for The Intermediate Break S-IB-3 Test

Events	Time, Seconds
Rupture initiated; Core power, pump speed transients initiated	0
Upper plenum fluid saturates	1.5
Broken loop steam generator feedwater valve closed	2.5
Intact loop steam generator feedwater valve closed	30
First temperature excursion starts	50
Accumulator flow starts	163
Lower plenum refilled; Reflood starts	190
Intact loop steam generator steam valve closed	240
Blowdown ends; LPIS flow starts; Power to broken loop pump tripped	240
Core quenched	350
Data acquisition system shut down	531

Table 3.1

Revised Differential Pressure and Liquid Level in Intact Loop

Measurement ID	ΔP, test (kPa)	Volume or Junction	Elevation Difference (cm)	ΔP, corrected (kPa)
D-V13A*I1	7.8	16301/20102	33.0	11.03
DPI*1*3C	5.05	20102/20201	0.0	5.05
DPI*3C*5	1.26	20201/20301	58.0	6.94
DPI*5*9	117.0	20301/24002	39.0	120.82
DPI*9*14	15.1	24002/24005	-380.0	-22.14
DPI*14*18	-2.51	24005/24008	257.0	22.68
DPI*21*18	219.2	26102/24008	25.0	-216.55
DPI*21*22	1.06	26102/26201	0.0	1.06
D*I22+VD29	6.04	26201/10101	10.0	7.02
LIS1117+50	50.79	60304/60201	-1067.0	-53.78

Table 3.2

Revised Differential Pressure and Liquid Level in Broken Loop

Measurement ID	ΔP, test (kPa)	Volume or Junction	Elevation Difference (cm)	ΔP, corrected (kPa)
D-V13A*50	6.85	16301/30102	33.0	11.08
DB*50*55	5.28	30102/30103	0.0	5.28
DB*55*57	0.63	30103/30104	61.0	6.61
DPB*57*62	112.96	30104/34002	9.0	113.84
DPB*62*65	15.83	34002/34005	-377.0	-21.12
DPB*65*73	1.10	34005/34007	233.0	23.93
DB*74*73	-254.74	36101/34007	58.0	-249.06
DB*74*76U	8.16	36101/36201	0.0	8.16
DB*76U*79	4.16	36201/36302	0.0	4.16
D*B79+VD29	0.15	36302/10101	25.0	2.60
LBS1117+50	49.39	70304/70201	-1067.0	-55.18

Table 3.3

Revised Differential Pressure and Liquid Level in Vessel

Measurement ID	ΔP, test (kPa)	Volume or Junction	Elevation Difference (cm)	ΔP, corrected (kPa)
LVD+29-578	35.47	10101/12001	-607.0	-23.99
LVD+29-170	15.76	10101/11003	-199.0	-3.742
LVD170-435	17.27	11003/11008	-265.0	-8.70
LVD435-578	4.76	11008/12001	-143.0	-9.25
LV+421-578	-38.23	19401/12001	-999.0	-136.13
LV+421-13M	18.75	19401/16301	-434.0	-23.78
LV+421+160	6.11	19401/19101	-261.0	-19.47
LV-13M-578	-54.98	16301/12001	-565.0	-110.37
LV-13M-105	-10.67	16301/16101	-92.0	-19.69
LV-105-195	-19.29	16101/15005	-90.0	-28.11
LV-195-278	-7.67	15005/15004	-83.0	-15.81
LV-278-360	-7.54	15004/15003	-82.0	-15.58
LV-360-442	-4.90	15003/15001	-82.0	-12.94
LV-442-501	-1.56	15001/14001	-59.0	-7.34
LV-501-578	-15.53	14001/12001	-77.0	-23.08

Table 3.4
Comparison of Specified, Measured and Calculated Initial Conditions

	Specified	Measured	RELAP5/MOD2 Calculated
1. Primary Coolant System			
Intact/Broken loop flow rate	3:1	2.9:1	3:1
Pressurizer pressure (MPa)	15.5 ± 0.2	15.53	15.47
Upper plenum pressure (MPa)	15.5 ± 0.2	15.58	15.49
Cold leg temperature (K)			
Intact loop	563 ± 2	559.4	560.3
Broken loop	563 ± 2	566.4	568.0
Hot leg temperature (K)			
Intact loop	596 ± 2	596.1	593.6
Broken loop	596 ± 2	596.9	593.9
Core temperature rise (K)			
Intact loop	33	36.7	33.3
Broken loop	33	30.5	25.9
Total core electrical power (MW)	1.44 ± 0.05	1.45	1.45
Core inlet flow rate (kg/s)	$7 \sim 8$	8.02	8.01
Core bypass flow (% of Total)	2.5	3.7	3.44
Pressurizer liquid mass (kg)	8.2 ± 0.1	10.1	9.99

Table 3.4
Comparison of Specified, Measured
and Calculated Initial Conditions (Cont'd)

	Specified	Measured	RELAP5/MOD2 Calculated
2. Secondary Coolant System			
Steam Generator			
Secondaries Pressure:			
Intact loop (MPa)	5.4 ± 0.2	6.48	6.47
Broken loop (MPa)	5.4 ± 0.2	7.53	7.51
Feedwater Temperature:			
Intact loop (K)	483 ± 2	492.5	494
Broken loop (K)	483 ± 2	484.7	494
Steam Temperature:			
Intact loop (K)	542 ± 2	553.5	553.6
Broken loop (K)	542 ± 2	564.4	563.6
3. Coolant Injection System			
Intact loop accumulator			
Pressure (Mpa)	2.7 ± 0.1	2.6	2.6
Water temperature (K)	305 ± 10	298	299.6
4. Pressure Suppression System			
Suppression tank			
Pressure (Mpa)	0.024 ± 0.01	0.25	0.25

Table 4.1
Comparison Between Calculated and Measured Sequence of Events

Events	Time, Seconds RELAP5/MOD2	Measured
Rupture initiated	0	0
Upper plenum fluid saturates	15.9	1.5
Fluid in intact loop hot leg saturates	4.1	2.2
Broken loop steam generator feed valve closed	B.C.[a]	2.5
Fluid in broken loop hot leg saturates	3.64	4.5
Pressurizer empties	9.96	7
Guide tube flow reverses	N/A[b]	14
Core bypass line flow reverses	14.68	14
Fluid in broken loop cold leg (downcomer to break) saturates	10	16
Fluid in intact loop cold leg saturates	13	17
Flow reverses in broken loop hot leg	11.6	22
Broken loop steam generator secondary becomes energy source	11.8	22
Broken loop pump suction liquid seal starts to clear	35	27
Intact loop steam generator feed valve closed	B.C.	30
Intact loop pump reaches steady (.37) of initial speed	B.C.	30
Broken loop pump reaches steady (.52) of initial speed	B.C.	30
First temperature excursion starts	N/A	50
Intact loop pump suction liquid seal starts to clear	N/A	89
Intact loop steam generator secondary becomes energy source	300	105
Accumulator liquid flow starts	B.C.	163
Accumulator liquid bypass ends, Refill starts, Secondary temperature excursion starts	N/A	190
Most of core quenched	N/A	280

a: Boundary Conditions

b: Unpredicted Events

Table 4.2

Cases Analyzed in the Sensitivity Studies of the Semiscale Test S-IB-3 Simulation

Cases	Condition Descriptions
PRESSB	Providing pressure boundaries in steam generator secondary side
PB-IRFL	Infinite reverse form loss coefficients between the junctions C163-C301 and C163-C164 are used to impede the reversed flow
PUMPCD	Intact loop pump speed coasts to a stop from 20 s to the end of the test
CROSFJ	Cross-flow junction is used (instead of normal junction in the base case) in modeling of loop-pipe connections to the reactor vessel
BREAKJ	Change the direction of break junction from C362 to C363
TDC-1.0	Two-phase discharge coefficient of 1.0 (instead of 0.84 in the base case) is used in the broken loop cold leg

Table 5.1

Run Statistics of the Semiscale Test S–IB–3 Simulation

Cases	Transient Time (s)	CPU(s)	Number of Time Step	Number of Volume Cell	Performance Number *
BASE	323	7039.16	12255	142	4.045
PRESSB	320	6400.94	11080	142	4.068
PB–IRFL	50	1508.86	2500	142	4.250
PUMPCD	90	2653.01	4500	142	4.152
CROSFJ	35	1063.09	1750	142	4.278
BREAKJ	30	926.49	1500	142	4.350
TDC–1.0	100	2880.43	5000	142	4.057

* Performance Number =

CPU ×10[illegible] /[Number of Time Step]/[Number of Volume Cell]

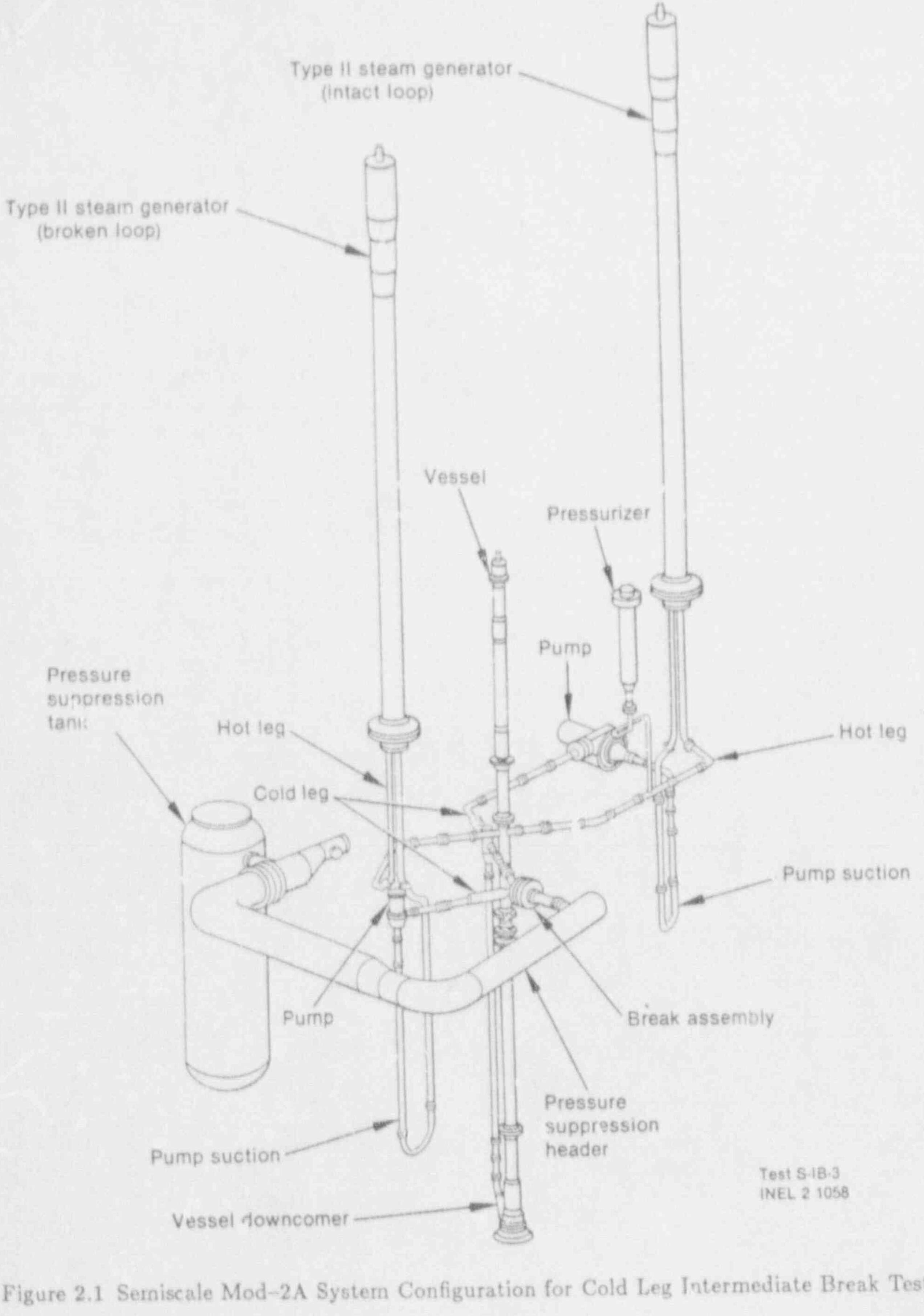

Figure 2.1 Semiscale Mod-2A System Configuration for Cold Leg Intermediate Break Test

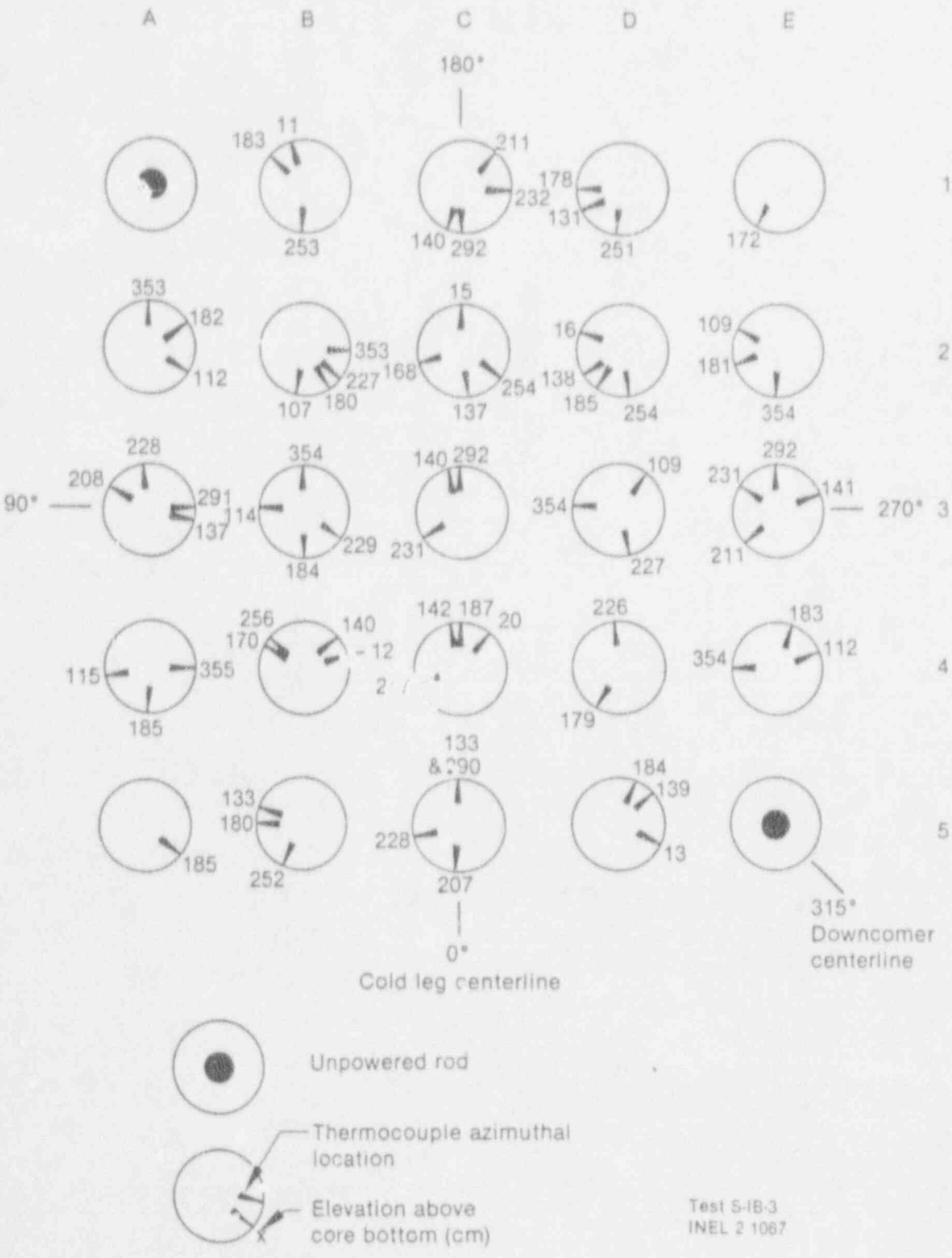

Figure 2.2 Semiscale Mod-2A Heated Core Plan View

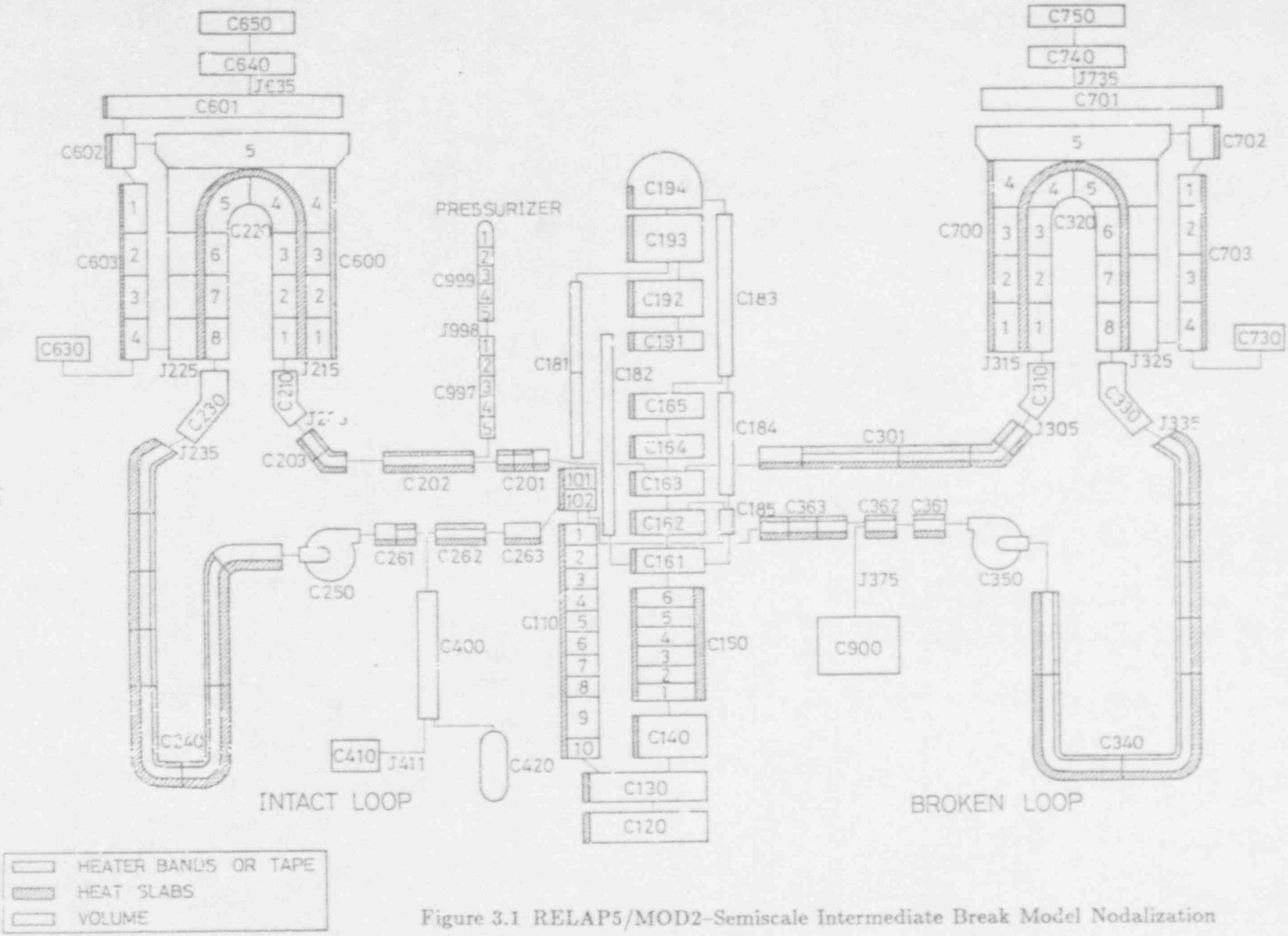

Figure 3.1 RELAP5/MOD2-Semiscale Intermediate Break Model Nodalization for Experiment S-IB-3

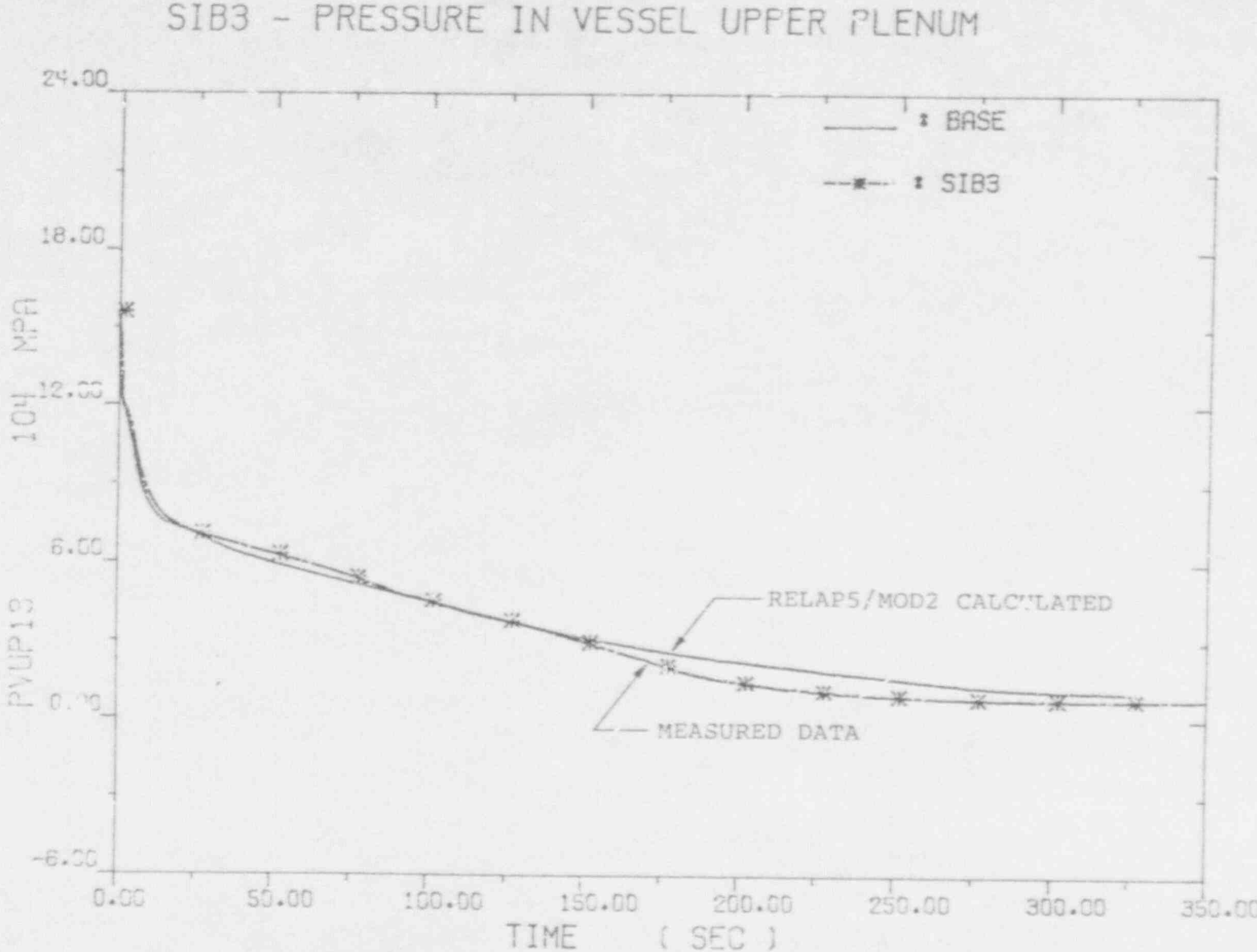

Figure 4.1 Comparison Between the Calculated and Measured Vessel Upper Plenum Pressure of Test S-IB-3

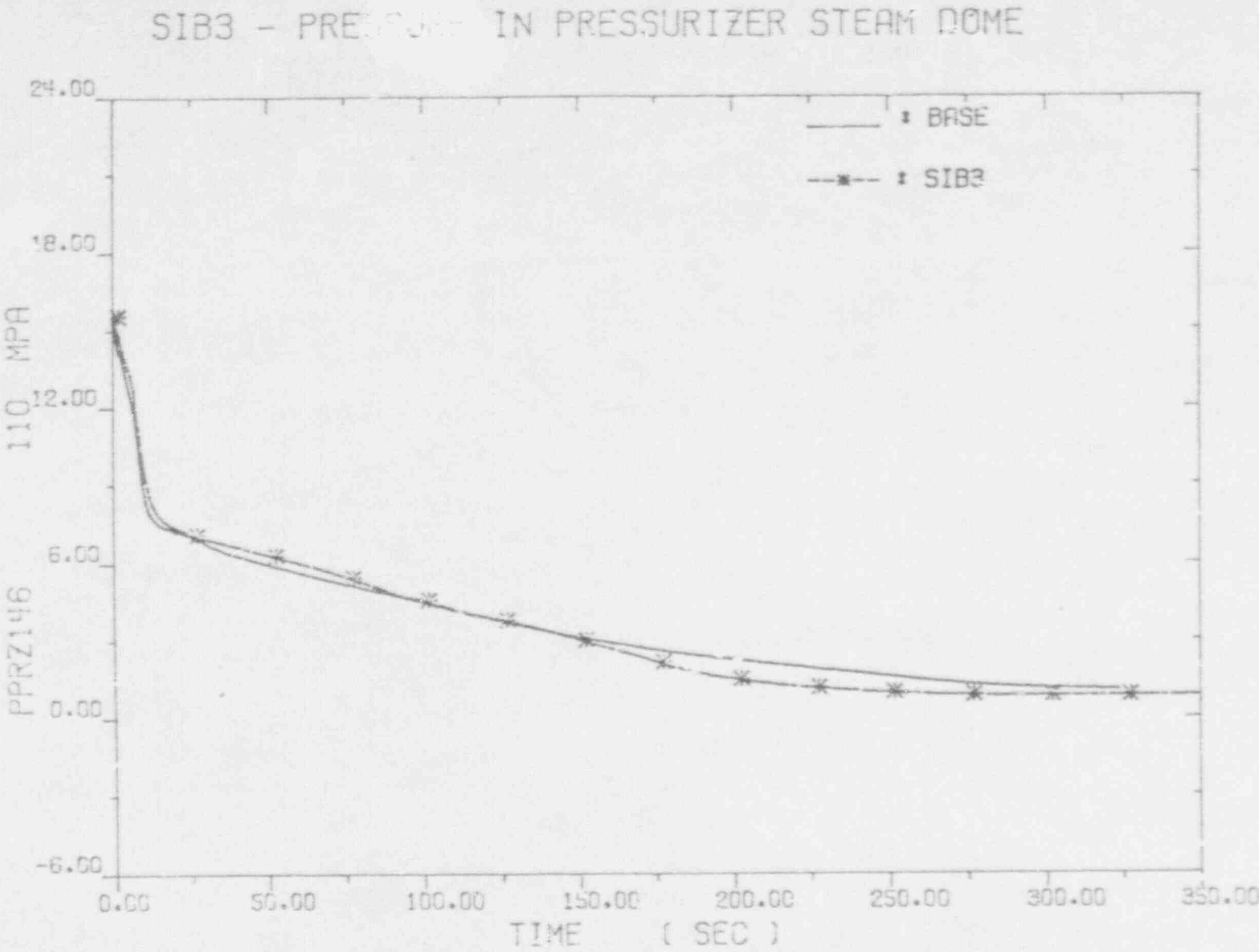

Figure 4.2 Comparison Between the Calculated and Measured Pressurizer Steam Dome Pressure of Test S–IB–3

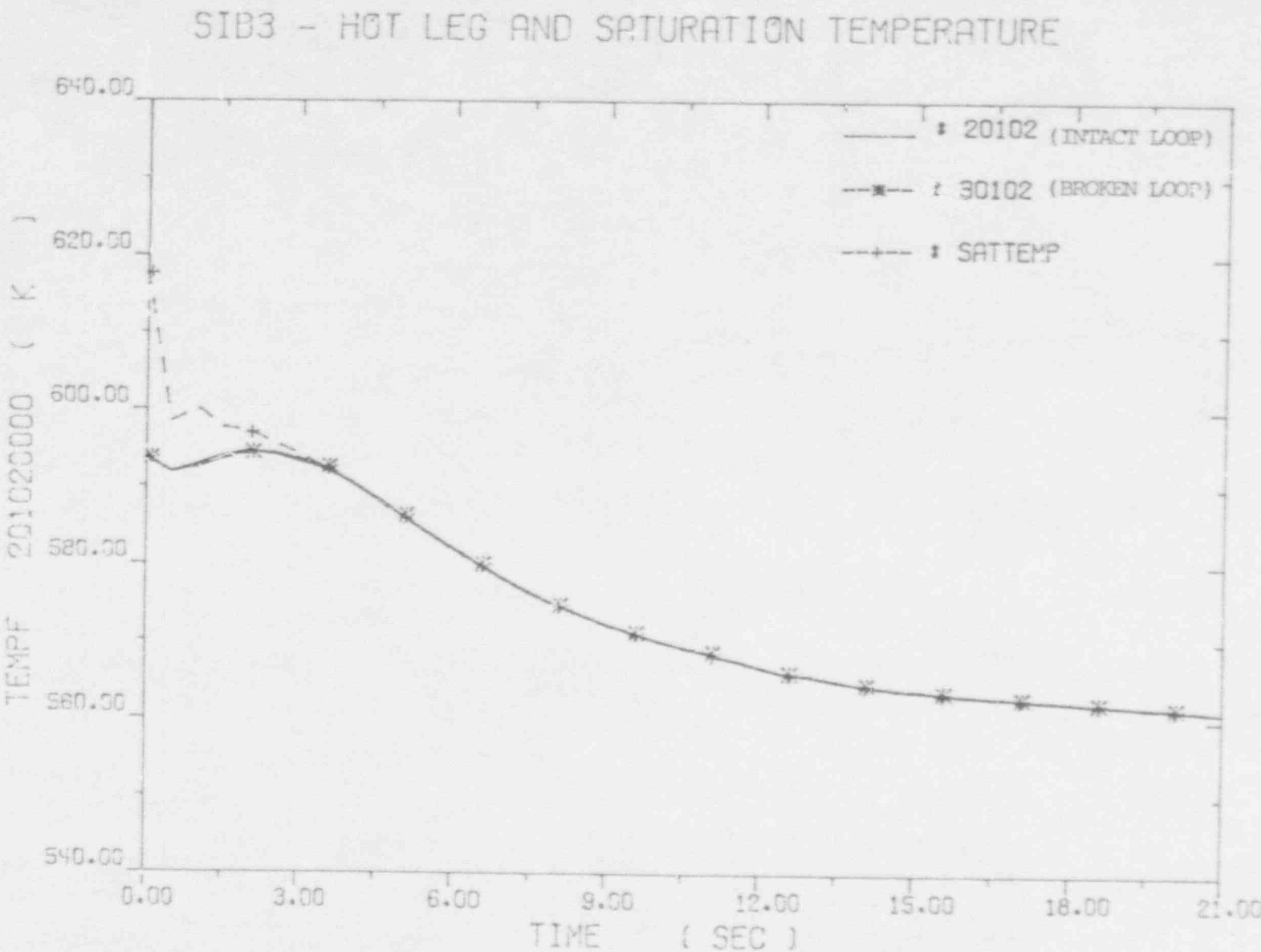

Figure 4.3 Calculated Hot Leg and Saturation Temperature of Test S–IB–3 Simulation

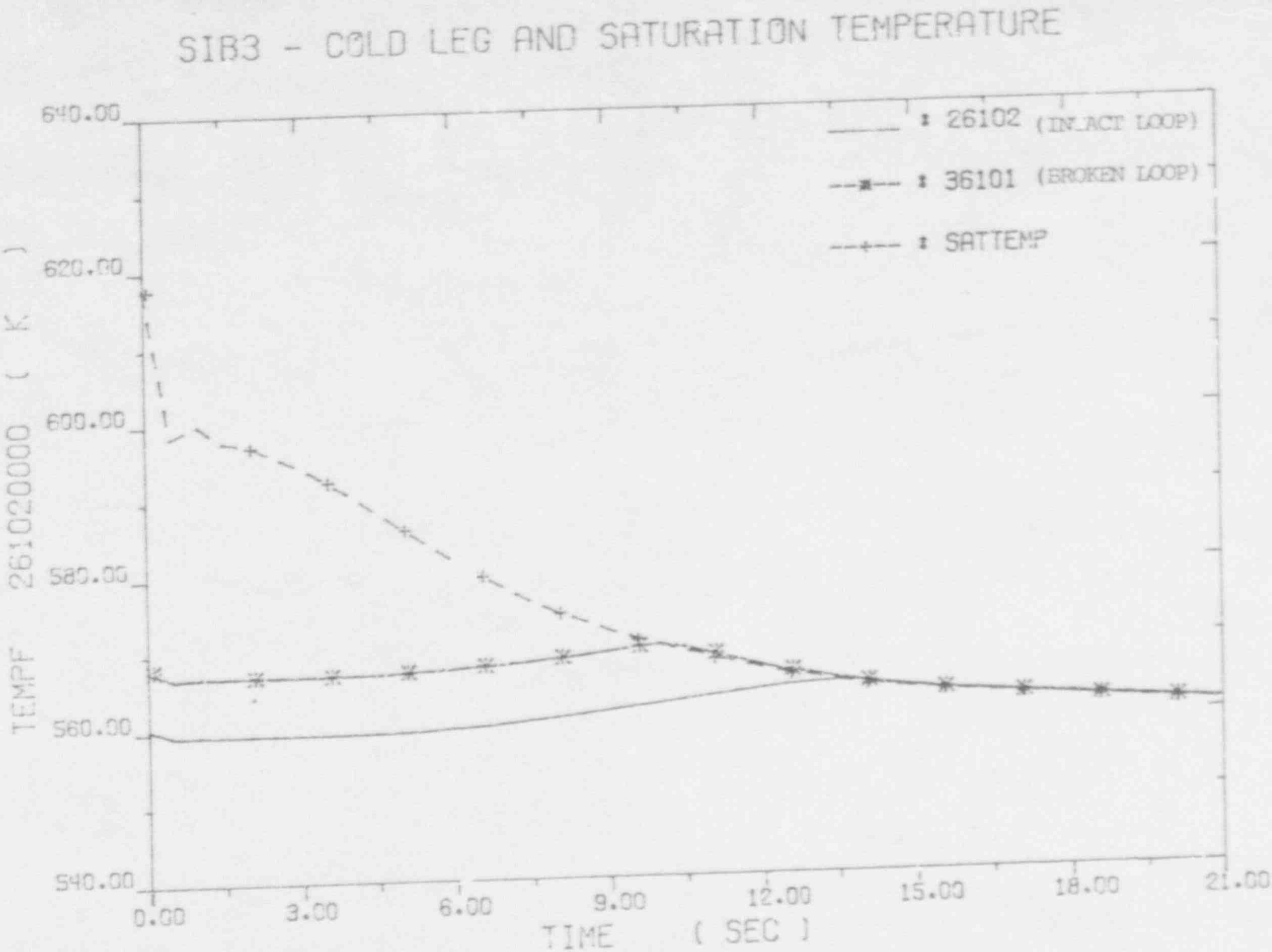

Figure 4.4 Calculated Cold Leg and Saturation Temperature of Test S–IB–3 Simulation

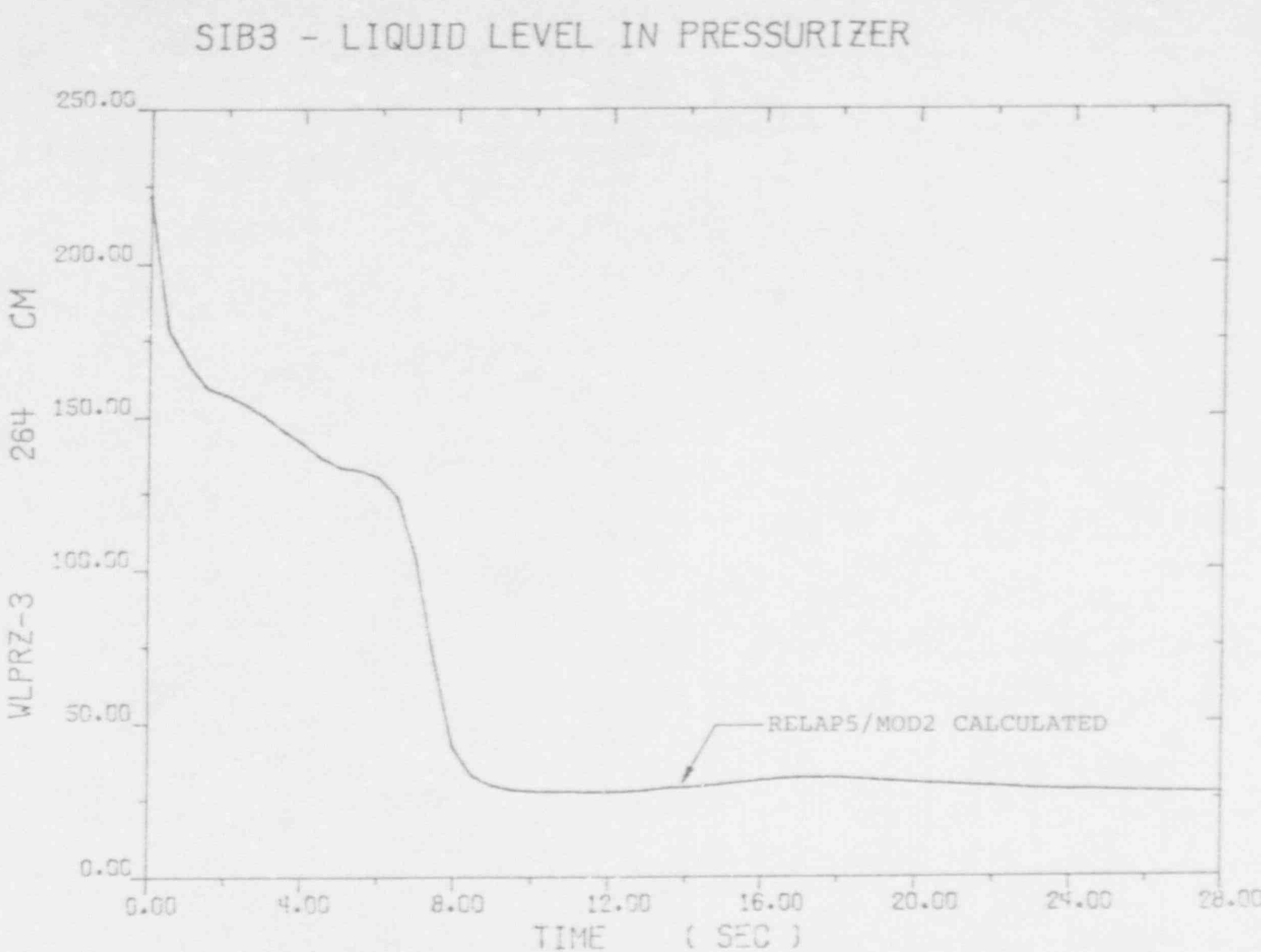

Figure 4.5 Calculated Liquid Level in Pressurizer of Test S-IB-3 Simulation

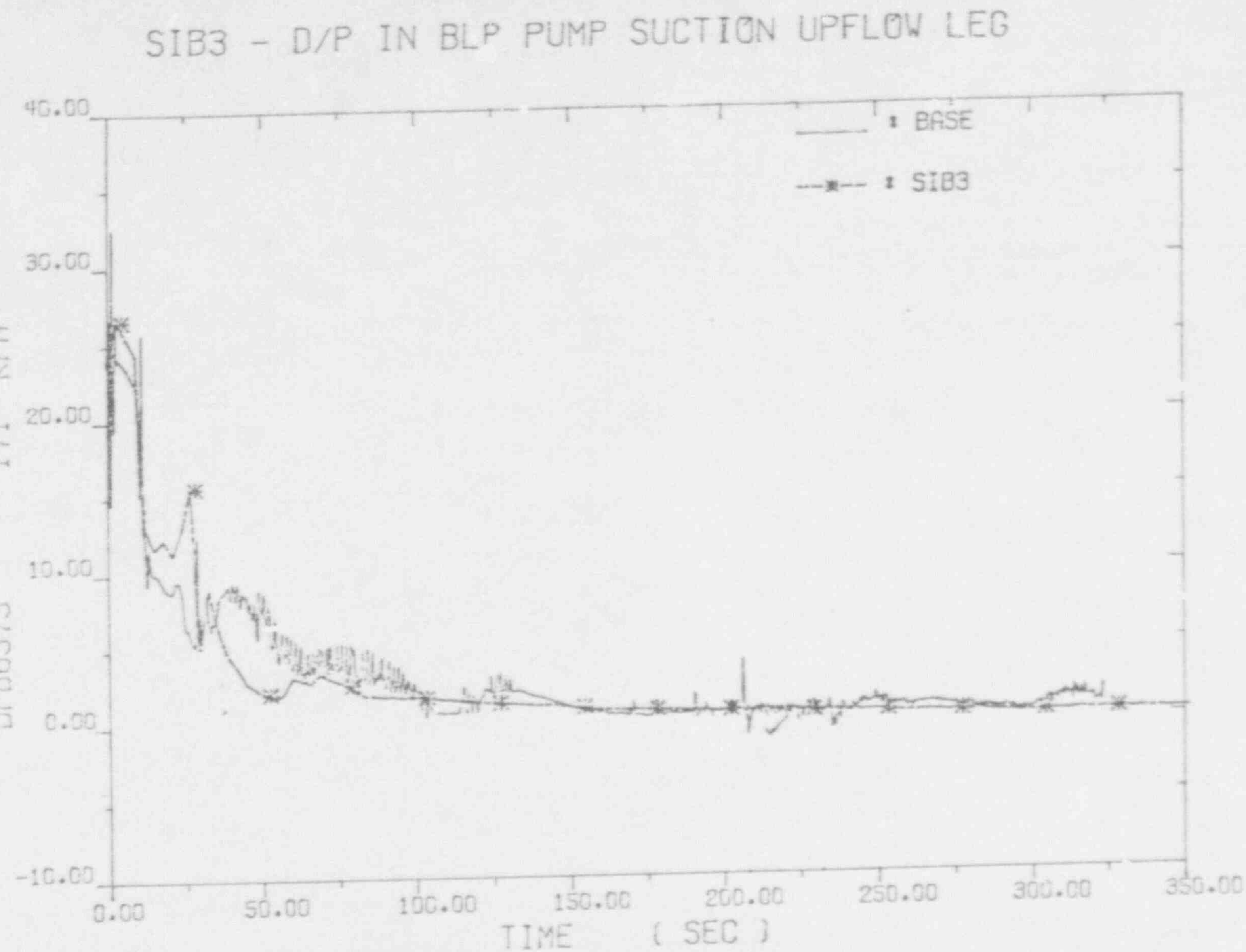

Figure 4.6 Comparison Between the Calculated and Measured Differential Pressure in Broken Loop Pump Suction Upflow Leg of Test S–IB-3

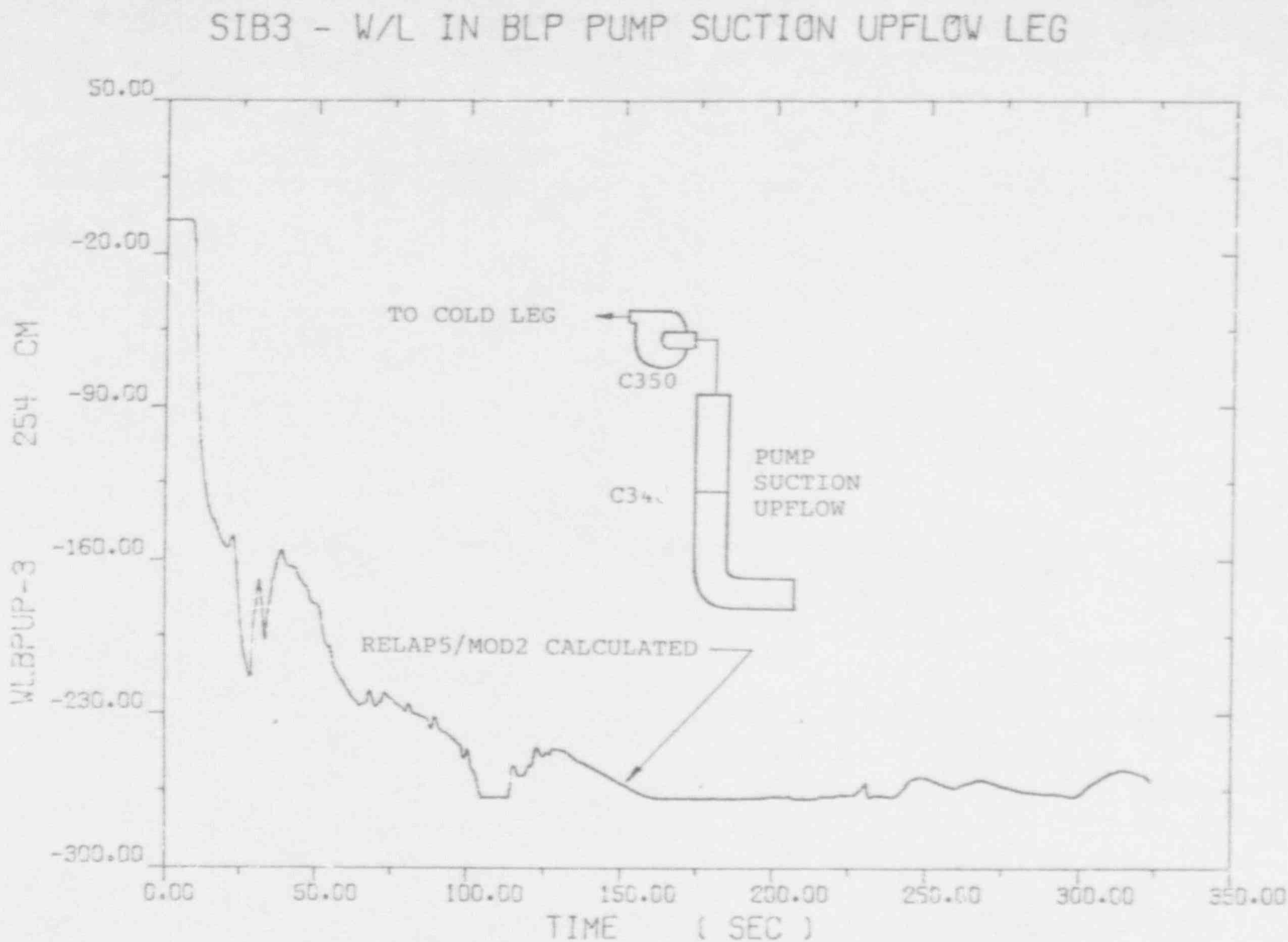

Figure 4.7 Calculated Liquid Level in Broken Loop Pump Suction Upflow Leg of Test S-IB-3 Simulation

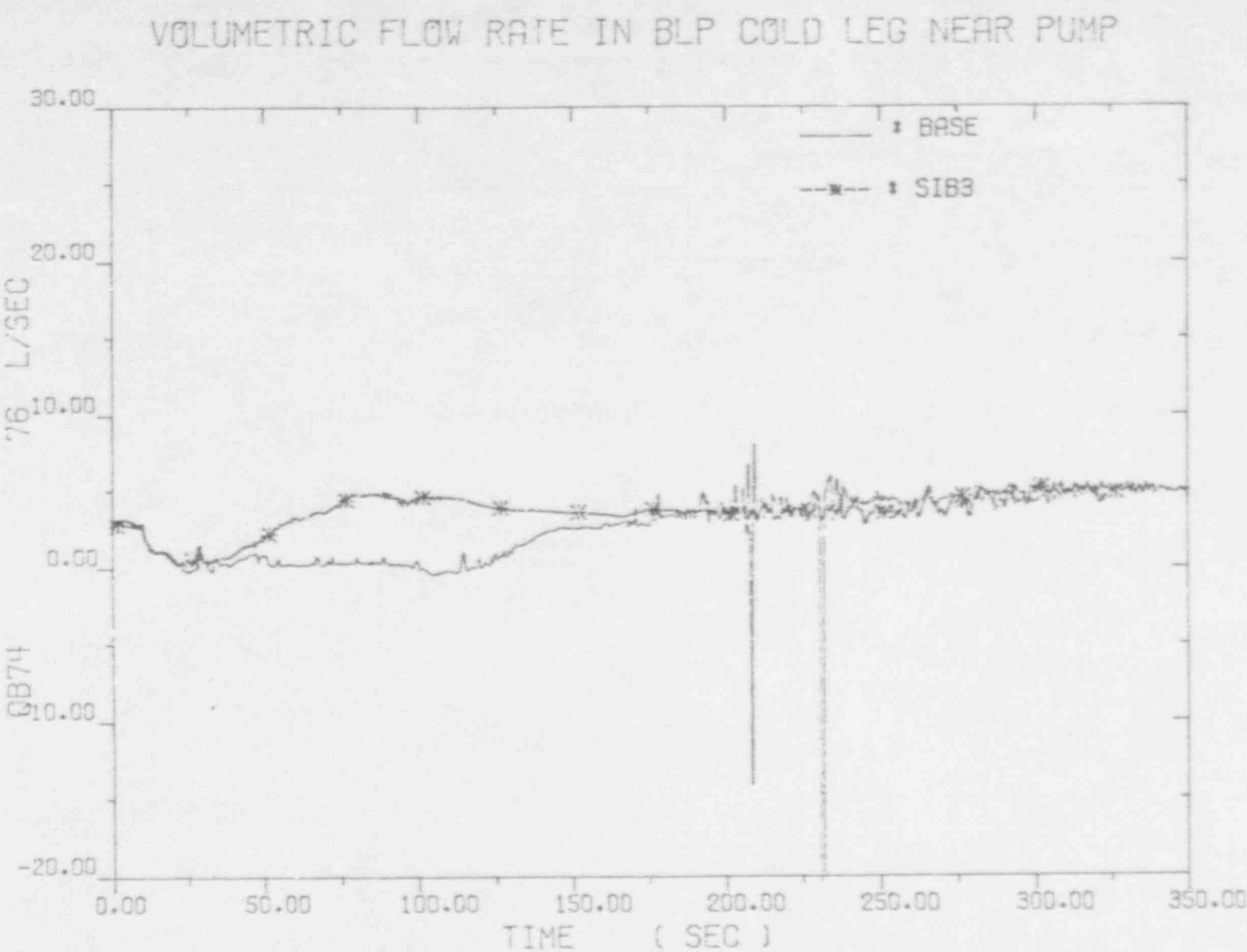

Figure 4.8 Comparison Between the Calculated and Measured Volumetric Flow Rate in Broken Loop Cold Leg Near Pump of Test S–IB–3

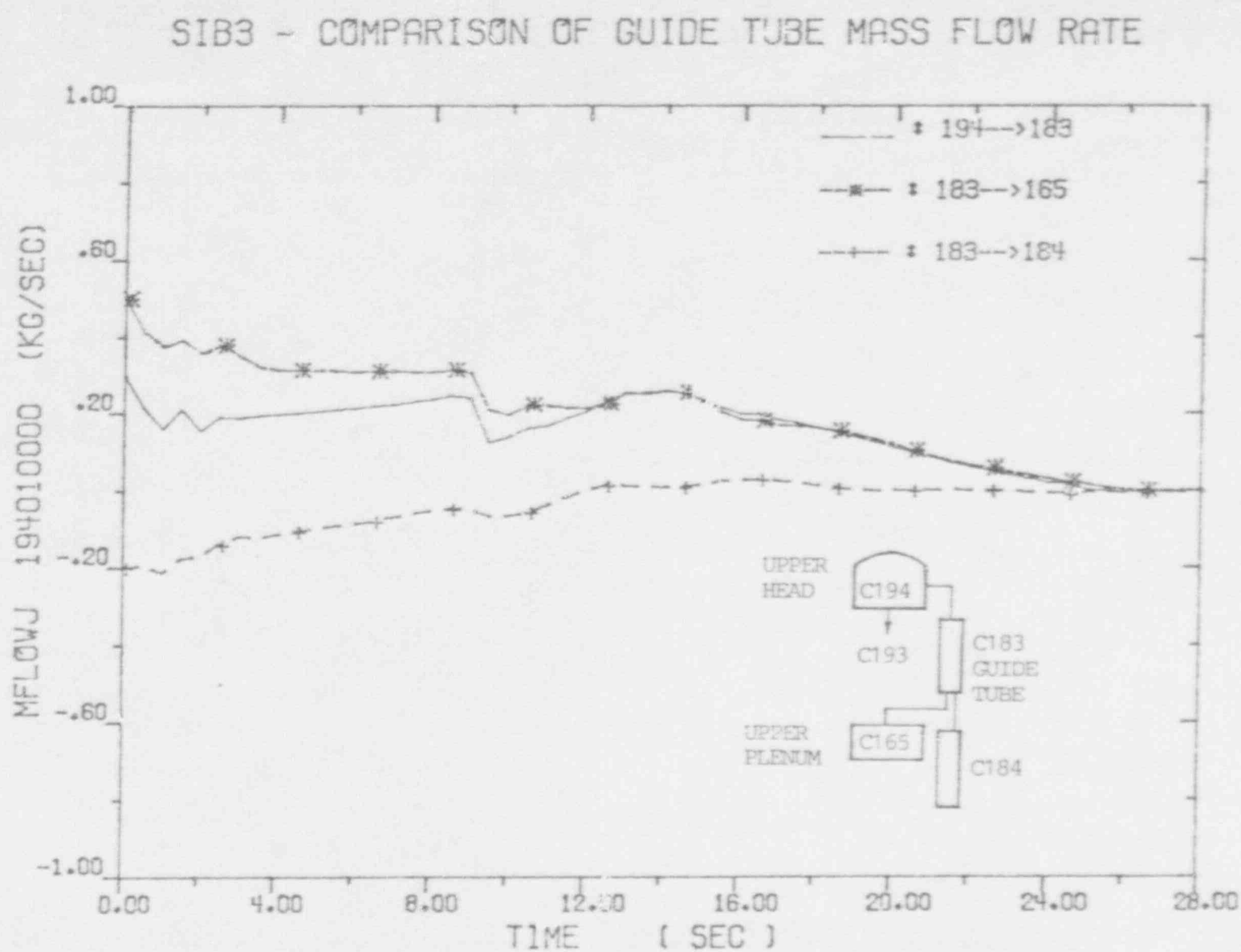

Figure 4.9 Calculated Guide Tube Mass Flow Rate of Test S-IB-3 Simulation

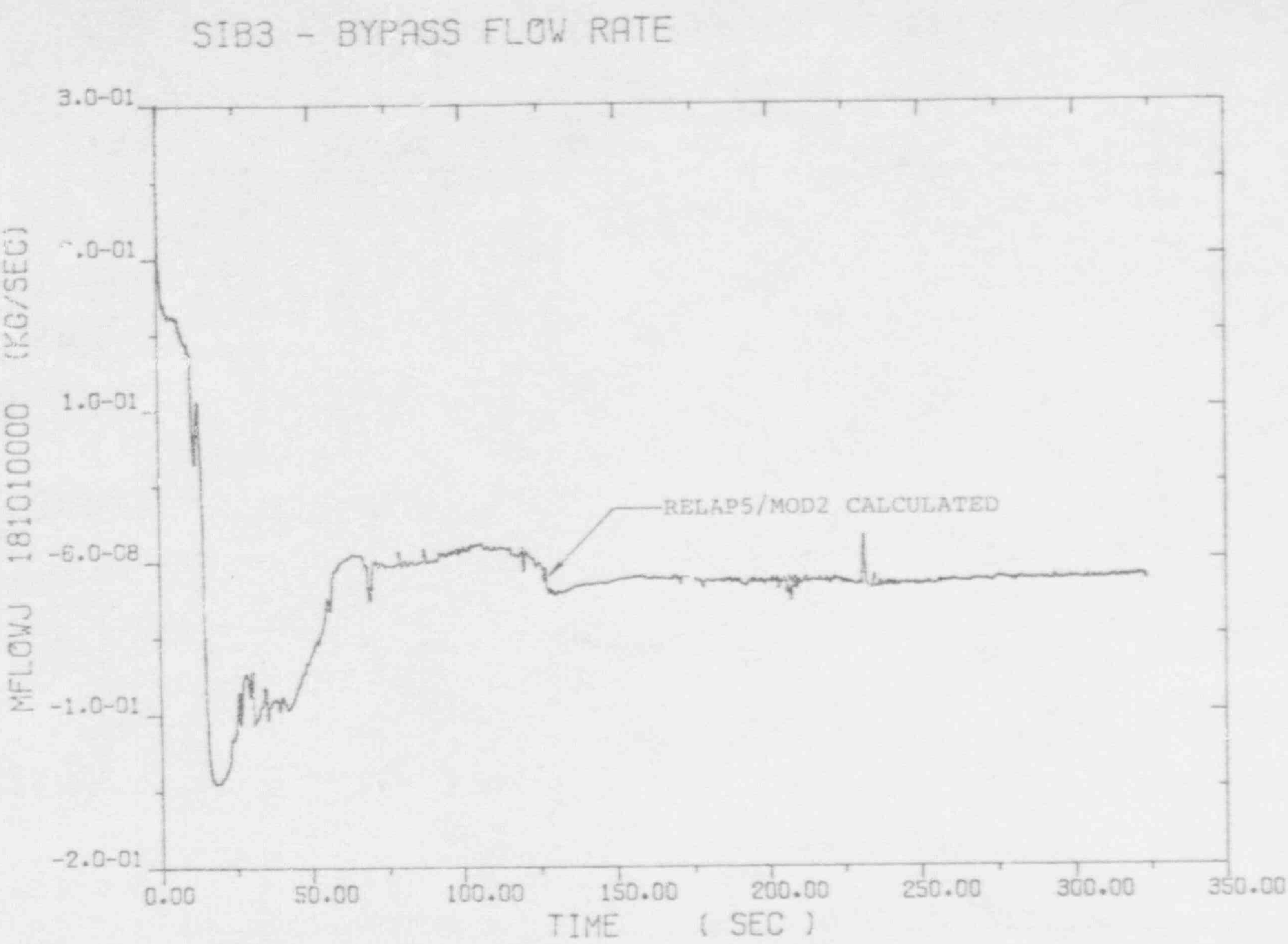

Figure 4.10 Calculated Core Bypass Line Mass Flow Rate of Test S–IB–3 Simulation

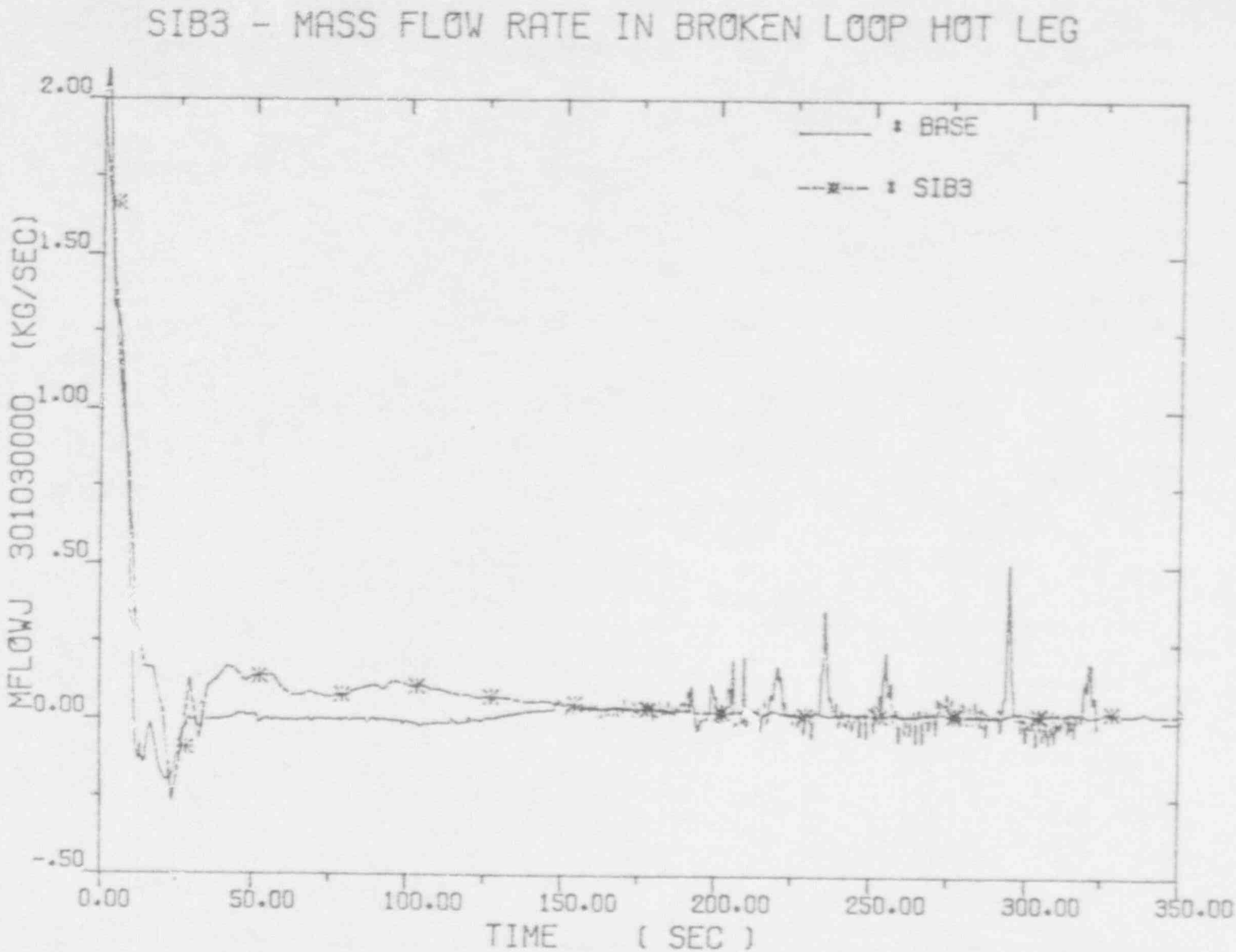

Figure 4.11 Comparison Betw..en the Calculated and Measured Mass Flow Rate in Broken Loop Hot Leg of Test S-IB-3

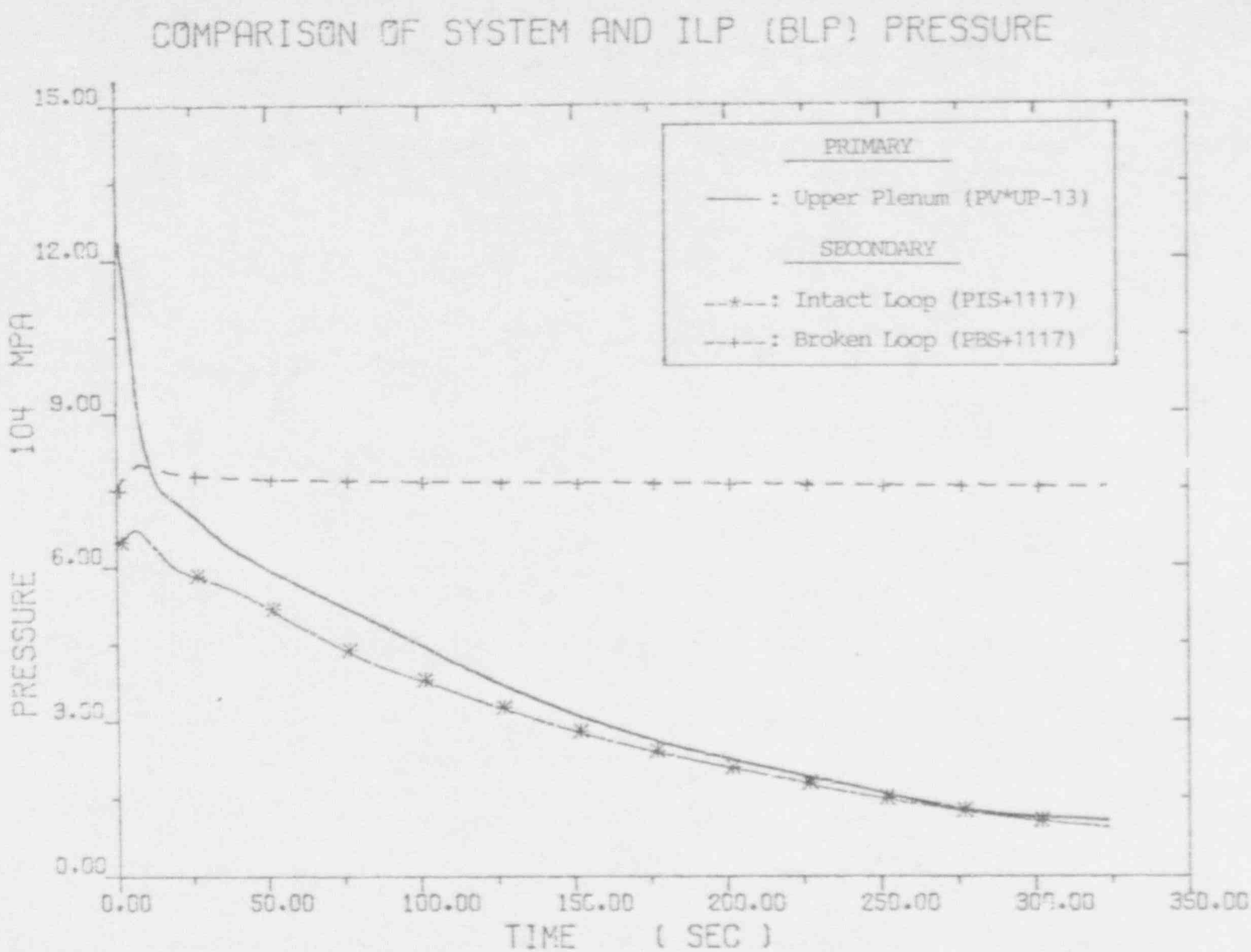

Figure 4.12 Comparison Among the Calculated System, Intact Loop and Broken Loop Steam Generator Steam Dome Pressure of Test S–IB–3

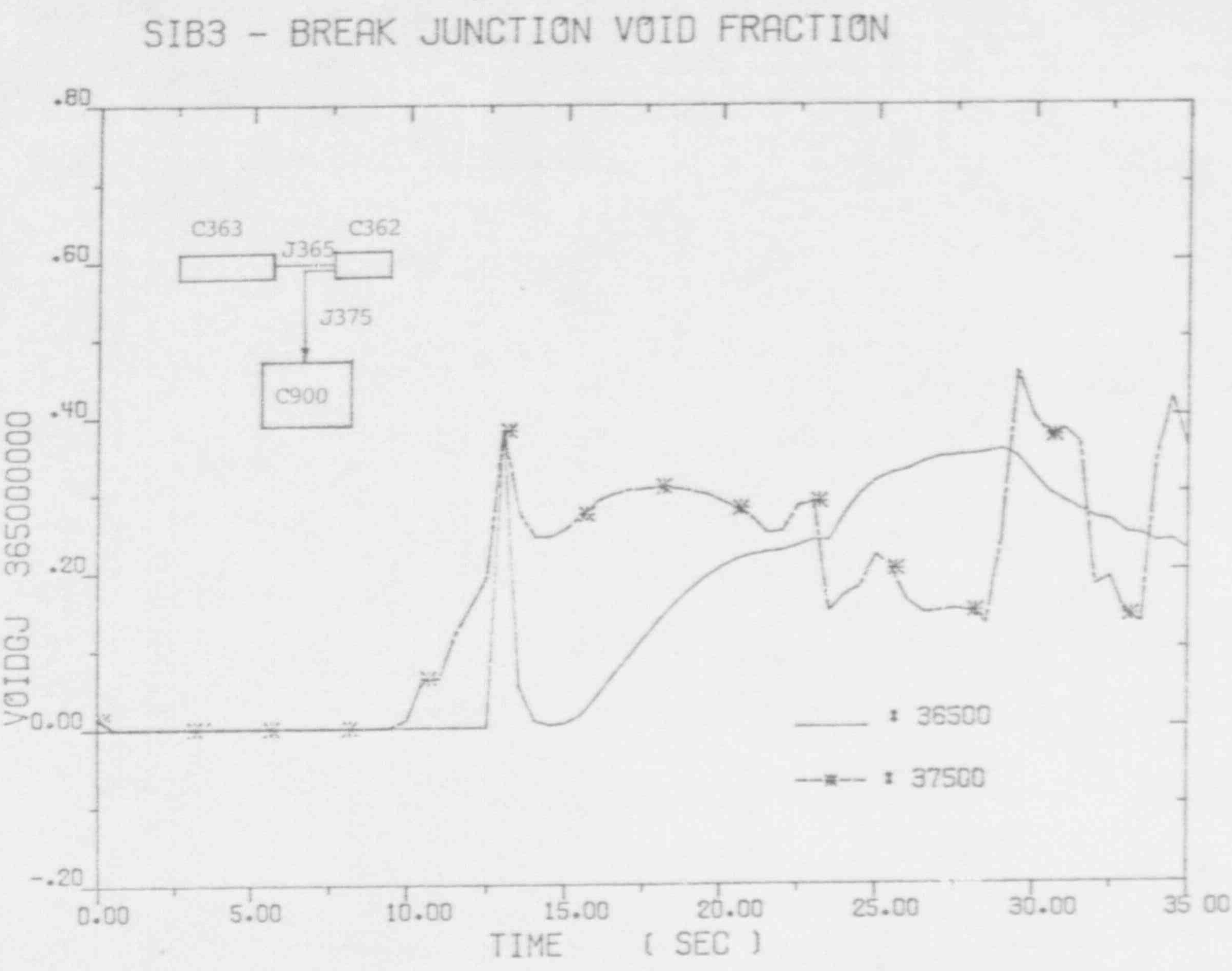

Figure 4.13 Calculated Break Junction Void Fraction of Test S–IB–3 Simulation

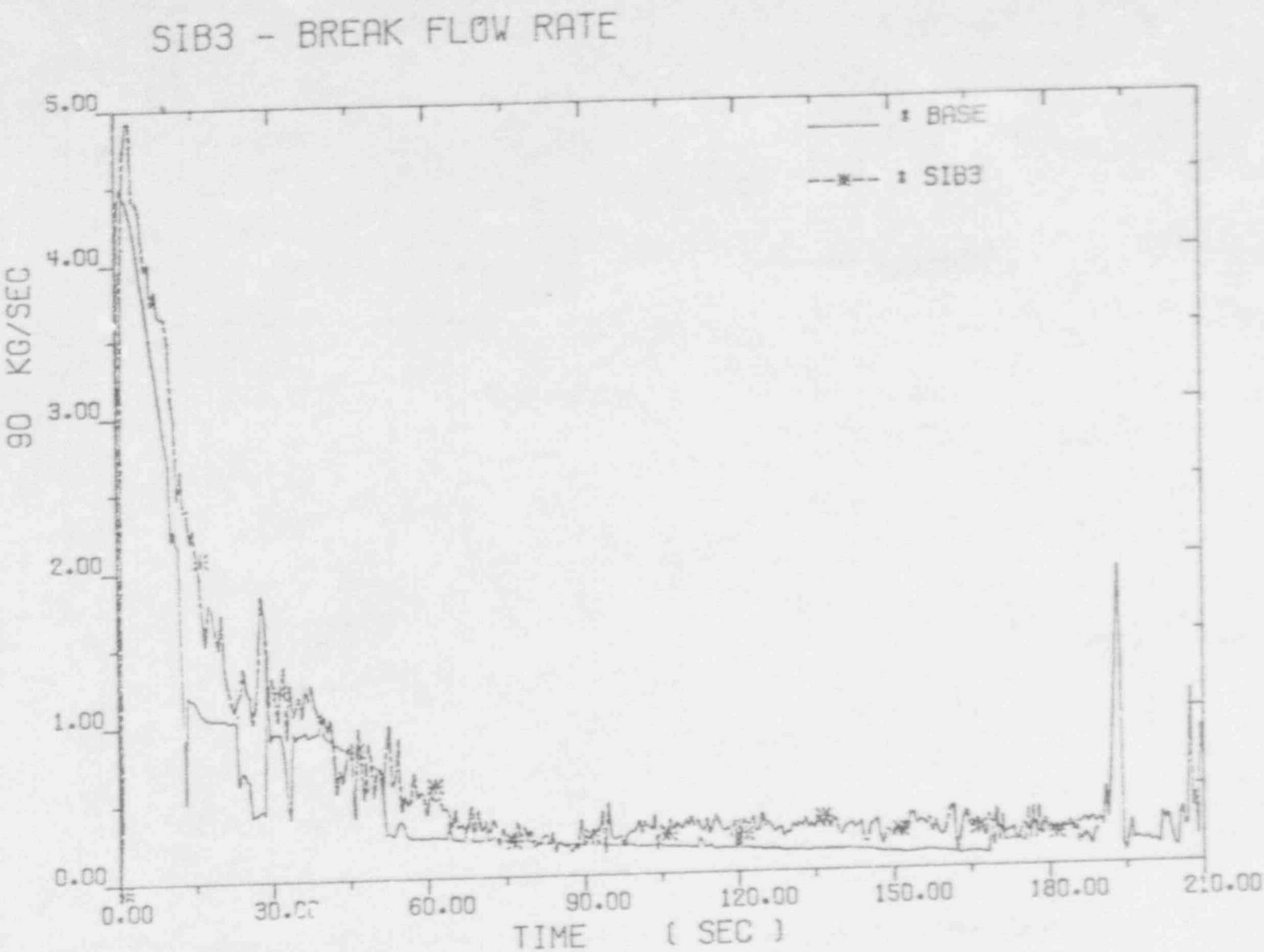

Figure 4.14 Comparison Between the Calculated and Measured Break Mass Flow Rate of Test S–IB–3

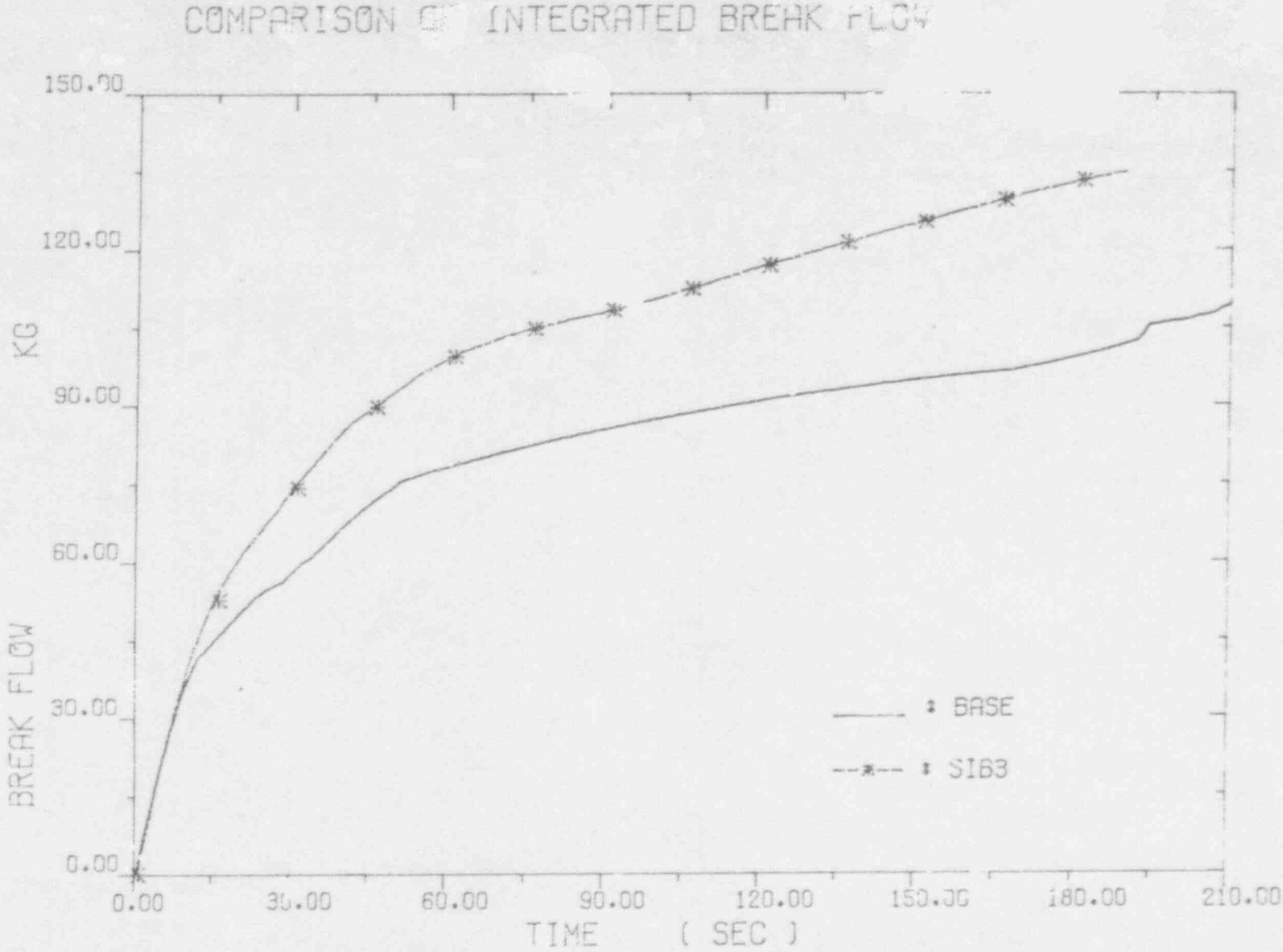

Figure 4.15 Comparison Between the Calculated and Measured Integrated Break Mass Flow of Test S-IB-3

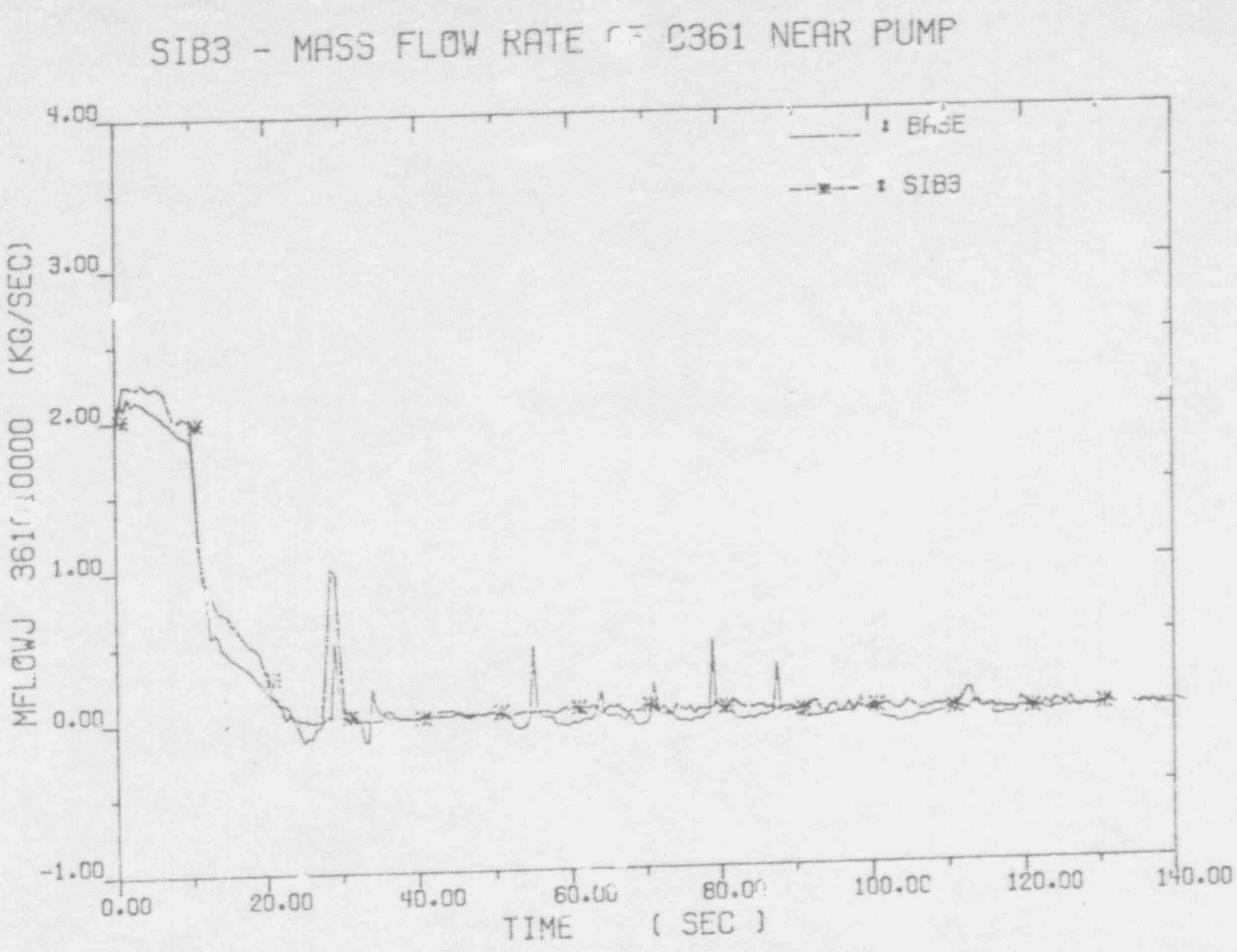

Figure 4.16 Comparison Between the Calculated and Measured Mass Flow Rate of Component 361 Near Pump of Test S-IB-3

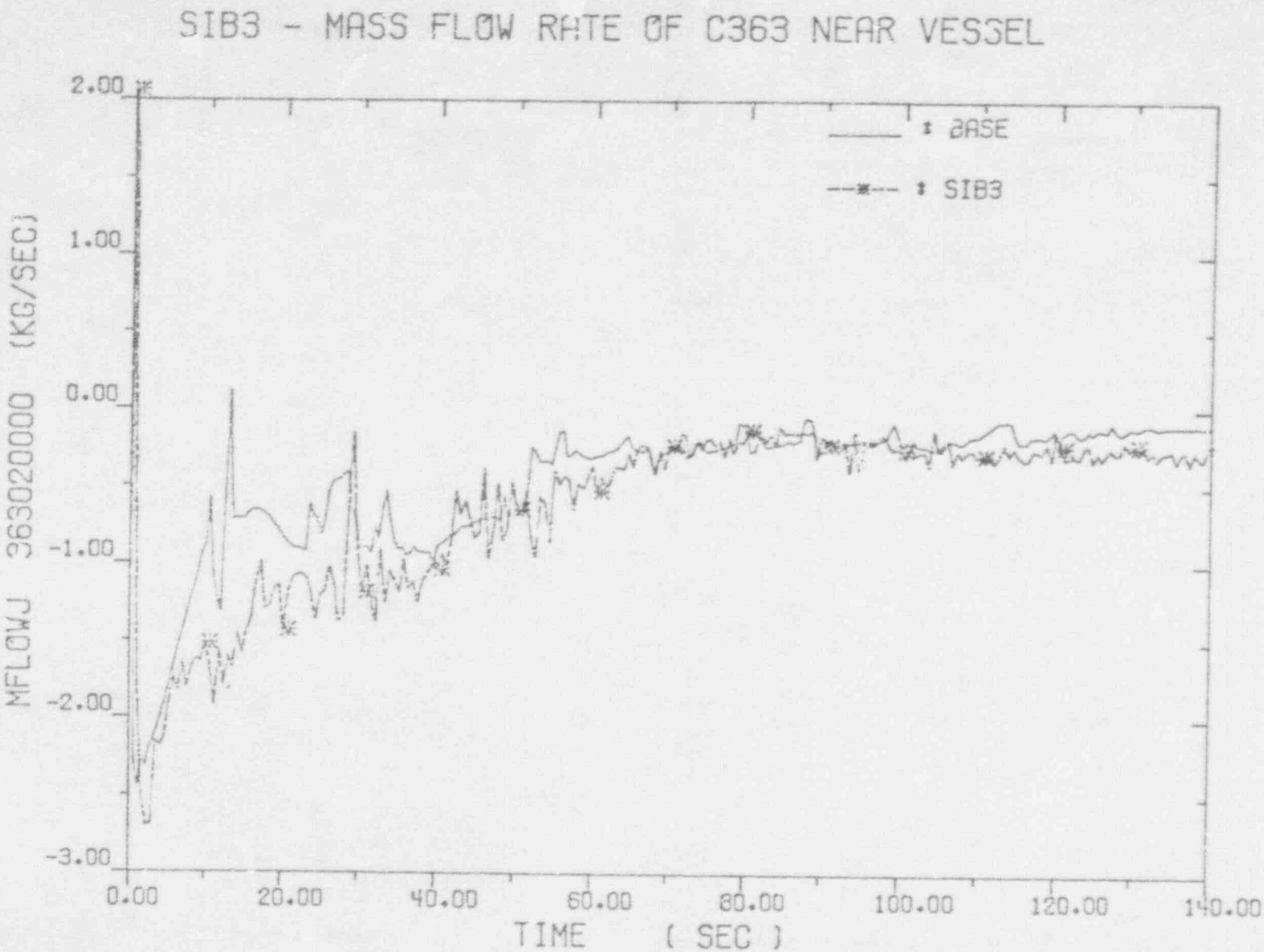

Figure 4.17 Comparison Between the Calculated and Measured Mass Flow Rate of Component 363 Near Vessel of Test S–IB–3

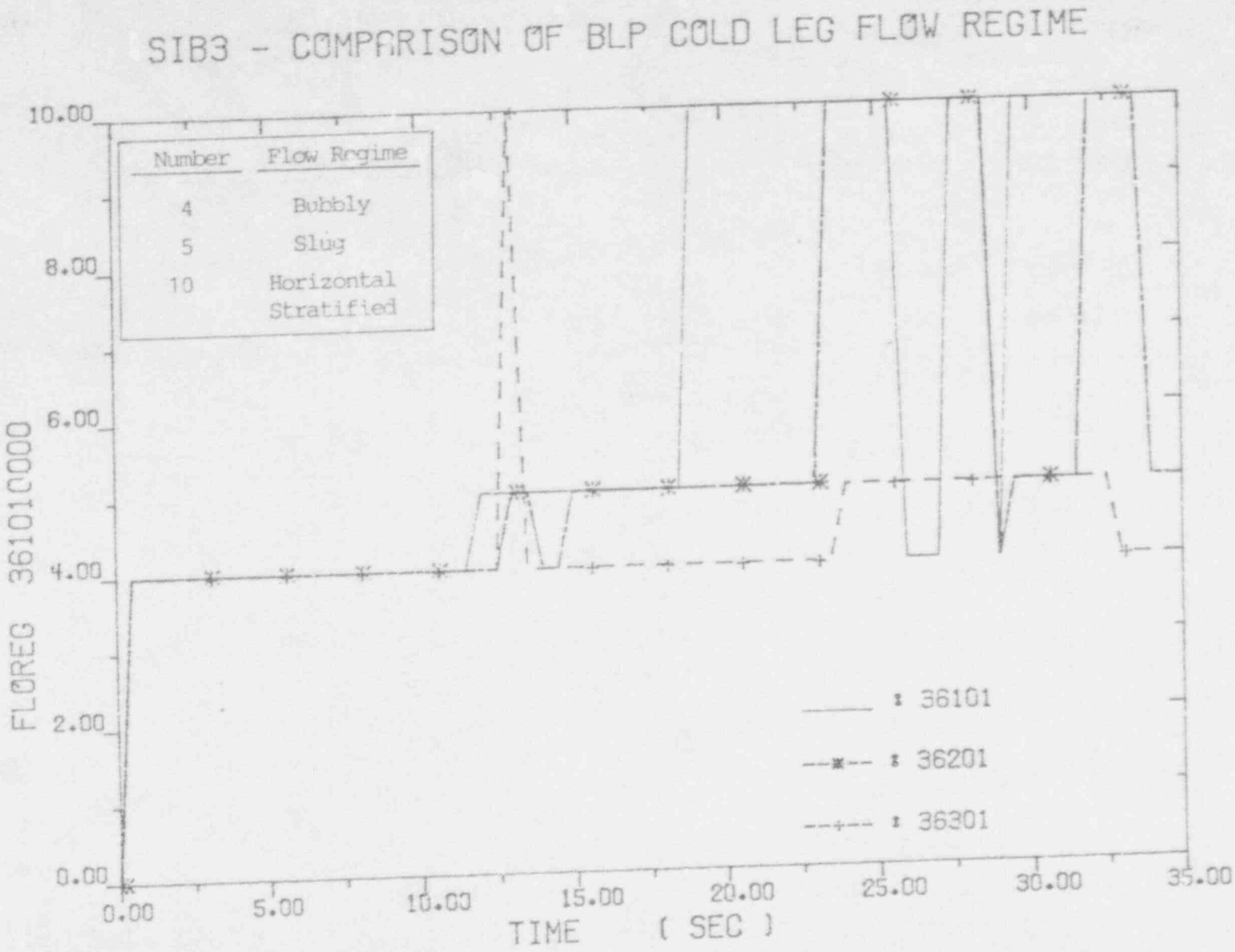

Figure 4.18 Calculated Broken Loop Cold Leg Flow Regime of Test S-IB-3 Simulation

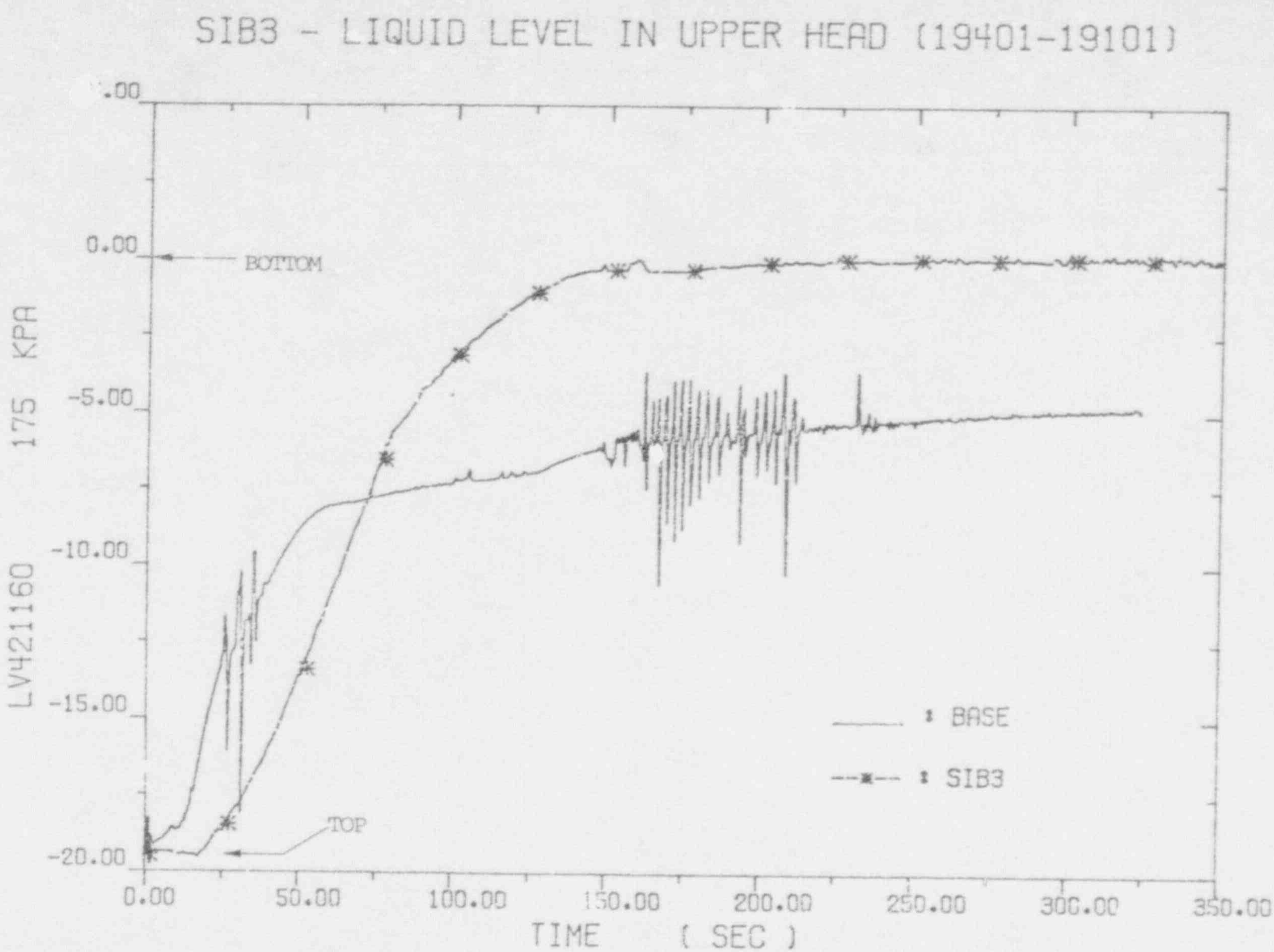

Figure 4.19 Comparison Between the Calculated and Measured Liquid Level in Upper Head of Test S-IB-3

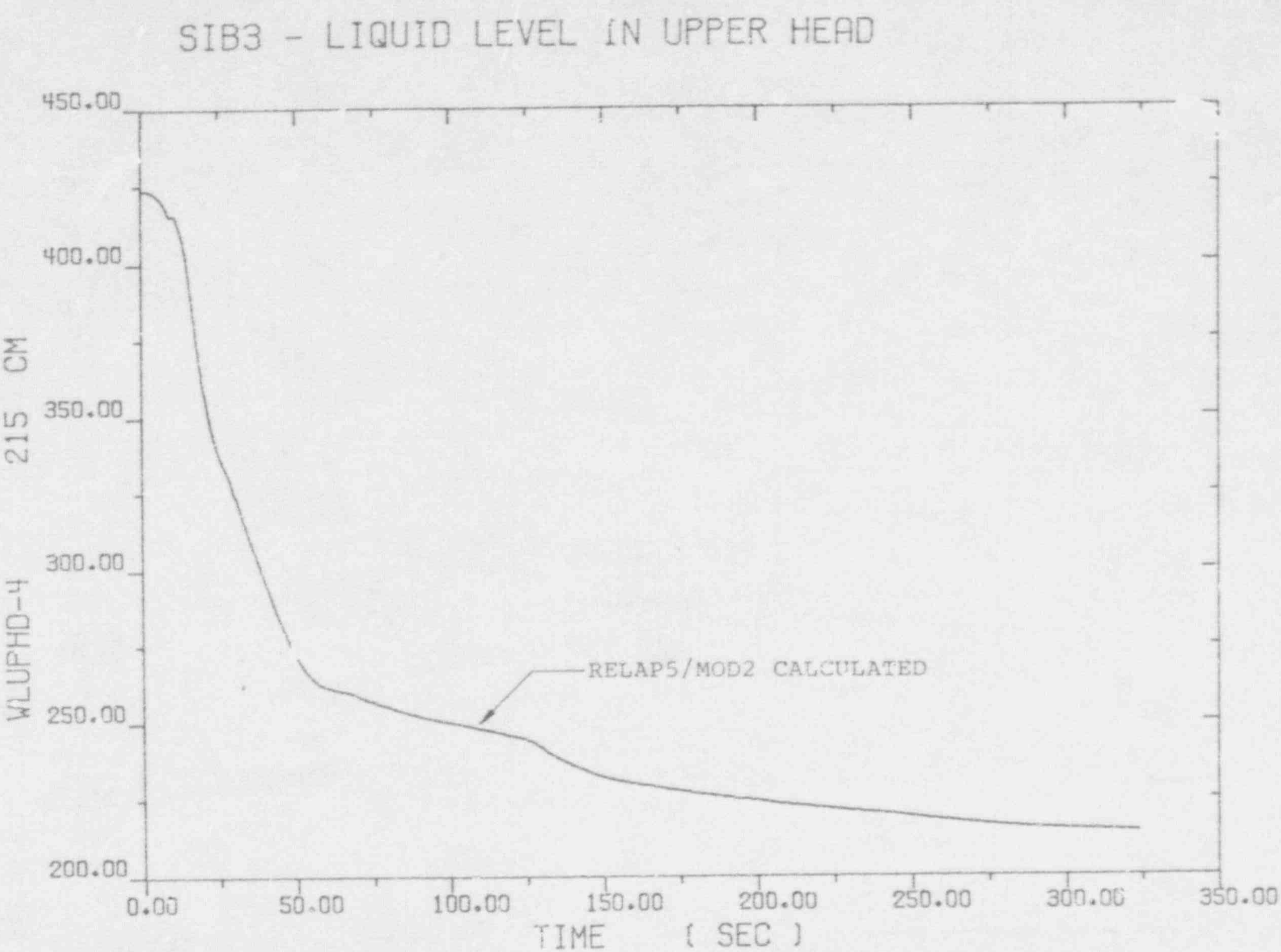

Figure 4.20 Calculated Liquid Level in Upper Head of Test S IB-3 Simulation

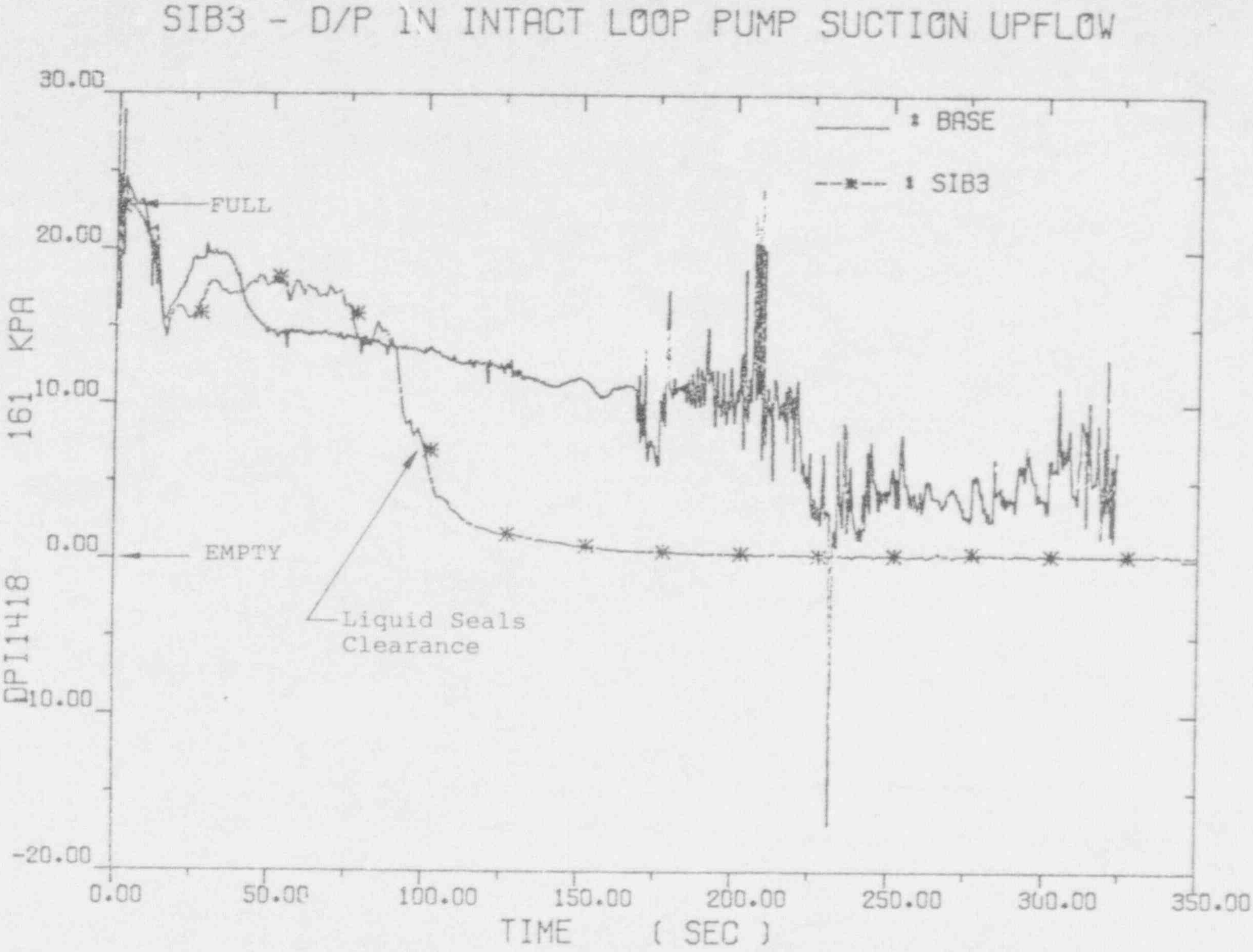

Figure 4.21 Comparison Between the Calculated and Measured Differential Pressure in Intact Loop Pump Suction Upflow Leg of Test S-IB-3

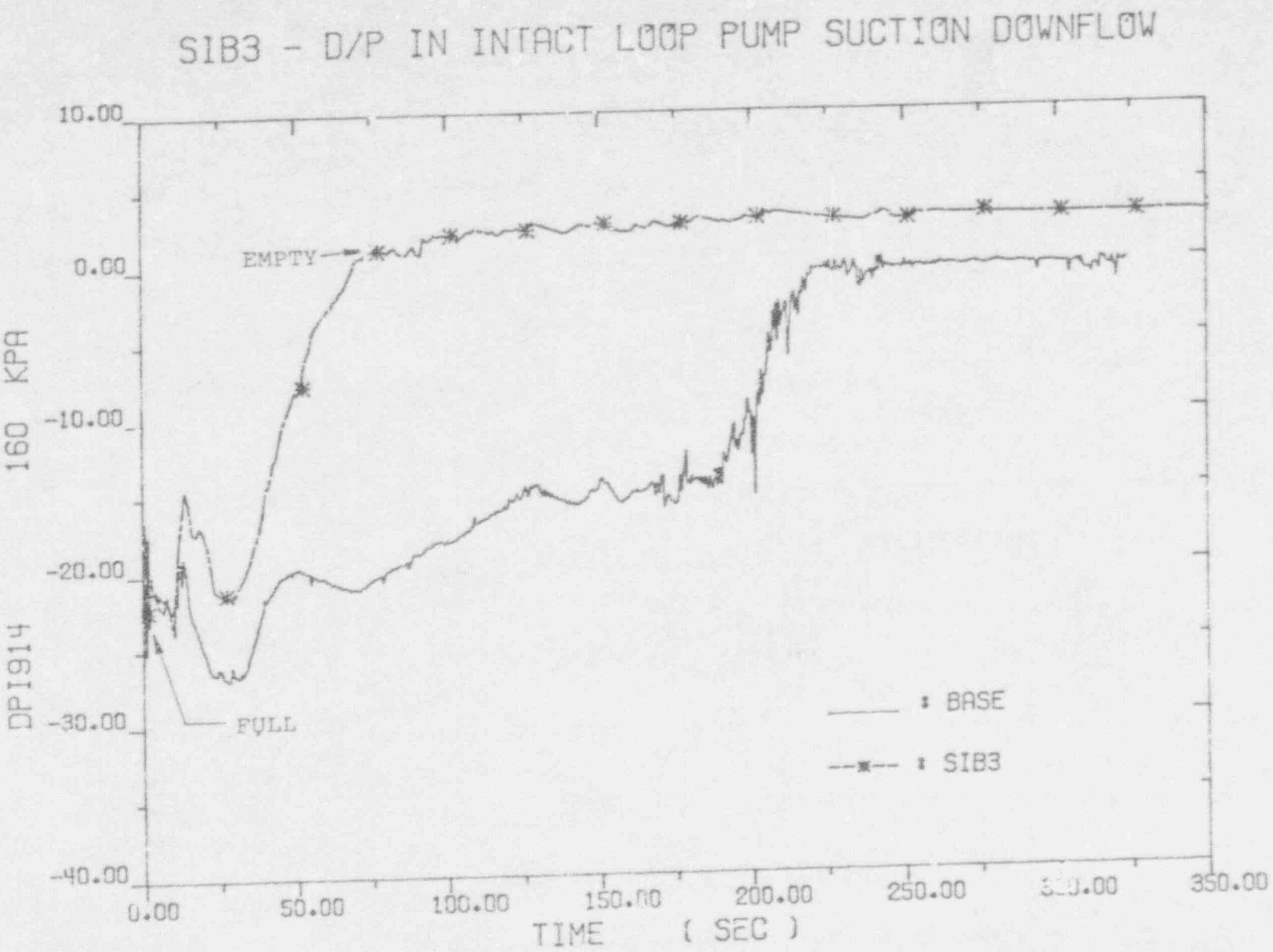

Figure 4.22 Comparison Between the Calculated and Measured Differential Pressure in Intact Loop Pump Suction Downflow Leg of Test S-IB-3

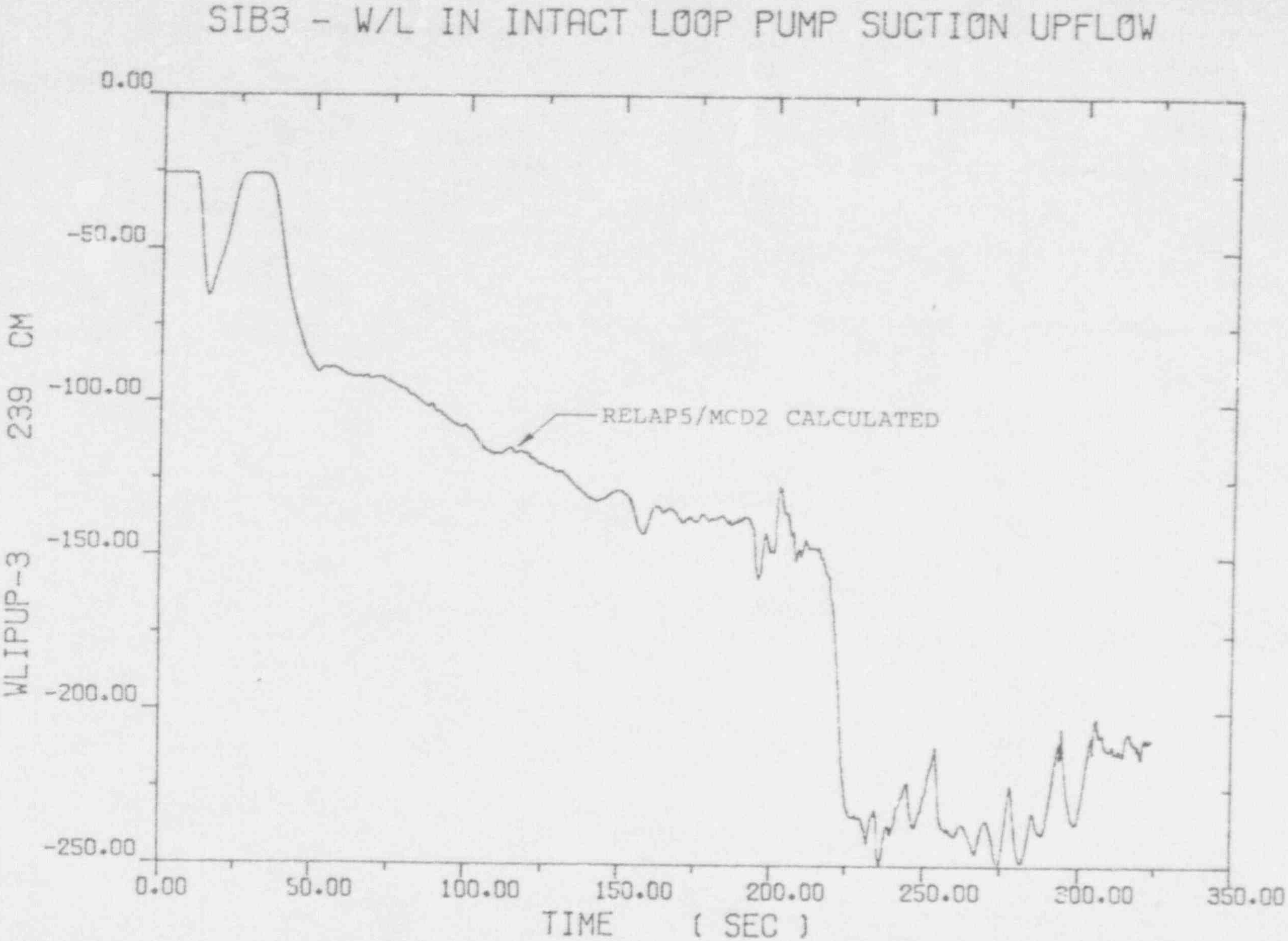

Figure 4.23 Calculated Liquid Level in Intact Loop Pump Suction Upflow Leg Simulation of Test S-IB-3

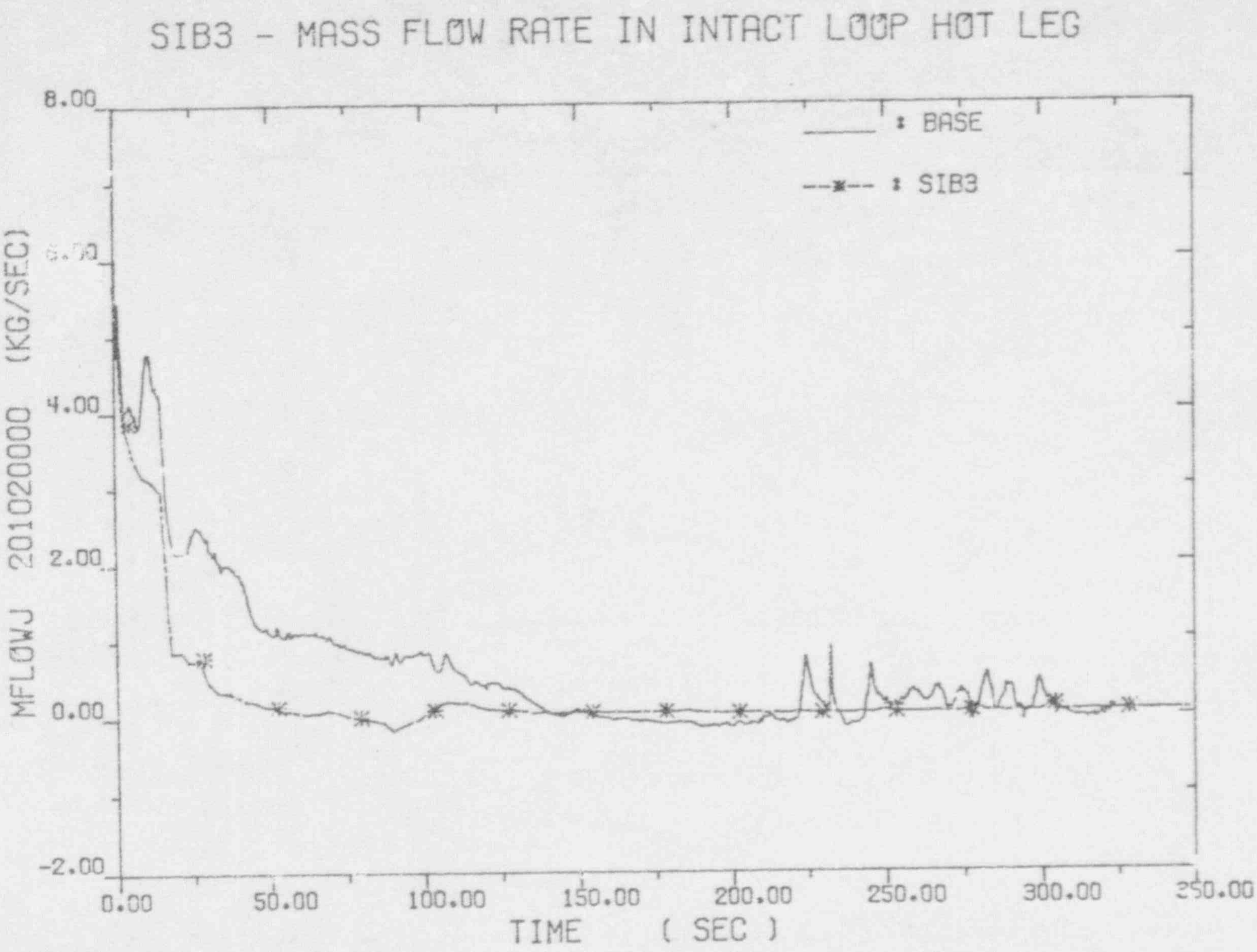

Figure 4.24 Comparison Between the Calculated and Measured Mass Flow Rate in Intact Loop Hot Leg of Test S-IB-3

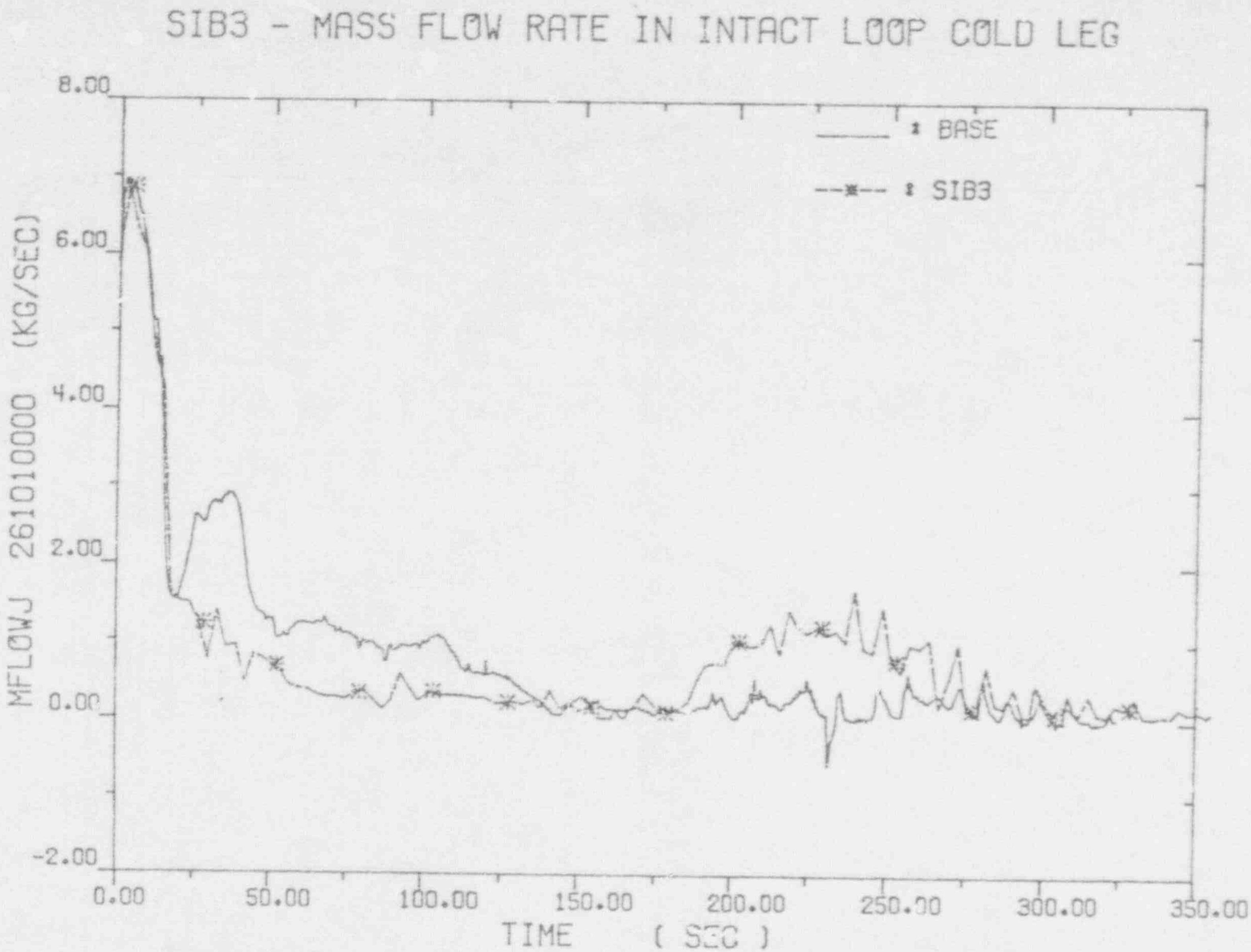

Figure 4.25 Comparison Between the Calculated and Measured Mass Flow Rate in Intact Loop Cold Leg of Test S-IB-3

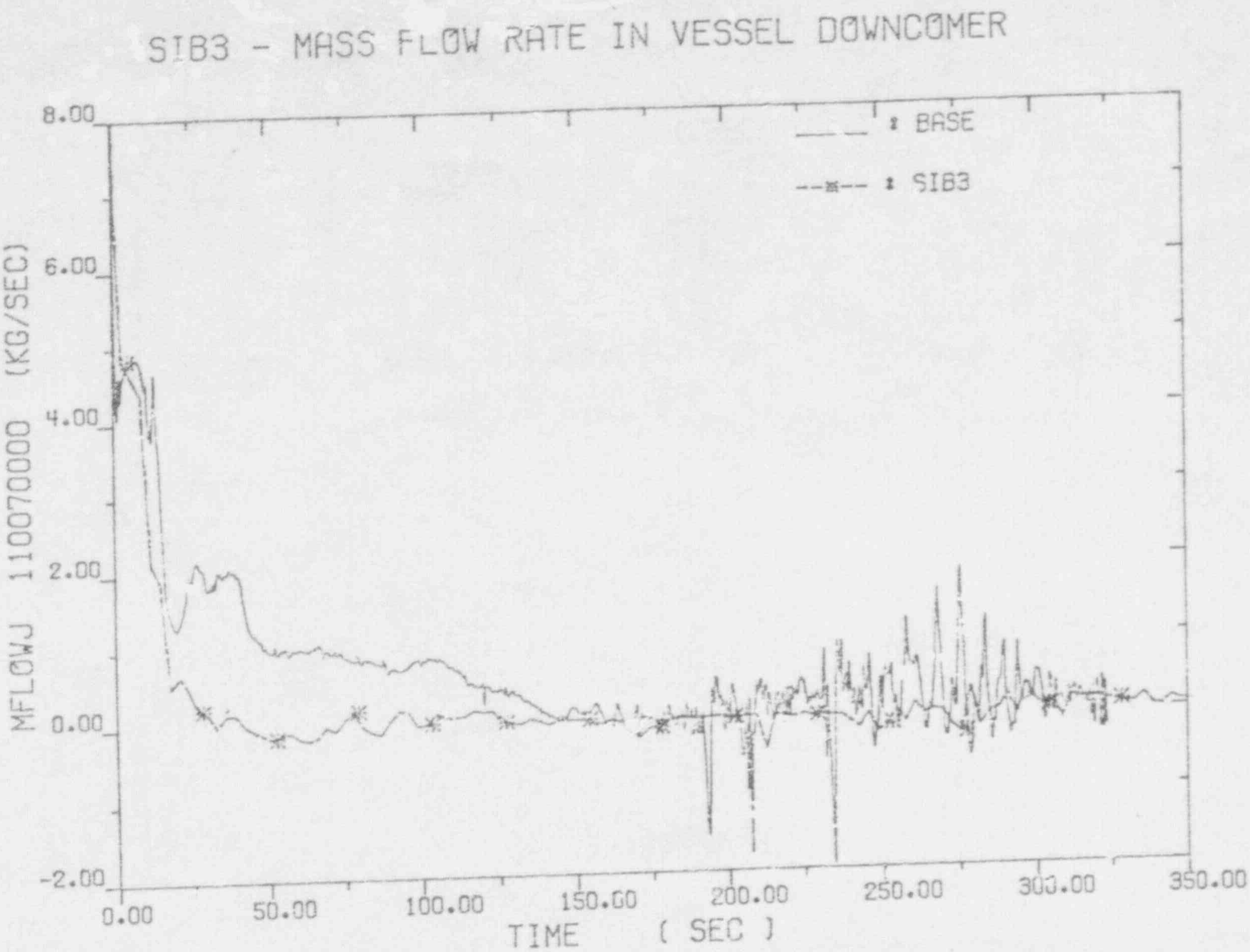

Figure 4.26 Comparison Between the Calculated and Measured Mass Flow Rate in Vessel Downcomer of Test S–IB–3

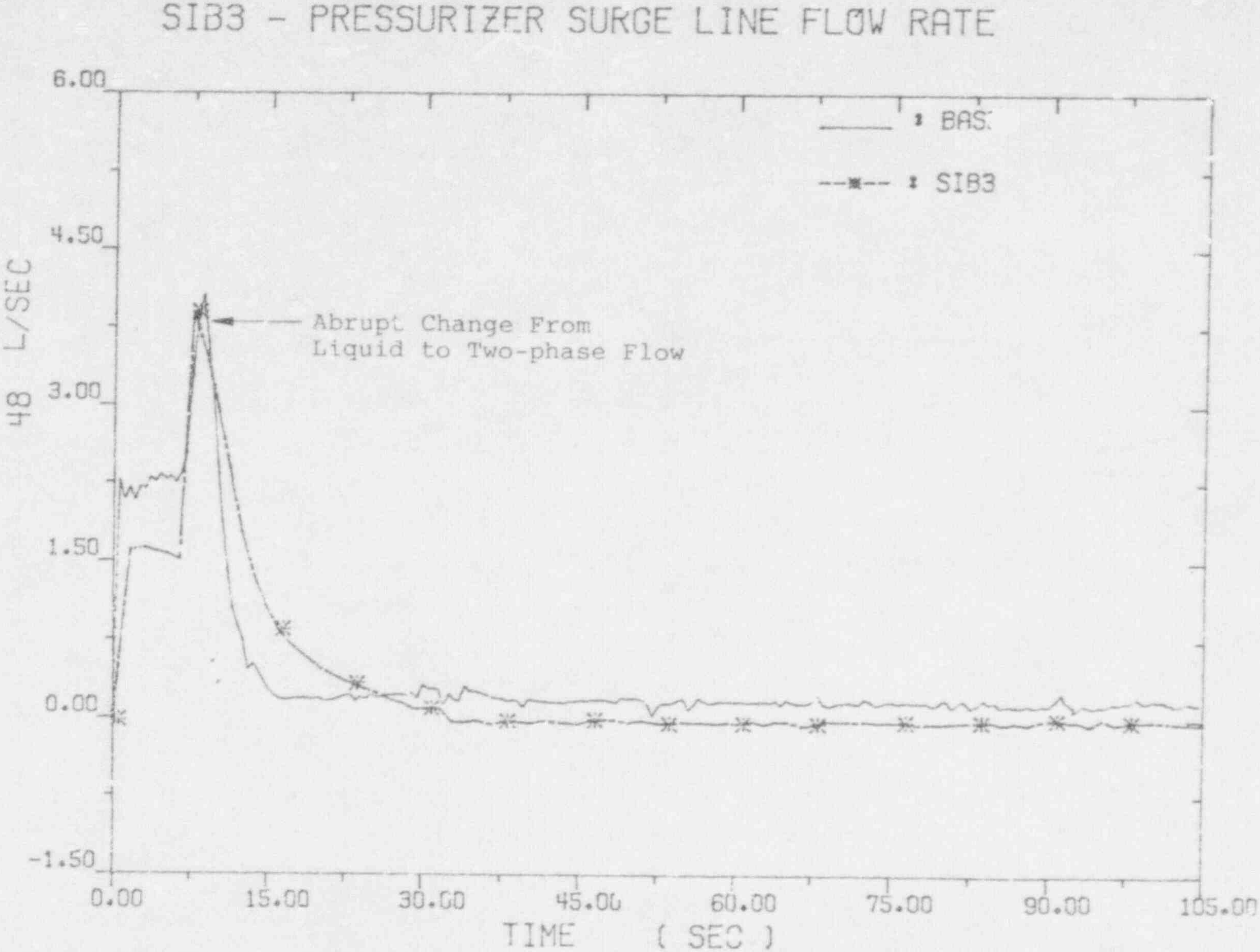

Figure 4.27 Comparison Between the Calculated and Measured Pressurizer Surge Line Volumetric Flow Rate of Test S-IB-3

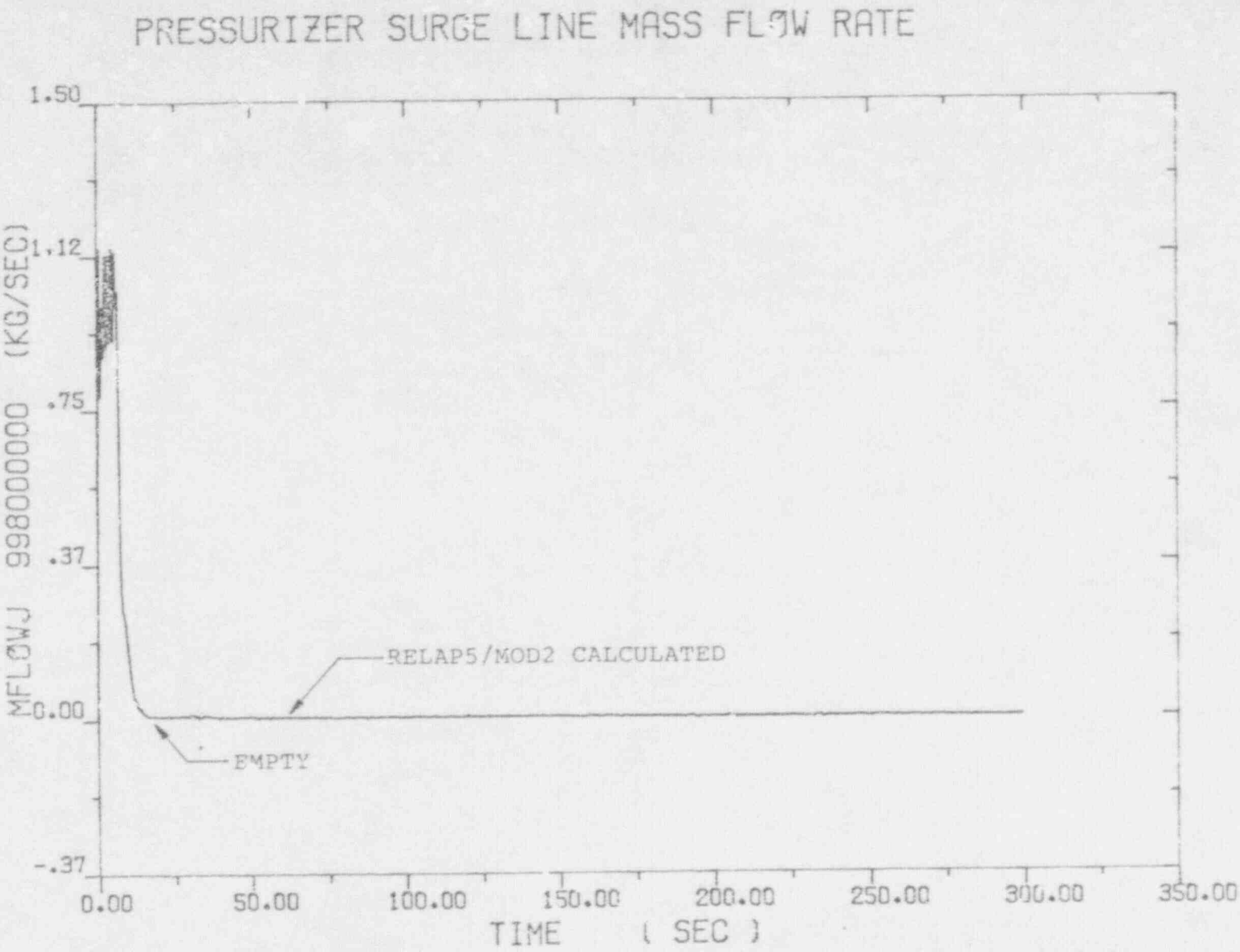

Figure 4.28 Calculated Pressurizer Surge Line Mass Flow Rate of Test S–IB–3 Simulation

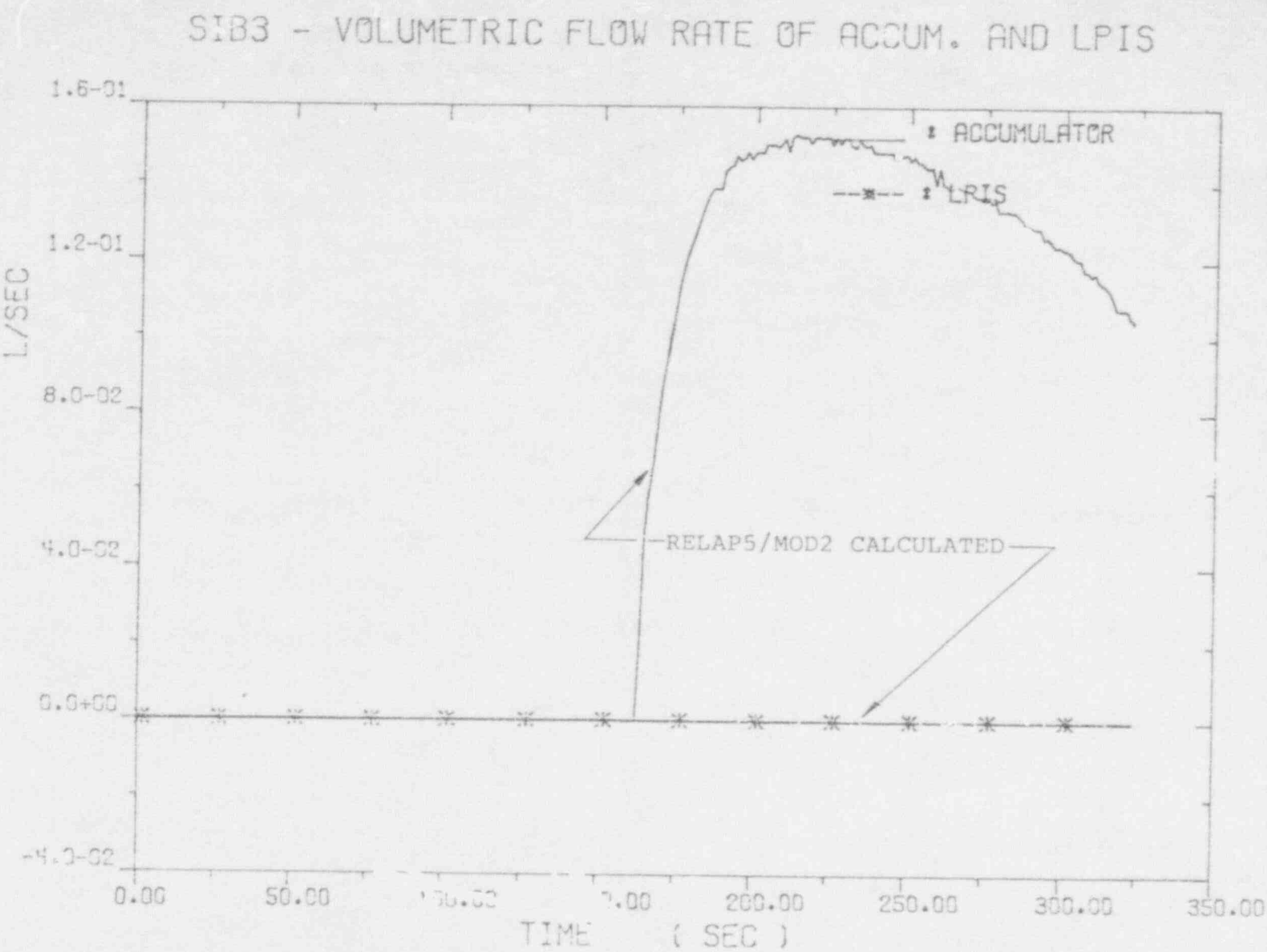

Figure 4.29 Calculated Volumetric Flow Rate of Accumulator and Low Pressure Injection System of Test S–IB–3 Simulation

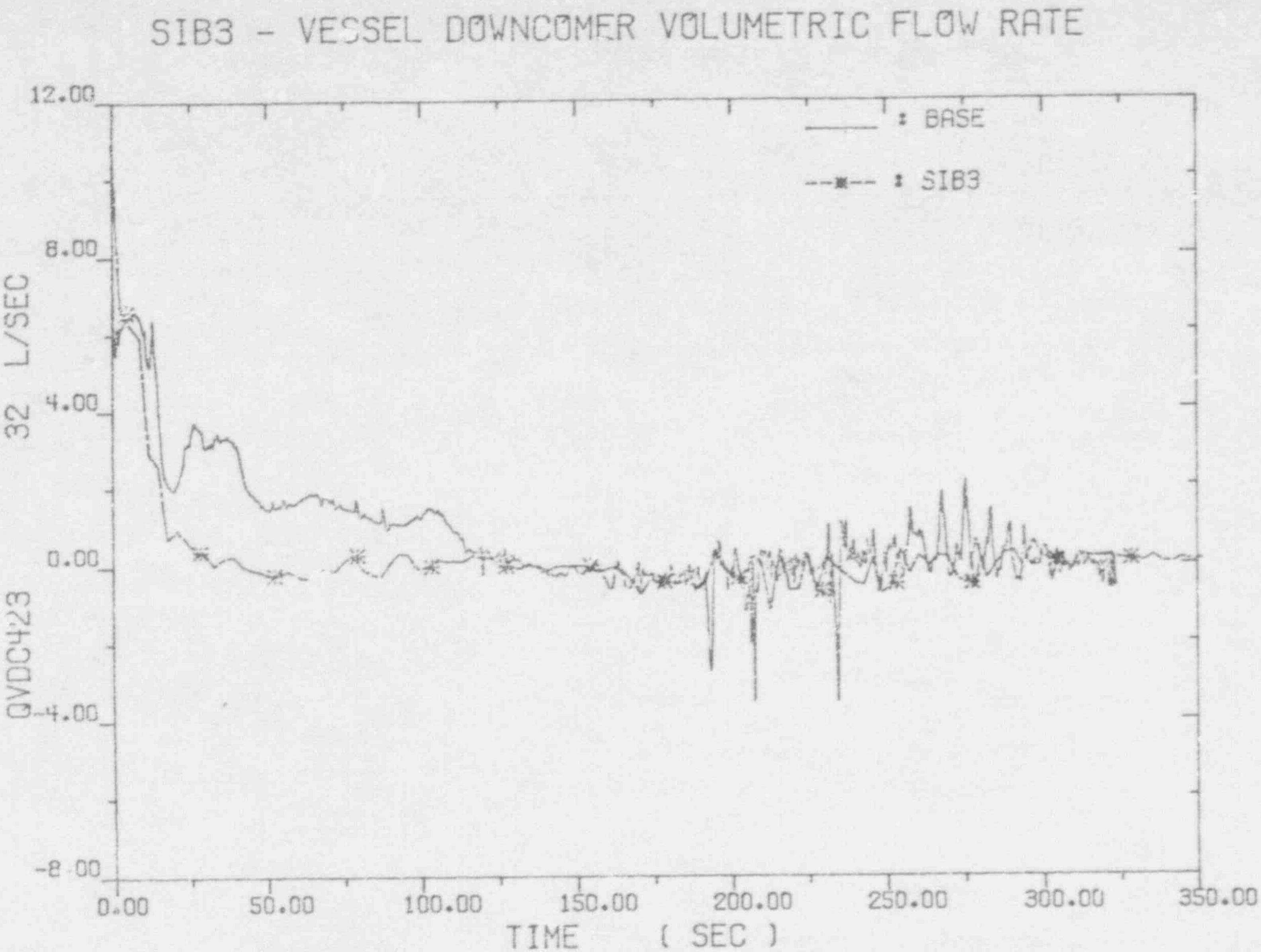

Figure 4.30 Comparison Between the Calculated and Measured Volumetric Flow Rate in Vessel Downcomer of Test S-IB-3 Simulation

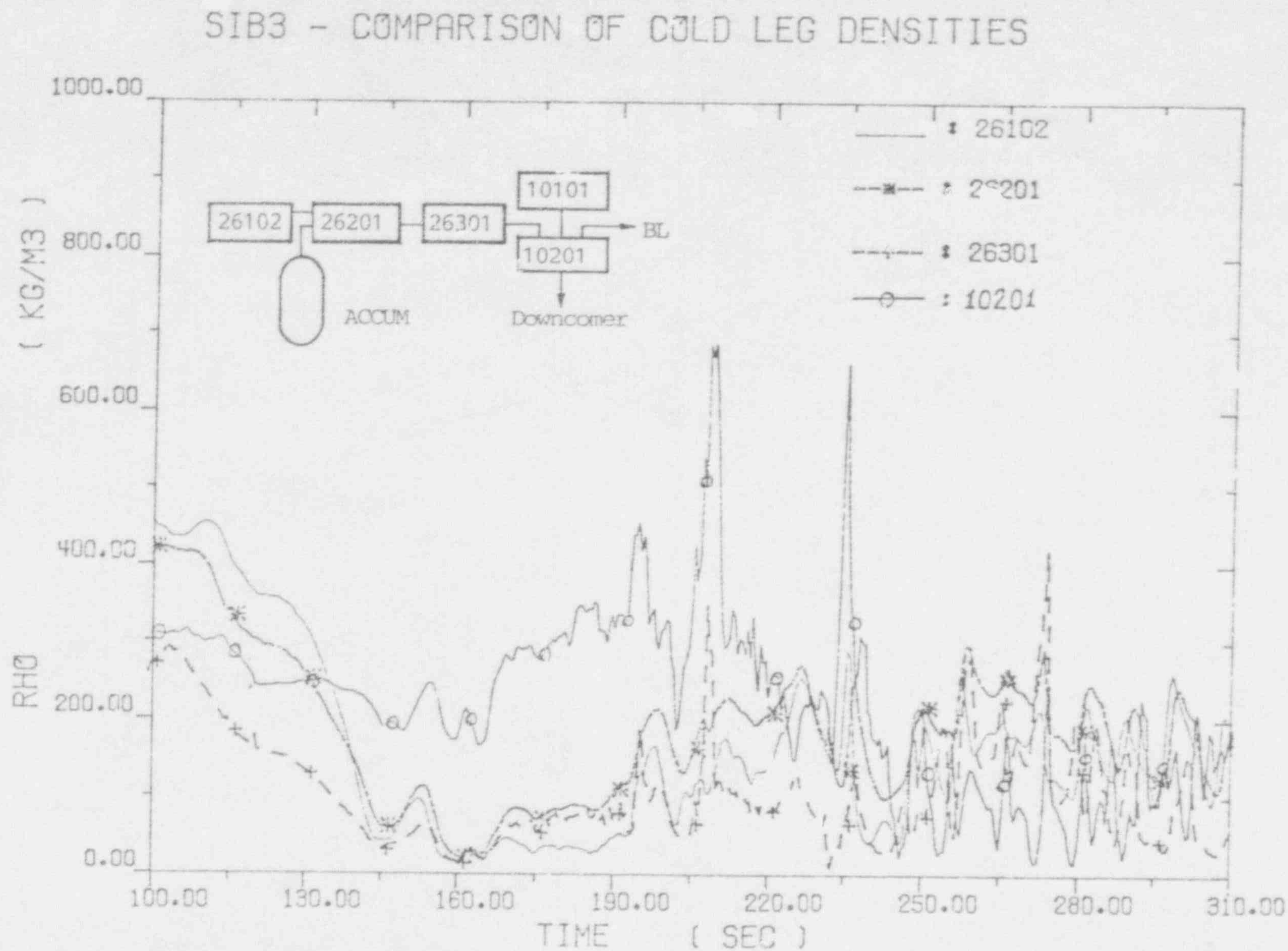

Figure 4.31 Comparison Among the Calculated Cold Leg Density of Test S-IB-3

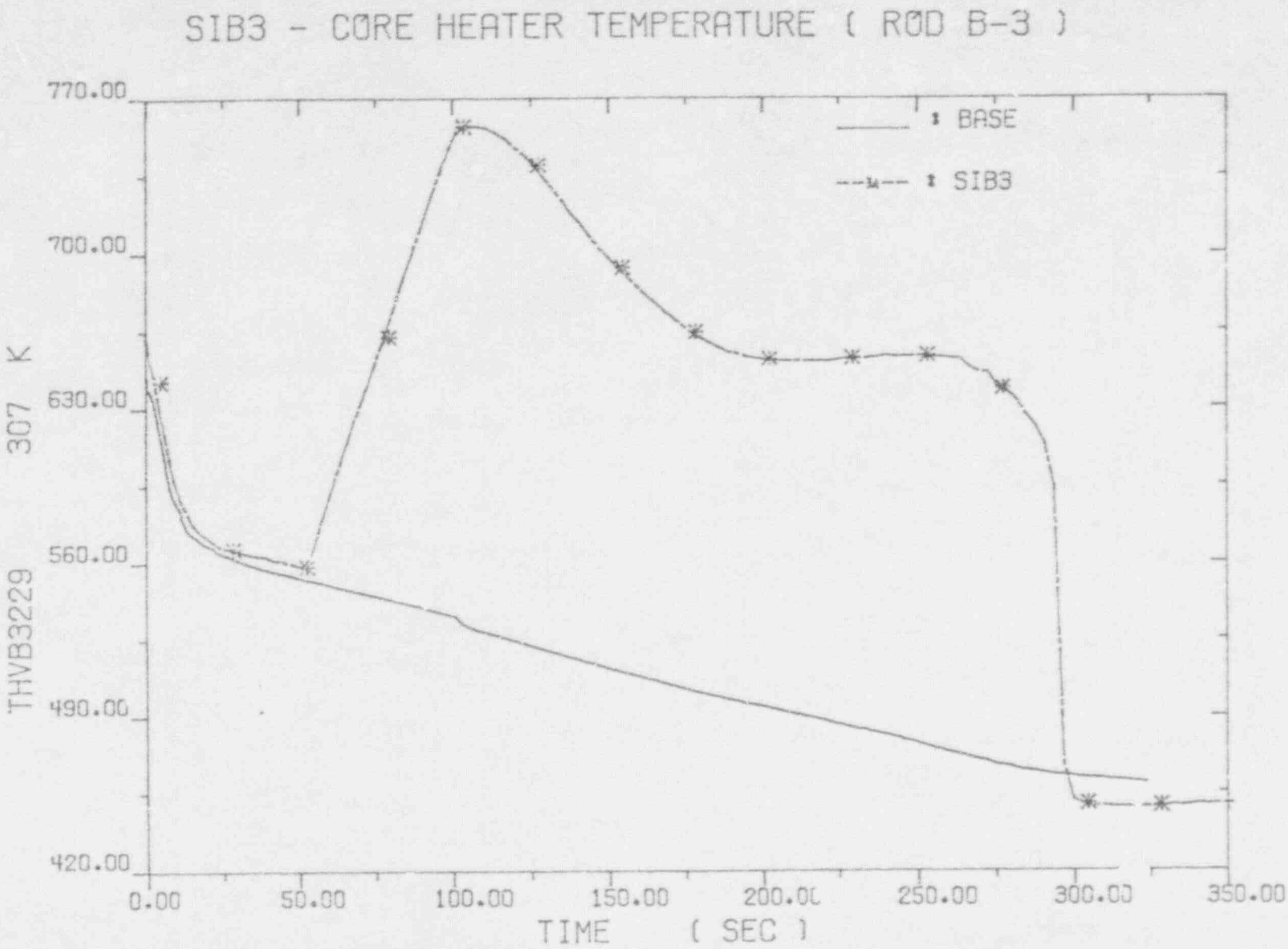

Figure 4.32 Comparison Between the Calculated and Measured Core Heater Temperature of Test S-IB-3

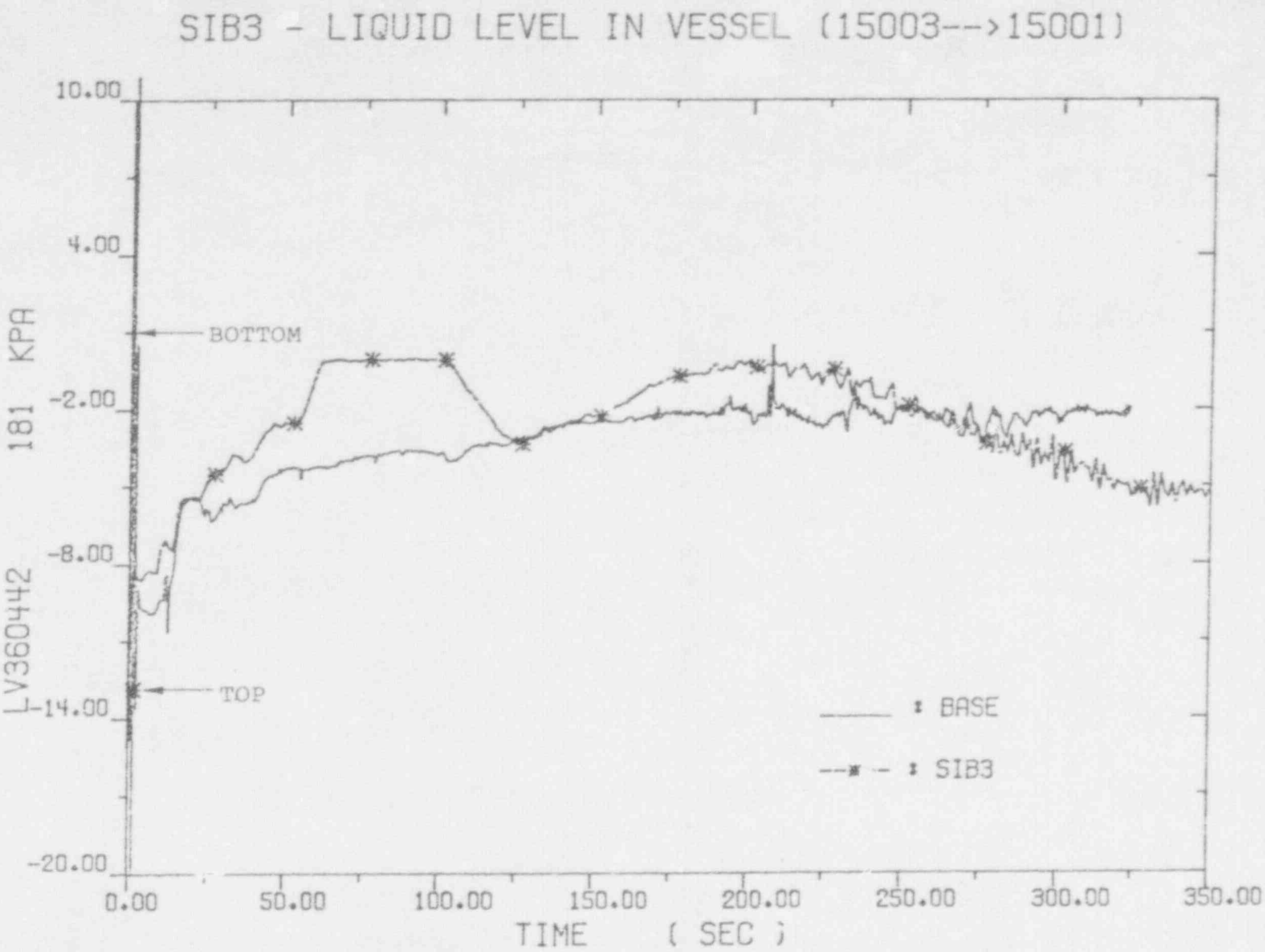

Figure 4.33 Comparison Between the Calculated and Measured Liquid Level in Vessel of Test S-IB-3

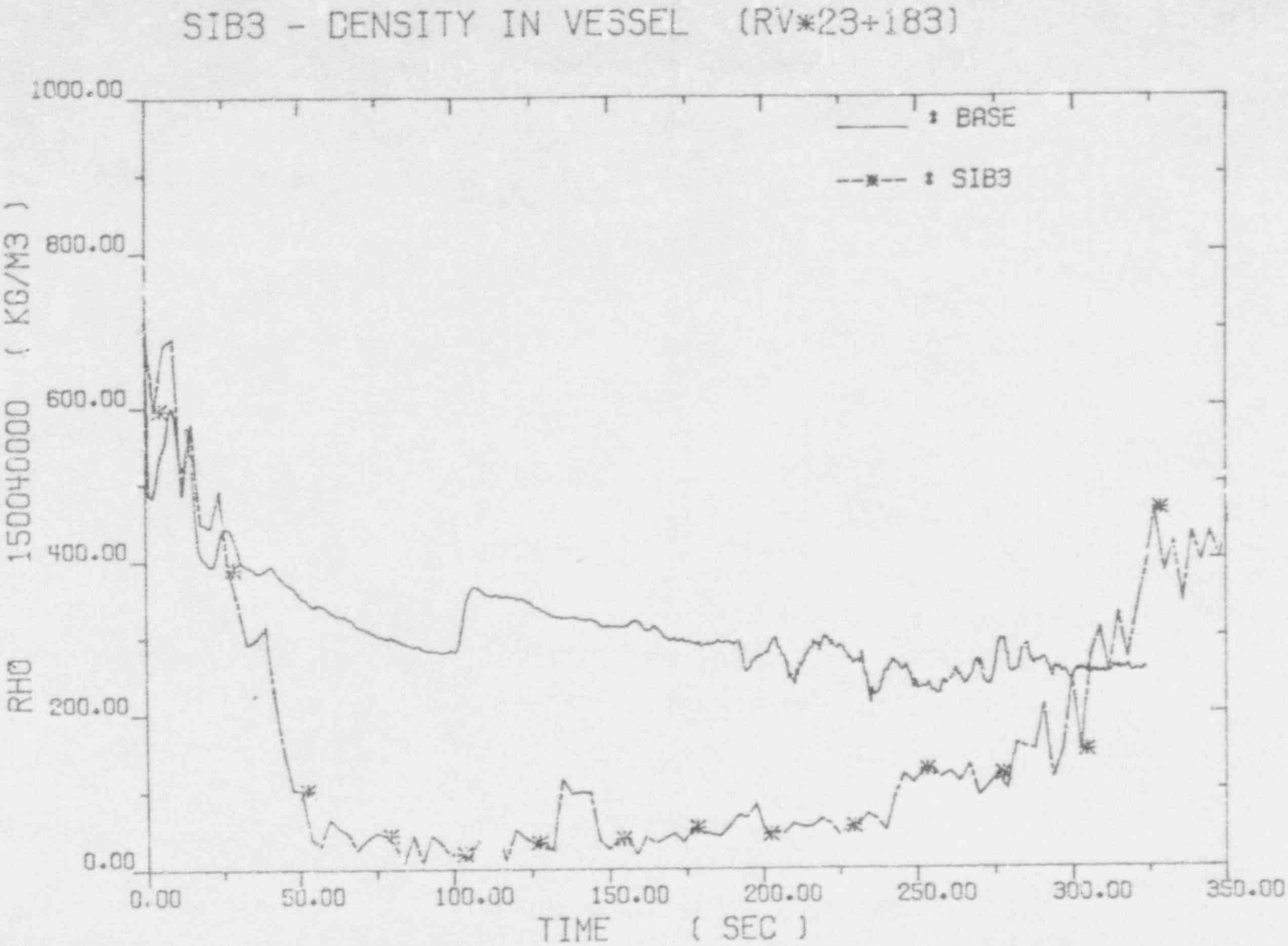

Figure 4.34 Comparison Between the Calculated and Measured Density in Vessel of Test S-IB-3

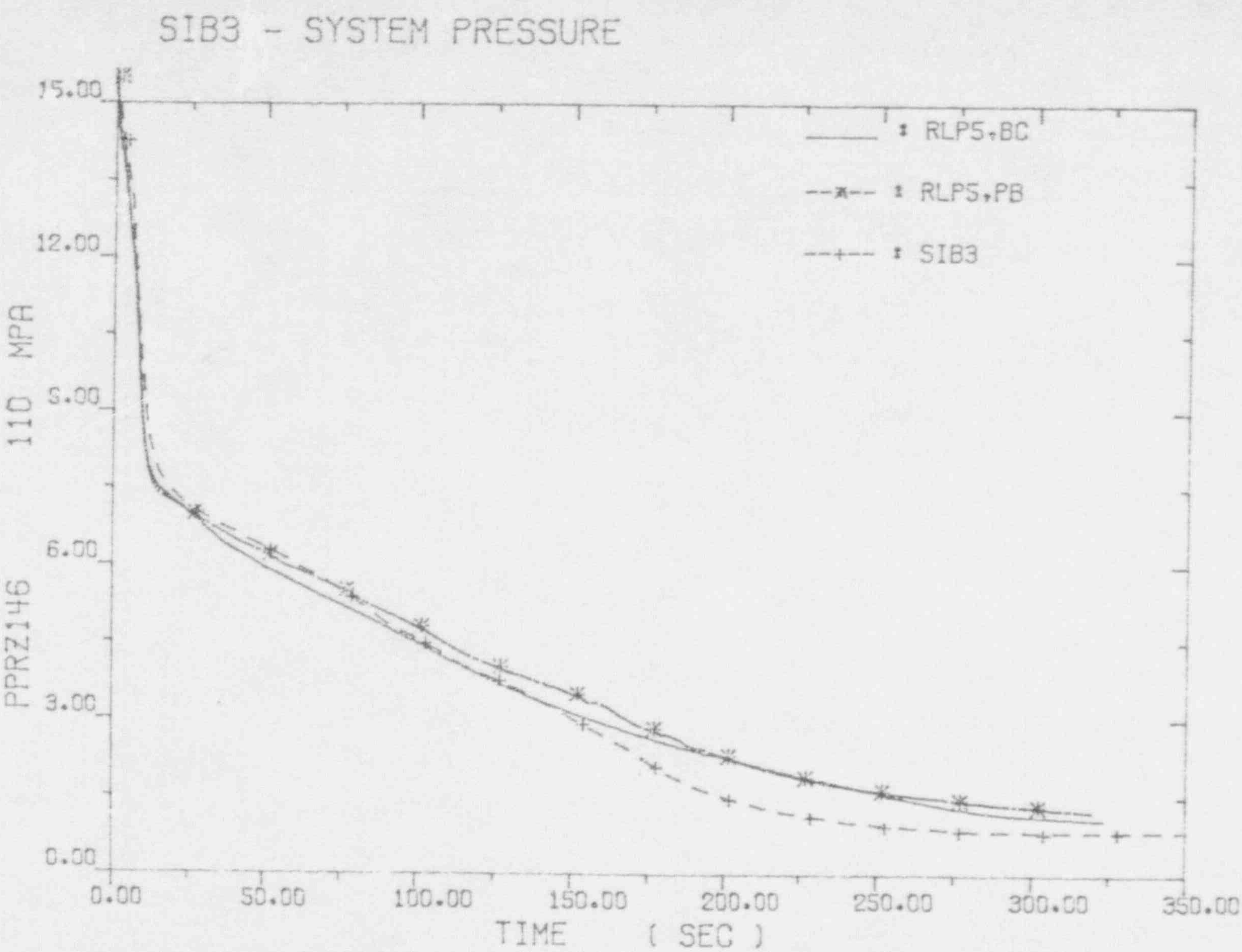

Figure 4.35 Comparison Among Calculated System Pressure of the BASE, PRESSB Cases and Test Data

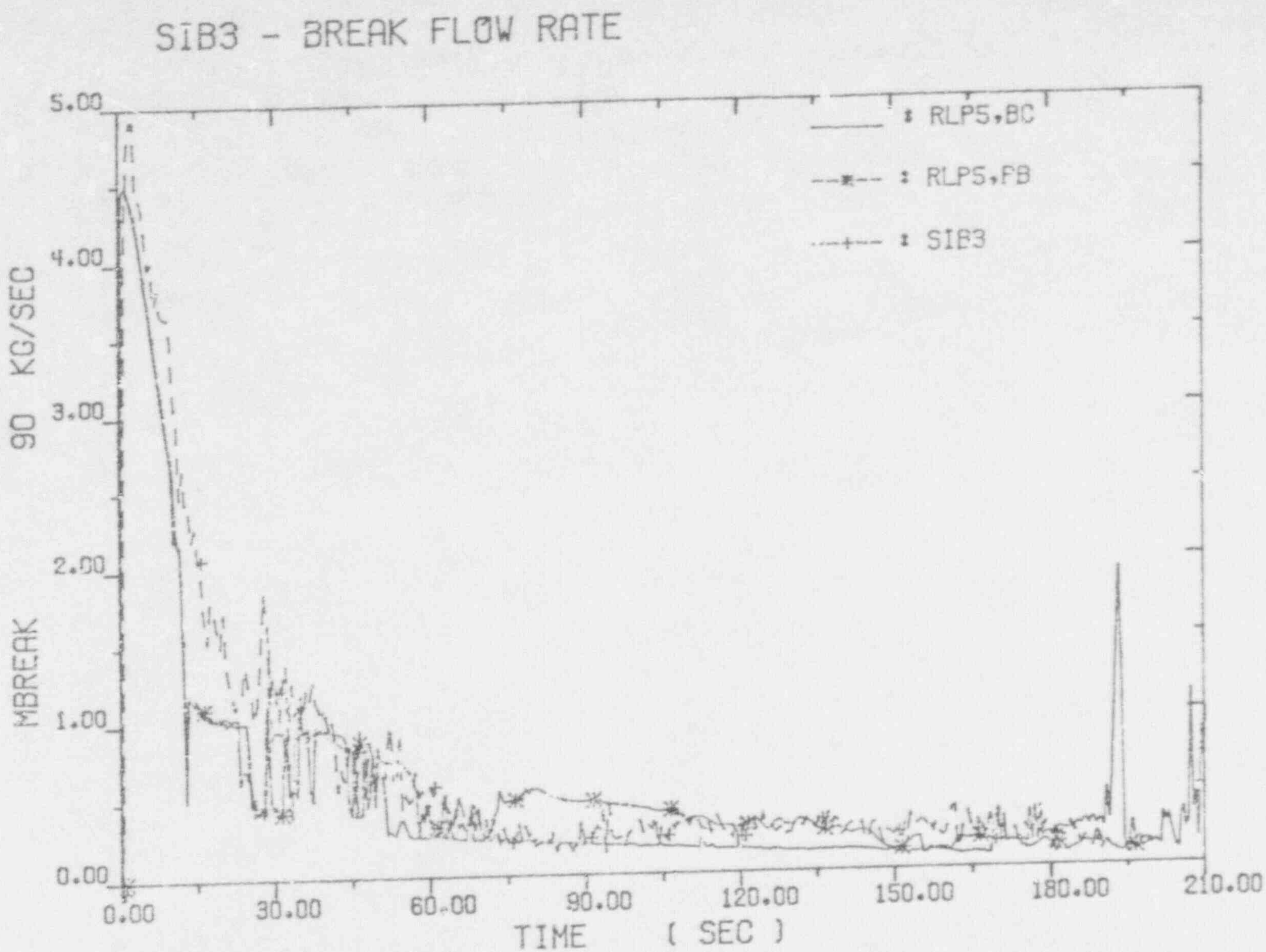

Figure 4.36 Comparison Among Calculated Break Mass Flow Rate of the BASE, PRESSB Cases and Test Data

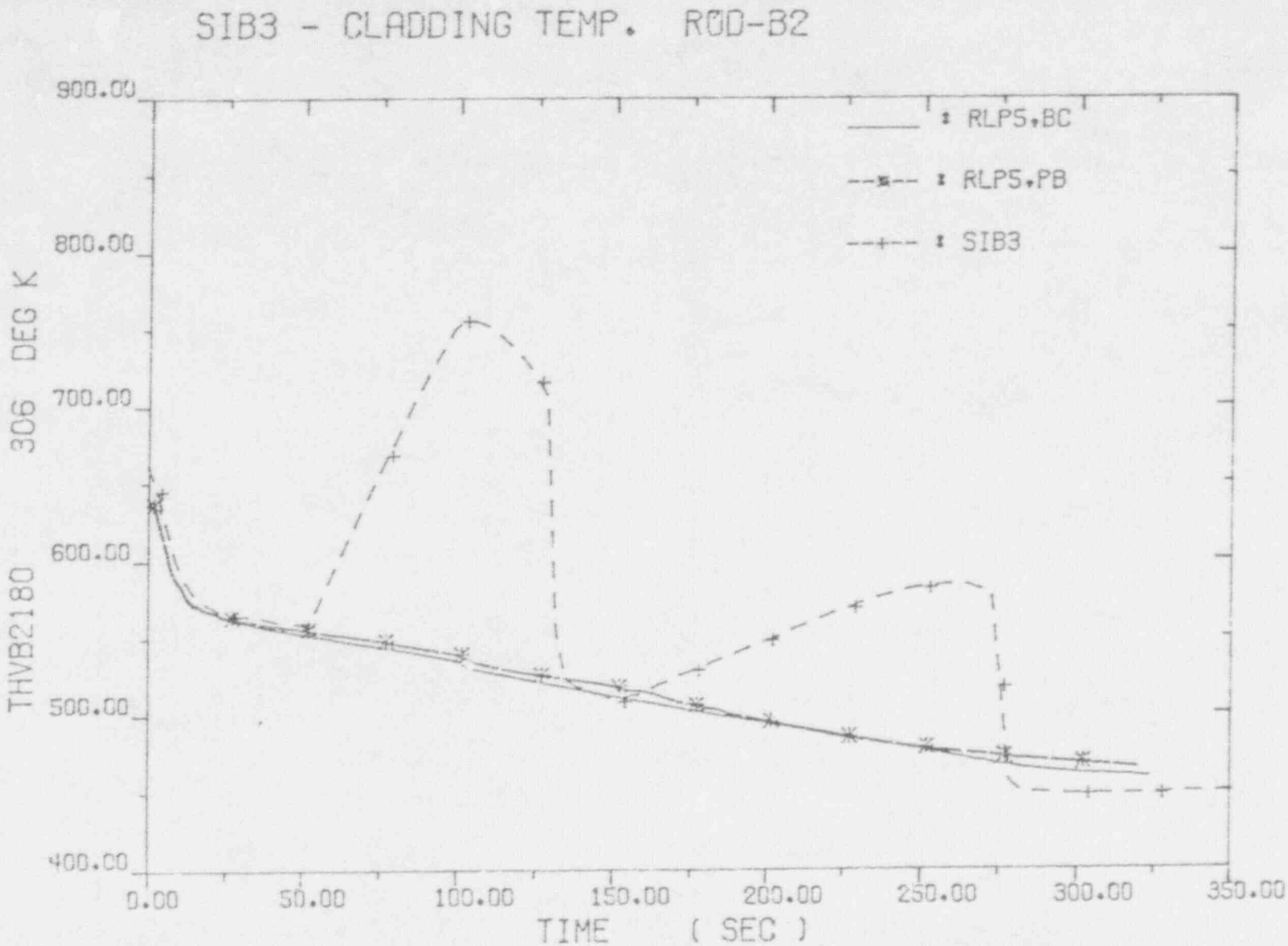

Figure 4.37 Comparison Among Calculated Cladding Temperature of the BASE, PRESSB Cases and Test Data

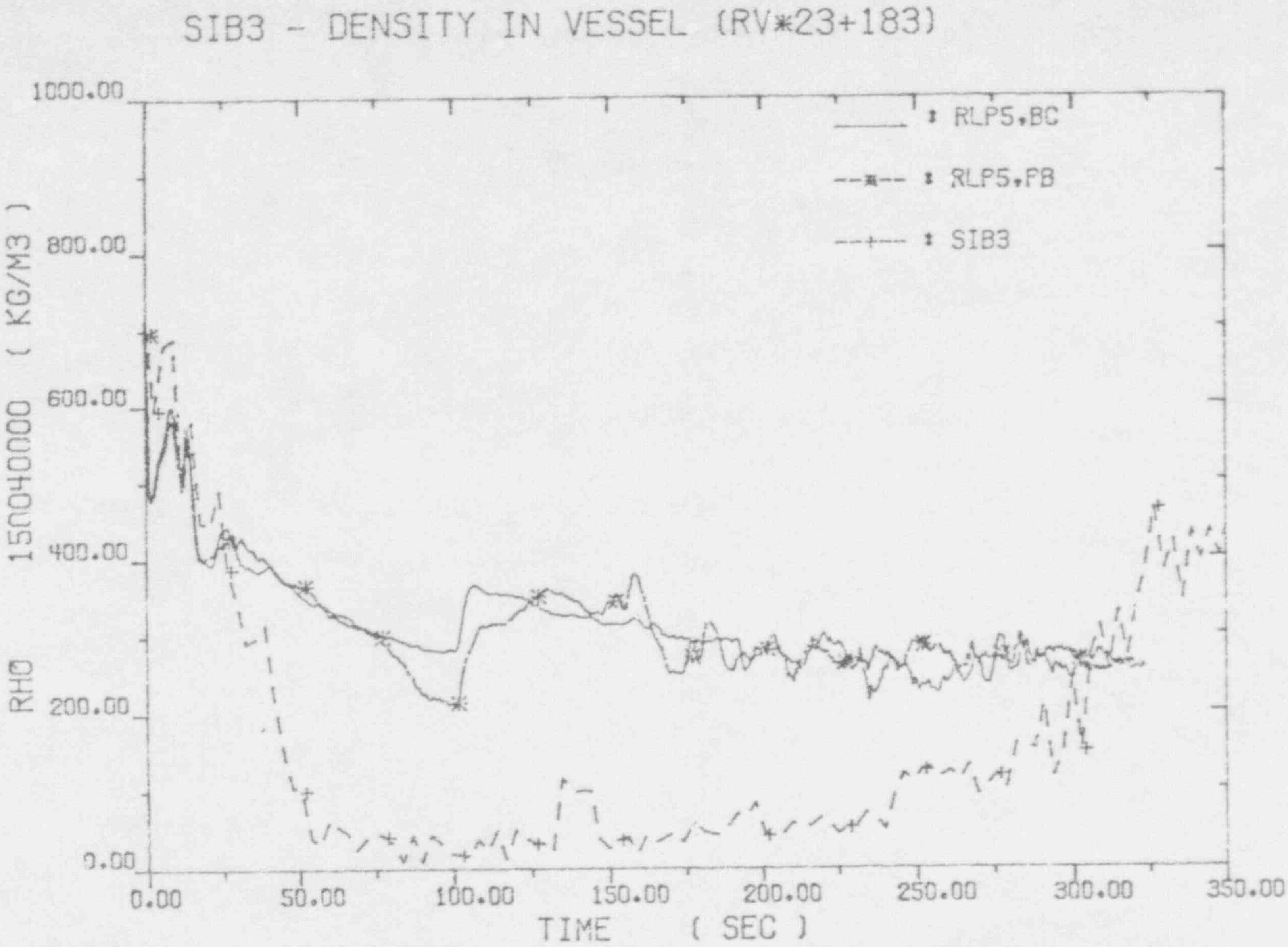

Figure 4.38 Comparison Among Calculated Vessel Density of the BASE, PRESSB Cases and Test Data

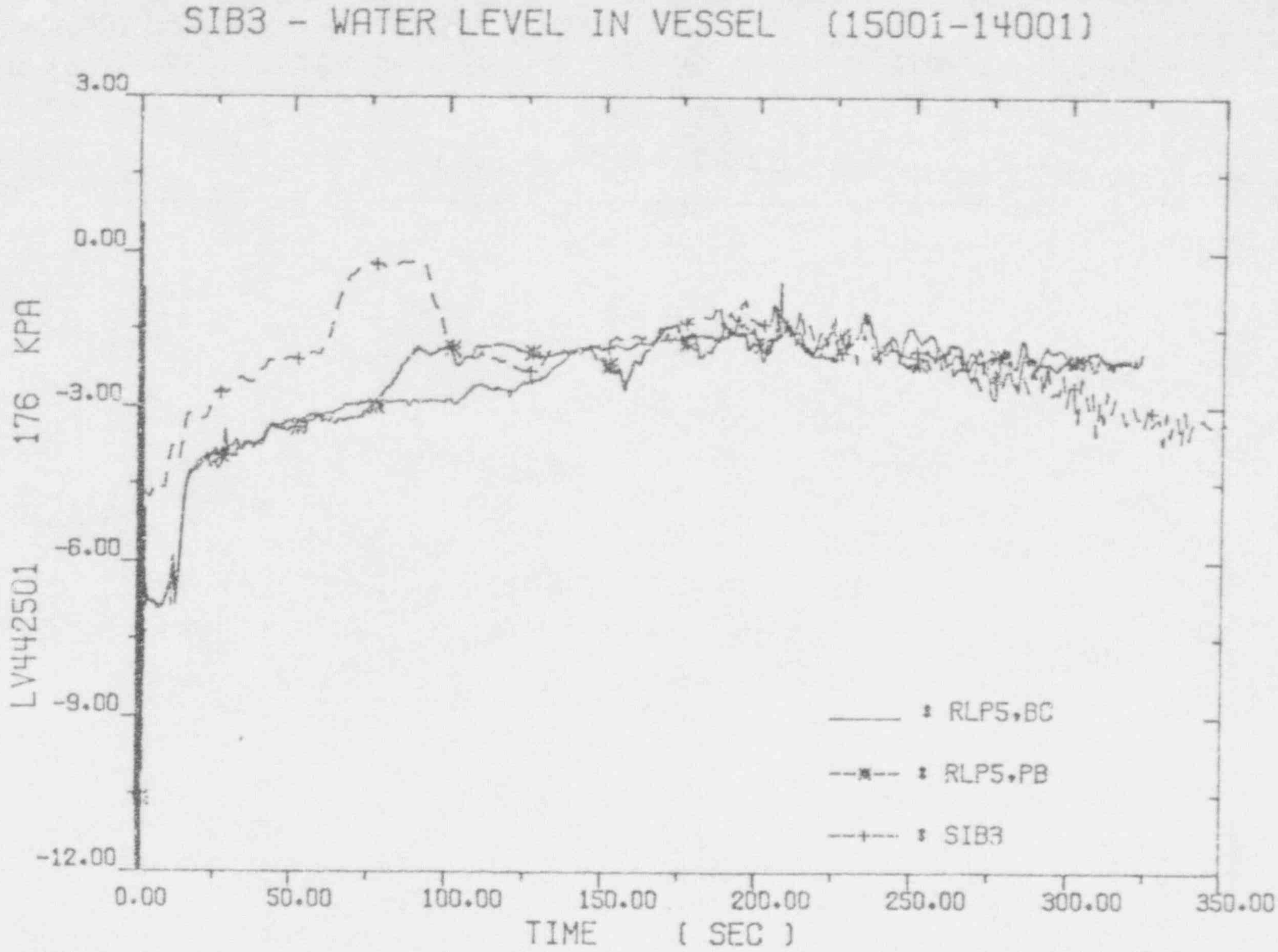

Figure 4.39 Comparison Among Calculated Vessel Liquid Level of the BASE, PRESSB Cases and Test Data

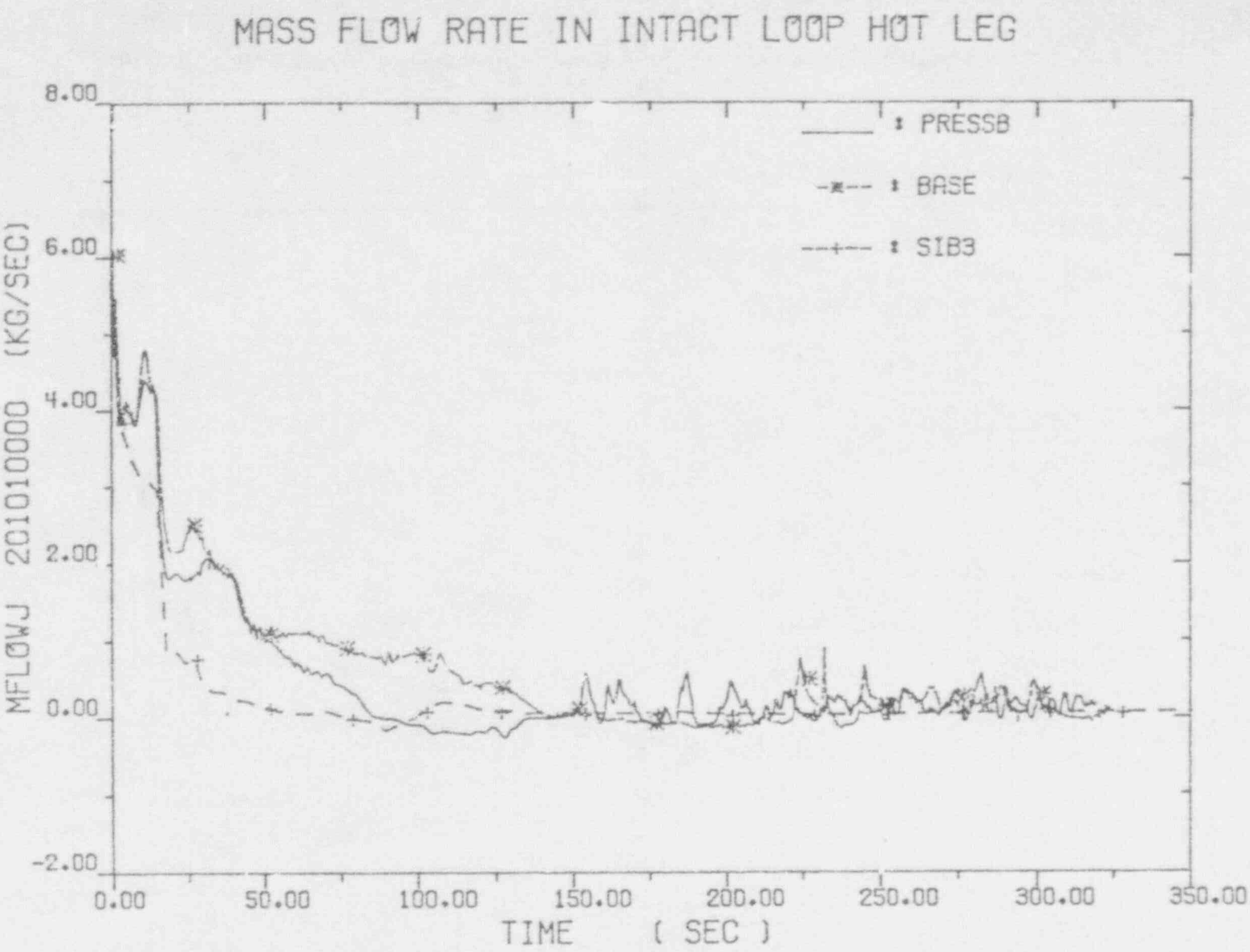

Figure 4.40 Comparison Among Calculated Intact Loop Hot Leg Mass Flow Rate of PRESSB, BASE Cases and Test Data

1

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

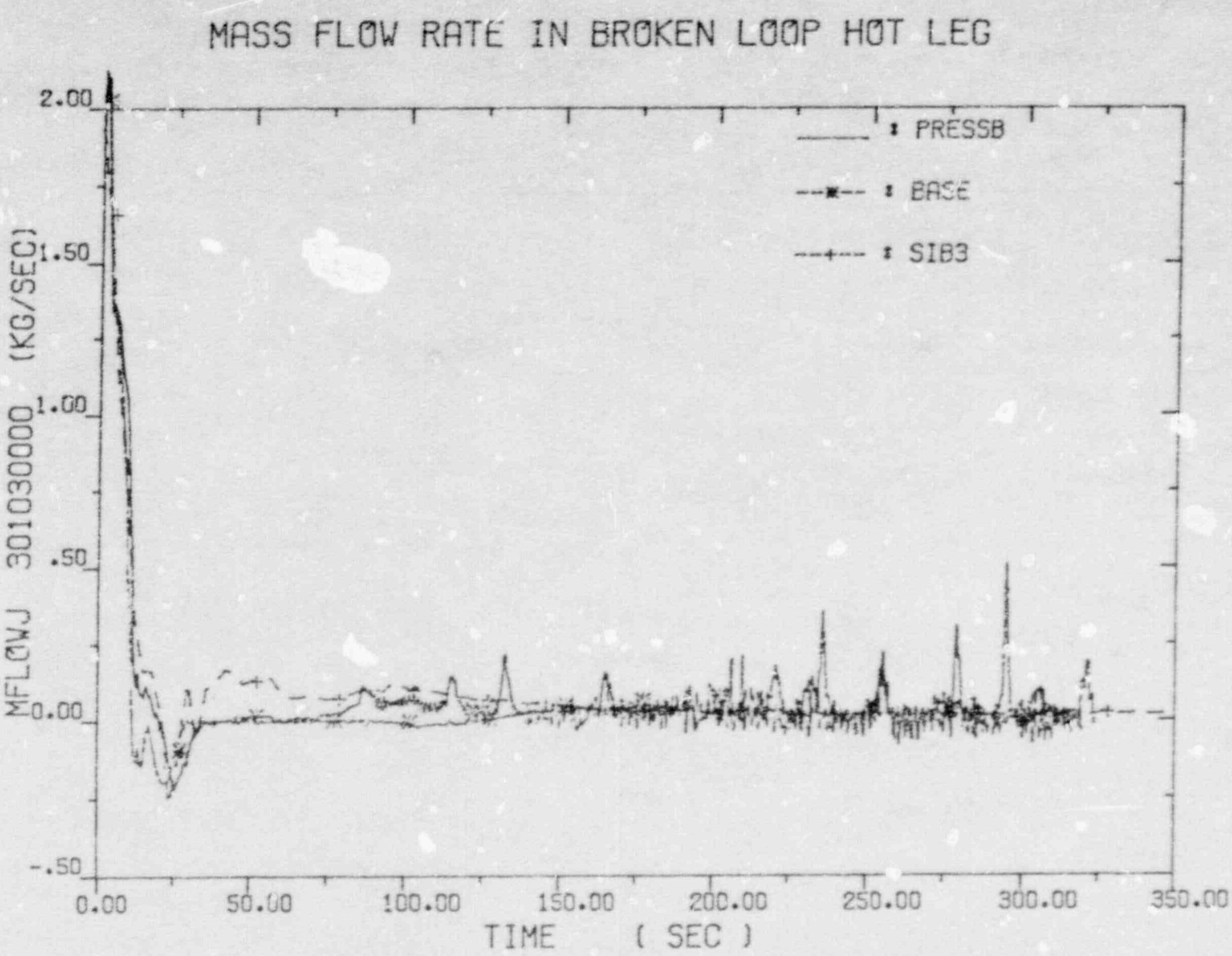

Figure 4.41 Comparison Among Calculated Broken Loop Hot Leg Mass Flow Rate of PRESSB, BASE Cases and Test Data

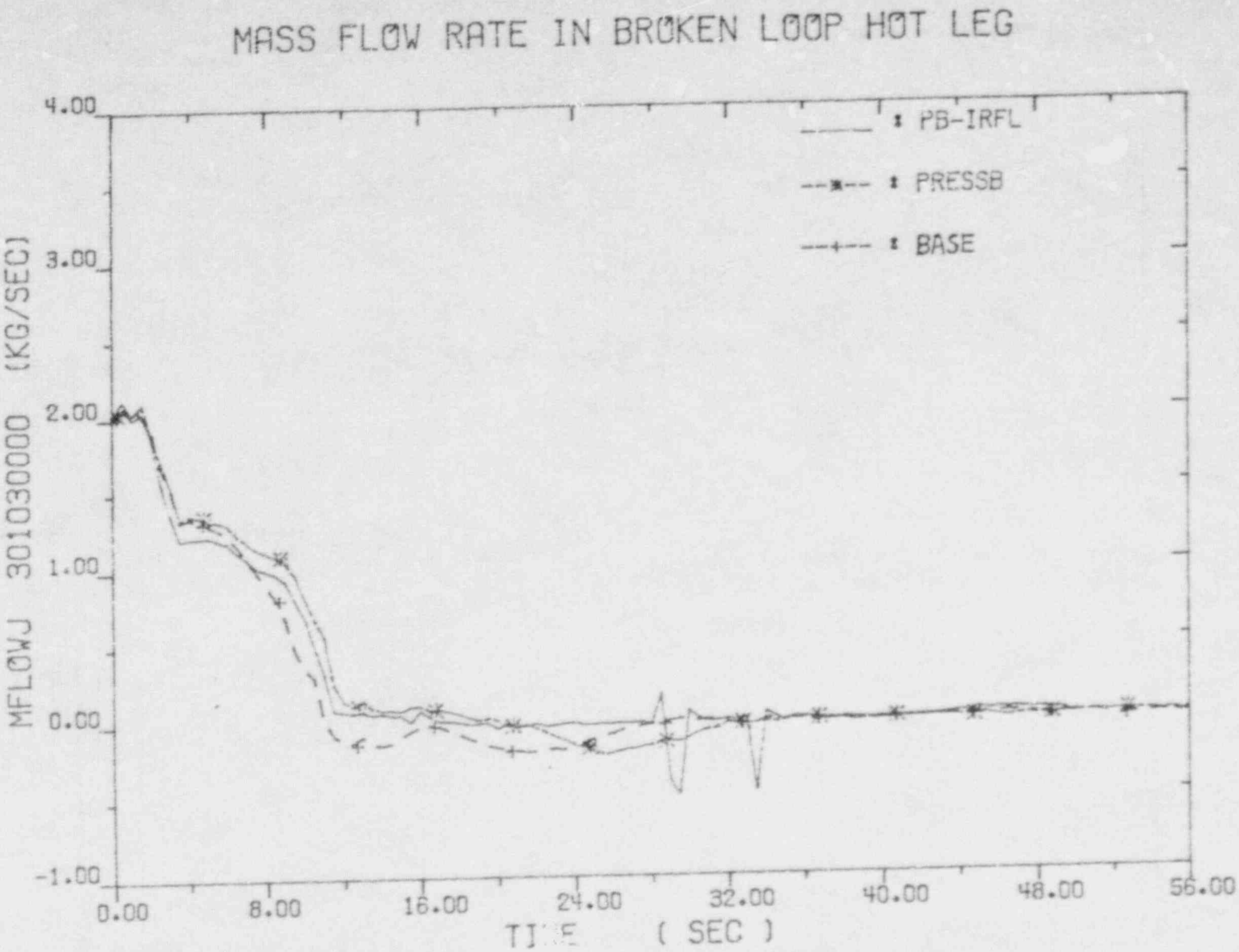

Figure 4.42 Comparison Among Calculated Broken Loop Hot Leg Mass Flow Rate of PB-IRFL, PRESSB, and BASE Cases

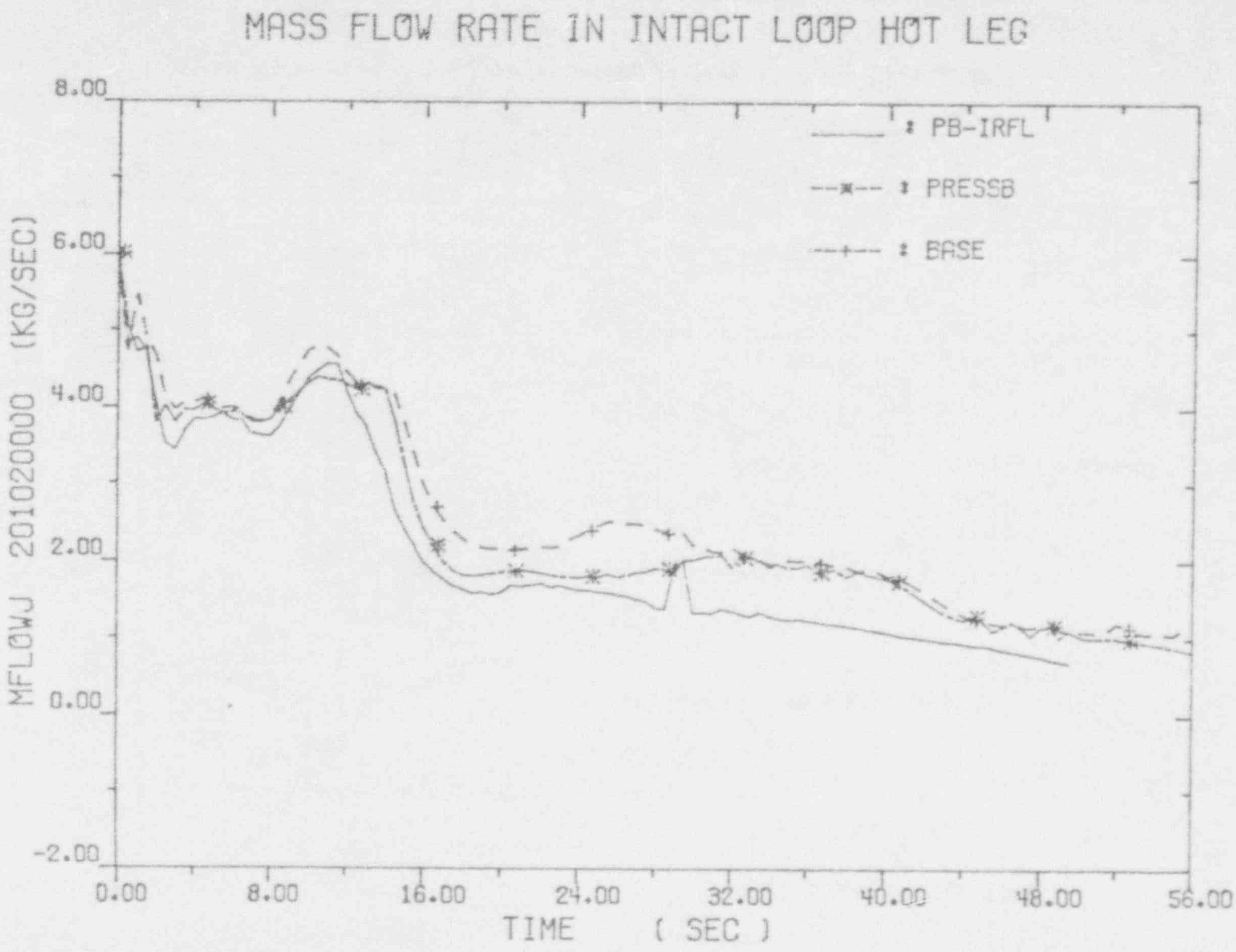

Figure 4.43 Comparison Among Calculated Intact Loop Hot Leg Mass Flow Rate of PB-IRFL, PRESSB and BASE Cases

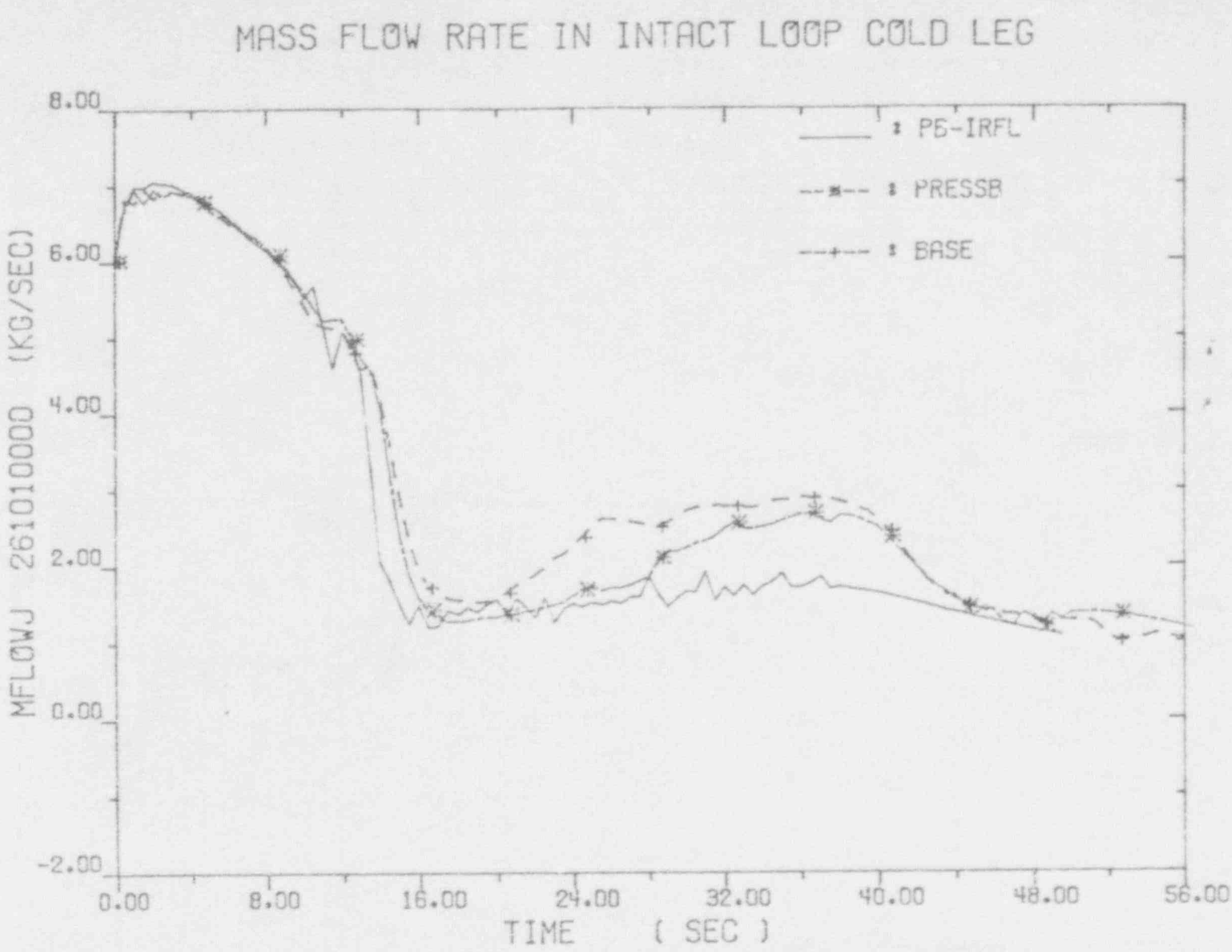

Figure 4.44 Comparison Among Calculated Intact Loop Cold Leg Mass Flow Rate of PB-IRFL, PRESSB and BASE Cases

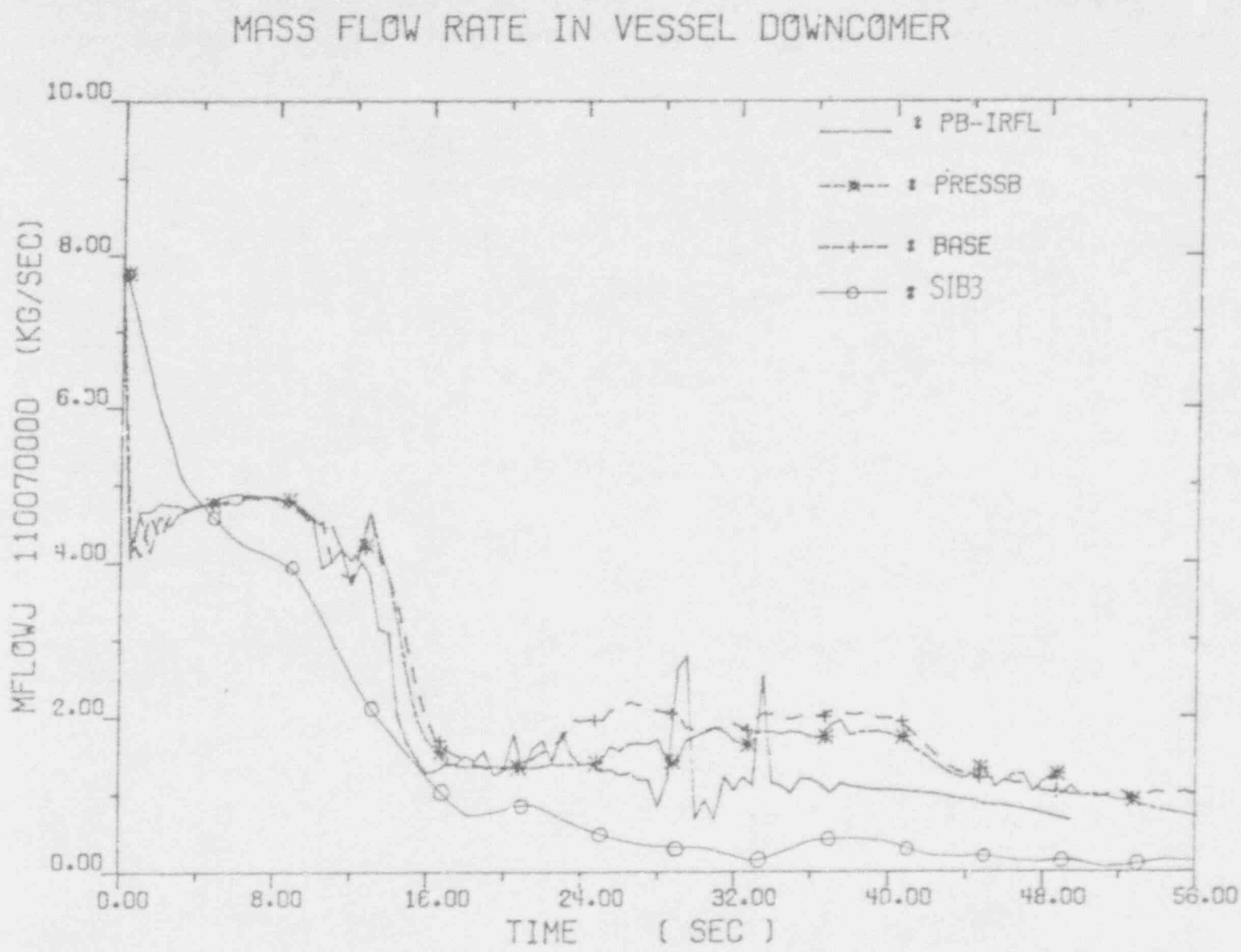

Figure 4.45 Comparison Among Calculated Vessel Downcomer Mass Flow Rate of PB-IRFL, PRESSB and BASE Cases

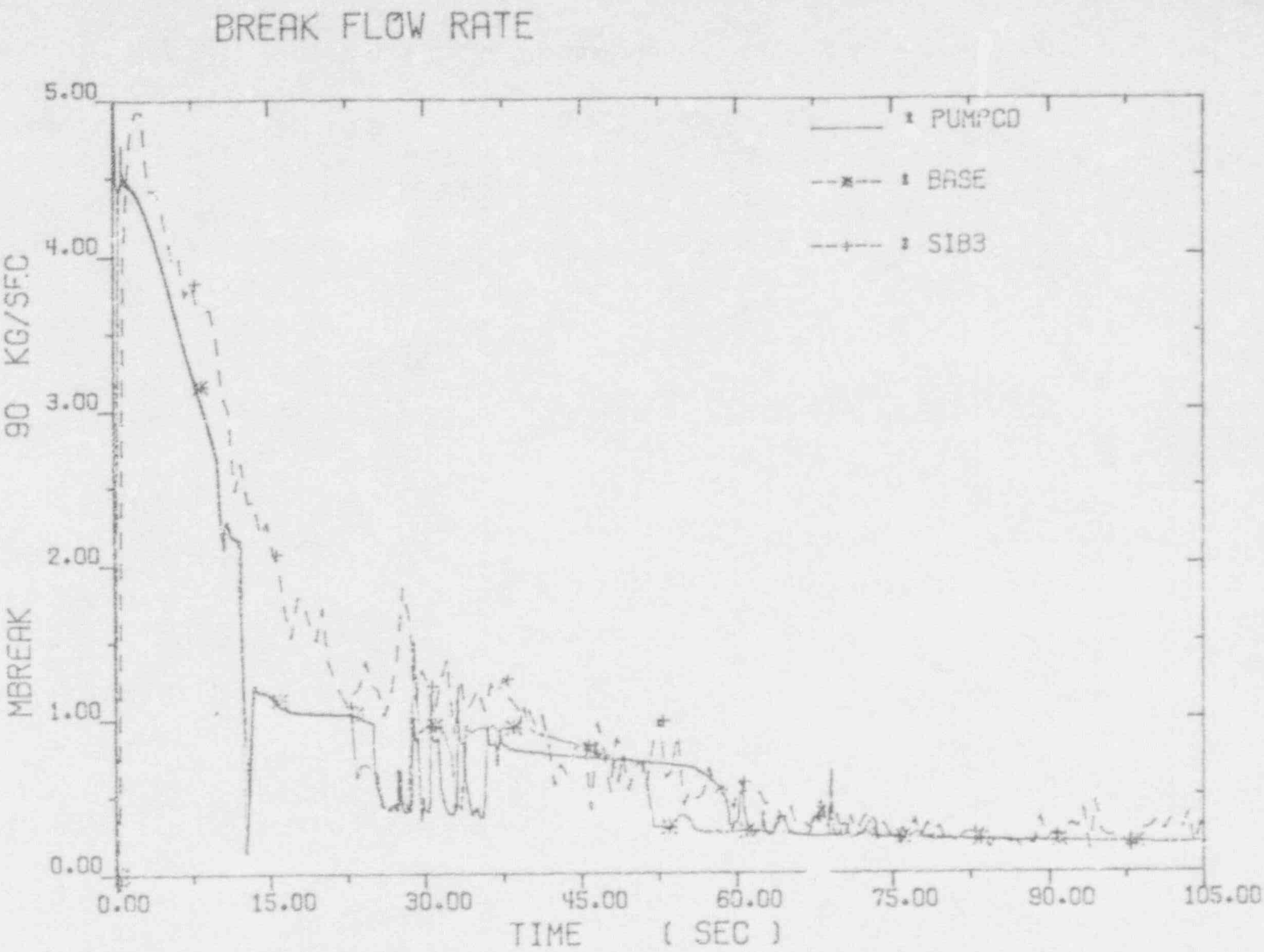

Figure 1.46 Comparison Among Calculated Break Mass Flow Rate of PUMPCD, BASE Cases and Test Data

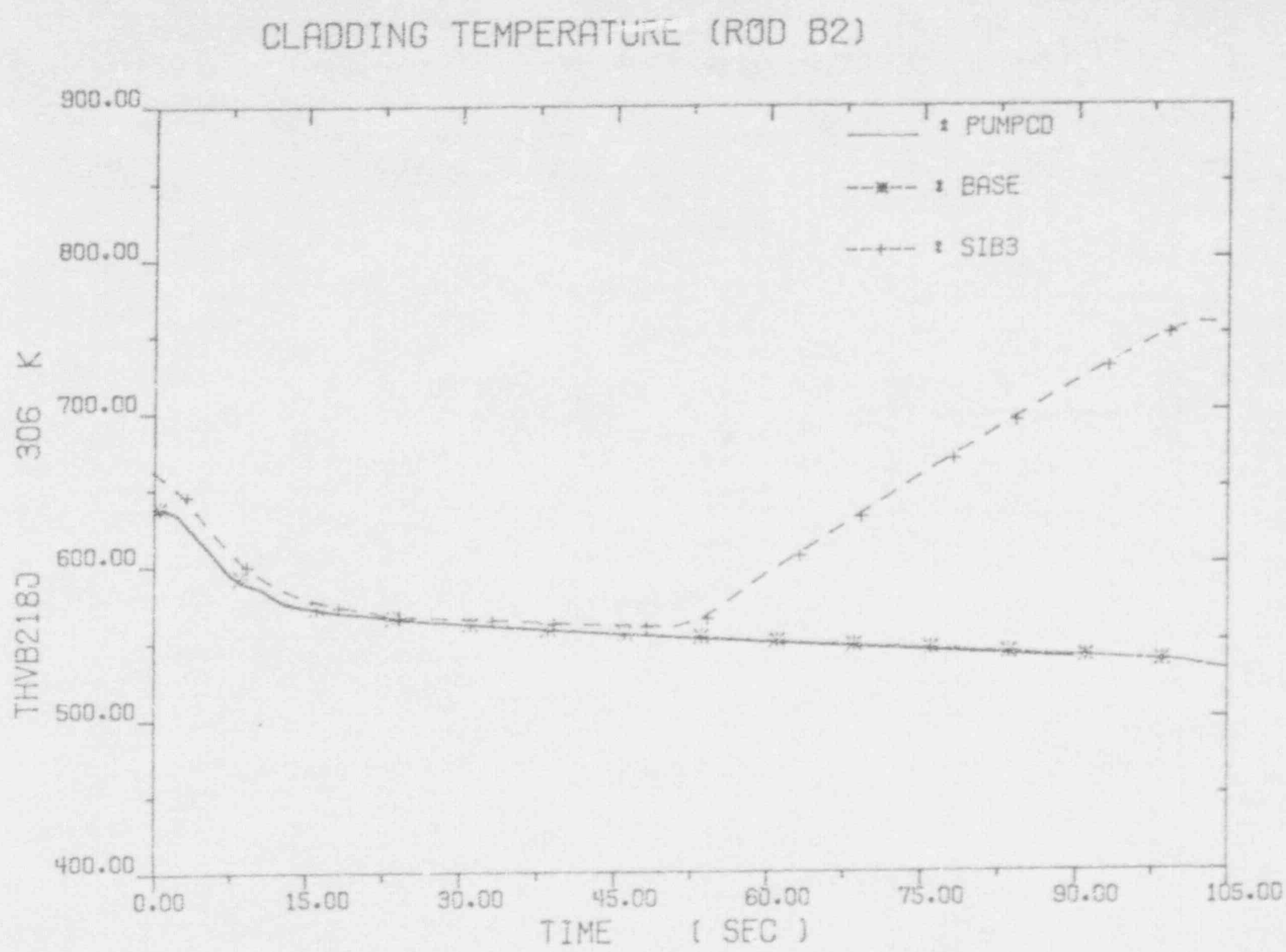

Figure 4.47 Comparison Among Calculated Cladding Temperature of PUMPCD, BASE Cases and Test Data

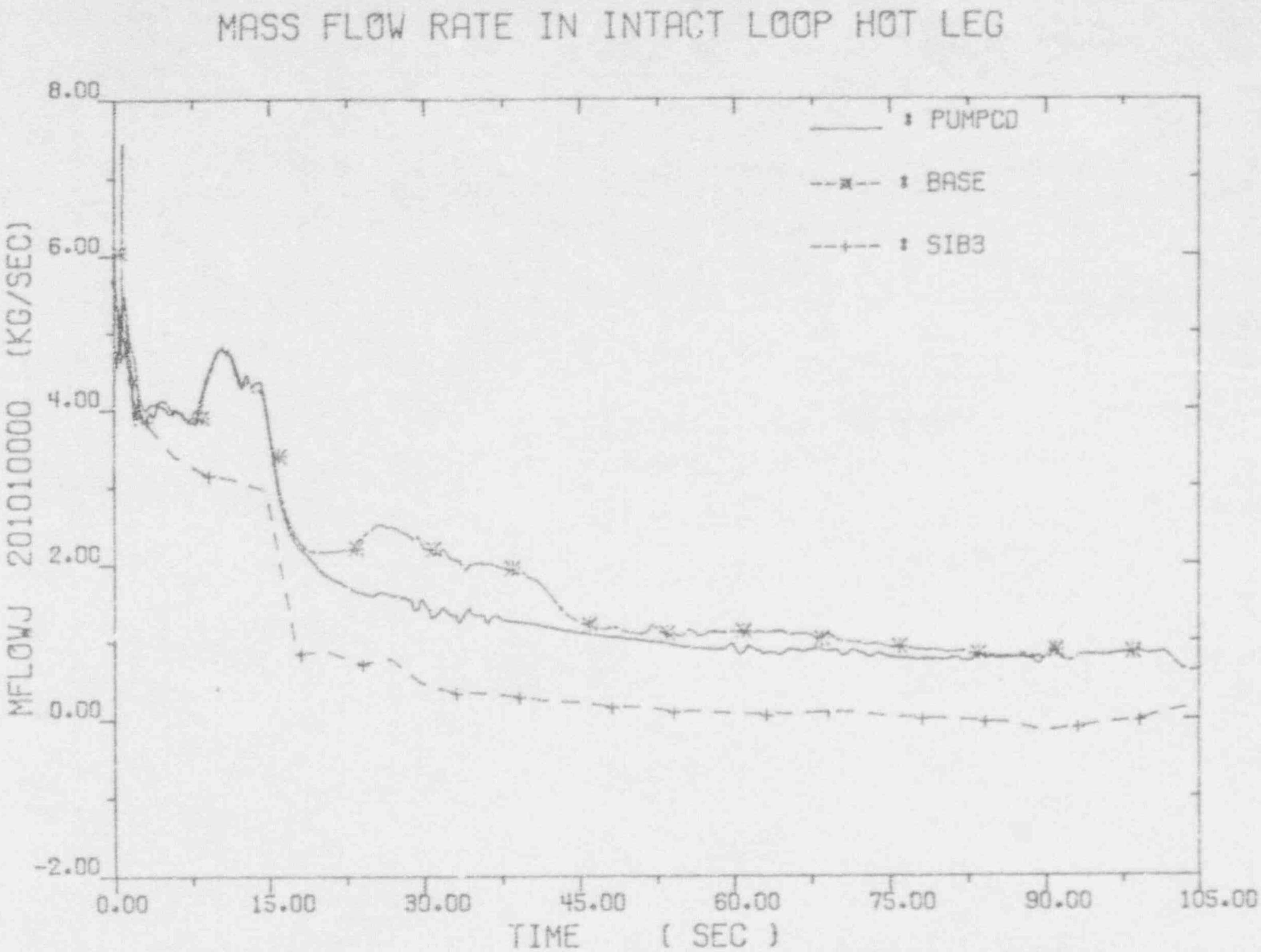

Figure 4.48 Comparison Among Calculated Intact Loop Hot Leg Mass Flow Rate of PUMPCD, BASE Cases and Test Data

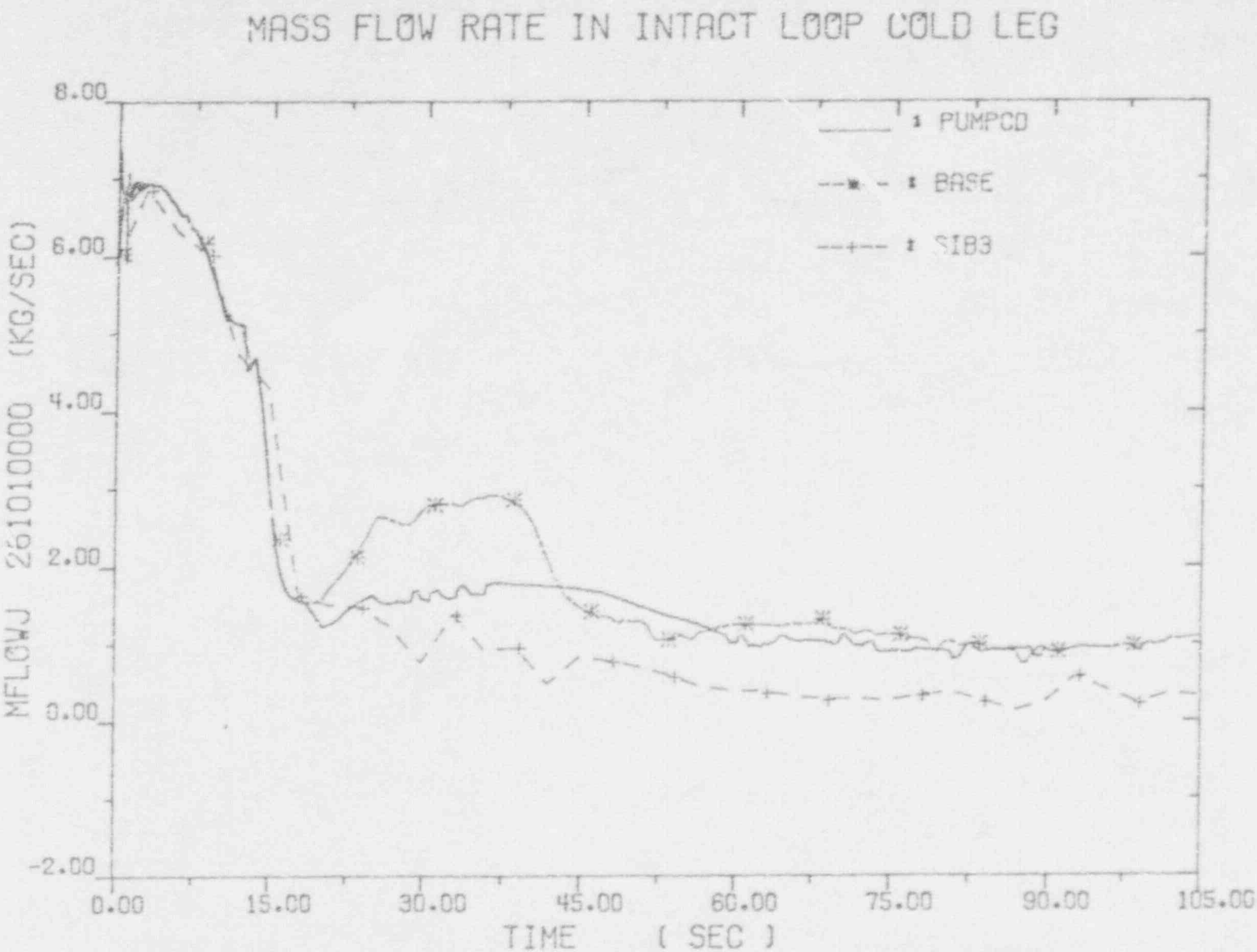

Figure 4.49 Comparison Among Calculated Intact Loop Cold Leg Mass Flow Rate of PUMPCD, BASE Cases and Test Data

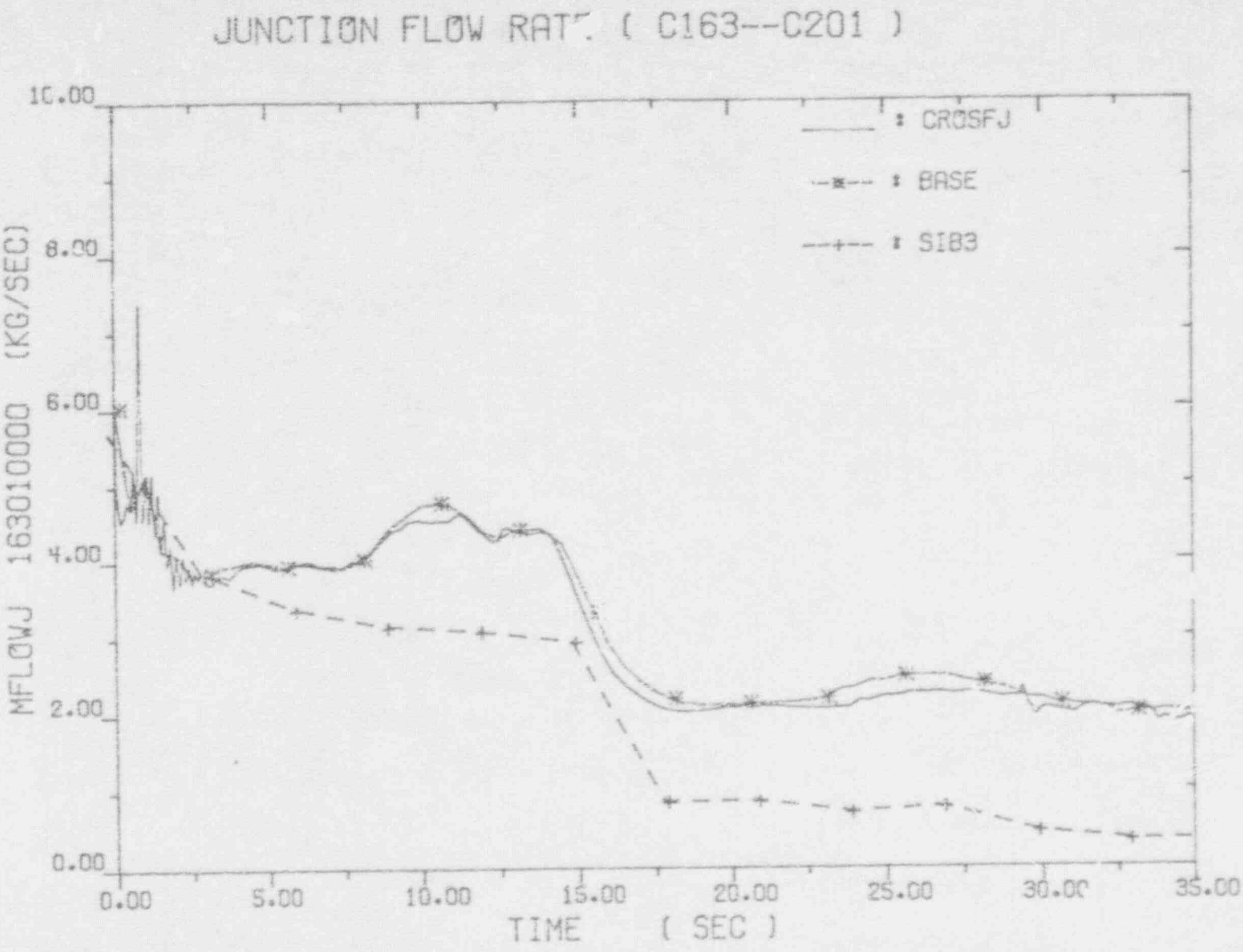

Figure 4.50 Comparison Among Calculated C163–C201 Junction Mass Flow Rate of CROSFJ, BASE Cases and Test Data

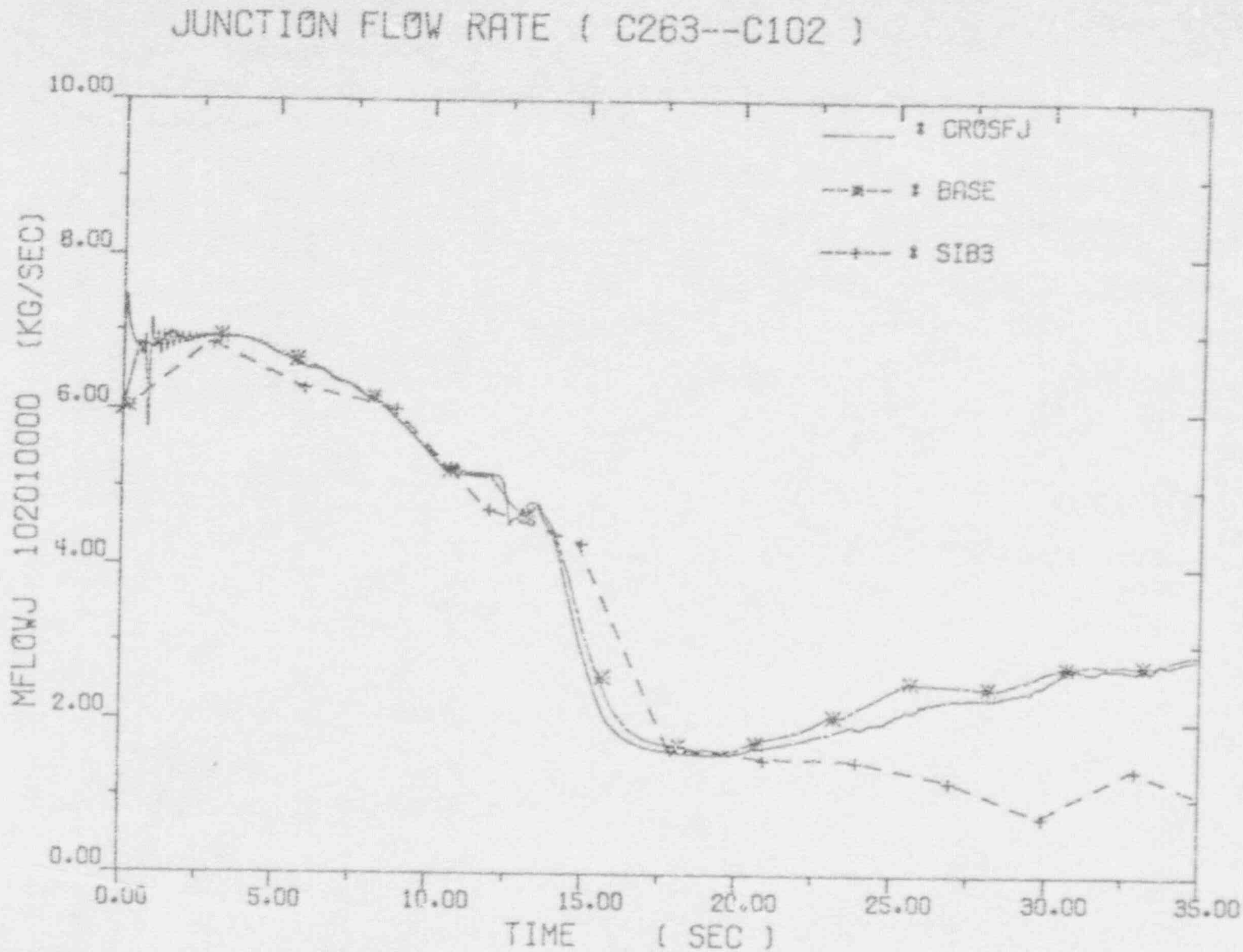

Figure 4.51 Comparison Among Calculated C263–C102 Junction Mass Flow Rate of CROSFJ, BASE Cases and Test Data

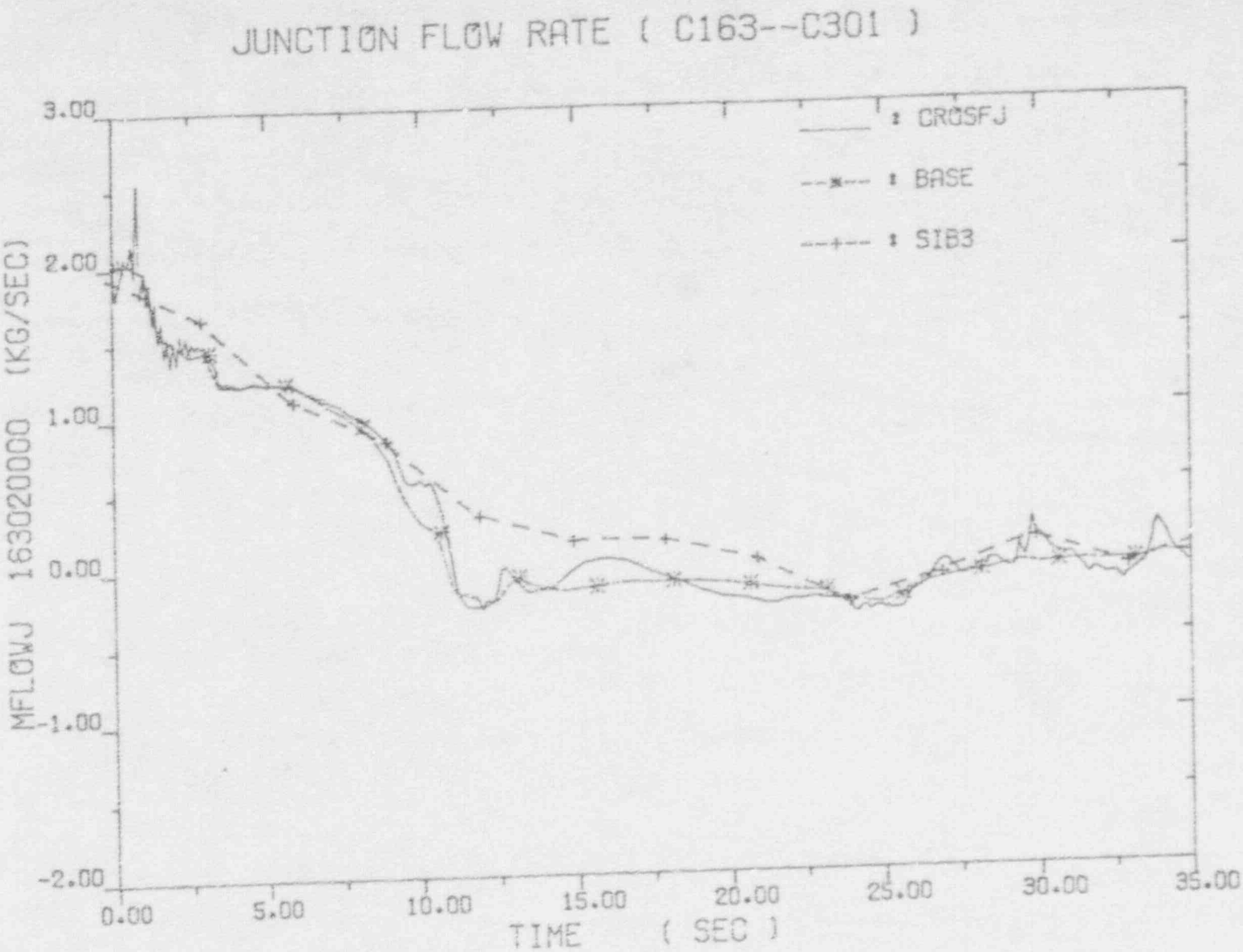

Figure 4.52 Comparison Among Calculated C163–C301 Junction Mass Flow Rate of CROSFJ, BASE Cases and Test Data

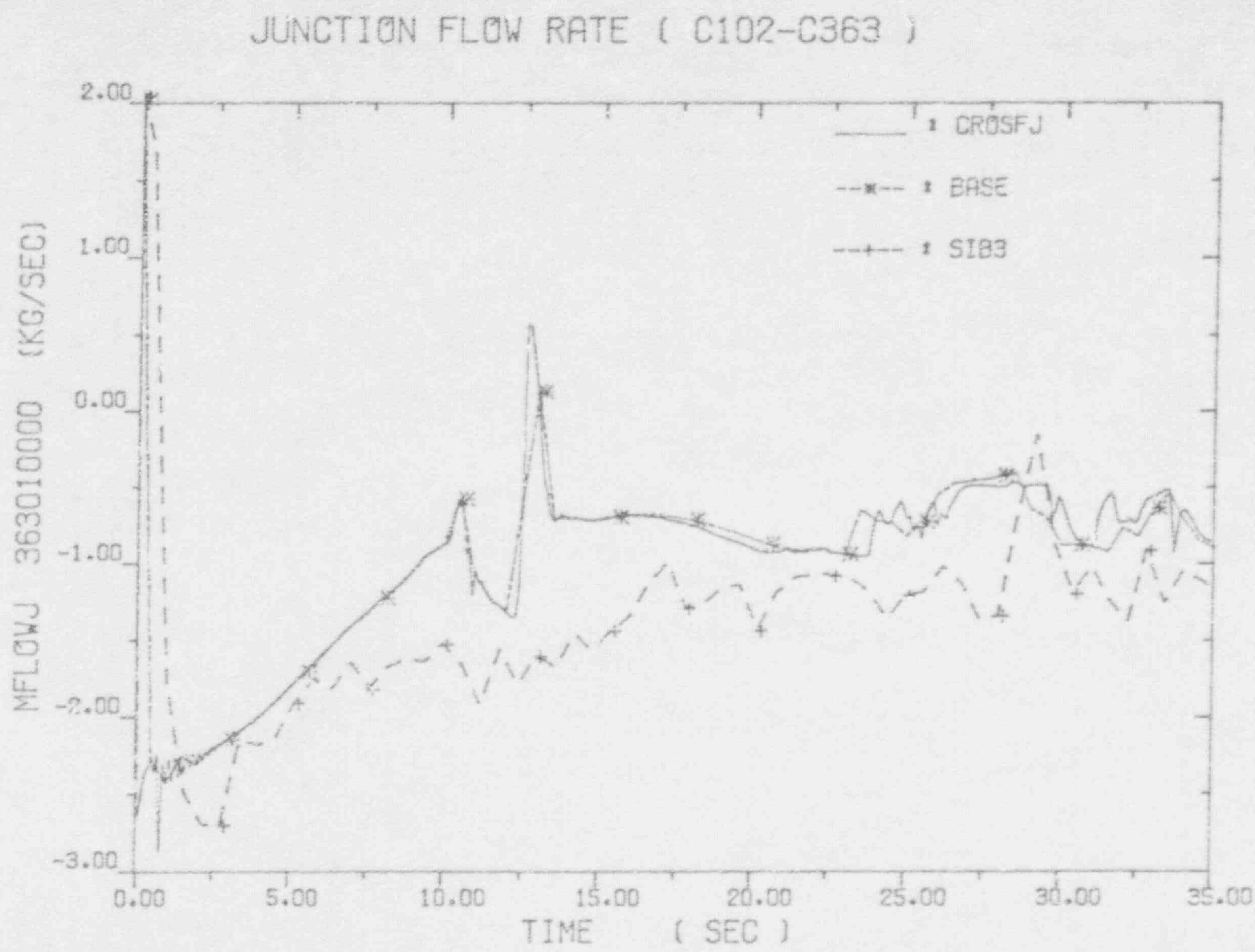

Figure 4.53 Comparison Among Calculated C102-C363 Junction Mass Flow Rate of CROSFJ, BASE Cases and Test Data

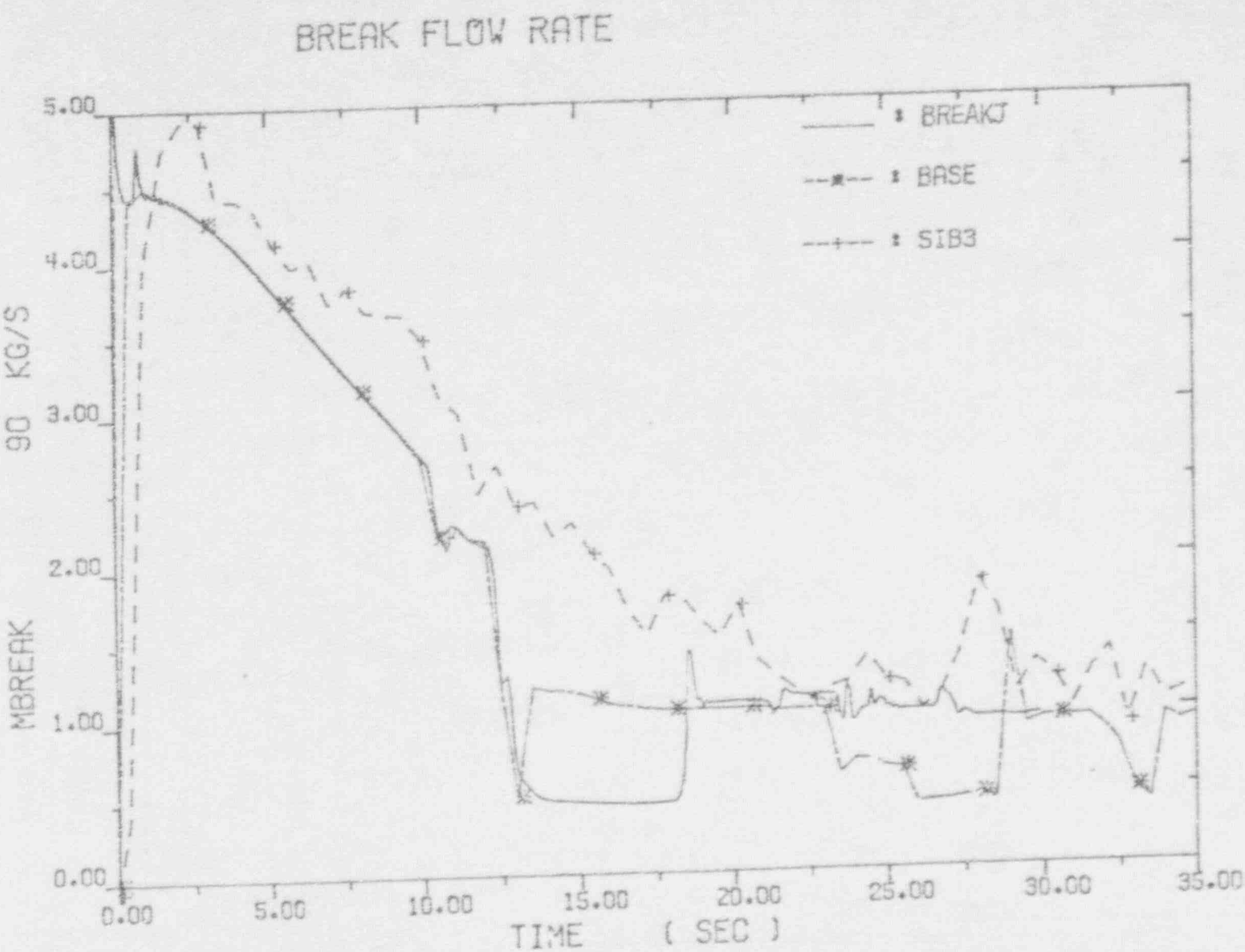

Figure 4.54 Comparison Among Calculated Break Mass Flow Rate of BREAKJ, BASE Cases and Test Data

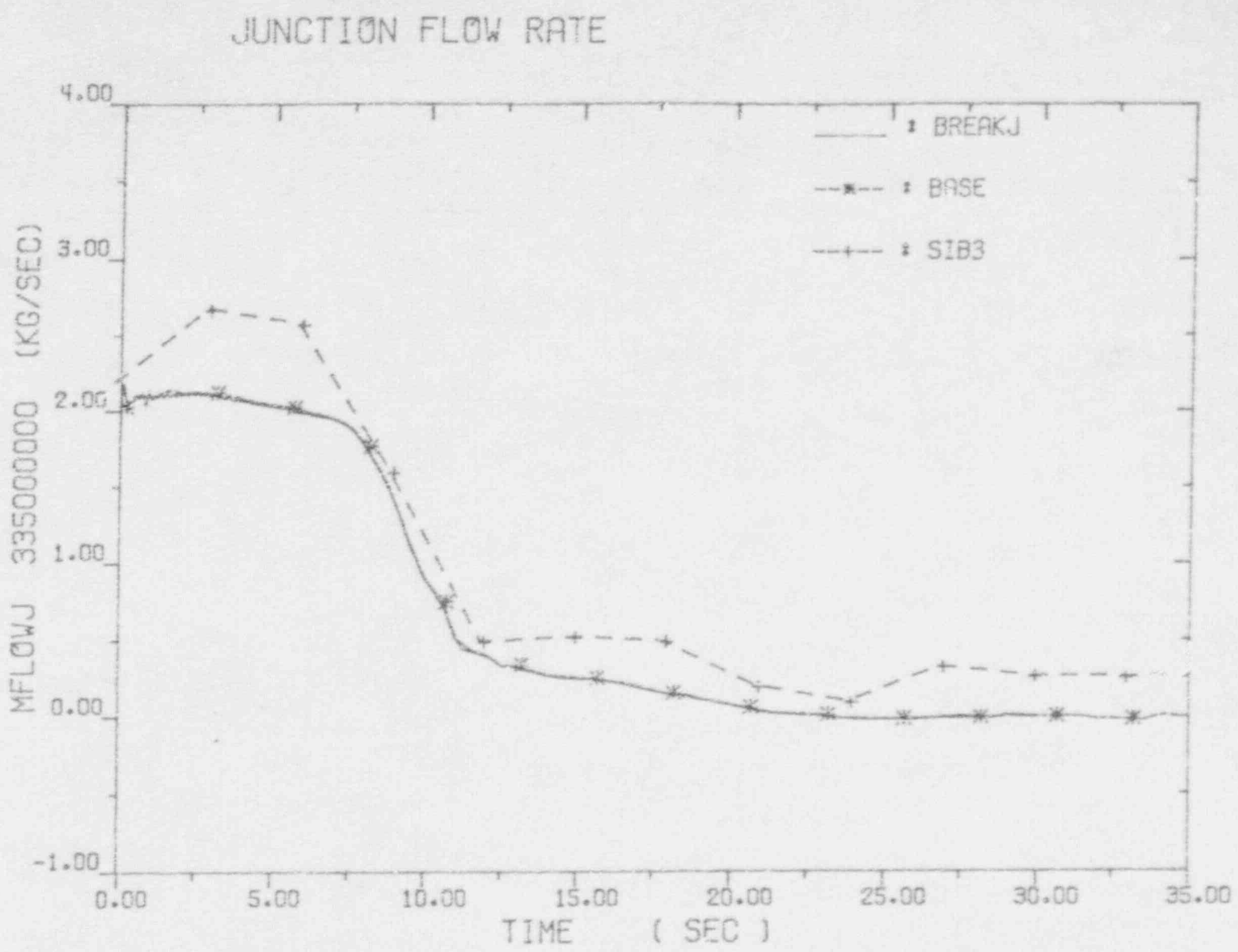

Figure 4.55 Comparison Among Calculated C330–C340 Junction Mass Flow Rate of BREAKJ, BASE Cases and Test Data

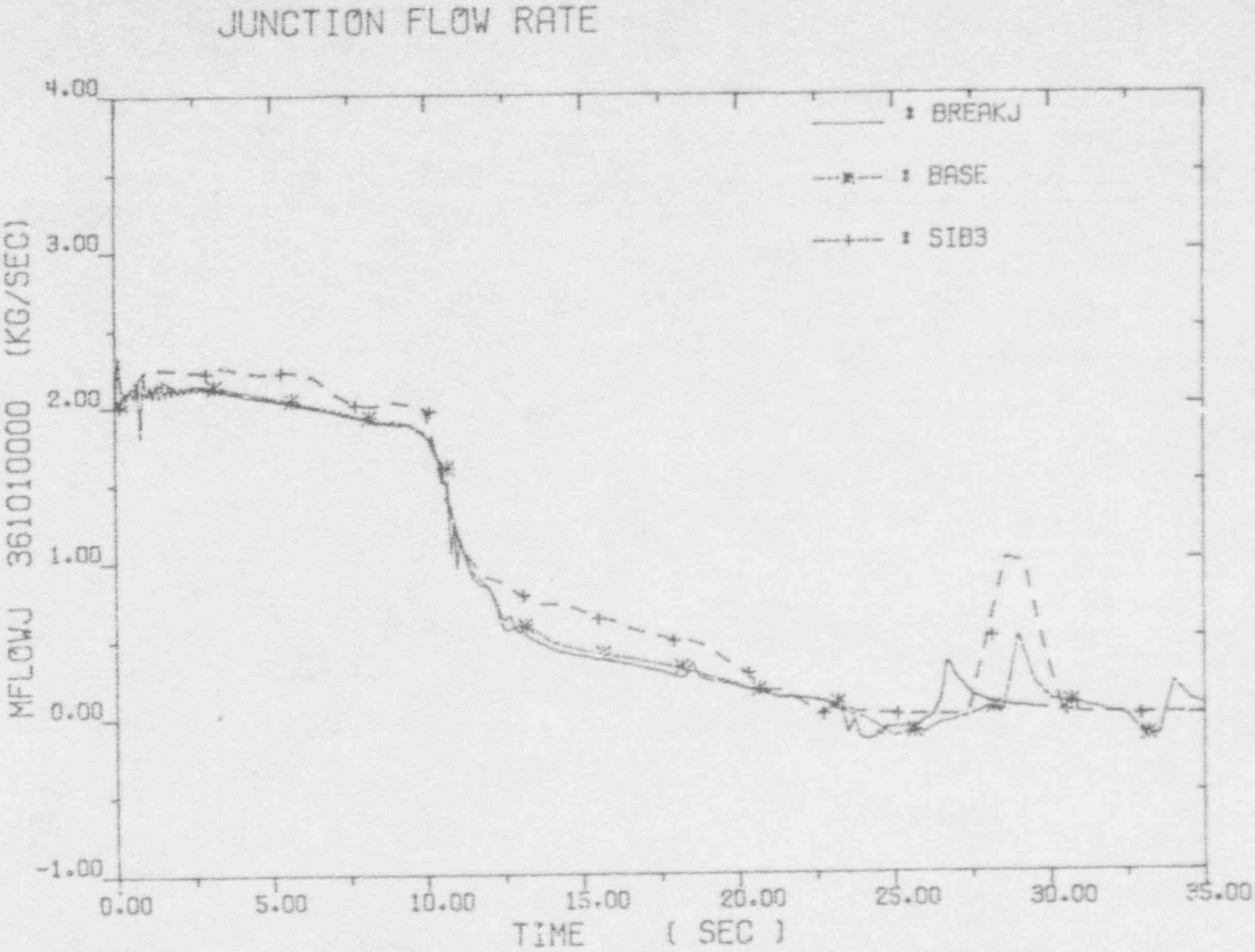

Figure 4.56 Comparison Among Calculated C361–C362 Junction Mass Flow Rate of BREAKJ, BASE Cases and Test Data

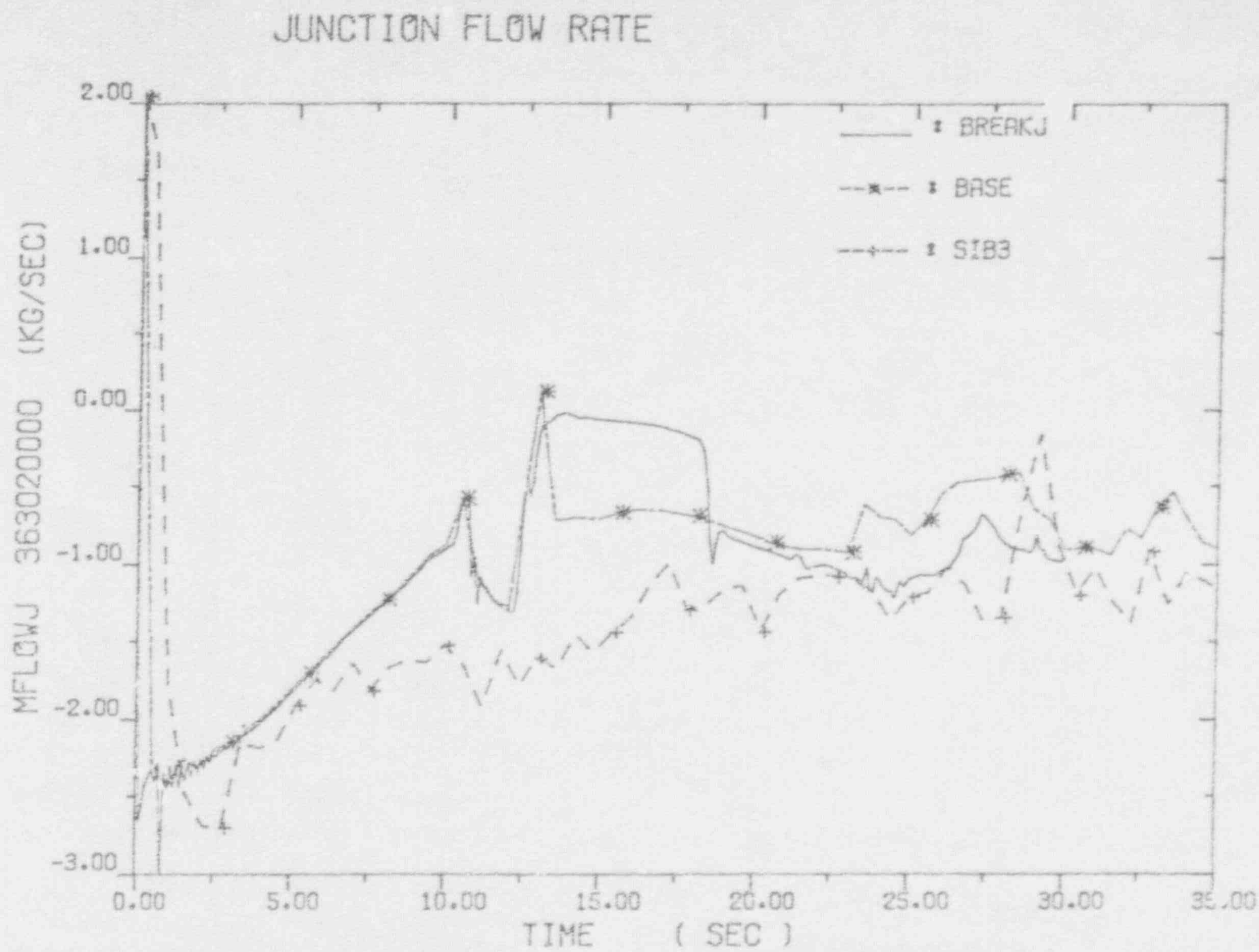

Figure 4.57 Comparison Among Calculated C363 Junction Mass Flow Rate of BREAKJ, BASE Cases and Test Data

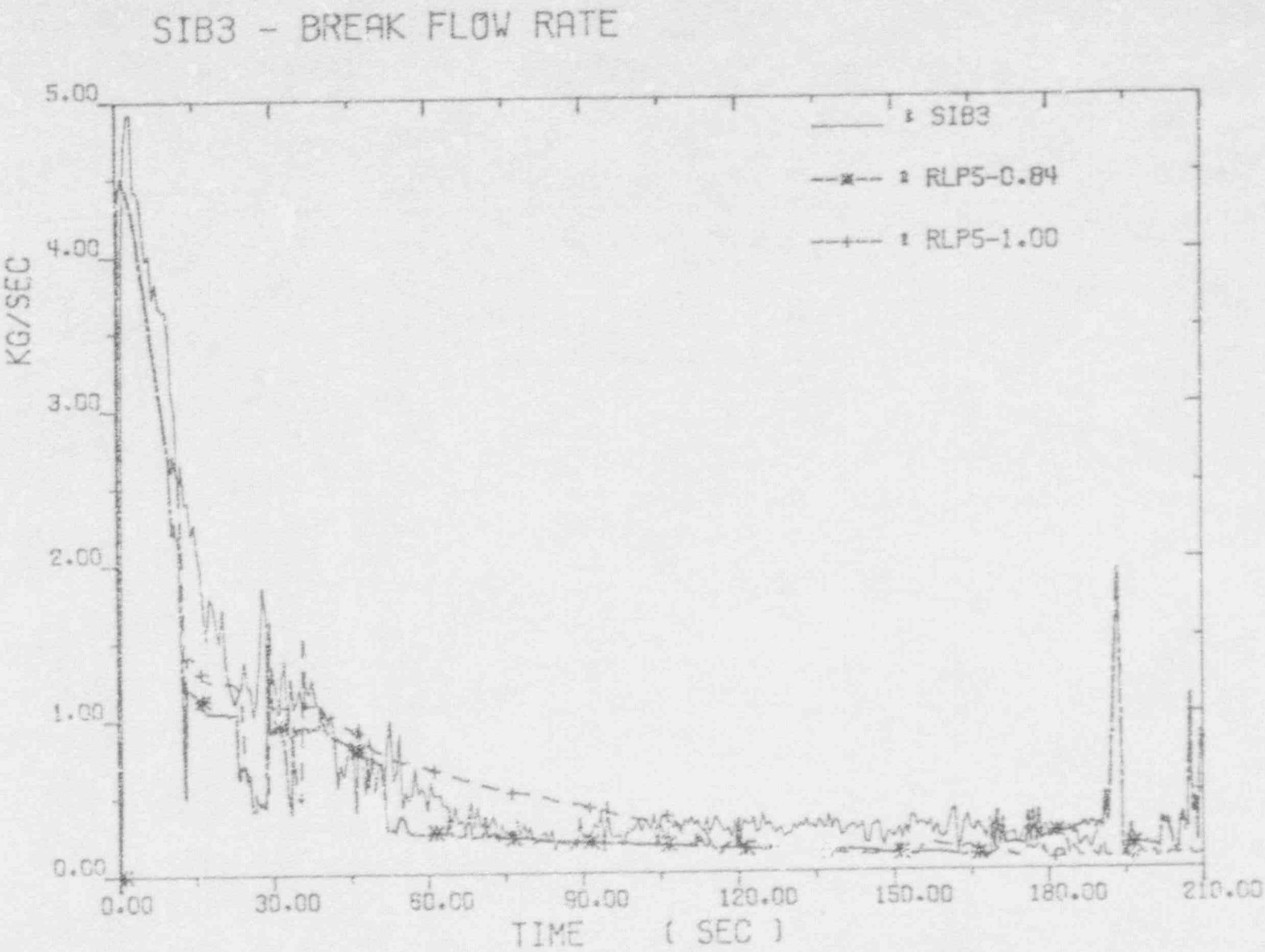

Fig. 4.58 Comparison Among Calculated Break Mass Flow Rate of TDC-1.0, BASE Cases and Test Data

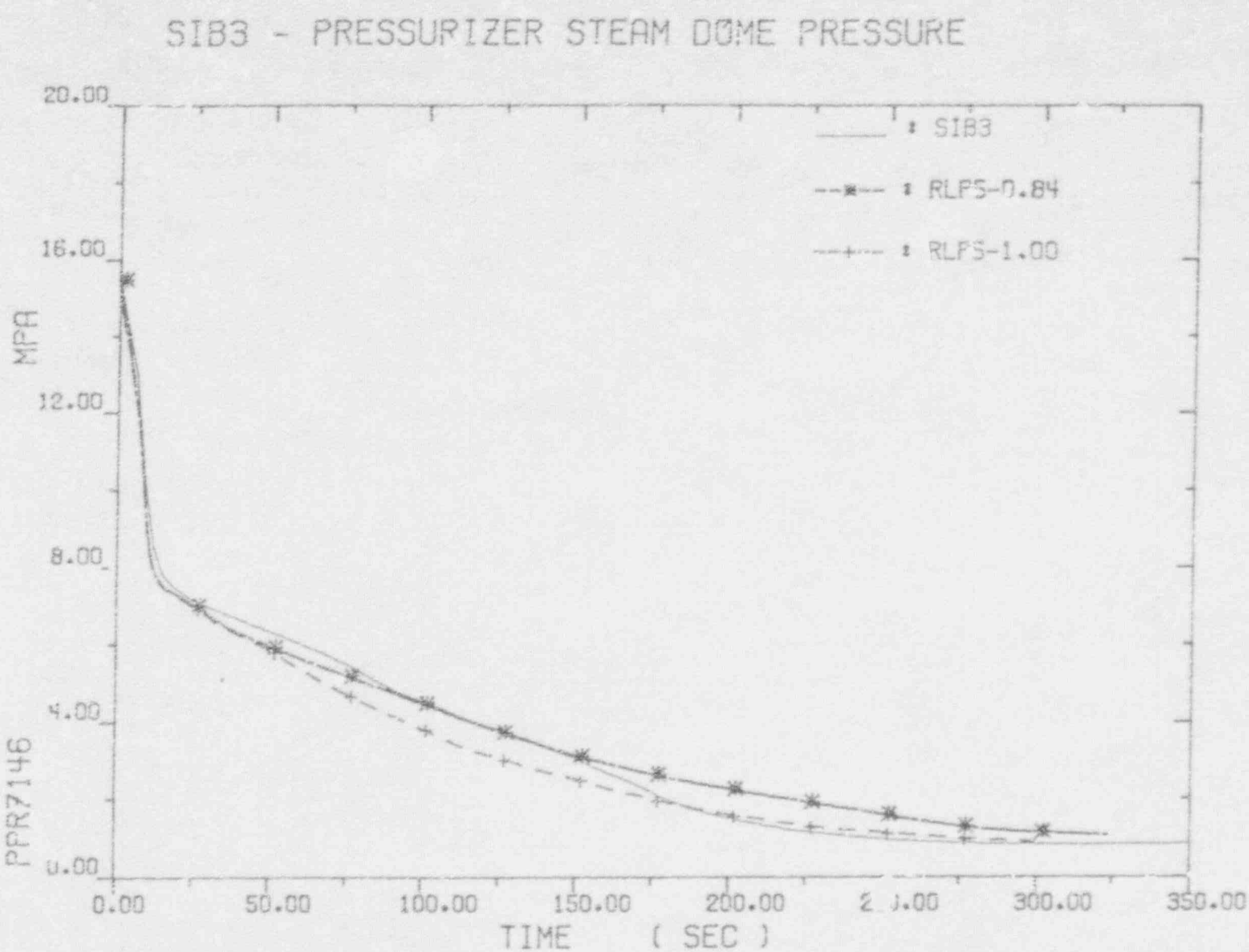

Figure 4.50 Comparison Among Calculated Pressurizer Steam Dome Pressure of TDC-1.0, BASE Cases and Test Data

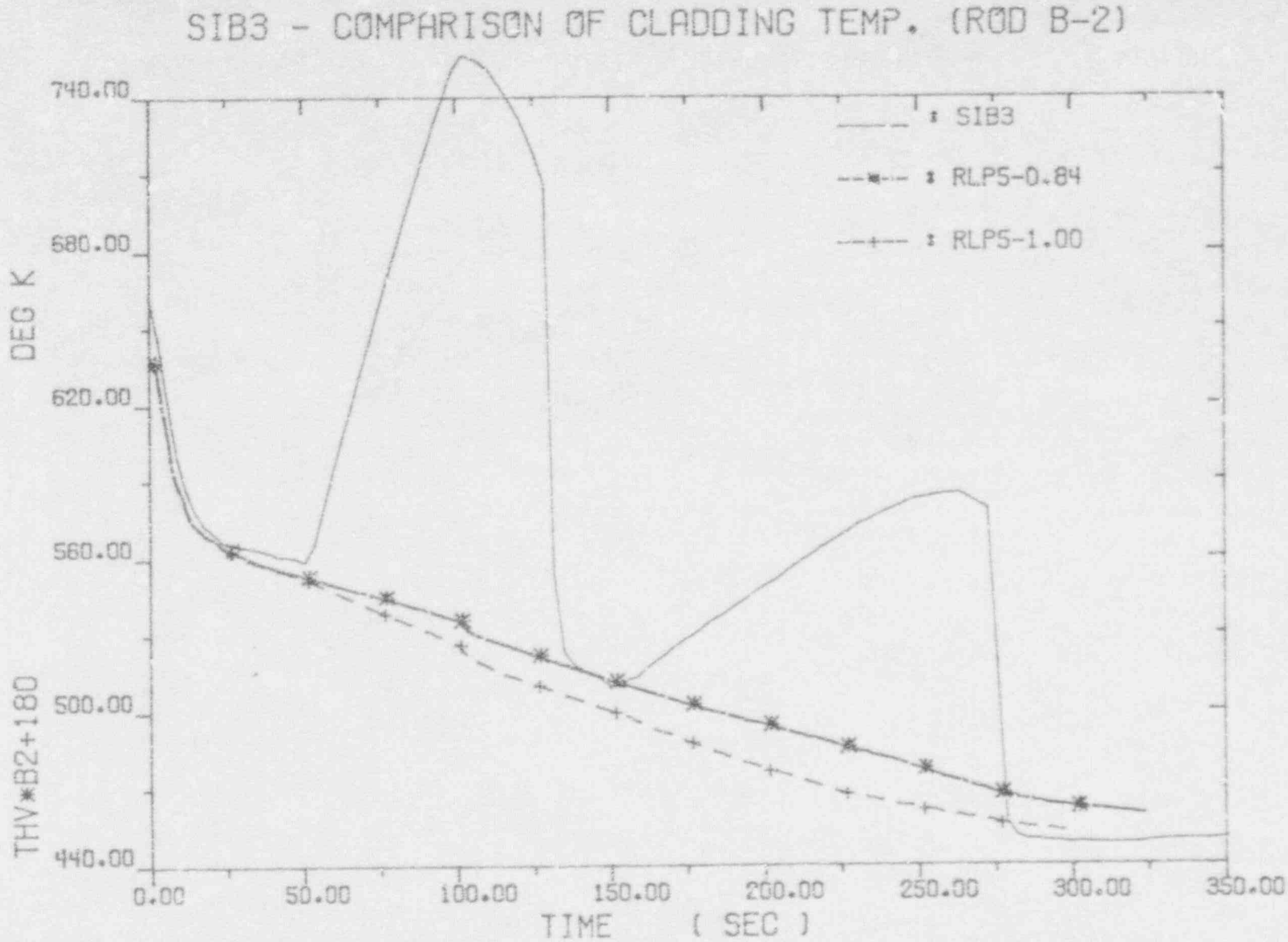

Figure 4.60 Comparison Among Calculated Cladding Temperature of TDC-1.0, BASE Cases and Test Data

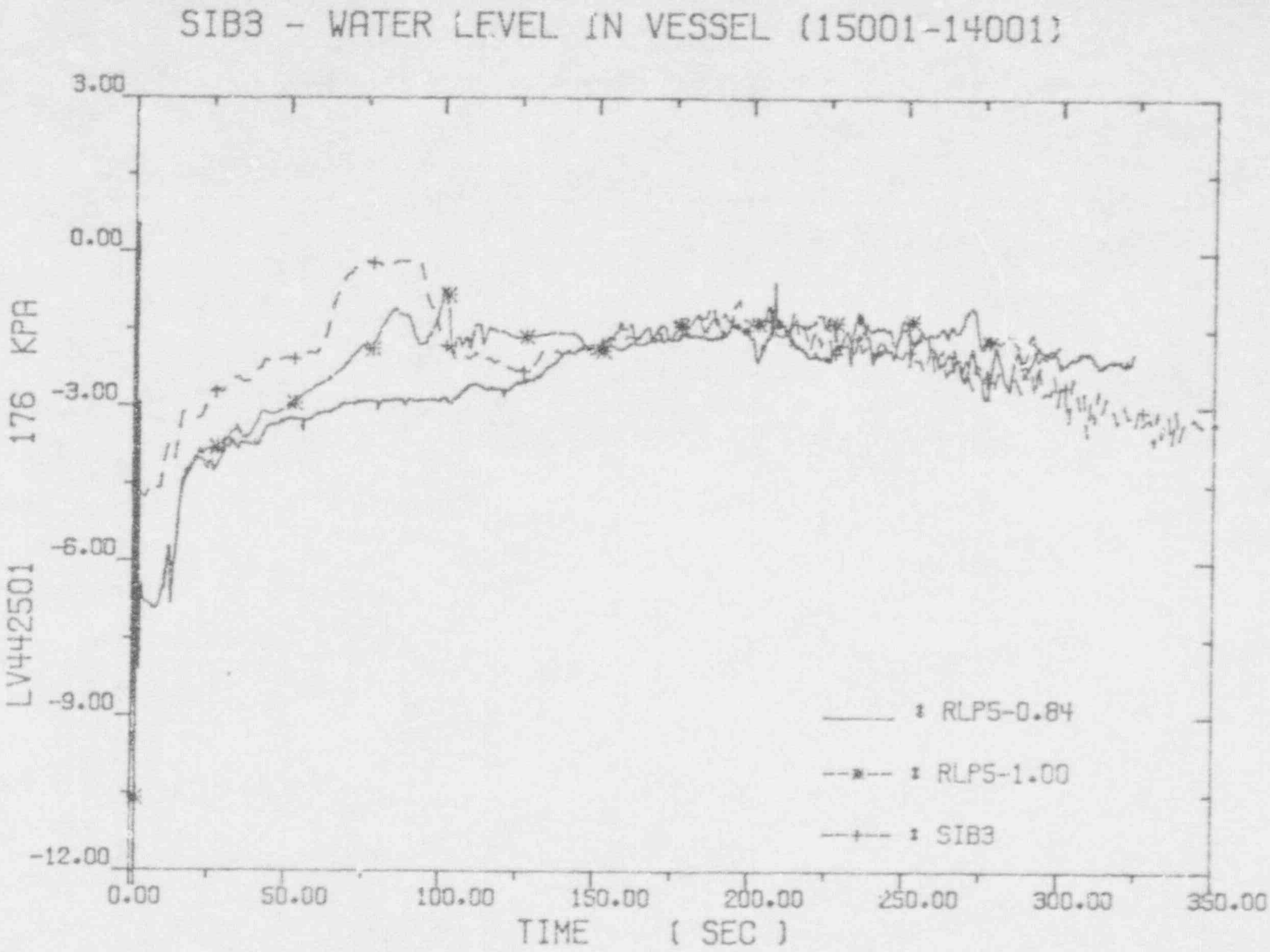

Figure 4.61 Comparison Among Calculated Vessel Liquid Level of TDC-1.0, BASE Cases and Test Data

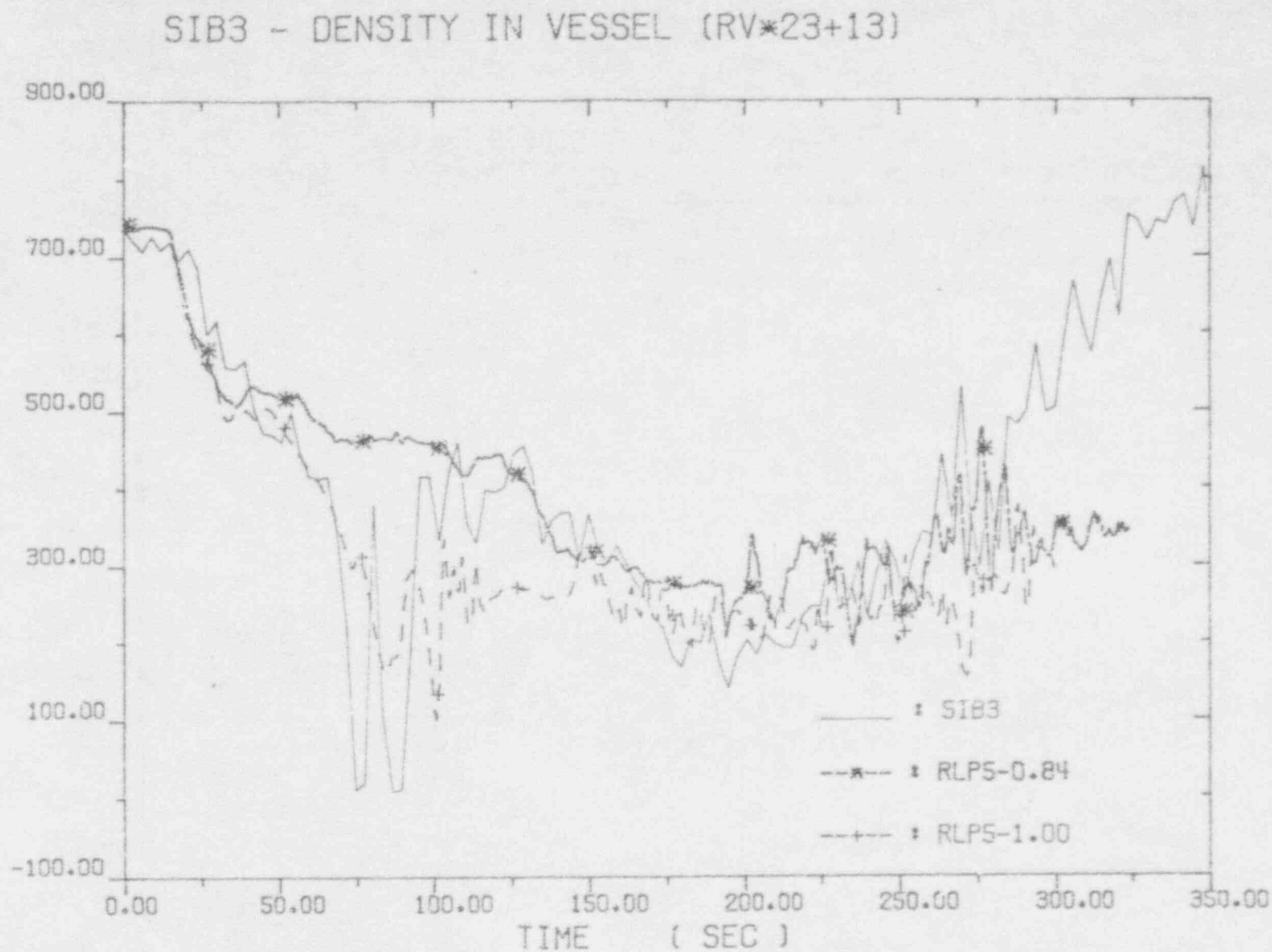

Figure 4.62 Comparison Among Calculated Vessel Density of TDC-1.0, BASE Cases and Test Data

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11. E. A. Shaw and G.G. Loomis, "Vessel Coolant Mass Depletion During A 5% SBLOCA in The Semiscale MOD-2C Facility," Specialists Meeting on Small Break LOCA Analyses in LWRs, pp.159-175, Vol. 2, Pisa, Italy, 23-27 June 1985.

APPENDIX

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* SEMISCALE INTERMEDIATE BREAK TEST S-13-3 BASE CASE RUN
*
* 95 R9'-,1)
******************************************************************
*
*                      INPUT DATA BEGIN
*
******************************************************************
*
***       NEW/RESTART      STDT-ST/TRANSNT
0000100 NEW                TRANSNT
*
***       INP-CHK / RUN
0000101 RUN
*
***       INP-UN     OUT-UN
0000102 BRITISH    BRITISH
*
0000104 NOACTION
*
*C000105 10.0        15.0 * W
*
*         TIME STEP CONTROL CARD
***       TIME-END  DT-MIN   DT-MAX  SSDTT    MIN-ED  MAJ-ED    REST
*C000201 50.0     1.0E-8   0.1       8003     1       250       250 * W
0000201    30.0     1.0E-8  0.02      8003      5       250        250 * W
*C000202  400.0     1.0E-8  0.05      8003   10       400        400 * W
*
******************************************************************************
*
****                       MINOR EDIT REQUESTS                            ****
*
******************************************************************************
*
*C003XX  VAR        PARMAMETER             * REMARK
*
*PRESSURE
*
0000301  CNTRLVAR     110 *999010000
0000302  CNTRLVAR     101 *110030000
0000303  CNTRLVAR     111 *601010000
0000304  CNTRLVAR     119 *701010000
0000305  CNTRLVAR     109 *201020000
0000306  CNTRLVAR     118 *301020000
*
*PRESSURIZER MASS
*
0000307  CNTRLVAR     910
* DELTA - P
*
0000308  CNTRLVAR   1[illegible]
0000309  CNTRLVAR   151
0000310  CNTRLVAR   152
0000311  CNTRLVAR   153
0000312  CNTRLVAR   154
0000313  CNTRLVAR   155
0000314  CNTRLVAR   156
0000315  CNTRLVAR   157
0000316  CNTRLVAR   158
0000317  CNTRLVAR   159
0000318  CNTRLVAR   160
0000319  CNTRLVAR   161
```

```
0000320  CNTRLVAR   162
0000321  CNTRLVAR   163
0000322  CNTRLVAR   164
0000323  CNTRLVAR   165
0000324  CNTRLVAR   166
0000325  CNTRLVAR   167
0000326  CNTRLVAR   168
0000327  CNTRLVAR   169
0000328  CNTRLVAR   170
0000329  CNTRLVAR   171
0000330  CNTRLVAR   172
0000331  CNTRLVAR   173
0000332  CNTRLVAR   174
0000333  CNTRLVAR   175
0000334  CNTRLVAR   176
0000335  CNTRLVAR   177
0000336  CNTRLVAR   178
0000337  CNTRLVAR   179
0000338  CNTRLVAR   180
0000339  CNTRLVAR   181
0000340  CNTRLVAR   182
*
* VOLUMETRIC FLOW RATE
*
0000341  CNTRLVAR    60 *I.L.
0000342  CNTRLVAR    76 *B.L.
*
* MASS FLOW RATE
*
0000343  MFLOWJ     635000000
0000344  MFLOWJ     735000000
0000345  MFLOWJ     .81010000
0000346  MFLOWJ     .45000000
*
* TEMPERATURE
*
0000351  CNTRLVAR     1
0000352  CNTHLVAR     2
0000353  CNTRLVAR     8
0000354  CNTRLVAR     9
0000355  CNTRLVAR    15
0000356  CNTRLVAR    24
0000357  CNTRLVAR    19
*
* PUMP VELOCITY
*
0000358  PMPVEL     250
0000359  PMPVEL     350
*
* S/G W/L
*
0000360  CNTRLVAR  616  * I.L.
0000361  CNTRLVAR  716  * B.L.
*
*************************************************************************
*
****               EXPANDED EDIT/PLOT VARIABLES                      ****
*
*************************************************************************
*20800001       FWALF          16301
*20800002       FWALJ          16301
*
```

```
*20800003      FWALF        16401
*20800004      FWALG        16401
*
*20800005      FWALF        16501
*20800006      FWALG        16501
*
*20800007      FIJ          16401
*20800008      FORMFJ       16401
*20800009      FORMGJ       16401
*
*20800010      FIJ          16402
*20800011      FORMFJ       16402
*20800012      FORMGJ       16402
*
0000362       FWALF        163010000
0000363       FWALG        163010000
*
0000364       FWALF        164010000
0000365       FWALG        164010000
*
0000366       FWALF        165010000
0000367       FWALG        165010000
*
0000368       FIJ          164010000
0000369       FORMFJ       164010000
0000370       FORMGJ       164010000
*
0000371       FIJ          164020000
0000372       FORMFJ       164020000
0000373       FORMGJ       164020000
0000374       CNTRLVAR           901
*==========================================================================
*
****                         TRIPS                                     ****
*
*==========================================================================
*
*   401  --  UPPER PLENUM FLUID  SATURATES
*   402  --  INTACT LOOP HOT LEG SATURATES
*   403  --  BROKEN LOOP HOT LEG SATURATES
*   404  --  PRESSURIZER EMPTIES
*   405  --  GUIDE TUBE FLOW REVERSES
*   406  --  CORE BYPASS FLOW REVERSES
*   407  --  FLOW REVERSES IN BROKEN LOOP HOT LEG
*   403  --  ACCUMULATOR FLOW STARTS
*
*
*        VAR    PARM       OP   VAR       PARM     CNST     L/N   TMOF
*
0000401 TEMPF  194010000  GE   SATTEMP  194010000 0.0      L     -1.0
0000402 TEMPF  201010000  GE   SATTEMP  201010000 0.0      L     -1.0
0000403 TEMPF  301010000  GE   SATTEMP  301010000 0.0      L     -1.0
0000404 VOIDG  999050000  GE   NULL     0         0.99     L     -1.0
0000405 MFLOWJ 194010000  LE   NULL     0         0.0      L     -1.0
0000406 MFLOWJ 181010000  LE   NULL     0         0.0      L     -1.0
0000407 MFLOWJ 301020000  LE   NULL     0         0.0      L     -1.0
*
*
*   501  --  BREAK INITIATES / PUMPS COASTDOWN / CORE POWER DECAY
*   502  --  ENABLE ACCUMULATOR = 501 + 1.0 SEC
*   503  --  ENABLE HPIS/LPIS ECCS
*   504  --  S/G STEAM VALVES CLOSE / BROKEN LOOP PUMP TRIPS
```

```
*   505  --  INTACT LOOP S/G STEAM VALVES CLOSE * X
*   598  --  NEVER TRUE
*   599  --  NEVER TRUE
*
*        VAR     PARM         OP   VAR       PARM        CNST     L/N   TMOF

0000501 TIME    0             GE   NULL      0           0.0       L    -1.0
0000502 TIME    0             GE   TIMEOF    501         1.0       L    -1.0
0000503 P        999010000    LE   NULL      0           1827.48   L    -1.0
0000504 P        999010000    LE   NULL      0           145.038   L    -1.0
0000505 TIME    0             GE   NULL      0           240.0     L    -1.0 * X
0000598 TIME    0             LT   NULL      0           0.0       L    -1.0
0000599 TIME    0             LT   NULL      0           0.0       L    -1.0
*
*
***      TRIPS FOR CONTROL OF STEAM VALVE OPERATIONS        **
*
*0000562  P         601010000  GE     NULL   0           941.0     N     -1.0
*0000563  P         601010000  LE     NULL   0           933.0     N     -1.0
*0000564  CNTRLVAR        631  GT     NULL   0          -200.0     N     -1.0
*0000565  CNTRLVAR        631  LT     NULL   0           200.0     N     -1.0
*
*0000662  562    AND   564     N    -1.0
*0000663  563    AND   565     N    -1.0
*
***      TRIPS FOR CONTROL OF STEAM VALVE OPERATIONS        **
*
*0000572  P         701010000  GE     NULL   0           1093.0    N     -1.0
*0000573  P         701010000  LE     NULL   0           1091.0    N     -1.0
*0000574  CNTRLVAR        731  GT     NULL   0          -200.0     N     -1.0
*0000575  CNTRLVAR        731  LT     NULL   0           200.0     N     -1.0
*
*0000672  572    AND   574     N    -1.0
*0000673  573    AND   575     N    -1.0
*
*****************************************************************************
*
****                HYDRODYNAMIC  COMPONENTS                             ****
*
*****************************************************************************
*
*
*******************************************
******        REACTOR VESSEL        ******
*******************************************
*
*****************************************
*****  DOWNCOMER INLET ANNULUS  *****
*****************************************
*
1010000  C.          BRANCH
101[illegible]1  2           1
101[illegible]01  0.105697    0.8750     0.0        0.0        -90.0       -0.975
1010102  0.0         0.142750   0
1010200  3           2260.1     552.22
**                                          0.0        0.0         00100
1011101  102000000 101010000 0.105697   0.0        0.0         00000
1011201  0.66344     0.0        0.0
**                                          0.0        0.0         00100
1012101  101000000 181000000 7.46674-4  1.0        1.0         00100
1012201  0.66344     0.0        0.0
*
```

```
*************************************
*****  DOWNCOMER INLET ANNULUS *****
*************************************
*
1020000  C102       BRANCH
1020001  3          1
1020101  0.105697   1.00      0.0        0.0         -90.0       -1.000
1020102  0.0        0.142750  0
1020200  3          2260.4    552.57
*
                                         3.5         3.5         00100
1021101  263010000  102000000 0.045239   3.7         3.7         00100
1021201  13.282     0.0       0.0
**
                                         0.0         0.0         00100
1022101  102000000  363010000 0.0375539  3.5         3.5         00100
1022201  -4.4692    0.0       0.0
**
                                         0.0         0.0         00000
1023101  102010000  110000000 0.026039   0.0         0.0         00000
1023201  17.088     0.0       0.0
*
*************************************
*****       DOWNCOMER          *****
*************************************
*
1100000  C110       PIPE
1100001  10
1100101  0.030975      1
1100102  0.026039      8
1100103  0.031502      9
1100104  0.032270      10
1100201  0.026039      8
1100202  0.031502      9
1100301  2.260833      1
1100302  1.000833      2
1100303  2.0           7
1100304  1.465667      8
1100305  1.434751      9
1100306  0.962500      10
1100601  -90.0         10
1100701  -2.260833     1
1100702  -1.000833     2
1100703  -2.0          7
1100704  -1.465667     8
1100705  -1.207667     9
1100706  -0.962500     10
1100801  0.0        0.159535  1
*
*
**  USE RESONABLE VALUE OF HYDRO-D IN NO. 10
**  SEE Q.A. REPORT PXXX
1100802  0.0        0.0       10
**       0.491      0.491     7
1100901  0.1        0.1       7
1100902  0.2        0.2       8
**       1.193      1.193     8
1100903  0.0        0.0       9
1101001  0          10
1101101  00000      9
1101201  3          2260.2    552.55    0.0        0.0        0.0        1
1101202  3          2260.3    552.54    0.0        0.0        0.0        2
1101203  3          2260.6    552.53    0.0        0.0        0.0        3
1101204  3          2261.0    552.52    0.0        0.0        0.0        4
1101205  3          2261.4    552.50    0.0        0.0        0.0        5
```

```
1101206  3          2261.9    552.49    0.0       0.0       0.0       6
1101207  3          2262.3    552.48    0.0       0.0       0.0       7
1101208  3          2262.7    552.47    0.0       0.0       0.0       8
1101209  3          2263.2    552.46    0.0       0.0       0.0       9
1101210  3          2263.5    552.45    0.0       0.0       0.0       10
1101300  1
1101301  17.088     0.0       0.0       9
*
***********************************
*****      LOWER     HEAD      *****
***********************************
*
1200000  C120       SNGLVOL
1200101  0.510279   0.466667  0.0       0.0       -90.0     -0.466667
1200102  0.0        0.381247  0
1200200  3          2263.5    552.40    0.0
*
***********************************
*****      LOWER     PLENUM    *****
***********************************
*
1300000  C130       BRANCH
1300001  3          1
1300101  0.322478   0.721917  0.0       0.0       -90.0     -0.721917
1300102  0.0        0.229414  0
1300200  3          2263.3    552.40
**                                      1.0       1.0       00100
1301101  110010000 130000000 0.032270   1.0       1.0       00100
1301201  17.088     0.0       0.0
**                                      0.0       0.0       00100
1302101  130000000 140000000 0.075189   1.0       1.0       00100
1302201  17.087     0.0       0.0
**                                      0.0       0.0       00000
1303101  130010000 120000000 0.322478   0.0       0.0       00000
1303201  6.4717-4   0.0       0.0
*
***********************************
*****      CORE      INLET     *****
***********************************
*
1400000  C140       SNGLVOL
1400101  0.075189   1.635833  0.0       0.0       90.0      1.635833
1400102  0.0        0.278329  0
1400200  3          2262.7    552.33
*
***********************************
*****   CORE  INLET  JUNCTION  *****
***********************************
*
1450000  J145       SNGLJUN
**                                      0.0       0.0       00000
1450101  140010000 150000000 0.030747   0.0       0.0       00000
1450201  1          17.087    0.0       0.0
*
***********************************
*****    CORE ACTIVE LENGTH    *****
***********************************
*
1500000  C150       PIPE
1500001  6
1500101  0.030747       6
1500301  2.00           6
```

```
1500601  90.0           6
1500701  2.00           6
1500801  0.0      0.033237  6
**       0.0      0.0       5
1500901  0.00     0.00      2
1500902  1.00     1.00      5
1501001  0        6
1501101  00000    5
1501201  3        2261.2    557.04    0.0      0.0      0.0      1
1501202  3        2259.9    568.10    0.0      0.0      0.0      2
1501203  3        2258.6    583.24    0.0      0.0      0.0      3
1501204  3        2256.5    597.64    0.0      0.0      0.0      4
1501205  3        2254.4    607.45    0.0      0.0      0.0      5
1501206  3        2252.3    611.47    0.0      0.0      0.0      6
1501300  1
1501301  17.087   0.0       0.0       5
*
************************************
*****     CORE     OUTLET   1 *****
************************************
*
1610000  C161     BRANCH
1610001  4        1
1610101  0.057359 1.000833  0.0       0.0      90.0     1.000833
1610102  0.0      0.075610  0
1610200  3        2250.1    611.42    *0.3     0.3
1611101  150010000 161000000 0.030747  2.5      2.5      00000
1611201  17.087   0.0       0.0       *0.5     0.5
1612101  161010000 162000000 0.034560  1.5      1.5      00100
1612201  15.196   0.0       0.0
1613101  182010000 161010000 0.0016085 0.0      0.0      00100
1613201  4.6911-7 0.0       0.0
1614101  185010000 161010000 0.006606  0.43613  0.43613  00100
1614201  -1.8911  0.0       0.0
*
************************************
*****     CORE     OUTLET   2 *****
************************************
*
1620000  C162     BRANCH
1620001  1        1
1620101  0.043927 2.260833  0.0       0.0      90.0     2.260833
1620102  0.0      0.131407  0
1620200  3        2248.8    611.36
1621101  185000000 162010000 0.076458  0.92664  0.77720  00000
1621201  1.4526   0.0       0.0
*
************************************
*****     HOT   LEG  OUTLET     *****
************************************
*
1630000  C163     BRANCH
1630001  3        1
1630101  0.045112 1.708333  0.0       0.0      90.0     1.708333
1630102  0.0      0.158413  0
1630200  3        2247.2    609.14    *2.5     2.5
1631101  163010000 201000000 0.045112  5.8      5.8      00100
1631201  13.281   0.0       0.0       *0.0     *0.0
1632101  163010000 301000000 0.0375539 2.0      2.0      00100
1632201  4.4690   0.0       0.0       *0.0     0.0
1633101  162010000 163000000 0.043927  2.7      2.7      00100
1633201  16.649   0.0       0.0
```

```
*
**********************************
*****     UPPER     PLENUM    1 *****
**********************************
*
1640000  C164        BRANCH
1640001  2           1
1640101  0.054582    1.791667   0.0        0.0        90.0       1.791667
1640102  0.0         0.133503   0
1640200  3           2247.0     574.46 *JOU
1641101  164010000   165000000  0.054582   0.0        0.0        00000
1641201  -1.1015     0.0        0.0
1642101  163010000   164000000  0.045112   0.0        0.0        00000
1642201  -1.1015     0.0        0.0
*
**********************************
*****     UPPER     PLENUM    2 *****
**********************************
*
1650000  C165        SNGLVOL
1650101  0.055890    1.966667   0.0        0.0        90.0       1.966667
1650102  0.0         0.167013   0
1650200  3           2246.4     575.10 *JOU
*
**********************************
*****     CORE BYPASS LINE      *****
**********************************
* UPDATE - 1 - (SEE REF. 02 )
*
1810000  C181        PIPE
1810001  2
1810101  7.46674E-4      2
1810301  3.546917        1
1810302  3.140583        2
1810601  90.0            2
1810701  3.546917        1
1810702  3.140583        2
1810801  0.0         0.0        2
*        0.2701      0.2701     1     *** FOR 4.0% BYPASS FLOWRATE ***
1810901  1.0         1.0        1     *** FOR 4.0% BYPASS FLOWRATE ***
1811001  0           2
1811101  00000       1
1811201  3           2253.6     552.20     0.0        0.0        0.0        1
1811202  3           2247.9     552.18     0.0        0.0        0.0        2
1811300  1
1811301  0.66344     0.0        0.0        1
*
**********************************
*****  CORE SUPPORT COLUMES     *****
**********************************
*
1820000  C182        PIPE
1820001  1
1820101  0.0016085       1
1820301  8.8575          1
1820601  -90.0           1
1820701  -8.8575         1
1820801  0.0         0.032000   1
1821001  0           1
1821201  3           2248.9     611.22     0.0        0.0        0.0        1
*
**********************************
```

```
* **  CONTROL ROD GUIDE TUBE  *****
***********************************
* UPDATE - 1 - (SEE REF. 02 )
*
1830000  C183         BRANCH
1830001  2            1
1830101 2.19233E-3 6.549167  0.0        0.0        -90.0      -6.549167
1830102  0.0          0.0      0
1830200  3            2245.5   575.80
*
*
* MODIFIED JUN AREA - (SEE REF. 04  PXXX )
**                                       0.0        0.0         00100
1831101  183010000 165010000 3.9787-3  0.0        0.0         00000
1831201  1.1015     0.0        0.0
**                                       0.0        0.0         00000
1832101  183010000 184000000 2.19233-3 0.0        0.0         00000
1832201  -0.43841   0.0        0.0
*
***********************************
***** GUIDE TUBE SLOTED SECTION ****
***********************************
* UPDATE - 1 - (SEE REF. 02 )
*
1840000  C184         PIPE
1840001  1
1840101  2.19233E-3       1
1840301  5.466667         1
1840601 -90.0             1
1840701 -5.466667         1
1840801  0.0              0.0       1
1841001  0                1
1841201  3            2247.8    611.40    0.0       0.0       0.0       1
*
***********************************
*****  GUID TUBE LOWER PART    *****
***********************************
* UPDATE - 1 - (SEE REF. 02 )
*
1850000  C185         BRANCH
1850001  1            1
1850101  0.012718     2.260833  0.0       0.0       -90.0     -2.260833
1850102  0.0          0.0       0
1850200  3            2249.1    611.41
1851101  184010000 185000000 2.19233E-3     0.43613   0.43613  00000
1851201  -0.43841   0.0       0.0
*
***********************************
*****  BOTTOM  OF  UPPER HEAD  *****
***********************************
*
1910000  C191         PIPE
1910001  1
1910101  0.044149         1
1910301  0.476667         1
1910601  -90.0            1
1910701  -0.476667        1
1910801  0.0          0.104161  1
1911001  0            1
1911201  3            2246.9    551.18    0.0       0.0       0.0       1
*
***********************************
```

```
*****       UPPER      HEAD  1  ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
1920000  C192       BRANCH
1920001  1          1
1920101  0.05233    1.965833  0.0        0.0        -90.0       -1.965833
1920102  0.0        0.134597  0
1920200  3          2246.5    551.18
1921101  192010000 191000000 0.0        0.0        0.0         00000
1921201  5.1223-5   0.0       0.0
*
************************************
*****       UPPER      HEAD  2  ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
1930000  C193       BRANCH
1930001  2          1
1930101  0.053694   3.453333  0.0        0.0        -90.0       -3.453333
1930102  0.0        0.148122  0
1930200  3          2245.6    551.18
1931101  193010000 192000000 0.0        0.0        0.0         00000
1931201  4.0019-4   0.0       0.0                              *00100
1932101  181010000 193010000 7.46674-4 0.0        0.0         00100
1932201  0.66344    0.0       0.0
*
*
************************************
*****       UPPER      HEAD  3  ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
1940000  C194       BRANCH
1940001  2          1
1940101  0.061685   2.88083   0.0        0.0        -90.0       -2.88083
1940102  0.0        0.196917  0
1940200  3          2244.6    550.24
*
*
*  MODIFIED JUN AREA - ( SEE REF. 04 PXXX )
*                                                              * 00100
1941101  194010000 183000000 8.42017E-4  0.0        0.0        00000
1941201   0.66307  0.0       0.0
**                                      0.0        0.0         00000
1942101  194010000 193000000 0.0        0.0        0.0         00000
1942201  -0.66306  0.0       0.0
*
******************************************
******  INTACT  LOOP   ******
******************************************
*
************************************
*****    HOT  LEG  NOZZLE      *****
************************************
*
* COMPNONT 1 - HOT LEG NOZZLE
* COMPNONT 2 - SP - 1 AND 2
* COMPNONT 3 - SP - 3
*
2010000  C201       PIPE
2010001  3
```

```
2010101  0.045239        1
2010102  0.037554        2
2010103  0.024629        3
2010201  0.037554        1
2010202  0.024629        2
2010301  0.720833        1
2010302  3.2225          2
2010303  2.5425          3
2010601  0.0             3
2010701  0.0             3
2010801  0.0       0.0       3
**       0.0       0.0       2
2010901  0.0       0.0       1
2010902  0.23      0.23      2
2011001  0         3
2011101  00000     2
2011201  3         2245.7    609.12    0.0       0.0       0.0       1
2011202  3         2245.6    609.06    0.0       0.0       0.0       2
2011203  3         2244.9    609.02    0.0       0.0       0.0       3
2011300  1
2011301  13.281    0.0       0.0       2
*
************************************
*****       TO     ELBOW        ****
************************************
*
2020000  C202      BRANCH
2020001  3         1
2020101  0.024629  2.453333  0.0       0.0       0.0       0.0
2020102  0.0       0.0       0
2020200  3         2244.8    608.98
**                                     0.0       0.0       00000
2021101  201010000 202000000 0.024629  0.0       0.0       00000
2021201  13.281    0.0       0.0
**                                     0.0       0.0       00000
2022101  202010000 203000000 0.024629  0.35      0.35      00000
2022201  13.282    0.0       0.0
**                                     0.0       0.0       00100
2023101  997010000 202000000 7.4667-4  0.0       0.0       00100
2023201  5.5927-4  0.0       0.0
*
************************************
*****       ELBOW               *****
************************************
*
2030000  C203      PIPE
2030001  2
2030101  0.024629        2
2030301  3.90542         1
2030302  2.12625         2
2030601  90.0            2
2030701  3.727080        1
2030702  1.728330        2
2030801  0.0       0.0       2
**       0.0       1.705     1
2030901  0.0       1.705     1
2031001  0         2
2031101  00000     1
2031201  3         2243.9    608.92    0.0       0.0       0.0       1
2031202  3         2242.9    608.88    0.0       0.0       0.0       2
2031300  1
2031301  13.282    0.0       0.0       1
```

```
*
************************************
*****        203  -  210  JUN ,  ****
************************************
*
2050000  J205       SNGLJUN
**                                    0.0        1.35       00000
2050101  203010000 210000000 0.024629 0.0        1.35       00000
2050201  1         13.282    0.0      0.0
*
************************************
***** S. G.  INLET PLENUM       ****
************************************
*
2100000  C210       SNGLVOL
2100101  0.080177  0.68750   0.0      0.0        90.0       0.68750
2100102  0.0       0.27514   0
2100200  3         2243.2    608.88
*
************************************
*****        210  -  220  JUN .  ****
************************************
*
2150000  J215       SNGLJUN
**                                    0.0        0.013      00100
2150101  210010000 220000000 0.019757 4.0        0.013      00100
2150201  1         13.282    0.0      0.0
*
************************************
*****      S. G.   U-TUBES      *****
************************************
*
* UPDATE - 1 - (SEE REF. 02 )
*
2200000  C220       PIPE
2200001  8
2200101  0.0197570       8
2200301  7.9525          1
2200302  7.9108334       3
2200303  6.6781367       5
2200304  7.9108334       7
2200305  7.9525          8
2200601  90.0            3
2200602  45.0            4
2200603  -45.0           5
2200604  -90.0           8
2200701  7.9525          1
2200702  7.9108334       3
2200703  6.6008367       4
2200704 -6.6008367       5
2200705 -7.9108334       7
2200706 -7.9525          8
2200801  0.0       0.0       8
**       0.1       0.026     4
2200901  0.1       0.026     4
**       0.1       0.0       7
2200902  0.1       0.0       7
2201001  0         8
2201101  00000     7
2201201  3         2235.4    593.31   0.0        0.0        0.0        1
2201202  3         2232.4    581.42   0.0        0.0        0.0        2
2201203  3         2229.3    572.15   0.0        0.0        0.0        3
```

```
2201204  3          2226.4    566.00    0.0       0.0       0.0       4
2201205  3          2225.8    560.88    0.0       0.0       0.0       5
2201206  3          2227.5    556.08    0.0       0.0       0.0       6
2201207  3          2229.4    552.31    0.0       0.0       0.0       7
2201208  3          2231.4    549.27    0.0       0.0       0.0       8
2201300  1
2201301  13.282     0.0       0.0       7
*
**********************************
*****       220  -  230  JUN .  ****
**********************************
*
2250000  J225       SNGLJUN
**                                      0.0       0.0       00100
2250101  220010000 230000000 0.019757 3.4       0.0       00100
2250201  1          13.282    0.0       0.0
*
**********************************
***** S. G. OUTLET PLENUM        ****
**********************************
*
2300000  C230       SNGLVOL
2300101  0.080177   0.68750   0.0       0.0       -90.0     -0.68750
2300102  0.0        0.27514   0
2300200  3          2229.3    549.26
*
**********************************
*****       230  -  240  JUN .  ****
**********************************
*
2350000  J235       SNGLJUN
2350101  230010000 210000000 0.024629 1.64      1.64      00000
2350201  1          13.282    0.0       0.0
*
**********************************
*****     PUMP      SUCTION     *****
**********************************
*
* COMPONENT 1 - SP - 8
* COMPONENT 2 - SP - 8 , 9 AND 10
* COMPONENT 3 - SP - 11 AND 12
* COMPONENT 4 - SP - 13
* COMPONENT 5 - SP - 13 TO BOTTOM P. S.
* COMPONENT 6 - SP - BOTTOM OF P. S. TO SP - 15
* COMPONENT 7 - SP - 16
* COMPONENT 8 - SP - 17 AND 18
*
2400000  C240       PIPE
2400001  8
2400101  0.024629       3
2400102  0.037554       8
2400201  0.024629       3
2400202  0.037554       7
2400301  1.45958        1
2400302  3.66625        2
2400303  2.78417        3
2400304  3.87500        4
2400305  4.08908        5
2400306  6.02658        6
2400307  2.78158        7
2400308  1.71083        8
2400601  -90.0          5
```

```
2400602  90.0           7
2400603  0.0            8
2400701  -1.18333       1
2400702  -3.66625       2
2400703  -2.78417       3
2400704  -3.87500       4
2400705  -3.87500       5
2400706  5.81250        6
2400707  2.56750        7
2400708  0.0            8
2400801  0.0       0.0       8
*2400901  3.12      0.0       3
*2400902  1.34      0.36      4
*2400903  0.0       0.36      6
*2400904  0.0       0.24      7
2400901  3.12      0.0       1
2400902  0.35      0.0       2
2400903  1.34      0.36      4
2400904  0.0       0.36      6
2400905  1.0       0.24      7
2401001  0         8
2401101  0         7
2401201  3         2227.9    549.23    0.0       0.0       0.0       1
2401202  3         2226.5    549.17    0.0       0.0       0.0       2
2401203  3         2227.2    549.13    0.0       0.0       0.0       3
2401204  3         2228.3    549.07    0.0       0.0       0.0       4
2401205  3         2229.1    549.00    0.0       0.0       0.0       5
2401206  3         2228.7    548.90    0.0       0.0       0.0       6
2401207  3         2227.3    548.84    0.0       0.0       0.0       7
2401208  3         2226.6    548.84    0.0       0.0       0.0       8
2401300  1
2401301  13.282    0.0       0.0       7
*
********************************
*****        PUMP          *****
********************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE Q.A. REPORT PXXX
* RATED PERFORMANCES SEE REF. - 01 PXXX
*
2500000  C250      PUMP
2500101  0.034951  4.120     0.0       0.0       90.0      0.840007  0
**  INLET                    0.0       0.0       00000
2500108  240010000 0.034951  0.0       0.0       00000
**  OUTLET                   0.0       0.0       00000
2500109  261000000 8.52212-3 0.0       0.0       00000
2500200  3         2243.8    549.20
2500201  1         13.282    0.0       0.0
2500202  1         13.282    0.0       0.0
2500301  0         0         0         -1        0         0         1
2500302  3500.0    0.4953314 258.7     436.6     101.0     38.3
2500303  62.3082   0.0       0.0       8.7200    0.0       0.0
2500310  0.0       0.0       0.0
**       SINGLE  PHASE  HOMOLOGOUS  CURVES
**       HEAD  CURVES
2501100  1         1
2501101  0.0       1.2
2501102  1.0       1.0
2501200  1         2
2501201  0.0       -0.35
2501202  0.3       -0.2
2501203  0.5       0.0
```

```
2501204  0.8       0.545
2501205  1.0       1.0
2501300  1         3
2301301  -1.0      1.50
2501302  -0.8      1.275
2501303  -0.6      1.375
2501304  -0.4      1.375
2501305  0.0       1.200
25014[illegible]0  1         4
2501[illegible]1  -1.0      1.500
2501402  -0.8      1.150
2501403  -0.6      0.950
2501404  -0.4      0.830
2501405  -0.2      0.775
2501406  0.0       0.725
2501500  1         5
2501501  0.0       0.975
2501502  0.5       1.350
2501503  1.0       1.950
2501600  1         6
2501601  0.0       0.725
2501602  0.2       0.725
2501603  0.4       0.800
2501604  0.6       1.025
2501605  1.0       1.950
2501700  1         7
2501701  -1.0      0.175
2501702  -0.5      0.650
2501703  0.0       0.975
2501800  1         8
2501801  -1.0      0.175
2501802  -0.75     -0.15
2501803  -0.55     -0.30
2501804  -0.275    -0.40
2501805  0.0       -0.35
**       TORQUE  CURVES
2501900  2         1
2501901  0.0       0.540
2501902  0.2       0.590
2501903  0.4       0.650
2501904  0.6       0.770
2501905  0.8       0.950
2501906  0.9       0.980
2501907  0.95      0.960
2501908  1.0       0.870
2502000  2         2
2502001  0.0       -0.15
2502002  0.2       0.020
2502003  0.4       0.220
2502004  0.6       0.460
2502005  0.8       0.710
2502006  0.9       0.810
2502007  0.95      0.850
2502008  1.0       0.870
2502100  2         3
2502101  -1.0      0.620
2502102  -0.8      0.680
2502103  -0.6      0.530
2502104  -0.4      0.460
2502105  -0.2      0.490
2502106  0.0       0.540
2502200  2         4
```

```
2502201  -1.0      0.620
2502202  -0.8      0.530
2502203  -0.6      0.460
2502204  -0.4      0.420
2502205  -0.2      0.390
2502206  0.0       0.360
2502300  2         5
2502301  0.0       -0.63
2502302  0.2       -0.51
2502303  0.4       -0.39
2502304  0.6       -0.29
2502305  0.8       -0.20
2502306  0.9       -0.16
2502307  1.0       -0.13
2502400  2         6
2502401  0.0       0.360
2502402  0.2       0.320
2502403  0.4       0.270
2502404  0.6       0.180
2502405  0.8       0.050
2502406  1.0       -0.13
2502500  2         7
2502501  -1.0      -1.44
2502502  -0.8      -1.25
2502503  -0.6      -1.08
2502504  -0.4      -0.92
2502505  -0.2      -0.77
2502506  0.0       -0.63
2502600  2         8
2502601  -1.0      -1.44
2502602  -0.8      -1.12
2502603  -0.6      -0.79
2502604  -0.4      -0.52
2502605  -0.2      -0.31
2502606  0.0       -0.15
**       TOW - PHASE  MULTIPLIER  TABLES
**       HEAD MULTIPLIER
2503000  0
2503001  0.00      0.00
2503002  0.10      0.00
2503003  0.15      0.05
2503004  0.24      0.80
2503005  0.30      0.96
2503006  0.40      0.98
2503007  0.60      0.97
2503008  0.80      0.90
2503009  0.90      0.80
2503010  0.96      0.50
2503011  1.00      0.0
**       TORQUE MULTIPLIER
2503100  0
2503101  0.00      -0.17
2503102  1.0E-4    -0.17
2503103  6.0E-3    0.00
2503104  0.10      0.00
2503105  0.15      0.05
2503106  0.24      0.56
2503107  0.80      0.56
2503108  0.96      0.45
2503109  1.00      0.00
**       TWO - PHASE  DIFFERENCE  TABLES
**       HEAD  CURVES
```

2504100	1	1
2504101	0.0	0.00
2504102	0.1	0.83
2504103	0.2	1.09
2504104	0.5	1.02
2504105	0.7	1.01
2504106	0.9	0.94
2504107	1.0	1.0
2504200	1	2
2504201	0.0	0.00
2504202	0.1	-0.04
2504203	0.2	0.0
2504204	0.3	0.10
2504205	0.4	0.21
2504206	0.8	0.67
2504207	0.9	0.80
2504208	1.0	1.0
2504300	1	3
2504301	-1.0	-1.16
2504302	-0.9	-1.24
2504303	-0.8	-1.77
2504304	-0.7	-2.36
2504305	-0.6	-2.79
2504306	-0.5	-2.91
2504307	-0.4	-2.67
2504308	-0.25	-1.69
2504309	-0.1	-0.50
2504310	0.0	0.000
2504400	1	4
2504401	-1.0	-1.16
2504402	-0.9	-0.78
2504403	-0.8	-0.50
2504404	-0.7	-0.31
2504405	-0.6	-0.17
2504406	-0.5	-0.08
2504407	-0.35	0.000
2504408	-0.2	0.050
2504409	-0.1	0.080
2504410	0.0	0.110
2504500	1	5
2504501	0.0	0.000
2504502	0.2	-0.34
2504503	0.4	-0.65
2504504	0.6	-0.93
2504505	0.8	-1.19
2504506	1.0	-1.47
2504600	1	6
2504601	0.0	0.11
2504602	0.1	0.13
2504603	0.25	0.15
2504604	0.4	0.13
2504605	0.5	0.07
2504606	0.6	-0.04
2504607	0.7	-0.23
2504608	0.8	-0.51
2504609	0.9	-0.91
2504610	1.0	-1.47
2504700	1	7
2504701	-1.0	0.00
2504702	0.0	0.00
2504800	1	8
2504801	-1.0	0.00

```
2504802  0.0       0.00
**       TORQUE   CURVES
2504900  2         1
2504901  0.0       0.540
2504902  0.2       0.590
2504903  0.4       0.650
2504904  0.6       0.770
2504905  0.8       0.950
2504906  0.9       0.980
2504907  0.95      0.960
2504908  1.0       0.870
2505000  2         2
2505001  0.0       -0.15
2505002  0.2       0.020
2505003  0.4       0.220
2505004  0.6       0.460
2505005  0.8       0.710
2505006  0.9       0.810
2505007  0.95      0.850
2505008  1.0       0.870
2505100  2         3
2505101  -1.0      0.620
2505102  -0.8      0.680
2505103  -0.6      0.530
2505104  -0.4      0.460
2505105  -0.2      0.490
2505106  0.0       0.540
2505200  2         4
2505201  -1.0      0.620
2505202  -0.8      0.530
2505203  -0.6      0.460
2505204  -0.4      0.420
2505205  -0.2      0.390
2505206  0.0       0.360
2505300  2         5
2505301  0.0       -0.63
2505302  0.2       -0.51
2505303  0.4       -0.39
2505304  0.6       -0.29
2505305  0.8       -0.20
2505306  0.9       -0.16
2505307  1.0       -0.13
2505400  2         6
2505401  0.0       0.360
2505402  0.2       0.320
2505403  0.4       0.270
2505404  0.6       0.180
2505405  0.8       0.050
2505406  1.0       -0.13
2505500  2         7
2505501  -1.0      -1.44
2505502  -0.8      -1.25
2505503  -0.6      -1.08
2505504  -0.4      -0.92
2505505  -0.2      -0.77
2505506  0.0       -0.63
2505600  2         8
2505601  -1.0      -1.44
2505602  -0.8      -1.[illegible]2
2505603  -0.6      -0.79
2505604  -0.4      -0.52
2505605  -0.2      -0.31
```

```
2505606  0.0         -0.15
**        TIME DEPENDENT PUMP VELOCITY CNTRL CARD
**        TRIP        VAR        NUM
*2506100  501
2506100  0           CNTRLVAR  725
**        SRCH VAR    PUMP VELOCITY
2506101  0.0         1733.6
*2506102  1000.0      1693.755
2506102   0.0        0.0
2506103  1.0E6       1.0E6
*
************************************
*****       COLD       LEG      *****
************************************
*
* COMPONENT 1 - SP - 19 AND 20
* COMPONENT 2 - SP - 21 TO ECC TAP IN SP - 22
*
2610000  C261        PIPE
2610001  2
2610101  0.037554         2
2610301  2.854167         1
2610302  2.479170         2
2610601  0.0              2
2610701  0.0              2
2610801  0.0         0.0         2
**       0.0         0.0         1
2610901  0.0         0.0         1
2611001  0           2
2611101  00000       1
2611201  3           2261.2      549.27      0.0         0.0         0.0         1
2611202  3           2261.2      549.23      0.0         0.0         0.0         2
2611300  1
2611301  13.282      0.0         0.0         1
*
************************************
*****         ECC  -  TAP        ****
************************************
*
* ECC TAP THROUGH SP - 22
*
2620000  C262        BRANCH
2620001  3           1
2620101  0.037554  2.5960    0.0         0.0         0.0         0.0
2620102  0.0         0.0         0
2620200  3           2261.0      549.18
**                                        0.87        0.53        00000
2621101  261010000 262000000 0.037554  0.28        0.53        00000
2621201  13.282      0.0         0.0
**                                        0.87        0.53        00000
2622101  262010000 263000000 0.037554  0.87        0.53        00000
2622201  13.282      0.0         0.0
**                                        0.0         0.0         00120
**   K.S. LIANG USED IN NH-1 DECK         0.0         0.0         20121
2623101  400010000 262000000 0.004995  0.0         0.0         20121
2623201  0.0         0.0         0.0
*
************************************
*****    COLD  LEG   NOZZLE    *****
************************************
*
2630000  C263        PIPE
```

```
2630001  1
2630101  0.045239          1
2630301  0.595833          1
2630601  0.0               1
2630701  0.0               1
2630801  0.0         0.0         1
2631001  0           1
2631201  3           2260.9.   549.17    0.0       0.0       0.0       1
*
*****************************************
*****    PRESSURIZER  *****
*****************************************
*
*************************************
*****    PRESSURIZER  VESSEL   *****
*************************************
*
9990000  C999        PIPE
9990001  5
9990101  0.289667          2
9990102  0.287295          3
9990103  0.293841          4
9990104  0.184446          5
9990201  0.289667          1
9990202  0.072423          2
9990203  0.287295          3
9990204  0.184446          4
9990301  1.880252          1
9990302  0.769748          2
9990303  0.728611          3
9990304  0.364306          4
9990305  0.217500          5
9990601  -90.0             5
9990701  -1.880252         1
9990702  -0.769748         2
9990703  -0.728611         3
9990704  -0.364306         4
9990705  -0.217500         5
9990801  0.0         0.444928  2
9990802  0.0         0.471013  4
9990803  0.0         0.307163  5
**       0.0         0.0       4
9990901  0.0         0.0       4
9991001  0           5
9991101  00000       1
9991102  00100       2
9991103  00000       4
9991201  2           2243.8    1.0       0.0       0.0       0.0       1
9991202  0           2243.8    689.41    1052.8    0.66794   0.0       2
9991203  2           2244.0    0.0       0.0       0.0       0.0       3
9991204  2           2244.1    0.0       0.0       0.0       0.0       4
9991205  3           2244.2    650.49    0.0       0.0       0.0       5
9991300  0
9991301  4.4759      3.8513-5  0.0       1
9991302  1.4793-4    -1.7981   0.0       2
9991303  5.0281-5    5.0281-5  0.0       3
9991304  7.9243-5    7.9243-5  0.0       4
*
*************************************
*****       999  -  997  JUN .  *****
*************************************
*
```

```
9980000  J998      SNGLJUN
9980101  999010000 99700000. 0.037583  0.0      0.0      00100
9980201  1         5.4932-4  0.0       0.0
*
*********************************
*****     SURGE    LINE     *****
*********************************
*
9970000  C997      PIPE
9970001  5
9970101  0.037583      1
9970102  0.014053      2
9970103  0.003623      3
9970104  7.4667E-4     5
9970201  0.014053      1
9970202  0.003623      2
9970203  7.4667E-4     4
9970301  0.675000      1
9970302  0.583333      2
9970303  1.604167      3
9970304  4.416667      5
9970601  -90.0         5
9970701  -0.675000     1
9970702  -0.583333     2
9970703  -1.604167     3
9970704  -1.074583     5
9970801  0.0       0.0       5
**       502.83    502.83    1
*
*        FOR R' = 1.4E+09  M**-4  SEE REF. - 04 PXXX
9970901  1193.152  1193.152  1
**       33.42     33.42     2
9970902  33.42     33.42     2
**       1.42      1.42      4
9970903  1.42      1.42      4
9971001  0         5
9971101  00000     4
9971201  3         2244.3    649.34    0.0      0.0      0.0      1
9971202  3         2244.5    648.87    0.0      0.0      0.0      2
9971203  3         2244.8    648.43    0.0      0.0      0.0      3
9971204  3         2245.1    648.11    0.0      0.0      0.0      4
9971205  3         2245.4    647.40    0.0      0.0      0.0      5
9971300  1
9971301  5.5351-4  0.0       0.0       1
9971302  5.5509-4  0.0       0.0       2
9971303  5.5647-4  0.0       0.0       3
9971304  5.5741-4  0.0       0.0       4
*
*********************************
*****  PRZ LIQUID LEVEL CONTRL  ****
*********************************
*
* TEMPORARY CONTROL FOR INITIALIZATION
*
*900000   C990      TMDPVOL
*900101   1.0       0.0       1.0      0.0      0.0      0.0
*900102   0.0       0.0       00
*900200   1         0         TEMPF    999050000
*900201   -0.0      649.97    0.0
*900202   0.0       0.0       0.0
*900203   1000.0    1000.0    0.0
*
```

```
*910000   J991        TMDPJUN
*910101   990000000 *99010000 1.0
*910200   1           0           CNTRLVAR  925
*910201   -1.1E6      0.0         0.0       0.0
*910202   -1.0E6      -1.0E6      0.0       0.0
*910203   0.0         0.0         0.0       0.0
*910204   1.0E6       1.0E6       0.0       0.0
*
*****************************************
*****   PRZ  PRESSURE  CONTRL   *****
*****************************************
*
* TEMPORARY CONTROL FOR INITIALIZATION
*
*500000   C950        TMDPVOL
*500101   1.0         0.0         1.0        0.0        0.0        0.0
*500102   0.0         0.0         00
*500200   2
*500201   0.0         2255.6      1.0
*
*510000   J951        SNGLJUN
*510101   950000000 999000000 0.0         0.0        0.0        01000
*510201   0           0.0         0.0        0.0
*
*********************************************
******  ECCS   SYSTEM  ******
*********************************************
*
****************************************
*****       ECCS      HEADER       *****
****************************************
*
4000000  C400        PIPE
4000001  1
4000101  0.004995          1
4000301  10.0              1
4000601  0.0               1
4000701  0.0               1
4000801  0.0         0.0         1
4001001  0           1
4001201  3           2261.0      77.060     0.0        0.0        0.0        1
* CHANGE ACCUM. TEMP. FROM 555.83 TO 77.0
****************************************
*****   HPIS/LPIS    SOURCE      ****
****************************************
*
4100000  C410        TMDPVOL
4100101  10.0        10.0        0.0        0.0        0.0        0.0
4100102  0.0         0.0         00
4100200  3
4100201  0.0         12.3        80.0
*
****************************************
*****        PIS JUNCTION          ****
*******    ****************************
* SEE Rcr. - 03 - PXXX
* SEE Q.A. REPORT PXXX
*
4110000  J411        TMDPJUN
4110101  410000000 400000000 0.004955
4110200  1           503         P          261010000
**       PRESS       FLOW-F      FLOW-G     VELJ
```

```
4110201  -1.5      0.0        0.0        0.0
4110202  0.0       0.0        0.0        0.0
4110203  29.01     0.2[illegible]5686   0.0        0.0
4110204  49.31     0.207890   0.0        0.0
4110205  [illegible].62     0.172068   0.0        0.0
4110206  89.92     0.134490   0.0        0.0
4110207  118.93    0.090835   0.0        0.0
4110208  142.14    0.051852   0.0        0.0
4110209  145.04    0.0        0.0        0.0
4110210  [illegible]000.0    0.0        0.0        0.0
*
***********************************
*****        ACCUMULATOR          ****
***********************************
* SEE REF. - 04 - PXXX (UPDATED BY CHOU 04/18/'89)
*
*4200000  C420      ACCUM
*4200101  0.7085    0.0        2.860515  0.0       90.0       4.037424
*4200102  0.0       0.0        00
*4200200  377.099   77.0       0.0
**                            12.0       12.0      00000
*4201101  400000000 0.004955  12.0       12.0      00000
**        LP-VOL  LQ-LEV  LNLEN  ELEV  WTHCK       HFG   TKDEN   TKCP
*4202200  2.5307  0.0     30.0   0.0   4.7833E-3   0     0.0     0.0
*
4200000  C420     TMDPVOL
4200101  10.0     10.0      0.0     0.0     0.0     0.0
4200102  0.0      0.0       10
4200200  3
4200201  0.0      377.104   80.0
4200202  50.0     377.104   80.0
4200203  100.0    377.104   80.0
4200204  160.0    377.104   80.0
4200205  180.0    333.592   80.0
4200206  200.0    275.376   80.0
4200207  240.0    214.659   80.0
4200208  280.0    176.[illegible]   80.0
4200209  340.0    162.445   80.0
4200210  400.0    134.887   80.0
4200211  460.0    127.635   80.0
4200212  520.0    120.333   80.0
*
4210000  J421     TMDPJUN
4210101  420000000 400000000 0.004955
4210200  1          501
4210201    0.0    0.0       0.0     0.0
4210202  120.0    0.0       0.0     0.0
4210203  140.0    0.0       0.0     0.0
4210204  163.0    0.0       0.0     0.0
4210205  170.0    0.18032 0.0     0.0
4210206  180.0    0.27705 0.0     0.0
4210207  200.0    0.32766 0.0     0.0
4210208  220.0    0.33427 0.0     0.0
4210209  240.0    0.32[illegible]44 0.0     0.0
4210210  260.0    0.31226 0.0     0.0
4210211  280.0    0.27468 0.0     0.0
4210212  300.0    0.26830 0.0     0.0
*
*****************************************
******  BROKEN  LOOP   ******
*****************************************
*
```

```
************************************
*****     HOT   LEG   NOZZLE   *****
************************************
*
* COMPONENT 1 - HOT LEG NOZZLE
* COMPONENT 2 - SP - 50
* COMPONENT 3 - SP - 55
* COMPONENT 4 - SP - 56 , 57 AND 58
* COMPONENT 5 - SP - 59
*
3010000  C301        PIPE
3[illegible]0001  5
3010101  0.[illegible]75533          1
3010102  0.0097643          5
3010201  0.0097643          4
3010301  1.3391667          1
3010302  3.2342933          3
3010303  3.7796910          4
3010304  1.9973268          5
3010601  0.0                3
3010602  90.0               5
3010701  0.0                3
3010702  3.672667           4
3010703  1.532500           5
3010801  0.0        0.0        5
**       0.0        0.0        4
3010901  1.5        1.5        1
3010902  1.0        1.0        2
3010903  0.3        0.3        3
3010904  0.0        0.0        4
3011001  0          5
3011101  00000      4
3011201  3          2247.1     609.09     0.0        0.0        0.0        1
3011202  3          2245.7     608.99     0.0        0.0        0.0        2
3011203  3          2245.0     608.90     0.0        0.0        0.0        3
3011204  3          2244.1     608.79     0.0        0.0        0.0        4
3011205  3          2243.2     608.[illegible]     0.0        0.0        0.0        5
3011300  1
3011301  4.4690     0.0        0.0        4
*
************************************
*****        301  -  310  JUN .  ****
************************************
*
3050000  J305       SNGLJUN
**                                        0.868      0.868      00000
3050101  301010000 310000000 0.0097643 1.868      1.868      00000
3050201  1          4.4690     0.0        0.0
*
************************************
***** S. G. INLET  PLENUM        ****
************************************
*
3100000  C310       SNGLVOL
31001[illegible]  0.055513   0.8541667 0.0        0.0        90.0       0.8541667
3100102  0.0        0.255822   0
3100200  3          2242.3     608.72     0.0
*
************************************
*****        310  -  320  JUN .  ****
************************************
*
```

```
3150000  J315       SNGLJUN
**
                                                0.0        0.0        00100
3150101  310010000 320000000 6.58566E-3         1.0        1.0        00100
3150201  1         4.4691    0.0                0.0
*
************************************
*****      S. G.   U-TUBES      *****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
3200000  C320      PIPE
3200001  8
3200101  6.58566E-3      8
3200301  7.9629167       1
3200302  7.82750         2
3200303  7.9108333       3
3200304  6.7190773       5
3200305  7.9108333       6
3200306  7.82750         7
3200307  7.9629167       8
3200501  -90.0           8
3200601  +90.0           3
3200602  +45.0           4
3200603  -45.0           5
3200604  -90.0           8
3200701  +7.9629167      1
3200702  +7.82750        2
3200703  +7.9108333      3
3200704  +6.6358363      4
3200705  -6.6358363      5
3200706  -7.9108333      6
3200707  -7.82750        7
3200708  -7.9629167      8
3200801  0.0       0.0       8
**       0.34      0.34      7
3200901  0.30      0.30      7
3201001  0         8
3201101  00000     7
3201201  3         2237.6    596.64   0.0      0.0      0.0      1
3201202  3         2233.7    587.43   0.0      0.0      0.0      2
3201203  3         2229.8    580.26   0.0      0.0      0.0      3
3201204  3         2226.2    575.35   0.0      0.0      0.0      4
3201205  3         2225.0    571.49   0.0      0.0      0.0      5
3201206  3         2225.9    568.08   0.0      0.0      0.0      6
3201207  3         2227.0    565.44   0.0      0.0      0.0      7
3201208  3         2228.1    563.31   0.0      0.0      0.0      8
3201300  1
3201301  4.4691    0.0       0.0      7
*
************************************
*****       320  -  330  JUN .  ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
3250000  J325       SNGLJUN
**
                                                0.0        0.0        00100
3250101  320010000 330000000 6.58566E-3         1.0        1.0        00100
3250201  1         4.4691    0.0                0.0
*
************************************
***** S. G. OUTLET PLENUM       ****
************************************
```

```
*
3300000  C330      SNGLVOL
3300101  0.055513  0.8541667 0.0       0.0        -90.0       -0.8541667
3300102  0.0       0.255822  0
3300200  3         2228.1    563.31    0.0
*
**********************************
*****      330  -  340  JUN .  ****
**********************************
*
3350000  J335      SNGLJUN
**                                     0.0        0.0         00000
3350101  330010000 340000000 0.0097643 1.0        1.0         00000
3350201  1         4.4691    0.0       0.0
*
**********************************
*****    PUMP     SUCTION     *****
**********************************
*
* COMPONENT 1 - SP - 60
* COMPONENT 2 - SP - 61 AND 62
* COMPONENT 3 - SP - 63 AND 64 TO P-TAP
* COMPONENT 4 - SP - 64
* COMPONENT 5 - SP - 64 TO P. S. BOTTOM
* COMPONENT 6 - SP - BOTTOM OF P. S. THROUGH SP - 72
* COMPONENT 7 - SP - 73
*
3400000  C340      PIPE
3400001  7
3400101  0.0097643      7
3400301  1.6215085      1
3400302  2.3018333      2
3400303  1.3879167      3
3400304  4.8500         4
3400305  5.219115       5
3400306  6.757448       6
3400307  2.2966667      7
3400601  -90.0          5
3400602  90.0           7
3400701 -1.3526788      1
3400702 -2.3018333      2
3400703 -1.3879167      3
3400704 -4.8500000      5
3400705  6.3883333      6
3400706  2.2966667      7
3400801  0.0       0.0       7
**       2.45      2.45      1
3400901  2.45      2.45      1
**       0.45      0.45      2
3400902  0.0       0.0       2
**       1.24      1.24      5
3400903  0.0       0.0       4
3400904  1.24      1.24      5
**       0.58      0.58      6
3400905  0.58      0.58      6
3401001  0         7
3401101  00000     6
3401201  3         2227.4    563.26    0.0       0.0       0.0       1
3401202  3         2226.7    563.19    0.0       0.0       0.0       2
3401203  3         2227.2    563.15    0.0       0.0       0.0       3
3401204  3         2228.0    563.02    0.0       0.0       0.0       4
3401205  3         2229.3    562.98    0.0       0.0       0.0       5
```

```
3401206  3          2228.1    562.66    0.0       0.0       0.0       6
3401207  3          2226.2    562.59    0.0       0.0       0.0       7
3401300  1
3401301  4.4691     0.0       0.0       6
*
***********************************
*****        PUMP            *****
***********************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE REF. - 04 - PXXX
* SEE Q.A. REPORT PXXX
* RATED PERFORMANCES SEE REF. - 01 - PXXX
*
3500000  C350       PUMP
3500101  0.015457   1.9635    0.0       0.0       90.0      0.143928  0
**       INLET                0.0       0.0       00000
3500108  340010000  0.0097643 0.0       0.0       00000
**       OUTLET               0.0       0.0       00000
3500109  361000000  0.0089295 2.0       2.0       00000
3500200  3          2245.4    562.88
3500201  1          4.4691    0.0       0.0
3500202  1          4.4691    0.0       0.0
3500301  0          0         0         -1        0         0         1
3500302  15250.0    0.77541   51.3      261.0     2.2       0.22
3500303  62.3002    0.0       0.0       0.0       0.0       0.0
3500310  0.0        0.0       0.0
**       SINGLE  PHASE  HOMOLOGOUS  CURVES
**       HEAD  CURVES
3501100  1          1
3501101  0.0        1.7821
3501102  0.2845     1.7059
3501103  0.569      1.627
3501104  0.8535     1.1878
3501105  1.0        1.0
3501200  1          2
3501201  0.0        -1.6359
3501202  0.713      0.00
3501203  0.8271     0.2959
3501204  1.0        1.00
3501300  1          3
3501301  -1.0       1.50
3501302  -0.8       1.275
3501303  -0.6       1.375
3501304  -0.4       1.375
3501305  0.0        1.200
3501400  1          4
3501401  -1.0       1.500
3501402  -0.8       1.150
3501403  -0.6       0.950
3501404  -0.4       0.830
3501405  -0.2       0.775
3501406  0.0        0.725
3501500  1          5
3501501  0.0        0.975
3501502  0.5        1.350
3501503  1.0        1.950
3501600  1          6
3501601  0.0        0.725
3501602  0.2        0.725
3501603  0.4        0.800
3501604  0.6        1.025
3501605  1.0        1.950
```

```
3501700  1        7
3501701  -1.0     0.175
3501702  -0.5     0.650
3501703  0.0      0.975
3501800  1        8
3501801  -1.0     0.175
3501802  -0.75    -0.15
3501803  -0.55    -0.30
3501804  -0.275   -0.40
3501805  0.0      -0.35
**       TORQUE   CURVES
3501900  2        1
3501901  0.0      0.540
3501902  0.2      0.590
3501903  0.4      0.650
3501904  0.6      0.770
3501905  0.8      0.950
3501906  0.9      0.980
3501907  0.95     0.960
3501908  1.0      0.870
3502000  2        2
3502001  0.0      -0.15
3502002  0.2      0.020
3502003  0.4      0.220
3502004  0.6      0.460
3502005  0.8      0.710
3502006  0.9      0.810
3502007  0.95     0.850
3502008  1.0      0.870
3502100  2        3
3502101  -1.0     0.620
3502102  -0.8     0.680
3502103  -0.6     0.530
3502104  -0.4     0.460
3502105  -0.2     0.490
3502106  0.0      0.540
3502200  2        4
3502201  -1.0     0.620
3502202  -0.8     0.530
3502203  -0.6     0.460
3502204  -0.4     0.420
3502205  -0.2     0.390
3502206  0.0      0.360
3502300  2        5
3502301  0.0      -0.63
3502302  0.2      -0.51
3502303  0.4      -0.39
3502304  0.6      -0.29
3502305  0.8      -0.20
3502306  0.9      -0.16
3502307  1.0      -0.13
3502400  2        6
3502401  0.0      0.360
3502402  0.2      0.320
3502403  0.4      0.270
3502404  0.6      0.180
3502405  0.8      0.050
3502406  1.0      -0.13
3502500  2        7
3502501  -1.0     -1.44
3502502  -0.8     -1.25
3502503  -0.6     -1.08
```

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3502504  -0.4       -0.92
3502505  -0.2       -0.77
3502506  0.0        -0.63
3502600  2          8
3502601  -1.0       -1.44
3502602  -0.8       -1.12
3502603  -0.6       -0.79
3502604  -0.4       -0.52
3502605  -0.2       -0.31
3502606  0.0        -0.15
**       TOW - PHASE  MULTIPLIER  TARLES
**       HEAD MULTIPLIER
3503000  0
3503001  0.00       0.00
3503002  0.10       0.00
3503003  0.15       0.05
3503004  0.24       0.80
3503005  0.30       0.96
3503006  0.40       0.98
3503007  0.60       0.97
3503008  0.80       0.90
3503009  0.90       0.80
3503010  0.96       0.50
3503011  1.00       0.0
**       TORQUE MULTIPLIER
3503100  0
3503101  0.00       -0.17
3503102  1.0E-4     -0.17
3503103  6.0E-3     0.00
3503104  0.10       0.00
3503105  0.15       0.15
3503106  0.24       0.56
3503107  0.80       0.56
3503108  0.96       0.45
3503109  1.00       0.00
**       TWO - PHASE  DIFFERENCE  TARLES
**       HEAD  CURVES
3504100  1          1
3504101  0.0        0.00
3504102  0.1        0.53
3504103  0.2        1.09
3504104  0.5        1.02
3504105  0.7        1.01
3504106  0.9        0.94
3504107  1.0        1.0
3504200  1          2
3504201  0.0        0.00
3504202  0.1        -0.04
3504203  0.2        0.0
3504204  0.3        0.10
3504205  0.4        0.21
3504206  0.8        0.67
3504207  0.9        0.80
3504208  1.0        1.0
3504300  1          3
3504301  -1.0       -1.16
3504302  -0.9       -1.24
3504303  -0.8       -1.77
3504304  -0.7       -2.36
3504305  -0.6       -2.79
3504306  -0.5       -2.91
3504307  -0.4       -2.67
```

```
3504308  -0.25     -1.69
3504309  -0.1      -0.50
3504310  0.0       0.000
3504400  1         4
3504401  -1.0      -1.16
3504402  -0.9      -0.78
3504403  -0.8      -0.50
3504404  -0.7      -0.31
3504405  -0.6      -0.17
3504406  -0.5      -0.08
3504407  -0.35     0.000
3504408  -0.2      0.050
3504409  -0.1      0.080
3504410  0.0       0.110
3504500  1         5
3504501  0.0       0.000
3504502  0.2       -0.034
3504503  0.4       -0.65
3504504  0.6       -0.93
3504505  0.8       -1.19
3504506  1.0       -1.47
3504600  1         6
3504601  0.0       0.11
3504602  0.1       0.13
3504603  0.25      0.15
3504604  0.4       0 13
3504605  0.5       0.07
3504606  0.6       -0.04
3504607  0.7       -0.23
3504608  0.8       -0.51
3504609  0.9       -0.91
3504610  1.0       -1.47
3504700  1         7
3504701  -1.0      0.00
3504702  0.0       0.00
3504800  1         8
3504801  -1.0      0.00
3504802  0.0       0.00
**       TORQUE  CURVES
3504900  2         1
3504901  0.0       0.540
3504902  0.2       0.590
3504903  0.4       0.650
3504904  0.6       0.770
3504905  0.8       0.950
3504906  0.9       0.980
3504907  0.95      0.960
3504908  1.0       0.870
3505000  2         2
3505001  0.0       -0.15
3505002  0.2       0.020
3505003  0.4       0.220
3505004  0.6       0.460
3505005  0.8       0.710
3505006  0.9       0.810
3505007  0.95      0.850
3505008  1.0       0.370
3505100  2         3
3505101  -1.0      0.620
3505102  -0.8      0.680
3505103  -0.6      0.530
3505104  -0.4      0.460
```

```
3505105  -0.2      0.490
3505106  0.0       0.540
3505200  2         4
3505201  -1.0      0.620
3505202  -0.8      0.530
3505203  -0.6      0.460
3505204  -0.4      0.420
3505205  -0.2      0.390
3505206  0.0       0.360
3505300  2         5
3505301  0.0       -0.63
3505302  0.2       -0.51
3505303  0.4       -0.39
3505304  0.6       -0.29
3505305  0.8       -0.20
3505306  0.9       -0.16
3505307  1.0       -0.13
3505400  2         6
3505401  0.0       0.360
3505402  0.2       0.320
3505403  0.4       0.270
3505404  0.6       0.180
3505405  0.8       0.050
3505406  1.0       -0.13
3505500  2         7
3505501  -1.0      -1.44
3505502  -0.8      -1.25
3505503  -0.6      -1.08
3505504  -0.4      -0.92
3505505  -0.2      -0.77
3505506  0.0       -0.63
3505600  2         8
3505601  -1.0      -1.44
3505602  -0.8      -1.12
3505603  -0.6      -0.79
3505604  -0.4      -0.52
3505605  -0.2      -0.31
3505606  0.0       -0.15
**       TIME DEPENDENT PUMP VELOCITY CNTRL CARD
**       TRIP      ( VAR )   ( NUM )
*3506100  501
3506100  0         CNTRLVAR  735
**       TIME      PUMP VELOCITY
3506101 -0.0       11825.0
*3506102  1.0E6     11095.0
3506102  0.0       0.0
3506103  1.0E6     1.0E6
*
************************************
*****      COLD      LEG      *****
************************************
*
3610000  C361      BRANCH
3610001  1         1
3610101  0.0097643 1.970     0.0       0.0       0.0       0.1
3610102  0.0       0.0       0
3610200  3         2263.2    562.[illegible]
**                                      1.5       1.5       00000
3611101  361010000 362000000 0.0097643 3.5       3.5       00000
3611201  4.4591    0.0       0.0
*
************************************
```

```
*****      TO       BREAK        ****
*************************************
*
* COMPONENT 1 - SP - 76 TO BREAK
*
3620000  C362       PIPE
3620001  1
3620101  0.0097643       1
3620301  0.755833        1
3620601  0.0             1
3620701  0.0             1
3620801  0.0        0.0       1
3621001  0          1
3621201  3          2261.4    562.87    0.0       0.0       0.0       1
*
*************************************
*****     COLD  LEG   NOZZLE    *****
*************************************
*
* COMPONENT 1 - BREAK THROUGH SP - 76
* COMPONE      - SP - 79
* COMPONENT 3 - COLD LEG NOZZLE
*
3630000  C363       PIPE
3630001  3
3630101  0.0097643       2
3630102  0.0375539       3
3630201  0.0097643       2
3630301  0.891667        1
3630302  2.334167        2
3630303  1.276167        3
3630601  0.0             3
3630701  0.0             3
3630801  0.0        0.0       3
**       0.0        0.0       2
3630901  0.0        0.0       1
3630902  0.6        0.6       2
3631001  0          3
3631101  00000      2
3631201  3          2260.4    562.84    0.0       0.0       0.0       1
3631202  3          2260.3    562.79    0.0       0.0       0.0       2
3631203  3          2260.4    562.73    0.0       0.0       0.0       3
3631300  1
3631301  4.4691   0.0     0.0       2
*
*************************************
*****       362  -  363  JUN .  ****
*************************************
*
3650000  J365       SNGLJUN
**                                      0.0       0.0       00000
3650101  362010000 363000000 0.0097643 2.0       2.0       00100
3650201  1          4.4691    0.0       0.0
*
*************************************
*****    C-L BREAK  JUNCTION    ****
*************************************
* UPDATE - 1 - ( SEE REF. 02 )
*
3750000  BREAK-V   VALVE
**                                      0.0       0.0       00100
3750101  [illegible] 900000000 5.25[illegible]36-4 0.0 [illegible] [illegible]
```

```
3750102  1.00      0.84
3750201  1         0.0       0.0       0.0
3750300  TRPVLV
3750301  501
*
************************************
**    BLOWDOWN AMBIENT VOLUMES    **
************************************
* SEE Q.A. REPORT PXXX
*
9000000  C900      TMDPVOL
9000101  10.0       1.0      0.0       0.0       0.0       0.0
9000102  0.0        0.0      10
9000200  2
9000201  0.0        36.1435  1.0
9000202  1.6        36.9962  1.0
9000203  2.0        37.1586  1.0
9000204  5.2        35.7984  1.0
9000205  12.4       36.5495  1.0
9000206  16.0       36.1435  1.0
9000207  20.8       36.8135  1.0
9000208  25.6       36.6307  1.0
9000209  26.8       36.6510  1.0
9000210  30.4       35.8796  1.0
9000211  32.8       36.3262  1.0
9000212  35.2       35.7578  1.0
9000213  37.6       36.1435  1.0
9000214  40.0       36.1435  1.0
9000215  42.4       36.0623  1.0
9000216  46.0       36.7119  1.0
9000217  49.6       35.3314  1.0
9000218  55.6       37.5443  1.0
9000219  3.0        35.4532  1.0
9000220  61.6       37.9300  1.0
9000221  67.6       30.2558  1.0
9000222  76.0       19.1085  1.0
9000223  80.8       17.8089  1.0
9000224  86.8       17.5450  1.0
9000225  94.0       18.1135  1.0
9000226  98.8       17.8496  1.0
9000227  120.4      19.2507  1.0
9000228  131.2      22.0935  1.0
9000229  140.8      23.4945  1.0
9000230  152.8      27.3321  1.0
9000231  154.0      27.5351  1.0
9000232  166.0      38.5594  1.0
9000233  172.0      28.3270  1.0
9000234  182.8      38.5797  1.0
9000235  188.8      30.0934  1.0
9000236  197.2      38.0518  1.0
9000237  203.2      35.1690  1.0
9000238  209.2      35.9202  1.0
9000239  218.8      36.1435  1.0
9000240  220.0      36.0623  1.0
9000241  233.2      36.1435  1.0
9000242  244.0      36.1435  1.0
9000243  246.4      35.6766  1.0
9000244  250.0      35.6563  1.0
9000245  259.6      35.6563  1.0
9000246  263.2      35.4735  1.0
9000247  264.4      35.6563  1.0
9000248  269.2      35.4126  1.0
```

```
9000249  281.2     35.5750   1.0
9000250  292.0     35.6563   1.0
9000251  314.8     35.6563   1.0
9000252  320.8     35.7984   1.0
9000253  328.0     35.8999   1.0
9000254  340.0     35.8999   1.0
9000255  349.6     35.6563   1.0
9000256  359.2     35.6563   1.0
9000257  362.8     35.4735   1.0
9000258  367.6     35.6563   1.0
9000259  379.6     35.4126   1.0
9000260  382.0     35.4126   1.0
9000261  390.4     35.8187   1.0
9000262  400.0     36.1232   1.0
9000263  401.2     36.1435   1.0
9000264  408.4     36.1435   1.0
9000265  419.2     35.6563   1.0
9000266  433.6     35.6563   1.0
9000267  434.8     35.5750   1.0
9000268  438.4     35.4126   1.0
9000269  440.8     35.5750   1.0
9000270  444.4     35.6360   1.0
9000271  451.6     35.9811   1.0
9000272  456.4     35.9202   1.0
9000273  460.0     36.1435   1.0
9000274  500.0     36.1435   1.0
*
******************************************************************************
******SECONDARY SIDE OF STEAM GENERATOR INTACT LOOP***************
******************************************************************************
*
**********************************************
***** RISING SECONDARY - BOILER SECTION ****
**********************************************
* UPDATE - 1 - (SEE REF. 02 )
*
6000000  C600       PIPE
6000001  4
6000101  0.0              4
6000201  0.04299          3
6000301  7.9525           1
6000302  7.9108334        3
6000303  7.47625          4
6000401  0.8881858        1
6000402  0.8846853        3
6000403  0.8994333        4
6000601  90.0             4
6000701  7.9525           1
6000702  7.9108334        3
6000703  7.47625          4
6000801  0.0        0.1019770 3
6000802  0.0        0.1333038 4
**       0.0        0.0       3
6000901  0.0        0.0       3
6001001  0          4
6001101  00100      3
6001201  0          946.03     526.99    1111.7    0.31232   0.0        1
6001202  0          944.12     529.60    1111.8    0.51503   0.0        2
6001203  0          942.49     529.85    1111.8    0.61986   0.0        3
6001204  0          940.99     529.68    1111.8    0.67810   0.0        4
6001300  0
6001301  2.6922     4.0900     0.0       1
```

```
6001302  3.6730     5.6450     0.0        2
6001303  4.4561     7.2345     0.0        3
*
***********************************
*****      BOILER UP-PLENUM     *****
***********************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE Q.A. REPORT PXXX
*
6060000  C606       BRANCH
6060001  1          0
6060101  0.0        5.94875    2.6797920   0.0      -90.0      -5.94875
6060102  0.0        0.0        0
6060200  0          940.62     529.59     1111.9    0.99999
6061101  600010000 606010000 0.03939     0.0       0.0        01000
6061201  -16.913    4.2229-3   0.0
*
* SEE Q.A. REPORT PXXX
*
*6070000  C607       BRANCH
*6070001  0          0
*6070101  0.0        2.974375  1.3398960   0.0      90.0       2.974375
*6070102  0.0        0.0       0
*6070200  0          940.45    529.56     1111.9    1.0
*
***********************************
*****        STEAM   DOME        ; **
***********************************
*
6010000  C601       SNGLVOL
6010101  0.9122177 1.3125     0.0        0.0       90.0       1.3125
6010102  0.0        0.0        0
6010200  0          939.32     529.39     1111.9    0.99999
*
***********************************
***** SEPARATOR/UPPER DOWNCOMER ****
***********************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE Q.A. REPORT PXXX
*
*
6020000  C602       SEPARATR
6020001  3          0
6020101  0.0        5.94875    2.6797920   0.0      90.0       5.94875
6020102  0.0        0.0        0
6020200  0          939.94     529.83     1111.8    0.38004
**       STEAM OUTLET                      0.0       0.0       01100
6021101  602010000 601000000 0.6283259   0.0       0.0       01000
6021201  -2.4272-2 1.3383     0.0
**       LIQUID FALLBACK      0.0          0.0       0.0       01100
6022101  602000000 603000000 0.4464736   0.0       0.0       01000
6022201  0.41457    0.29383    0.0
**       STEAM INLET         *0.0          0.0       0.0       01100
6023101  600010000 602000000 0.450479848 0.0       0.0       01000
6023201  1.2775     2.0907     0.0
*
* SEE Q.A. REPORT PXXX
*
*6080000  C608       BRANCH
*6080001  1          0
*6080101  0.0        2.974375  1.3398960 0.0      -90.0      -2.974375
*6080102  0.0        0.0       0
```

```
*6080200  0           940.86    529.57       1111.9  0.21470
*6081101  603010000 603000000 0.4464736   0.0      0.0     01000
*6081201  0.26685   0.20698   0.0
************************************
*****         DOWNCOMER          ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
6030000  C603       PIPE
6030001  4
6030101  0.0278071       4
6030301  7.47625         1
6030302  7.9108334       3
6030303  7.9525          4
6030601  -90.0           4
6030701  -7.47625        1
6030702  -7.9108334      3
6030703  -7.9525         4
6030801  0.0        0.03357905  4
6030901  0.0        0.0         3
6031001  0          4
6031101  00000      3
6031201  3          941.12    537.18    0.0       0.0       0.0     1
6031202  3          942.73    537.12    0.0       0.0       0.0     2
6031203  3          944.40    537.06    0.0       0.0       0.0     3
6031204  3          946.03    523.57    0.0       0.0       0.0     4
6031300  0
6031301  6.6573     6.6573    0.0       1
6031302  6.6566     6.6566    0.0       2
6031303  6.6559     6.6559    0.0       3
*
************************************
*****        603  -  600  JUN .  ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
6040000  J604       SNGLJUN
**                                      0.0       0.0       00000
6040101  603010000 600000000 0.0278071 0.0       0.0       00000
6040201  0          7.5454    7.6914    0.0
*
************************************
*****  MAIN  FEEDWATER  SOURCE  ****
************************************
* SEE Q.A. REPORT PXXX
*
6300000  C630       TMDPVOL
6300101  0.012      0.0       0.12      0.0       0.0       0.0
6300102  0.0        0.0       10
6300200  3
6300201  0.0        952.0     429.8
*
************************************
*****  MAIN  FEEDWATER  JUNCTION****
************************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE REF. - 04 - PXXX
* SEE Q.A. REPORT PXXX
*
6100000  J610       TMDPJUN
6100101  630000000 603010000 0.012
6100200  1          501
```

```
6100201  0.0        1.3427     0.0         0.0
6100202  30.0       0.0000     0.0         0.0    * FEEDWATER VALVE CLOSE
6100203  1000.0     0.0000     0.0         0.0    * AT TIME = 30.0 SEC
*
*6100000  RJ610      TMDPJUN
*6100101  630000000 603010000 0.012
*6100200  1          0         CNTRLVAR  610
*6100201  -1.1E6     1.3231    0.0        0.0
*6100202  -1.0E6     -1.0E6    0.0        0.0
*6100203   0.0       0.0       0.0        0.0
*6100204   1.0E6     1.0E6     0.0        0.0
*
***********************************
*****      RELIEF      VALVE    ****
***********************************
*
*6340000  V634       VALVE
*6340101  601010000 640000000 0.021      0.0        0.0        00100
*6340102  0.6        0.8
*6340201  1          0.0       0.0        0.0
*6340300  TRPVLV
*6340301  599
*
***********************************
*****     STEAM     DISCHARGE    ****
***********************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE Q.A. REPORT PXXX
* STEAM VALVE WITH CHOKE !!
*
*
6350000  V635       VALVE
**                                        204.67     204.67     00100
6350101  601010000 640000000 0.007      204.67     204.67     00100
6350201  0          0.87895    0.90582    0.0
6350300  MTRVLV
**       OP-TRN     CL-TRN     SLOP       INT-POS    TABLE
6350301  598        504        0.2        9.5413 -2 0      * % CL 504
*6350300  SRVVLV
**        CNTRLVAR
*6350301  637
*
*6350000  V635       VALVE
*6350101  601010000 640000000 0.007      204.67     204.67     00100
*6350201  0          0.88872    0.90835    0.0
*6350300  SRVVLV
*6350301  637
*
***********************************
*****       STEAM      LINE       ****
***********************************
*
6400000  C640       BRANCH
6400001  1          0
6400101  0.70584    10.0       0.0        0.0        0.0        0.0
6400102  0.0        0.0        0
6400200  0          14.010     177.74     1076.5     0.99969
6401101  640010000 650000000 0.70584    0.0        0.0        01000
6401201  3.7776     51.084     0.0
*
*6400000  R640       TMDPVOL
*6400101  0.70584    10.0       0.0        0.0        0.0        0.0
```

```
*6400102  0.0         0.0         00
*6400200  2
*6400201  0.0         937.0       1.00
*
*************************************
*****   ATOMSPHERIC  DISCHARGE  ****
*************************************
*
6500000  C650        TMDPVOL
6500101  0.70584     10.0        0.0         0.0         0.0         0.0
6500102  0.0         0.0         10
6500200  2
6500201  0.0         14.0        1.00
*
*************************************
*****  S/G LIQUID LEVEL CONTRL  ****
*************************************
*
* TEMPORARY CONTROL FOR INITIALIZATION
*
*6900000  C690        TMDPVOL
*6900101  1.0         0.0         1.0         0.0         0.0         0.0
*6900102  0.0         0.0         10
*6900200  1           0           TEMPF       603040000
*6900201 -0.0         517.03      0.0
*6900202  0.0         0.0         0.0
*6900203  1000.0      1000.0      0.0
*
*6910000  J691        TMDPJUN
*6910101  690000000 603010000 1.0
*6910200  1           0           CNTRLVAR   694
*6910201  -1.1E6      0.0         0.0         0.0
*6910202  -1.0E6      -1.0E6      0.0         0.0
*6910203   0.0        0.0         0.0         0.0
*6910204   1.0E6      1.0E6       0.0         0.0
*
*****************************************************************************
*****SECONDARY SIDE OF STEAM GENERATOR BROKEN LOOP*************
*****************************************************************************
*
*******************************************
***** RISING SECONDARY - BOILER SECTION ****
*******************************************
* UPDATE - 1 - (SEE REF. 02 )
*
7000000  C700        PIPE
7000001  4
7000101  0.0                4
7000201  0.04976944         3
7000301  7.9629167          1
7000302  7.82750            2
7000303  7.9108333          3
7000304  6.6354363          4
7000401  0.4541449          1
7000402  0.4464939          2
7000403  0.4512499          3
7000404  0.3938984          4
7000601  90.0               4
7000701  7.9629167          1
7000702  7.82750            2
7000703  7.9108333          3
7000704  6.6354363          4
```

```
7000801  0.0       0.0655926 4
**       0.0       0.0       3
7000901  0.0       0.0       3
7001001  0         4
7001101  00100     3
7001201  0         1095.8    549.01    1107.5    0.17322   0.0       1
7001202  0         1093.8    551.40    1107.6    0.32407   0.0       2
7001203  0         1092.1    551.69    1107.6    0.43349   0.0       3
7001204  0         1090.7    551.84    1107.7    0.46223   0.0       4
7001300  0
7001301  2.2588    3.0842    0.0       1
7001302  2.7170    3.7104    0.0       2
7001303  3.1796    4.3255    0.0       3
*
*************************************
*****     BOILER UP-PLENUM      *****
*************************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE Q.A. REPORT PXXX
*
7060000  C706      BRANCH
7060001  1         0
7060101  0.0       6.862087 2.6230297   0.0     -90.0     -6.862087
7060102  0.0       0.0      0
7060200  0         1090.1   551.73    1107.7    0.99993
7061101  700010000 706010000 0.04976944 0.0     0.0       01000
7061201  -2.6636   8.3956-3  0.0
*
* SEE Q.A. REPORT PXXX
*
*7070000  C707      BRANCH
*7070001  0         0
*7070101  0.0       3.4310435 1.31151485 0.0    90.0      3.4310435
*7070102  0.0       0.0      0
*7070200  0         1064.3   548.03    1108.8    1.0
*************************************
*****      STEAM   DOME          ****
*************************************
*
7010000  C701      SNGLVOL
7010101  0.9122177 1.3125    0.0       0.0       90.0      1.3125
7010102  0.0       0.0       0
7010200  2         1089.3    1.0
*
*************************************
***** SEPARATOR/UPPER DOWNCOMER ****
*************************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE Q.A. REPORT PXXX
*
7020000  C702      SEPARATR
7020001  3         0
7020101  0.0       6.862087 2.6230297   0.0     90.0      6.862087
7020102  0.0       0.0       0
7020200  0         1089.7    551.73    1107.7  0.69287
**       STEAM OUTLET                  0.0     0.0       01100
7021101  702010000 701000000 0.42473177 0.0    0.0       01000
7021201  -5.8775   0.32770   0.0
**       LIQUID FALLBACK     0.0       0.0     0.0       01000
7022101  702000000 703000000 0.4464736 0.0     0.0       01000
7022201  0.22619   -1.3684-2 0.0
**       STEAM INLET                   0.0     0.0       01100
```

```
7023101  700010000 702000000 0.33224955 0.0      0.0      01000
7023201  0.49128   0.78934   0.0
*
* SEE Q.A. REPORT PXXX
*
*7080000  C708      BRANCH
*7080001  1         0
*7080101  0.0       3.4310435 1.4572732  0.0      -90.0    -3.4310435
*7080102  0.0       0.0       0
*7080200  0         1064.8    547.99     1108.6   0.27345
*7081101  708010000 703000000 0.44647360 0.0      0.0      01000
*7081201  0.15240   0.10838   0.0
************************************
*****       DOWNCOMER           ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
7030000  C703       PIPE
7030001  4
7030101  0.01763689      4
7030301  6.6358363       1
7030302  7.9108333       2
7030303  7.82750         3
7030304  7.9629167       4
7030601  -90.0           4
7030701  -6.6358363      1
7030702  -7.9108333      2
7030703  -7.82750        3
7030704  -7.9629167      4
7030801  0.0        0.033338  4
7030901  0.0        0.0       3
7031001  0          4
7031101  00000      3
7031201  3          1090.7    555.05    0.0       0.0       0.0       1
7031202  3          1092.3    554.96    0.0       0.0       0.0       2
7031203  3          1094.2    554.85    0.0       0.0       0.0       3
7031204  3          1096.0    546.88    0.0       0.0       0.0       4
7031300  0
7031301  5.7248     5.7248    0.0       1
7031302  5.7235     5.7235    0.0       2
7031303  5.7222     5.7222    0.0       3
*
************************************
*****       703  -  700  JUN.  ****
************************************
* UPDATE - 1 - (SEE REF. 02 )
*
7040000  J704       SNGLJUN
**                                       0.0       0.0       00100
7040101  703010000 700000000 0.01763689  0.0       0.0       00100
7040201  0          6.0736    6.3084     0.0
*
************************************
***** MAIN  FEEDWATER  SOURCE  ****
************************************
*
7300000  C730       TMDPVOL
7300101  0.004      10.0      0.0       0.0       0.0       0.0
7300102  0.0        0.0       10
7300200  3
7300201  0.0        1097.0    429.8
*
```

```
*********************************
***** MAIN FEEDWATER JUNCTION****
*********************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE REF. - 04 - PXXX
* SEE Q.A. REPORT PXXX
*
7100000  J710      TMDPJUN
7100101  730000000 703010000 0.004
7100200  1         501
7100201  0.0       0.34464   0.0      0.0
7100202  1.0       0.34464   0.0      0.0
7200203  2.5       0.00000   0.0      0.0   * FEEDWATER VALVE CLOSE
7100204  1000.0    0.00000   0.0      0.0   * AT TIME = 2.5 SEC
*
*7100000  RJ710     TMDPJUN
*7100101  730000000  703010000 0.004
*7100200  1         0         CNTRLVAR  710
*7100201  -1.1E6    0.35527   0.0       0.0
*7100202  -1.0E6    -1.0E6    0.0       0.0
*7100203   0.0      0.0       0.0       0.0
*7100204   1.0E6    1.0E6     0.0       0.0
*
*********************************
*****      RELIEF      VALVE    ****
*********************************
*
*7340000  V734      VALVE
*7340101  701010000 740000000 0.007    0.0     0.0     00100
*7340102  0.6       0.8
*7340201  1         0.0       0.0      0.0
*7340300  TRPVLV
*7340301  599
*
*********************************
*****     STEAM     DISCHARGE    ****
*********************************
* UPDATE - 1 - (SEE REF. 02 )
* SEE Q.A. REPORT PXXX
* STEAM VALVE WITH CHOKE !!
*
*
7350000  V735      VALVE
**                                     1022.36   1022.36   00100
7350101  701010000 740000000 0.007     1022.36   1022.36   00100
7350201  0         0.47875   0.48546   0.0
7350300  MTRVLV
**       OP-TRN    CL-TRN    SLOP      INT-POS . TABLE
7350301  598       501       0.2       2.00153-2         * V CL 504
*7350300  SRVVLV
**       CNTRLVAR
*7350301  737
*
*7350000  V735      VALVE
**                                     1022.36   1022.36   00100
*7350101  701010000 740000000 0.007    1022.36   1022.36   00100
*7350201  0         0.48020   0.48572  0.0
*7350300  SRVVLV
*7350301  737
*
*********************************
*****      STEAM      LINE      ****
```

```
******************************************
*
7400000  C740        BRANCH
7400001  1           0
7400101  0.28649847 10.0      0.0        0.0        0.0        0.0
7400102  0.0        0.0       0
7400200  0          14.004    171.70     1076.7     0.99948
7401101  740010000 750000000 0.28649847 0.0       0.0        01000
7401201  1.5900     32.184    0.0
*
*7400000  R740        TMDPVOL
*7400101  0.28649847 10.0      0.0        0.0        0.0        0.0
*7400102  0.0        0.0       00
*7400200  2
*7400201  0.0        1066.5    1.0
*
******************************************
*****   ATOMSPHERIC  DISCHARGE   ****
******************************************
*
7500000  C750        TMDPVOL
7500101  0.28649847 10.0      0.0        0.0        0.0        0.0
7500102  0.0        0.0       10
7500200  2
7500201  0.0        14.0      1.0
*
******************************************
*****  S/G LIQUID LEVEL CONTRL   ****
******************************************
*
* TEMPORARY CONTROL FOR INITIALIZATION
*
*7900000  C790        TMDPVOL
*7900101  1.0        0.0       1.0        0.0        0.0        0.0
*7900102  0.0        0.0       00
*7900200  1          0         TEMPF      703040000
*7900201 -0.0        541.02    0.0
*7900202  0.0        0.0       0.0
*7900203  1000.0     1000.0    0.0
**
*7910000  J791        TMDPJUN
*7910101  790000000 703010000 1.0
*7910200  1          0         CNTRLVAR   794
*7910201  -1.1E6     0.0       0.0        0.0
*7910202  -1.0E6     -1.0E6    0.0        0.0
*7910203   0.0       0.0       0.0        0.0
*7910204   1.0E6     1.0E6     0.0        0.0
*
******************************************
**   HEAT LOSS FOR VESSEL UPPER    **
******************************************
*
8000000  C800        TMDPVOL
8000101  10.0        1.0       0.0        0.0        0.0        0.0
8000102  0.0         0.0       00
8000200  1
8000201  0.0         80.0      1.0
*
******************************************
**   HEAT LOSS FOR DOWNCOMER          **
******************************************
*
```

```
8010000  C801       TMDPVOL
8010101  10.0        1.0       0.0        0.0        0.0        0.0
8010102  0.0         0.0       00
8010200  1
8010201  0.0         80.0      1.0
*
**********************************
**   HEAT LOSS FOR OTHER VESSEL  **
**********************************
*
8020000  C802       TMDPVOL
8020101  10.0        1.0       0.0        0.0        0.0        0.0
8020102  0.0         0.0       00
8020200  1
8020201  0.0         80.0      1.0
*
**********************************
**   HEAT LOSS FOR IL PIPING     **
**********************************
*
8030000  C803       TMDPVOL
8030101  10.0        1.0       0.0        0.0        0.0        0.0
8030102  0.0         0.0       00
8030200  1
8030201  0.0         80.0      1.0
*
**********************************
**   HEAT LOSS FOR BL PIPING     **
**********************************
*
8040000  C804       TMDPVOL
8040101  10.0        1.0       0.0        0.0        0.0        0.0
8040102  0.0         0.0       00
8040200  1
8040201  0.0         80.0      1.0
*
**********************************
**   HEAT LOSS FOR IL S/G        **
**********************************
*
8050000  C805       TMDPVOL
8050101  10.0        1.0       0.0        0.0        0.0        0.0
8050102  0.0         0.0       00
8050200  1
8050201  0.0         80.0      1.0
*
**********************************
**   HEAT LOSS FOR BL S/G        **
**********************************
*
8060000  C806       TMDPVOL
8060101  10.0        1.0       0.0        0.0        0.0        0.0
8060102  0.0         0.0       00
8060200  1
8060201  0.0         80.0      1.0
*
*=====================================================================
*
****             HEAT STRUCTURE COMPONENTS                        ****
*
*=====================================================================
*
```

```
*
******************************************
******        VESSEL COMPONENTS    ******
******************************************
*
*************************************
*****       INLET ANNULUS      *****
*****        HEAT LOSS         *****
*************************************
*
11010000 1    7    2    1    0.271375
11010100 0    1
11010101 2    0.279708
11010102 1    0.283850
11010103 2    0.359375
11010104 1    0.526042
11010201 1    2
11010202 13   3
11010203 1    5
11010204 8    6
11010301 0.0  6
11010400 -1
11010401 548.11  547.83  547.55  435.53  436.07  433.83  334.82
11010501 101010000 0         1         1         0.8750    1
11010601 801010000 0         4100      1         0.8750    1
11010701 0         0.0       0.0       0.0       1
11010801 0         0.0       0.0       0.8750    1
11010901 0         0.0       0.0       0.8750    1
*
11020000 1    7    2    1    0.271375
11020100 0    1
11020101 2    0.279708
11020102 1    0.283850
11020103 2    0.359375
11020104 1    0.526042
11020201 1    2
11020202 13   3
11020203 1    5
11020204 8    6
11020301 0.0  6
11020400 -1
11020401 551.84  551.56  551.23  441.71  439.24  436.97  337.54
11020501 102010000 0         1         1         1.00      1
11020601 801010000 0         4100      1         1.00      1
11020701 0         0.0       0.0       0.0       1
11020801 0         0.0       0.0       1.00      1
11020901 0         0.0       0.0       1.00      1
*
*************************************
*****       INLET ANNULUS      *****
*****       HOLLOW CENTER      *****
*************************************
*
12010000 1    6    2    1    0.125000
12010100 0    1
12010101 2    0.187500
12010102 1    0.191667
12010103 2    0.200000
12010201 1    2
12010202 13   3
12010203 1    5
12010301 0.0  5
```

```
12010400 -1
12010401 558.58    558.55    558.46    552.63    552.61    552.59
12010501 0         0         0         1         0.8750    1
12010601 101010000 0         1         1         0.8750    1
12010701 0         0.0       0.0       0.0       1
12010801 0         0.0       0.0       0.8750    1
12010901 0         0.0       0.0       0.8750    1
*
12020000 1    6    2    1    0.125000
12020100 0    1
12020101 2    0.187500
12020102 1    0.191667
12020103 2    0.200000
12020201 1    2
12020202 13   3
12020203 1    5
12020301 0.0  5
12020400 -1
12020401 559.09    559.05    558.95    552.41    552.39    552.38
12020501 0         0         0         1         1.000     1
12020601 102010000 0         1         1         1.000     1
12020701 0         0.0       0.0       0.0       1
12020801 0         0.0       0.0       1.0000    1
12020901 0         0.0       0.0       1.0000    1
*
****************************************
*****       DOWNCOMER PIPE         *****
*****        HEAT LOSS             *****
****************************************
*
11100000 9    9    2    1    0.091042
11100100 0    1
11100101 1    0.092542
11100102 2    0.107825
11100103 1    0.109325
11100104 3    0.145833
11100105 1    0.312500
11100201 10   1
11100202 12   3
11100203 10   4
11100204 1    7
11100205 8    8
11100301 0.0  8
11100400 0
11100401 552.00  2  466.60  3  387.60  4  387.45  5  386.40  6
11100402 385.46  7  384.60  8  338.15  9
11100501 110010000 0         1         1         2.2608333 1
11100502 110020000 0         1         1         1.0833333 2
11100503 110030000 010000    1         1         2.0000000 7
11100504 110080000 0         1         1         1.465667  8
11100505 110090000 0         1         1         1.434751  9
11100601 801010000 0         4100      1         2.2608333 1
11100602 801010000 0         4100      1         1.0833333 2
11100603 801010000 0         4100      1         2.0000    3
11100604 801010000 0         4100      1         2.0000    4
11100605 801010000 0         4100      1         2.0000    5
11100606 801010000 0         4100      1         2.0000    6
11100607 801010000 0         4100      1         2.0000    7
11100608 801010000 0         4100      1         1.465667  8
11100609 801010000 0         4100      1         1.434751  9
11100701 0         0.0       0.0       0.0       9
11100801 0         0.0       0.0       16.244584 9
```

```
11100901 0          0.0        0.0        1.00      9
*
****************************************
*****       DOWNCOMER DISTRIB        *****
*****       ANNULUS HEAT LOSS        *****
****************************************
*
11110000 1    9    2    1    0.244875
11110100 0    1
11110101 1    0.246542
11110102 2    0.256958
11110103 1    0.258625
11110104 3    0.411542
11110105 1    0.577821
11110201 10   1
11110202 11   3
11110203 10   4
11110204 1    7
11110205 8    8
11110301 0.0  8
11110400 0
11110401 551.80  2  50[illegible].31  3  459.81  4  459.65  5  455.60  6
11110402 452.06  7  448.94  8  395.61  9
11110501 110100000 0        1          1          0.96250   1
11110601 801010000 0        4100       1          0.96250   1
11110701 0          0.0      0.0        0.0        1
11110801 0          0.0      0.198130   0.96250    1
11110901 0          0.0      0.0        0.96250    1
*
****************************************
*****       DOWNCOMER DISTRIB        *****
*****     ANNULUS TO CORE INLET      *****
****************************************
*
11140000 1    3    2    1    0.179667
11140100 0    1
11140101 2    0.188958
11140201 1    2
11140301 0.0  2
11140400 -1
11140401 552.11    552.14    552.17
11140501 140010000 0        1          1          0.96250   1
11140601 110100000 0        1          1          0.96250   1
11140701 0          0.0      0.0        0.0        1
11140801 0          0.0      0.0        0.96250    1
11140901 0          0.0      0.256760   0.96250    1
*
****************************************
*****           LOWER HEAD           *****
*****           HEAT LOSS            *****
****************************************
*
11200000 1    8    2    1    0.412500
11200100 0    1
11200101 1    0.414167
11200102 2    0.424833
11200103 1    0.426250
11200104 2    0.740417
11200105 1    0.907083
11200201 10   1
11200202 11   3
11200203 10   4
```

```
11200204 1     6
11200205 8     7
11200301 0.0   7
11200400 0
11200401 533.80     2    423.74     3    315.40     5    285.05      6
11200402 262.66     7    127.44     8
11200501 120010000 0          1          1          0.466667  1
11200601 802010000 0          4200       1          0.466667  1
11200701 0         0.0        0.0        0.0        1
11200801 0         0.0        0.0        0.466667   1
11200901 0         0.0        0.0        0.466667   1
*
****************************************
*****          LOWER  PLENUM       *****
*****           HEAT LOSS          *****
****************************************
*
11300000 1     8     2     1     0.363403
11300100 0     1
11300101 1     0.365070
11300102 2     0.375487
11300103 1     0.377153
11300104 2     0.691320
11300105 1     0.857987
11300201 10    1
11300202 11    3
11300203 10    4
11300204 1     6
11300205 8     7
11300301 0.0   7
11300400 0
11300401 540.50     2    427.31     3    315.70     5    285.25      6
11300402 262.62     7    127.11     8
11300501 130010000 0          1          1          0.721917  1
11300601 802010000 0          4200       1          0.721917  1
11300701 0         0.0        0.0        0.0        1
11300801 0         0.0        0.0        0.721917   1
11300901 0         0.0        0.0        0.721917   1
*
****************************************
*****           CORE  INLET        *****
*****           HEAT LOSS          *****
****************************************
*
11400000 1     5     2     1     0.149340
11400100 0     1
11400101 3     0.482674
11400102 1     0.649340
11400201 1     3
11400202 8     4
11400301 0.0   4
11400400 0
11400401 547.29     1    486.83     2    443.97     3    411.05      4
11400402 158.93     5
11400501 140010000 0          1          1          0.673333  1
11400601 802010000 0          4200       1          0.673333  1
11400701 0         0.0        0.0        0.0        1
11400801 0         0.0        0.0        0.673333   1
11400901 0         0.0        0.0        0.673333   1
*
****************************************
*****         CORE HEATER ROD      *****
```

```
*****          ( ACTIVE )               *****
*****************************************************
*
****        USING REFLOOD OPTION          ****
*
*11500000 12   18   2    1    0.0
11500000 12   18   2    1    0.0    1    1    0
11500100 0     1
11500101 1     0.002917
11500102 4     0.009375
11500103 4     0.014500
11500104 4     0.015500
11500105 4     0.017583
11500201 3     1
11500202 4     5
11500203 5     9
11500204 1     13
11500205 1     17
11500301 0.0   1
11500302 1.0   5
11500303 0.0   17
11500400 -1
11500401 649.0   649.0   647.1   642.3   635.0   625.2   615.1   606.1   598.0
+        590.6   589.1   587.6   586.1   584.7   581.8   578.9   576.2   573.5
11500402 725.1   725.1   721.5   712.4   698.4   679.8   651.0   644.2   629.0
+        615.1   612.2   609.4   606.7   604.0   598.4   593.1   587.9   582.8
11500403 815.5   815.5   810.2   796.4   775.2   747.3   719.5   694.9   672.4
+        651.8   647.6   643.4   639.3   635.3   627.1   619.1   611.4   603.8
11500404 901.8   901.8   894.6   875.6   846.6   808.3   771.3   738.0   707.8
+        680.0   674.2   668.6   663.0   657.6   646.3   635.6   625.0   614.7
11500405 972.0   972.0   963.4   941.0   906.8   861.6   818.8   780.3   745.1
+        712.7   706.1   699.5   693.1   686.7   673.7   661.1   648.7   636.7
11500406 1000.0  1000.0  990.7   966.6   929.8   881.1   835.4   794.2   756.6
+        721.9   714.7   707.7   700.8   694.0   680.3   666.5   653.2   640.3
11500407 1012.4  1012.4  1003.1  979.0   942.2   893.6   848.1   807.1   769.6
+        735.1   728.1   721.1   714.2   707.4   693.6   680.1   666.9   654.1
11500408 984.6   984.6   976.0   953.7   919.4   874.2   831.7   793.3   758.3
+        726.2   719.6   713.1   706.6   700.3   687.4   674.9   662.6   650.6
11500409 936.8   936.8   929.6   910.6   881.6   843.3   806.9   774.1   744.2
+        716.8   711.2   705.7   700.2   694.9   683.9   673.2   662.9   652.7
11500410 851.7   851.7   846.3   832.5   811.4   783.4   756.2   731.1   709.7
+        689.4   685.3   681.2   677.2   673.2   665.2   657.3   649.7   642.3
11500411 776.6   776.6   773.1   763.9   749.9   731.4   712.9   696.5   681.5
+        668.0   665.3   662.5   659.9   657.2   651.8   646.6   641.5   636.5
11500412 702.1   702.1   700.2   695.4   689.0   678.3   668.4   659.6   651.7
+        644.5   643.0   641.6   640.1   638.7   635.9   633.1   630.4   627.8
11500501 0            0          0          0          0.0        12
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
11500701 900          0.02584    0.0        0.0        1
11500702 900          0.04917    0.0        0.0        2
11500703 900          0.07416    0.0        0.0        3
```

```
11500704 900        0.10166   0.0        0.0        4
11500705 900        0.12001   0.0        0.0        5
11500706 900        0.12916   0.0        0.0        6
11500707 900        0.12916   0.0        0.0        7
11500708 900        0.12001   0.0        0.0        8
11500709 900        0.10166   0.0        0.0        9
11500710 900        0.07416   0.0        0.0        10
11500711 900        0.04917   0.0        0.0        11
11500712 900        0.02584   0.0        0.0        12
11500801 0          0.0       0.0        12.000     12
11500901 0          0.0       0.043992   12.000     12
*
************************************
*****          CORE  BARREL        *****
*****           HEAT  LOSS         *****
************************************
*
11501000 6     13   2    1    0.132114
11501100 0     1
11501101 2     0.133964
11501102 1     0.135531
11501103 2     0.143864
11501104 3     0.200256
11501105 2     0.272256
11501106 2     0.438956
11501201 1     2
11501202 2     3
11501203 1     5
11501204 1     8
11501205 1     10
11501206 8     12
11501301 0.0   12
11501400 -1
11501401 562.4   562.1   561.7   346.8   345.1   343.5   336.7   330.7   325.2
+        316.0   308.0   209.9   125.3
11501402 573.6   573.2   572.8   352.8   351.1   349.6   342.5   336.3   330.7
+        321.2   313.1   212.8   126.1
11501403 588.9   588.5   588.1   361.2   359.4   357.7   350.5   344.1   338.3
+        328.6   320.2   217.0   127.3
11501404 603.5   603.2   602.8   369.3   367.5   365.7   358.3   351.6   345.7
+        335.6   327.0   220.9   128.4
11501405 613.3   612.9   612.5   374.7   372.8   371.0   363.4   356.7   350.6
+        340.4   331.5   223.6   129.2
11501406 617.3   616.9   616.5   376.9   375.0   373.2   365.5   358.7   352.5
+        342.2   333.4   224.7   129.5
11501501 150010000 0          1          1          2.0000     1
11501502 150020000 0          1          1          2.0000     2
11501503 150030000 0          1          1          2.0000     3
11501504 150040000 0          1          1          2.0000     4
11501505 150050000 0          1          1          2.0000     5
11501506 150060000 0          1          1          2.0000     6
11501601 802010000 0          4200       1          2.0000     1
11501602 802010000 0          4200       1          2.0000     2
11501603 802010000 0          4200       1          2.0000     3
11501604 802010000 0          4200       1          2.0000     4
11501605 802010000 0          4200       1          2.0000     5
11501606 802010000 0          4200       1          2.0000     6
11501701 0          0.0       0.0        0.0        6
11501801 0          0.0       0.129489   12.000     6
11501901 0          0.0       0.0        12.000     6
*
************************************
```

```
*****           UPPER  PLENUM              *****
*****            HEAT LOSS                 *****
************************************************
*
11600000 4     12   2    1     0.133854
11600100 0     1
11600101 2     0.142184
11600102 1     0.146351
11600103 3     0.200518
11600104 4     0.422392
11600105 1     0.589059
11600201 1     2
11600202 2     3
11600203 1     6
11600204 1     10
11600205 8     11
11600301 0.0   11
11600400 -1
11600401 616.4   615.4   614.5   240.2   235.6   231.4   227.6   217.9   210.0
+        203.3   197.8   106.9
11600402 614.8   613.8   612.8   239.9   235.2   231.1   227.3   217.6   209.8
+        203.2   197.5   106.8
11600403 544.7   544.0   543.2   222.8   218.9   215.3   212.0   203.3   196.3
+        190.4   185.4   104.4
11600404 541.7   540.8   540.0   218.3   214.3   210.8   207.6   199.2   192.4
+        186.7   181.8   103.7
11600501 162010000 0          1           1              2.260833  1
11600502 163010000 0          1           1              1.708333  2
11600503 164010000 0          1           1              1.791667  3
11600504 165010000 0          1           1              1.966667  4
11600601 802010000 0          4200        1              2.260833  1
11600602 802010000 0          4200        1              1.708333  2
11600603 802010000 0          4200        1              1.791667  3
11600604 802010000 0          4200        1              1.966667  4
11600701 0          0.0       0.0         0.0            4
11600801 0          0.0       0.0         2.260833  1
11600802 0          0.0       0.0         1.708333  2
11600803 0          0.0       0.0         1.791667  3
11600804 0          0.0       0.0         1.966667  4
11600901 0          0.0       0.0         0.0            4
*
************************************************
*****           CORE OUTLET                *****
*****            HEAT LOSS                 *****
************************************************
*
11610000 1     12   2    1     0.132114
11610100 0     1
11610101 2     0.133964
11610102 1     0.135531
11610103 2     0.143864
11610104 5     0.200256
11610105 2     0.560256
11610106 1     0.726920
11610201 1     2
11610202 2     3
11610203 1     5
11610204 1     8
11610205 1     10
11610206 8     11
11610301 0.0   11
11610400 -1
```

```
11610401 616.3  615.8  615.4  346.4  344.3  342.2  333.6  325.4  319.0
+        274.8  247.1  116.9
11610501 161010000 0          1          1          1.000833  1
11610601 802010000 0          4200       1          1.000833  1
11610701 0          0.0       0.0        0.0        1
11610801 0          0.0       0.173513   1.000833   1
11610901 0          0.0       0.0        1.000833   1
*
******************************************
*****          UPPER CORE            *****
*****        SUPPORT  PLATE          *****
******************************************
*
11690000 1     4    1    1    0.0
11690100 0     1
11690101 3     0.65400
11690201 1     3
11690301 0.0   3
11690400 -1
11690401 562.8       578.1       592.0       605.2
11690501 165010000 0          1          0          0.1263155 1
11690601 191010000 0          1          0          0.1263155 1
11690701 0          0.0       0.0        0.0        1
11690801 0          0.0       0.0        0.476667   1
11690901 0          0.0       0.0        0.476667   1
*
******************************************
*****          UPPER  HEAD           *****
*****           HEAT LOSS            *****
******************************************
*
11910000 2     10    2    1    0.134417
11910100 0     1
11910101 2     0.142750
11910102 1     0.146917
11910103 2     0.207292
11910104 3     0.276042
11910105 1     0.442708
11910201 1     2
11910202 2     3
11910203 1     5
11910204 1     8
11910205 8     9
11910301 0.0   9
11910400 -1
11910401 600.9  600.4  599.9  405.4  401.6  398.3  396.2  394.2  392.4
+        331.4
11910402 549.3  548.7  548.2  369.5  366.1  363.2  361.3  359.6  358.0
+        304.6
11910501 192010000 0          1          1          1.965833  1
11910502 193010000 0          1          1          3.453333  2
11910601 800010000 0          4100       1          1.965833  1
11910602 800010000 0          4100       1          3.453333  2
11910701 0          0.0       0.0        0.0        2
11910801 0          0.0       0.0        1.965833   1
11910802 0          0.0       0.0        3.453333   2
11910901 0          0.0       0.0        0.0        2
*
11920000 2     10    2    1    0.134417
11920100 0     1
11920101 2     0.142750
11920102 1     0.146917
```

```
11920103 2    0.207292
11920104 3    0.413542
11920105 1    0.580208
11920201 1    2
11920202 2    3
11920203 1    5
11920204 1    8
11920205 8    9
11920301 0.0  9
11920400 -1
11920401 598.5  598.0  597.4  377.1  372.8  369.1  362.4  357.2  352.9
+        302.5
11920402 546.0  545.4  544.8  344.7  340.8  337.6  331.7  327.2  323.4
+        279.5
11920501 191010000 0        1        1        0.476667  1
11920502 194010000 0        1        1        2.88083   2
11920601 800010000 0        4100     1        0.476667  1
11920602 800010000 0        4100     1        2.88083   2
11920701 0         0.0      0.0      0.0      2
11920801 0         0.0      0.0      0.476667 1
11920802 0         0.0      0.0      2.88083  2
11920901 0         0.0      0.0      0.0      2
*
*
*********************************************
******     LOOP PIPING COMPONENTS      ******
*********************************************
*
********************************************
*****          INTACT LOOP           *****
*****      3-IN SCH-160 PIPE         *****
********************************************
*
*****          BAND HEATERS          *****
*
12001000 4    11   2    1    0.109333
12001100 0    1
12001101 2    0.145333
12001102 1    0.145866
12001103 1    0.148470
12001104 3    0.158887
12001105 1    0.161491
12001106 2    0.328158
12001201 1    2
12001202 13   3
12001203 1    4
12001204 9    7
12001205 1    8
12001206 16   10
12001301 0.0  10
12001400 -1
12001401 555.8  552.7  550.3  548.6  548.5  545.4  542.4  539.5  539.2
+        320.4  139.1
12001402 555.7  552.7  550.3  548.8  548.5  545.4  542.3  539.4  539.2
+        320.4  139.1
12001403 555.5  552.5  550.1  548.7  548.4  545.3  542.3  539.4  539.1
+        320.4  139.1
12001404 555.4  552.5  550.1  548.6  548.3  545.2  542.2  539.3  539.0
+        320.4  139.1
12001501 240040000 0        1        1        2.50000   1
12001502 240050000 0        1        1        2.08333   2
12001503 240060000 0        1        1        2.95833   3
```

```
12001504 240070000 0          1          1           0.16667    4
12001601 803010000 0          4500       1           2.50000    1
12001602 803010000 0          4500       1           2.08333    2
12001603 803010000 0          4500       1           2.95833    3
12001604 803010000 0          4500       1           0.16667    4
12001701 111         0.0      0.0        0.0         1
12001702 111         0.0      0.0        0.0         2
12001703 111         0.0      0.0        0.0         3
12001704 111         0.0      0.0        0.0         4
12001801 0           0.0      0.0        2.50000     1
12001802 0           0.0      0.0        2.08333     2
12001803 0           0.0      0.0        2.95833     3
12001804 0           0.0      0.0        0.16667     4
12001901 0           0.0      0.0        2.50000     1
12001902 0           0.0      0.0        2.08333     2
12001903 0           0.0      0.0        2.95833     3
12001904 0           0.0      0.0        0.16667     4
*
*****        HEATER TAPE              *****
*
12002000 7     8     2     1     0.109333
12002100 0     1
12002101 2     0.145833
12002102 1     0.145933
12002103 2     0.156350
12002104 2     0.323016
12002201 1     2
12002202 13    3
12002203 9     5
12002204 16    7
12002301 0.0   7
12002400 -1
12002401 615.0  612.5  610.2  605.6  600.6  595.7  351.2  145.4
12002402 555.7  552.8  550.5  546.1  541.6  537.3  318.4  138.6
12002403 555.5  552.7  550.4  546.0  541.5  537.2  318.4  138.6
12002404 555.7  552.9  550.6  546.1  541.5  537.2  318.4  138.6
12002405 555.6  552.8  550.5  546.0  541.5  537.1  318.3  138.6
12002406 614.5  612.4  610.5  606.7  602.6  598.5  400.4  240.7
12002407 565.2  563.2  561.5  558.0  554.4  550.9  369.4  226.4
12002501 201020000 0          1          1           0.72757    1
12002502 240050000 0          1          1           0.36379    2
12002503 240060000 0          1          1           0.36379    3
12002504 261020000 0          1          1           0.36379    4
12002505 262010000 0          1          1           0.18189    5
12002506 301010000 0          1          1           0.72757    6 * V-NOZZLE
12002507 363030000 0          1          1           0.36378    7 * V-NOZZLE
12002601 803010000 0          4500       1           0.72757    1
12002602 803010000 0          4500       1           0.36379    2
12002603 803010000 0          4500       1           0.36379    3
12002604 803010000 0          4500       1           0.36379    4
12002605 803010000 0          4500       1           0.18189    5
12002606 804010000 0          4300       1           0.72757    6 * V-NOZZLE
12002607 804010000 0          4300       1           0.36378    7 * V-NOZZLE
12002701 110         0.0      0.0        0.0         1
12002702 110         0.0      0.0        0.0         2
12002703 110         0.0      0.0        0.0         3
12002704 112         0.0      0.0        0.0         4
12002705 112         0.0      0.0        0.0         5
12002706 110         0.0      0.0        0.0         6
12002707 112         0.0      0.0        0.0         7
12002801 0           0.0      0.0        0.72757     1
12002802 0           0.0      0.0        0.36379     2
```

```
12002803 0          0.0        0.0        0.36379   3
12002804 0          0.0        0.0        0.36379   4
12002805 0          0.0        0.0        0.18189   5
12002806 0          0.0        0.0        0.72757   6
12002807 0          0.0        0.0        0.36378   7
12002901 0          0.0        0.0        0.72757   1
12002902 0          0.0        0.0        0.36379   2
12002903 0          0.0        0.0        0.36379   3
12002904 0          0.0        0.0        0.36379   4
12002905 0          0.0        0.0        0.18189   5
12002906 0          0.0        0.0        0.72757   6
12002907 0          0.0        0.0        0.36370   7
*
*****       UNHEATED                *****
*
12003000 9    5    2    1    0.109333
12003100 0    1
12003101 2    0.182333
12003102 2    0.349000
12003201 1    2
12003202 16   4
12003301 0.0  4
12003400 -1
12003401 614.9   609.5   605.0   360.9   147.8
12003402 615.0   609.6   605.1   361.0   147.8
12003403 555.7   549.5   545.2   326.9   140.8
12003404 555.5   549.4   545.2   326.9   140.8
12003405 555.3   549.4   545.1   326.9   140.8
12003406 555.2   549.3   545.1   326.9   140.8
12003407 555.5   549.4   545.1   326.9   140.8
12003408 555.4   549.3   545.0   326.8   140.7
12003409 555.2   549.2   544.9   326.7   140.7
12003501 201010000 0        1        1        0.720833  1
12003502 201020000 0        1        1        2.49493   2
12003503 240040000 0        1        1        1.37500   3
12003504 240050000 0        1        1        1.64196   4
12003505 240060000 0        1        1        2.70446   5
12003506 240070000 0        1        1        2.61491   6
12003507 261020000 0        1        1        2.11538   7
12003508 262010000 0        1        1        2.41411   8
12003509 263010000 0        1        1        0.59583   9
12003601 803010000 0        4500     1        0.720833  1
12003602 803010000 0        4500     1        2.49493   2
12003603 803010000 0        4500     1        1.37500   3
12003604 803010000 0        4500     1        1.64196   4
12003605 803010000 0        4500     1        2.70446   5
12003606 803010000 0        4500     1        2.61491   6
12003607 803010000 0        4500     1        2.11538   7
12003608 803010000 0        4500     1        2.41411   8
12003609 803010000 0        4500     1        0.59583   9
12003701 0          0.0        0.0        0.0       9
12003801 0          0.0        0.0        0.218666  9
12003901 0          0.0        0.0        0.218666  9
*
****************************************************
*****          INTACT LOOP                   *****
*****      2.5 - IN SCH-160 PIPE             ****
****************************************************
*
*****          HEATER TAPE                   *****
*
12004000 7    3    2    1    0.034542
```

```
12004100 0     1
12004101 2     0.119792
12004102 1     0.119692
12004103 2     0.130309
12004104 2     0.296975
12004201 1     2
12004202 13    3
12004203 9     5
12004204 16    7
12004301 0.0   7
12004400 -1
12004401 615.1  612.8  610.6  605.7  600.3  595.1  345.3  143.7
12004402 615.1  612.8  610.6  605.7  600.3  595.1  345.3  143.7
12004403 615.1  612.8  610.6  605.7  600.3  595.1  345.3  143.7
12004404 615.1  612.8  610.6  605.7  600.3  595.1  345.3  143.7
12004405 556.4  553.6  551.4  546.7  541.7  537.2  313.2  137.1
12004406 556.4  553.6  551.4  546.7  541.7  537.2  313.2  137.1
12004407 556.4  553.6  551.4  546.7  541.7  537.2  313.2  137.1
12004501 201030000 0          1          1          1.77146   1
12004502 202010000 0          1          1          1.99289   2
12004503 203010000 0          1          1          1.55003   3
12004504 203020000 0          1          1          0.88573   4
12004505 240010000 0          1          1          0.88573   5
12004506 240020000 0          1          1          1.55003   6
12004507 240030000 0          1          1          1.77146   7
12004601 803010000 0          4500       1          1.77146   1
12004602 803010000 0          4500       1          1.99289   2
12004603 803010000 0          4500       1          1.55003   3
12004604 803010000 0          4500       1          0.88573   4
12004605 803010000 0          4500       1          0.88573   5
12004606 803010000 0          4500       1          1.55003   6
12004607 803010000 0          4500       1          1.77146   7
12004701 110         0.0        0.0        0.0        1
12004702 110         0.0        0.0        0.0        2
12004703 110         0.0        0.0        0.0        3
12004704 110         0.0        0.0        0.0        4
12004705 110         0.0        0.0        0.0        5
12004706 110         0.0        0.0        0.0        6
12004707 110         0.0        0.0        0.0        7
12004801 0           0.0        0.0        0.177084   7
12004901 0           0.0        0.0        0.177084   7
*
*****        UNHEATED              *****
*
12005000 7     5     2     1     0.088542
12005100 0     1
12005101 2     0.151042
12005102 2     0.317709
12005201 1     2
12005202 16    4
12005301 0.0   4
12005400 -1
12005401 615.1  610.1  606.1  355.9  146.2
12005402 615.1  610.1  606.1  355.9  146.2
12005403 615.1  610.1  606.1  355.9  146.2
12005404 615.1  610.1  606.1  355.9  146.2
12005405 556.2  550.4  546.4  322.4  139.4
12005406 556.2  550.4  546.4  322.4  139.4
12005407 556.2  550.4  546.4  322.4  139.4
12005501 201030000 0          1          1          0.77104   1
12005502 202010000 0          1          1          0.46044   2
12005503 203010000 0          1          1          2.35539   3
```

```
12005504 203020000 0          1          1           1.24052   4
12005505 240010000 0          1          1           0.57385   5
12005506 240020000 0          1          1           2.11622   6
12005507 240030000 0          1          1           1.01271   7
12005601 803010000 0          4500       1           0.77104   1
12005602 803010000 0          4500       1           0.46044   2
12005603 803010000 0          4500       1           2.35539   3
12005604 803010000 0          4500       1           1.24052   4
12005605 803010000 0          4500       1           0.57385   5
12005606 803010000 0          4500       1           2.11622   6
12005607 803010000 0          4500       1           1.01271   7
12005701 0          0.0       0.0        0.0       7
12005801 0          0.0       0.0        0.177084  7
12005901 0          0.0       0.0        0.177084  7
*
****************************************
*****         BROKEN LOOP          *****
*****     1.5 - IN SCH-160 PIPE    *****
****************************************
*
*****         BAND HEATERS         *****
*
13001000 4    11   2    1    0.055750
13001100 0    1
13001101 2    0.079167
13001102 1    0.079200
13001103 1    0.081804
13001104 3    0.092221
13001105 1    0.094825
13001106 2    0.261492
13001201 1    2
13001202 13   3
13001203 1    4
13001204 9    7
13001205 1    8
13001206 16   10
13001301 0.0  10
13001400 -1
13001401 566.3  564.5  563.0  561.4  561.1  557.9  554.8  551.9  551.6
+        355.0  217.2
13001402 566.1  564.3  562.8  561.2  560.9  557.7  554.6  551.6  551.4
+        354.8  217.1
13001403 565.9  564.0  562.5  560.9  560.6  557.4  554.3  551.3  551.0
+        354.6  217.0
13001404 565.8  564.0  562.4  560.9  560.5  557.3  554.2  551.2  550.9
+        334.4  216.9
13001501 340040000 0          1          1           2.29167   1
13001502 340050000 0          1          1           2.08333   2
13001503 340060000 0          1          1           3.20833   3
13001504 340070000 0          1          1           0.20833   4
13001601 804010000 0          4300       1           2.29167   1
13001602 804010000 0          4300       1           2.08333   2
13001603 804010000 0          4300       1           3.20833   3
13001604 804010000 0          4300       1           0.20833   4
13001701 111        0.0       0.0        0.0       1
13001702 111        0.0       0.0        0.0       2
13001703 111        0.0       0.0        0.0       3
13001704 111        0.0       0.0        0.0       4
13001801 0          0.0       0.0        0.11150   4
13001901 0          0.0       0.0        0.11150   4
*
*****         HEATED TAPE          *****
```

```
#
13002000 14   5    2    1    0.055750
13002100 0    1
13002101 2    0.079167
13002102 1    0.079267
13002103 2    0.089686
13002104 2    0.256350
13002201 1    2
13002202 13   3
13002203 9    5
13002204 16   7
13002301 0.0  7
13002400 -1
13002401 615.0  613.0  611.5  606.5  601.0  595.9  379.8  228.7
13002402 615.0  613.0  611.5  606.5  601.0  595.9  379.8  228.7
13002403 615.0  613.0  611.5  606.5  601.0  595.9  379.8  228.7
13002404 615.0  613.0  611.5  606.5  601.0  595.9  379.8  228.7
13002405 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002406 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002407 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002408 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002409 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002410 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002411 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002412 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002413 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002414 566.2  564.4  562.9  558.3  553.5  549.0  351.6  215.3
13002501 301020000 0       1       1       0.33506  1
13002502 301030000 0       1       1       2.68050  2
13002503 301040000 0       1       1       1.34026  3
13002504 301050000 0       1       1       1.00519  4
13002505 340010000 0       1               0.67013  5
13002506 340020000 0       1               0.67013  6
13002507 340030000 0       1       1       0.67013  7
13002508 340040000 0       1       1       1.34026  8
13002509 340050000 0       1       1       0.83688  9
13002510 340060000 0       1       1       0.83688  10
13002511 361010000 0       1       1       0.33506  11
13002512 362010000 0       1       1       0.33506  12
13002513 363010000 0       1       1       0.33506  13
13002514 363020000 0       1       1       0.33506  14
13002601 804010000 0       4300    1       0.33506  1
13002602 804010000 0       4300    1       2.68050  2
13002603 804010000 0       4300    1       1.34026  3
13002604 804010000 0       4300    1       1.00519  4
13002605 804010000 0       4300    1       0.67013  5
13002606 804010000 0       4300    1       0.67013  6
13002607 804010000 0       4300    1       0.67013  7
13002608 804010000 0       4300    1       1.34026  8
13002609 804010000 0       4300    1       0.83688  9
13002610 804010000 0       4300    1       0.83688  10
13002611 804010000 0       4300    1       0.33506  11
13002612 804010000 0       4300    1       0.33506  12
13002613 804010000 0       4300    1       0.33506  13
13002614 804010000 0       4300    1       0.33506  14
13002701 110       0.0     0.0     0.0     1
13002702 110       0.0     0.0     0.0     2
13002703 110       0.0     0.0     0.0     3
13002704 110       0.0     0.0     0.0     4
13002705 110       0.0     0.0     0.0     5
13002706 110       0.0     0.0     0.0     6
13002707 110       0.0     0.0     0.0     7
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13002708 110       0.0        0.0        0.0        8
13002709 110       0.0        0.0        0.0        9
13002710 110       0.0        0.0        0.0        10
13002711 110       0.0        0.0        0.0        11
13002712 110       0.0        0.0        0.0        12
13002713 110       0.0        0.0        0.0        13
13002714 110       0.0        0.0        0.0        14
13002801 0         0.0        0.0        0.11150    14
13002901 0         0.0        0.0        0.11150    14
*
*****       UNHEATED              *****
*
13003000 15   5    2    1    0.055750
13003100 0    1
13003101 2    0.102584
13003102 2    0.269251
13003201 1    2
13003202 16   4
13003301 0.0  4
13003400 -1
13003401 614.9  611.1  608.1  392.3  235.0
13003402 614.9  611.1  608.1  392.3  235.0
13003403 614.9  611.1  608.1  392.3  235.0
13003404 614.9  611.1  608.1  392.3  235.0
13003405 565.8  562.2  559.5  362.2  221.0
13003406 565.8  562.2  559.5  362.2  221.0
13003407 565.8  562.2  559.5  362.2  221.0
13003408 565.8  562.2  559.5  362.2  221.0
13003409 565.8  562.2  559.5  362.2  221.0
13003410 565.8  562.2  559.5  362.2  221.0
13003411 565.8  562.2  559.5  362.2  221.0
13003412 565.8  562.2  559.5  362.2  221.0
13003413 565.8  562.2  559.5  362.2  221.0
13003414 565.8  562.2  559.5  362.2  221.0
13003415 565.8  562.2  559.5  362.2  221.0
13003501 301020000 0        1        1        2.89923   1
13003502 301030000 0        1        1        0.55379   2
13003503 301040000 0        1        1        2.43943   3
13003504 301050000 0        1        1        0.99214   4
13003505 340010000 0        1        1        0.95138   5
13003506 340020000 0        1        1        1.63170   6
13003507 340030000 0        1        1        0.71779   7
13003508 340040000 0        1        1        1.21808   8
13003509 340050000 0        1        1        2.29891   9
13003510 340060000 0        1        1        3.36615   10
13003511 340070000 0        1        1        2.08834   11
13003512 361010000 0        1        1        1.63494   12
13003513 362010000 0        1        1        0.42077   13
13003514 363010000 0        1        1        0.55661   14
13003515 363020000 0        1        1        1.99911   15
13003601 804010000 0        4300     1        2.89923   1
13003602 804010000 0        4300     1        0.55379   2
13003603 804010000 0        4300     1        2.43943   3
13003604 804010000 0        4300     1        0.99214   4
13003605 804010000 0        4300     1        0.95138   5
13003606 804010000 0        4300     1        1.63170   6
13003607 804010000 0        4300     1        0.71779   7
13003608 804010000 0        4300     1        1.21808   8
13003609 804010000 0        4300     1        2.29891   9
13003610 804010000 0        4300     1        3.36615   10
13003611 804010000 0        4300     1        2.08834   11
13003612 804010000 0        4300     1        1.63494   12
```

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13003613 804010000 0        4300      1          0.42077    13
13003614 804010000 0        4300      1          0.55661    14
13003615 804010000 0        4300      1          1.99911    15
13003701 0          0.0     0.0       0.0        15
13003801 0          0.0     0.0       0.11150    15
13003901 0          0.0     0.0       0.11150    15
*
******************************************
*****       VESSEL NOZZLES          *****
*****    3 - IN SCH-160 PIPE        *****
******************************************
*
*****         UNHEATED              *****
*
13004000 2    5    2    1    0.109333
13004100 0    1
13004101 2    0.145833
13004102 2    0.312500
13004201 1    2
13004202 16   4
13004301 0.0  4
13004400 -1
13004401 614.48  612.41  610.50  406.18  243.03
13004402 565.16  563.19  561.45  374.38  228.56
13004501 301010000 0        1         1          0.61160    1
13004502 363030000 0        1         1          0.91239    2
13004601 804010000 0        4300      1          0.61160    1
13004602 804010000 0        4300      1          0.91239    2
13004701 0          0.0     0.0       0.0        2
13004801 0          0.0     0.0       0.218666   2
13004901 0          0.0     0.0       0.218666   2
*
**********************************************
******          S/G  COMPONENTS         ******
**********************************************
*
******************************************
*****          INTACT LOOP          *****
******************************************
*
*****    U-TUBES ( UPSIDE )         *****
*
12200000 4    5    2    1    0.032375
12200100 0    1
12200101 4    0.036458
12200201 5    4
12200301 0.0  4
12200400 -1
12200401 581.43  572.95  564.68  556.63  548.77
12200402 575.10  568.48  562.04  555.78  549.67
12200403 569.18  563.79  558.54  553.46  548.47
12200404 564.82  560.31  555.93  551.67  547.52
*                                              47.71[illegible]998      1
*                                              47.[illegible]00         3
*                                              40[illegible]00          4
*        ORGINAL                               47.[illegible]98         1
*                                              47.4650000      3
*                                              40.0638200      4
12200501 220010000 0        1         1        64.4152497      1*X1.35
12200502 220020000 010000   1         1        64.0777500      3
12200503 220040000 0        1         1        54.0929070      4
12200601 600010000 0        1         1        64.4152497      1*X1.35
```

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12200602 600020000 010000    1        1             64.0777500    3
12200603 600040000 0         1        1             54.0929070    4
12200701 0         0.0       0.0      0.0           4
12200801 0         0.0       0.0      29.5000       4
12200901 0         0.0       0.1629349 29.5000      3
12200902 0         0.0       0.2363660 29.5000      4
*
*****   U-TUBES ( DOWNSIDE )        *****
*
12210000 4    5    2    1    0.032375
12210100 0    1
12210101 4    0.036458
12210201 5    4
12210301 0.0  4
12210400 -1
12210401 561.12  557.33  553.64  550.06  546.57
12210402 557.48  554.37  551.35  548.42  545.56
12210403 554.46  551.93  549.48  547.10  544.78
12210404 551.45  549.28  547.17  545.12  543.12
12210501 220050000 0          1        1        54.0929070    1
12210502 220060000 010000     1        1        64.0777500    3
12210503 220080000 0          1        1        64.4152497    4
12210601 600040000 0          1        1        54.0929070    1
12210602 600030000 0          1        1        64.0777500    2
12210603 600020000 0          1        1        64.0777500    3
12210604 600010000 0          1        1        64.4152497    4
12210701 0         0.0        0.0      0.0      4
12210801 0         0.0        0.0      29.50    4
12210901 0         0.0        0.232366 29.50    1
12210902 0         0.0        0.162994 29.50    4
*
*****  SECONDARY HEAT LOSS (RISER)  *****
*
16000000 5    13   2    1    0.245364
16000100 0    1
16000101 2    0.368332
16000102 1    0.370833
16000103 2    0.382400
16000104 1    0.384900
16000105 1    0.396000
16000106 1    0.398500
16000107 2    0.447917
16000108 2    0.697917
16000201 14   2
16000202 15   3
16000203 1    5
16000204 15   6
16000205 1    7
16000206 15   8
16000207 1    10
16000208 16   12
16000301 0.0  12
16000400 -1
16000401 535.3  498.9  486.8  485.3  485.2  485.1  483.8  483.6  482.5
+        482.1  481.7  430.5  387.5
16000402 537.8  524.7  515.1  513.7  513.6  513.5  512.1  511.9  510.
+        510.2  509.8  455.1  409.0
16000403 537.7  526.1  516.7  515.3  515.2  515.1  513.8  5 .6  512.
+        511.8  511.4  456.5  410.2
16000404 537.6  526.0  516.6  515.2  515.1  515.0  513.7  513.4  512.2
+        511.7  511.3  456.4  410.1
16000405 537.5  525.9  516.6  515.2  515.1  515.0  513.6  513.4  512.1
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*          511.7  511.3  456.3  410.1
16000501 600010000 0          1          1          6.8038055     1
16000502 600020000 010000     1          1          6.7681574     3
16000503 600040000 0          1          1          6.3963472     4
16000504 606010000 0          1          1          1.175854194   5
16000601 805010000 0          4400       1          6.8038055     1
16000602 805010000 0          4400       1          6.7681574     3
16000603 805010000 0          4400       1          6.3963472     4
16000604 805010000 0          4400       1          1.175854194   5
16000701 0         0.0        0.0        0.0        5
16000801 0         0.0        0.0        0.0        5
16000901 0         0.0        0.0        0.0        5
*
*****  SECONDARY HEAT LOSS (S-DOME) *****
*
16701000 6    5    2    1    0.671833
16701100 0    1
16701101 2    0.750000
16701102 2    1.000000
16701201 1    2
16701202 17   4
16701301 0.0  4
16701400 -1
16701401 537.49  536.97  536.54  437.86  344.69
16701402 537.47  536.94  536.52  437.83  344.69
16701403 552.51  552.05  551.62  450.05  353.44
16701404 552.51  552.05  551.62  450.05  353.44
16701405 552.51  552.05  551.62  450.05  353.44
16701406 552.51  552.05  551.62  450.05  353.44
16701501 601010000 0          1          1          1.500000  1
16701502 602010000 0          1          1          2.2871875 2
16701503 602010000 0          1          1          2.2871875 3
16701504 701010000 0          1          1          1.500000  4 * B-LOOP
16701505 702010000 0          1          1          2.2871875 5 * B-LOOP
16701506 702010000 0          1          1          2.2871875 6 * B-LOOP
16701601 805010000 0          4400       1          1.500000  1
16701602 805010000 0          4400       1          2.2871875 2
16701603 805010000 0          4400       1          2.2871875 3
16701604 806010000 0          4400       1          1.500000  4 * B-LOOP
16701605 806010000 0          4400       1          2.2871875 5 * B-LOOP
16701606 806010000 0          4400       1          2.2871875 6 * B-LOOP
16701701 0         0.0        0.0        0.0        6
16701801 0         0.0        0.0        1.500000   1
16701802 0         0.0        0.0        2.2871875  3
16701803 0         0.0        0.0        1.500000   4 * B-LOOP
16701804 0         0.0        0.0        2.2871875  6 * B-LOOP
16701901 0         0.0        0.0        0.0        6
*
*****  SECONDARY HEAT LOSS (DWCOMP) *****
*
16703000 10   5    2    1    0.398500
16703100 0    1
16703101 2    0.447917
16703102 2    0.697917
16703201 1    2
16703202 17   4
16703301 0.0  4
16703400 -1
16703401 537.48  537.09  536.79  430.59  337.62
16703402 537.47  537.11  536.82  430.62  337.65
16703403 537.58  537.24  536.95  430.73  337.72
16703404 537.52  536.53  535.96  429.40  336.47
```

```
16703405 307.62   482.75   476.11   370.55   294.89
16703406 552.51   552.18   551.87   442.58   346.12
16703407 552.55   552.21   551.90   442.62   346.15
16703408 552.64   552.17   551.81   442.54   346.09
16703409 548.29   543.92   542.21   434.08   340.13
16703410 491.37   483.15   480.42   384.32   304.69
16703501 602010000 0          1            1            1.3743749 1
16703502 603010000 0          1            1            7.4762500 2
16703503 603020000 0          1            1            7.9108334 3
16703504 603030000 0          1            1            7.9108334 4
16703505 603040000 0          1            1            7.9525000 5
16703506 702010000 0          1            1            2.2877054 6  * B-L
16703507 703010000 0          1            1            6.6358363 7  * B-L
16703508 703020000 0          1            1            7.9108.33 8  * B-L
16703509 703030000 0          1            1            7.8275000 9  * B-L
16703510 703040000 0          1            1            7.9629167 10 * B-L
16703601 805010000 0          4400         1            1.3743749 1
16703602 805010000 0          4400         1            7.4762500 2
16703603 805010000 0          4400         1            7.9108334 3
16703604 805010000 0          4400         1            7.9108334 4
16703605 805010000 0          4400         1            7.9525000 5
16703606 806010000 0          4400         1            2.2877054 6  * B-L
16703607 806010000 0          4400         1            6.6358363 7  * B-L
16703608 806010000 0          4400         1            7.9108333 8  * B-L
16703609 806010000 0          4400         1            7.8275000 9  * B-L
16703610 806010000 0          4400         1            7.9629167 10 * B-L
16703701 0          0.0       0.0          0.0          10
16703801 0          0.0       0.0          0.0          10
16703901 0          0.0       0.0          0.0          10
*
*****        RISER TO DOWNCOMER          *****
*
16003000 5    6    2    1    0.245364
16003100 0    1
16003101 2    0.368333
16003102 1    0.370833
16003102 2    0.382400
16003201 14   2
16003202 15   3
16003203 1    5
16003301 0.0  5
16003400 -1
16003401 534.85   489.60   488.85   505.16   507.53   511.04
160034.. 537.99   536.39   537.31   537.61   537.64   537.69
16003403 537.87   537.64   537.64   537.62   537.63   537.65
16003404 537.72   537.49   537.49   537.50   537.51   537.54
16003405 537.54   537.45   537.61   537.59   537.59   537.59
16003501 600010000 0          1          1          1.1486944      1
16003502 600020000 010000     1          1          1.1426759      3
16003503 600040000 0          1          1          1.0799028      4
16003504 506010000 0          1          1          0.19852083     5
16003601 603040000 0          1          1          1.1486944      1
16003602 603030000 0          1          1          1.1426759      2
16003603 603020000 0          1          1          1.1426759      3
16003604 603010000 0          1          1          1.0799028      4
16003605 602010000 0          1          1          0.19852083     5
16003701 0          0.0       0.0          0.0      5
16003801 0          0.0       0.19352495        0.0        3
16003802 0          0.0       0.234145932       0.0        4
16003803 0          0.0       0.27476691        0.0        5
16003901 0          0.0       0.16238317        0.0        5
*
```

```
****************************************
*****        BROKEN LOOP         *****
****************************************
*
*****   U-TUBES ( UPSIDE )          *****
*
13200000 4     5     2     1     0.032375
13200100 0     1
13200101 4     0.036458
13200201 5     4
13200301 0.0   4
13200400 -1
13200401 588.66  581.53  574.69  567.99  561.45
13200402 582.54  576.85  571.32  565.94  560.69
13200403 577.93  572.96  568.52  564.21  560.01
13200404 573.80  569.98  566.28  562.67  559.17                      * ORIGINAL
13200501 320010000 0          1         1         22.296176 1 * 15.92534
13200502 320020000 0          1         1         21.917000 2 * 15.555
13200503 320030000 0          1         1         22.150324 3 * 15.[illegible]166
13200504 320040000 0          1         1         18.813396 4 * 1[illegible].[illegible]3814
13200601 700010000 0          1         1         22.296176 1 * X [illegible].40
13200602 700020000 0          1         1         21.917000 2 *
13200603 700030000 0          1         1         22.150324 3 *
13200604 700040000 0          1         1         18.813396 4 *
13200701 0         0.0        0.0       0.0       4
13200801 0         0.0        0.0       29.5      4
13200901 0         0.0        0.195538  29.5      4
*
*****   U-TUBES ( DOWNSIDE )        *****
*
13210000 4     5     2     1     0.032375
13210100 0     1
13210101 4     0.036458
13210201 5     4
13210301 0.0   4
13210400 -1
13210401 570.66  567.50  564.43  561.44  558.54
13210402 567.76  565.23  562.77  560.38  558.05
13210403 565.35  563.28  561.28  559.33  557.43
13210404 563.04  561.29  559.58  557.93  556.32
13210501 320050000 0          1         1         18.813396  1
13210502 320060000 0          1         1         22.150324  2
13210503 320070000 0          1         1         21.917000  3
13210504 320080000 0          1         1         22.296176  4
13210601 700040000 0          1         1         18.813396  1
13210602 700030000 0          1         1         22.150324  2
13210603 700020000 0          1         1         21.917000  3
13210604 700010000 0          1         1         22.296176  4
13210701 0         0.0        0.0       0.0       4
13210801 0         0.0        0.0       29.50     4
13210901 0         0.0        0.195538  29.50     4
*
*****  SECONDARY HEAT LOSS (RISER)  *****
*
17000000 5     13    2     1     0.172413
17000100 0     1
17000101 2     0.356597
17000102 1     0.359097
17000103 2     0.371030
17000104 1     0.373530
17000105 1     0.396000
17000106 1     0.398500
```

```
17000107 2    0.447917
17000108 2    0.697917
17000201 14   2
17000202 15   3
17000203 1    5
17000204 15   6
17000205 1    7
17000206 15   8
17000207 1    10
17000208 16   12
17000301 0.0  12
17000400 -1
17000401 529.66  482.60  467.37  466.14  466.03  465.92  464.79
+        464.42  463.38  462.99  462.65  413.79  372.94
17000402 550.28  513.49  497.92  496.56  496.44  496.33  495.05
+        494.64  493.46  493.04  492.64  440.06  395.85
17000403 552.01  515.15  499.50  498.12  498.01  497.89  496.61
+        496.20  495.00  494.58  494.19  441.41  397.03
17000404 552.17  525.02  509.56  508.14  508.02  507.90  506.56
+        506.14  504.90  504.46  504.05  450.04  404.59
17000405 552.39  531.08  515.97  514.54  514.42  514.30  512.92
+        512.50  511.21  510.77  510.36  455.56  409.42
17000501 700010000 0         1         1          7.9629200 1
17000502 700020000 0         1         1          7.8275000 2
17000503 700030000 0         1         1          7.9108300 3
17000504 700040000 0         1         1          6.6358330 4
17000505 706010000 0         1         1          2.2877070 5
17000601 806010000 0         4400      1          7.9629200 1
17000602 806010000 0         4400      1          7.8275000 2
17000603 806010000 0         4400      1          7.9108300 3
17000604 806010000 0         4400      1          6.6358330 4
17000605 806010000 0         4400      1          7 [illegible]77070 5
17000701 0         0.0       0.0       0.0
17000801 0         0.0       0.3364087 0.0        5
17000901 0         0.0       0.0       0.0        5
*
*****      RISER TO DOWNCOMER        *****
*
17003000 5    6    2    1    0.172410
17003100 0    1
17003101 2    0.356597
17003102 1    0.359097
17003103 2    0.371030
17003201 14   2
17003202 15   3
17003203 1    5
17003301 0.0  5
17003400 -1
17003401 530.00  490.04  485.21  491.77  492.72  494.19
17003402 551.24  539.96  544.09  548.40  548.94  549.54
17003403 552.68  546.37  551.84  552.59  552.65  552.71
17003404 552.62  550.32  552.31  552.57  552.59  552.61
17003405 552.55  552.54  552.57  552.59  552.59  552.59
17003501 700010000 0         1         1          0.4423843 1
17003502 700020000 0         1         1          0.4348611 2
17003503 700030000 0         1         1          0.4394907 3
17003504 700040000 0         1         1          0.3686575 4
17003505 706010000 0         1         1          0.1270943 5
17003601 703040000 0         1         1          0.4423843 1
17003602 703030000 0         1         1          0.4348611 2
17003603 703020000 0         1         1          0.4394907 3
17003604 703010000 0         1         1          0.3686575 4
```

```
17003605 702010000 0          1          1          0.1270948 5
17003701 0         0.0        0.0                   0.0       5
17003801 0         0.0        0.3364087             0.0       5
17003901 0         0.0        0.27842689            0.0       5
*
*
******************************************************************************
*
****          HEAT STRUCTURE MATERIAL PROPERTIES                          ****
*
******************************************************************************
*
*
*****************************************************
*****        316L STAINLESS STEEL          *****
*****************************************************
*
20100100 TBL/FCTN  1          1
*        TEMP.     COND.      TEMP.      COND.
20100101 32.0      0.00215    100.0      0.00215
20100102 800.0     0.00306    1600.0     0.00397
20100103 4000.0    0.00397
*        TEMP.     CP.        TEMP.      CP.
20100151 32.0      61.30      400.0      61.30
20100152 600.0     64.60      800.0      67.10
20100153 1000.0    69.35      4000.0     69.35
*
*****************************************************
*****        AVERAGE TWO-PHASE             *****
*****************************************************
*
20100200 TBL/FCTN  1          1
*        TEMP.     COND.      TEMP.      COND.
20100201 32.0      0.000006   212.0      0.000006
20100202 572.0     0.000008   4000.0     0.000008
*        TEMP.     CP.        TEMP.      CP.
20100251 32.0      1.0        212.0      1.0
20100252 572.0     64.0       4000.0     64.0
*
*****************************************************
*****          BORON NITRIDE               *****
*****************************************************
*
20100300 TBL/FCTN  1          1
*        TEMP.     COND.      TEMP.      COND.
20100301 32.0      0.00255    200.0      0.00241
20100302 500.0     0.00216    1000.0     0.00176
20100303 1500.0    0.00133    2000.0     0.0[illegible]
20100304 2500.0    0.000491   3000.0     0.0[illegible]
20100305 3500.0    0.000074   4000.0     0.0[illegible]
*        TEMP.     CP.        TEMP.      CP.
20100351 32.0      37.50      400.0      37.5
20100352 800.0     48.3       1200.0     54.6
20100353 1600.0    58.3       2000.0     60.0
20100354 2400.0    61.40      3400.0     62.5
20100355 4000.0    62.5
*
*****************************************************
*****          CONSTANTAN                  *****
*****************************************************
*
20100400 TBL/FCTN  1          1
```

```
*         TEMP.     COND.      TEMP.     COND.
20100401 0.0        0.00389    3000.0    0.00389
20100402 4000.0     0.00389
*         TEMP.     CP.        TEMP.     CP.
20100451 32.0       56.00      212.0     56.0
20100452 572.0      61.0       932.0     67.0
20100453 1472.0     73.0       2192.0    78.0
20100454 2552.0     84.0       3000.0    90.0
20100455 4000.0     90.0
*
****************************************
*****        INCONEL 600          *****
****************************************
*
20100500 TBL/FCTN  1         1
*         TEMP.     COND.      TEMP.     COND.
20100501 32.0       0.00236    100.0     0.00236
20100502 300.0      0.00267    500.0     0.00294
20100503 700.0      0.00322    900.0     0.00350
20100504 1100.0     0.00378    4000.0    0.00378
*         TEMP.     CP.        TEMP.     CP.
20100551 32.0       52.225     4000.0    52.225
*
****************************************
*****          GRAFOIL            *****
****************************************
*
20100600 TBL/FCTN  1         1
*         TEMP.     COND.      TEMP.     COND.
20100601 32.0       0.000799   250.0     0.000799
20100602 500.0      0.000683   750.0     0.000579
20100603 1000.0     0.000509   1250.0    0.000434
20100604 1500.0     0.000468   2000.0    0.000463
20100605 3000.0     0.000486   4000.0    0.000486
*         TEMP.     CP.        TEMP.     CP.
20100651 32.0       11.9       80.4      11.9
20100652 170.4      14.7       260.4     17.15
20100653 350.4      19.6       440.4     21.35
20100654 530.4      22.4       620.4     23.8
20100655 710.4      25.2       800.4     26.32
20100656 4000.0     26.32
*
****************************************
*****       COPPER CA 102         *****
****************************************
*
20100700 TBL/FCTN  1         1
*         TEMP.     COND.      TEMP.     COND.
20100701 32.0       0.0622     212.0     0.0606
20100702 572.0      0.0589     932.0     0.0575
20100703 4000.0     0.0575
*         TEMP.     CP.        TEMP.     CP.
20100751 32.0       51.336     4000.0    51.336
*
****************************************
*****      CAL-TEMP INSULATION    *****
* --- ( INCREASED BY FACTOR 25.0      *
*         FOR VESSEL HEAT LOSS )  --- *
****************************************
*
20100800 TBL/FCTN  1         1
*         TEMP.     COND.      TEMP.     COND.
```

```
20100801 0.0       3.241E-4  100.0     3.241E-4
20100802 200.0     3.442E-4  300.0     3.650E-4
20100803 400.0     4.054E-4  500.0     4.453E-4
20100804 600.0     4.861E-4  700.0     5.329E-4
20100805 800.0     5.872E-4
*        TEMP.     CP.       TEMP.     CP.
20100851 0.0       2.898     1000.0    2.898
*
**************************************
*****          ALUMINA          *****
* ---  (     ALUMINUM OXIDE     )  --- *
**************************************
*
20100900 TBL/FCTN  1         1
*        TEMP.     COND.     TEMP.     COND.
20100901 0.0       3.4722E-4 3300.0    3.4722E-4
*        TEMP.     CP.       TEMP.     CP.
20100951 0.0       55.2      3300.0    55.20
*
**************************************
*****        INCONEL 718        *****
**************************************
*
20101000 TBL/FCTN  1         1
*        TEMP.     COND.     TEMP.     COND.
20101001 0.0       0.0021667 200.0     0.0022778
20101002 400.0     0.0023333 600.0     0.0025556
20101003 800.0     0.0028056 1000.0    0.0030556
20101004 1200.0    0.0033333 1400.0    0.0035556
20101005 1600.0    0.0038333
*        TEMP.     CP.       TEMP.     CP.
20101051 0.0       48.5797   200.0     53.7597
20101052 400.0     56.458    600.0     61.5912
20101053 800.0     65.184    1000.0    69.29
20101054 1200.0    74.4227   1400.0    76.989
20101055 1600.0    81.121
*
**************************************
*****         HONEYCOMB         *****
* --   ( HEXAGONAL MATRIX CORE )   -- *
**************************************
*
20101100 TBL/FCTN  1         1
*        TEMP.     COND.     TEMP.     COND.
20101101 0.0       2.6111E-5 700.0     2.6111E-5
*        TEMP.     CP.       TEMP.     CP.
20101151 0.0       2.28969   200.0     2.53081
20101152 400.0     2.6512    600.0     2.89224
20101153 800.0     3.06095   1000.0    3.2537
20101154 1200.0    3.49379   1400.0    3.6153
20101155 1600.0    3.8563
*
**************************************
*****         HONEYCOMB         *****
* --   (  SQUARE MATRIX CORE  )   -- *
**************************************
*
20101200 TBL/FCTN  1         1
*        TEMP.     COND.     TEMP.     COND.
20101201 0.0       2.2778E-5 700.0     2.2778E-5
*        TEMP.     CP.       TEMP.     CP.
20101251 0.0       2.15978   200.0     2.35713
```

```
20101252 400.0      2.5008    600.0      2.71815
20101253 800.0      2.88729   1000.0     3.0691
20101254 1200.0     3.29651   1400.0     3.41018
20101255 1600.0     3.6375
*
*******************************************
*****        CONTACT  ESISTANCE       *****
* --     (   HEATEF TO PIPING    )     -- *
*******************************************
*
20101300 TBL/FCTN   1          1
*        TEMP.      COND.      TEMP.      COND.
20101301 0.0        3.575E-6   80.0       4.211E-6
20101302 170.0      4.819E-6   260.0      5.40E-6
20101303 350.0      5.95E-6    440.0      6.431E-6
20101304 530.0      6.997E-6   620.0      7.478E-6
20101305 710.0      7.95E-6    800.0      8.394E-6
20101306 890.0      8.842E-6   930.0      9.275E-6
*        TEMP.      CP.        TEMP.      CP.
20101351 0.0        0.0        3310.      0.0
*
*******************************************
*****       S/G FILLER PIECE          *****
* --     (  FROM TEST GRB-14 o2  )     -- *
*******************************************
*
20101400 TBL/FCTN   1          1
*        TEMP.      COND.      TEMP.      COND.
20101401 80.0       3.028E-4   260.0      3.361E-4
20101402 440.0      3.695E-4   620.0      4.028E-4
20101403 800.0      4.361E-4
*        TEMP.      CP.        TEMP.      CP.
20101451 0.0        13.0       1000.0     13.0
*
*******************************************
*****             WATER               *****
* --         (  SATURATED  )           -- *
*******************************************
*
20101500 TBL/FCTN   1          1
*        TEMP.      COND.      TEMP.      COND.
20101501 32.0       88.611E-6  104.0      100.833E-6
20101502 176.0     107.222E-6  248.0      110.000E-6
20101503 356.0     108.[illegible]37E-6  464.0      101.994E-6
20101504 500.0      98.055E-6  572.0       86.666E-6
20101505 700.0      86.666E-6
*        TEMP.      CP.        TEMP.      CP.
20101551 32.0       63.033     104.0      61.996
20101552 176.0      60.95      248.0      59.495
20101553 356.0      58.553     464.0      57.845
20101554 500.0      57.989     572.0      60.999
20101555 700.0      62.576
*
*******************************************
*****        CAL-TEMP INSULATION      *****
* --- ( INCREASED BY FACTOR 7.0           *
*          FOR PIPING HEAT LOSS )    ---  *
*******************************************
*
20101600 TBL/FCTN   1          1
*        TEMP.      COND.      TEMP.      COND.
20101601 0.0        6.4810E-5  120.0      6.4810E-5
```

```
20101602 200.0      6.8830E-5 300.0      7.7000E-5
20101603 400.0      8.1080E-5 500.0      8.9050E-5
20101604 600.0      9.7220E-5 700.0     10.6580E-5
20101605 800.0     11.7440E-5
*        TEMP.      CP.       TEMP.      CP.
20101651 0.0        2.898     1000.0     2.898
*
**************************************************
*****       CAL-TEMP INSULATION          *****
* --- ( INCREASED BY FACTOR 2.6125              *
*         FOR  ILSG  HEAT LOSS )      ---      *
**************************************************
*
20101700 TBL/FCTN  1          1
*        TEMP.      COND.     TEMP.      COND.
20101701 0.0        2.4189E-5 100.0      2.4189E-5
20101702 200.0      2.5697E-5 300.0      2.8740E-5
20101703 400.0      3.0255E-5 500.0      3.3233E-5
20101704 600.0      3.6596E-5 700.0      3.9784E-5
20101705 800.0      4.3987E-5
*        TEMP.      CP.       TEMP.      CP.
20101751 0.0        2.898     1000.0     2.898
*
*
*******************************************************************************
*
****                   GENERAL REFERENCE TABLES                           ****
*
*******************************************************************************
*
*
*
*  --  POWER TABLES FOR PIPING HEATER OF IL/BL HOT LEG  --
*            ( TABLE USED FOR  110 )
*
*         TYPE       TRIP      T-COEFF.  P-COEFF.
*
20211000 POWER      599       1.0       8.00E-3
*
*         TIME       POWER (MW)
*
20211001 0.0        1.0000
20211002 10000.0    1.0000
*
*  --  POWER TABLES FOR PIPING HEATER OF BL PUMP SUCTION --
*            ( TABLE USED FOR  111 )
*
*         TYPE       TRIP      T-COEFF.  P-COEFF.
*
20211100 POWER      599       1.0       4.20E-3
*
*         TIME       POWER (MW)
*
20211101 0.0        1.0000
20211102 10000.0    1.0000
*
*  --  POWER TABLES FOR PIPING HEATER OF IL/BL COLD LEG --
*            ( TABLE USED FOR  112 )
*
*         TYPE       TRIP      T-COEFF.  P-COEFF.
*
20211200 POWER      599       1.0       3.30E-3
```

```
*
*        TIME       POWER (MW)
*
20211201 0.0        1.0000
20211202 10000.0    1.0000
*
*  --  POWER TABLES FOR PIPING HEATER OF IL PUMP SUCTION --
*              ( TABLE USED FOR  113 )
*
*        TYPE       TRIP       T-COEFF.  P-COEFF.
*
20211300 POWER      599        1.0       8.50E-3
*
*        TIME       POWER (MW)
*
20211301 0.0        1.0000
20211302 10000.0    1.0000
*
*  --  POWER TABLES FOR PIPING HEATER OF VESSEL & DWCR   --
*              ( TABLE USED FOR  116 )
*
*        TYPE       TRIP       T-COEFF.  P-COEFF.
*
20211600 POWER      599        1.0       20.0E-3
*
*        TIME       POWER (MW)
*
20211601 0.0        1.0000
20211602 10000.0    1.0000
*
*  --  POWER TABLES FOR CORE AVERAGE RODS  --
*              ( TABLE USED FOR  900 )
*
*        TYPE       TRIP       T-COEFF.  P-COEFF.
*
20290000 POWER      501        1.0       1.451
*
*        TIME       POWER (MW)
*
20290001 0.00       1.000
20290002 1.60       1.000
20290003 2.80       0.718
20290004 4.00       0.617
20290005 5.20       0.518
20290006 6.40       0.338
20290007 7.60       0.336
20290008 10.0       0.336
20290009 11.2       0.174
20290010 12.4       0.163
20290011 14.8       0.163
20290012 16.0       0.129
20290013 17.2       0.112
20290014 19.6       0.112
20290015 20.8       0.100
20290016 22.0       0.072
20290017 100.0      0.072
20290018 101.2      0.025
20290019 102.4      0.021
20290020 500.0      0.021
*
*
*  --  HEAT TRANSFER COEFFICIENT FOR VESSEL INSULATION  --
```

```
*            ( TABLE USED FOR  4100 )
*
20210000 HTC-TEMP  0          1.0        0.0        0.1
*
*        TEMP       HT. COEFF. (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
*
*  --  HEAT TRANSFER COEFFICIENT FOR  RV     INSULATION  --
*            ( TABLE USED FOR  4200 )
*
20220000 HTC-TEMP  0          1.0        0.0        3.0
*
*        TEMP       HT. COEFF. (BTU/S-FT2-F)
*
20220001 100.0      0.00136
20220002 [illegible].0      0.00206
20220003 [illegible].0      0.00247
20220004 300.0      0.00302
20220005 500.0      0.00374
20220006 750.0      0.00438
*
*  --  HEAT TRANSFER COEFFICIENT FOR  BL     INSULATION  --
*            ( TABLE USED FOR  4300 )
*
20230000 HTC-TEMP  0          1.0        0.0        0.2
*
*        TEMP       HT. COEFF. (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
*
*  --  HEAT TRANSFER COEFFICIENT FOR  S/G    INSULATION  --
*            ( TABLE USED FOR  4400 )
*
20240000 HTC-TEMP  0          1.0        0.0        0.025
*
*        TEMP       HT. COEFF. (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
*
*  --  HEAT TRANSFER COEFFICIENT FOR  IL     INSULATION  --
*            ( TABLE USED FOR  4500 )
*
20250000 HTC-TEMP
*
*        TEMP       HT. COEFF. (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
*
*
*  --  INTACT LOOP PUMP SPEED TABLE (NORMALIZED SPEED )  --
*           ( TABLE USED FOR  725 )
*
*       TABLE     TRIP
*
20225000 REAC-T    501
*
*              TIME          NORM PUMP SPEED
*
20225001       -1.0           1.0000
20225002        0.00          1.0000
*20225003      28.00           0.0
*20225004    1000.00          0.0
20225003        2.80          1.0000
20225004        4.00          0.9950
20225005        5.20          0.9658
20225006        6.40          0.9337
20225007        7.60          0.9022
20225008        8.80          0.8692
20225009       10.00          0.8391
20225010       11.20          0.8094
20225011       12.40          0.7764
20225012       13.60          0.7434
20225013       14.80          0.7144
20225014       16.00          0.6901
20225015       17.20          0.6617
20225016       18.40          0.6272
20225017       19.60          0.5910
20225018       20.80          0.5572
20225019       22.00          0.5267
20225020       23.20          0.4955
20225021       24.40          0.4644
20225022       25.60          0.4337
20225023       26.80          0.4032
20225024       28.00          0.3710
20225025       100.0          0.366
20225026       1000.0         0.366
*
*  --  BROKEN LOOP PUMP SPEED TABLE (NORMALIZED SPEED )  --
*           ( TABLE USED FOR  735 )
*
*       TABLE     TRIP
*
20235000 REAC-T    501
*
*              TIME          NORM PUMP SPEED
*
20235001       -1.0           1.0000
20235002        0.00          1.0000
20235003        2.80          1.0000
20235004        4.00          0.9776
20235005        5.20          0.9536
20235006        6.40          0.9235
20235007        7.60          0.8939
```

```
20235008      8.80         0.8671
20235009     10.00         0.8321
20235010     11.20         0.8131
20235011     12.40         0.7886
20235012     13.60         0.7529
20235013     14.80         0.7308
20235014     16.00         0.7097
20235015     17.20         0.6669
20235016     18.40         0.6374
20235017     19.60         0.6147
20235018     20.80         0.5955
20235019     22.00         0.5693
20235020     23.20         0.5567
20235021     24.40         0.5473
20235022     25.60         0.5379
20235023     26.80         0.5278
20235024     28.00         0.5206
20235025     29.20         0.5203
20235026     30.40         0.5297
20235027     31.60         0.5261
20235028     239.2         0.5261
20235029     240.4         0.3423
20235030     241.6         0.1986
20235031     242.8         0.1277
20235032     244.0         0.0680
20235033     245.2         0.0164
20235034     246.4         0.0000
20235035     1000.0        0.0000
*
*=======================================================================
*
****                    CONTROL VARIABLES                          ****
*
*=======================================================================
*
*
*---------------------------------------------------------------*
****          IMPORTANT PARAMETERS FOR COMPARISON              ****
*---------------------------------------------------------------*
*
*
*  **    TEMPERATURES     *   CTRL   001  --  029
*
*
*205XXX00       NAME       TYPE      COEFF     INIT-VAL  FLG
*
20500100        TFVLP552   SUM       1.0       0.0       1
20500101        0.0        1.0       TEMPF     130010000
*
20500200        TFI1       SUM       1.0       0.0       1
20500201        0.0        1.0       TEMPF     201020000
*
20500300        TFI5       SUM       1.0       0.0       1
20500301        0.0        1.0       TEMPF     203010000
*
20500400        TFIS1117   SUM       1.0       0.0       1
20500401        0.0        1.0       TEMPF     601010000
*
20500500        TFI9       SUM       1.0       0.0       1
20500501        0.0        1.0       TEMPF     240020000
*
20500600        TFI15      SUM       1.0       0.0       1
```

```
20500601      0.0        1.0       TEMPF     240060000
*
20500700      TF121      SUM       1.0       0.0         1
20500701      0.0        1.0       TEMPF     261020000
*
20500800      TF122      SUM       1.0       0.0         1
20500801      0.0        1.0       TEMPF     262010000
*
20500900      TFB50      SUM       1.0       0.0         1
20500901      0.0        1.0       TEMPF     301020000
*
20501000      TFB57      SUM       1.0       0.0         1
20501001      0.0        1.0       TEMPF     301040000
*
20501100      TFB51117   SUM       1.0       0.0         1
20501101      0.0        1.0       TEMPF     701010000
*
20501200      TFB62      SUM       1.0       0.0         1
20501201      0.0        1.0       TEMPF     340020000
*
20501300      TFB73      SUM       1.0       0.0         1
20501301      0.0        1.0       TEMPF     340070000
*
20501400      TFB74      SUM       1.0       0.0         1
20501401      0.0        1.0       TEMPF     361010000
*
20501500      TFB79      SUM       1.0       0.0         1
20501501      0.0        1.0       TEMPF     363010000
*
20501600      TFVDC84    SUM       1.0       0.0         1
20501601      0.0        1.0       TEMPF     110010000
*
20501700      TFVDC270   SUM       1.0       0.0         1
20501701      0.0        1.0       TEMPF     110050000
*
20501800      TFVDC436   SUM       1.0       0.0         1
20501801      0.0        1.0       TEMPF     110080000
*
20501900      TFVA4361   SUM       1.0       0.0         1
20501901      0.0        1.0       TEMPF     150060000
*
20502000      TFVB3162   SUM       1.0       0.0         1
20502001      0.0        1.0       TEMPF     150030000
*
20502100      TFVB3045   SUM       1.0       0.0         1
20502101      0.0        1.0       TEMPF     150010000
*
20502300      TFVU4282   SUM       1.0       0.0         1
20502301      0.0        1.0       TEMPF     193010000
*
20502400      TFVU4402   SUM       1.0       0.0         1
20502401      0.0        1.0       TEMPF     194010000
*
20502500      TFVBPS     SUM       1.0       0.0         1
20502501      0.0        1.0       TEMPF     181020000
*
20502600      TFPRZ132   SUM       1.0       0.0         1
20502601      0.0        1.0       TEMPF     999010000
*
*
*  **    QFLOW ( L/SEC )  =   CTRL   030  --  049
*
```

```
*
20503000      QG-DC423   MULT        2.4191     0.0          1
20503001      VOIDGJ     110070000       VELGJ        110070000
*
20503100      QF-DC423   MULT        2.4191     0.0          1
20503101      VOIDFJ     110070000       VELFJ        110070000
*
20503200      QFDC423    SUM         1.0        0.0          1
20503201      0.0        1.0         CNTRLVAR   30
20503202                 1.0         CNTRLVAR   31
*
20503400      QG-UP1     MULT        4.0809     0.0          1
20503401      VOIDGJ     163030000       VELGJ        163030000
*
20503500      QF-UP1     MULT        4.0809     0.0          1
20503501      VOIDFJ     163030000       VELFJ        163030000
*
20503600      QFUP1      SUM         1.0        0.0          1
20503601      0.0        1.0         CNTRLVAR   34
20503602                 1.0         CNTRLVAR   35
*
20503800      QG-GT321   MULT        7.8226-2   0.0          1
20503801      VOIDGJ     194010000       VELGJ        194010000
*
20503900      QF-GT321   MULT        7.8226-2   0.0          1
20503901      VOIDFJ     194010000       VELFJ        194010000
*
20504000      QFGT321    SUM         1.0        0.0          1
20504001      0.0        1.0         CNTRLVAR   38
20504002                 1.0         CNTRLVAR   39
*
20504200      QG-I1      MULT        2.2881     0.0          1
20504201      VOIDGJ     201020000       VELGJ        201020000
*
20504300      QF-I1      MULT        2.2881     0.0          1
20504301      VOIDFJ     201020000       VELFJ        201020000
*
20504400      QFI1       SUM         1.0        0.0          1
20504401      0.0        1.0         CNTRLVAR   42
20504402                 1.0         CNTRLVAR   43
*
20504600      QG-PRZ     MULT        6.9368-2   0.0          1
20504601      VOIDGJ     997030000       VELGJ        997030000
*
20504700      QF-PRZ     MULT        6.9328-2   0.0          1
20504701      VOIDFJ     997030000       VELFJ        997030000
*
20504800      QFPRZ      SUM         1.0        0.0          1
20504801      0.0        1.0         CNTRLVAR   46
20504802                 1.0         CNTRLVAR   47
*
20505000      QG-I6      MULT        2.2881     0.0          1
20505001      VOIDGJ     205000000       VELGJ        205000000
*
20505100      QF-I6      MULT        2.2881     0.0          1
20505101      VOIDFJ     205000000       VELFJ        205000000
*
20505200      QFI6       SUM         1.0        0.0          1
20505201      0.0        1.0         CNTRLVAR   50
20505202                 1.0         CNTRLVAR   51
*
20505400      QG-I15     MULT        3.4819     0.0          1
```

```
20505401      VOIDGJ    240050000      VELGJ      240050000
*
20505500      9F-115    MULT       3.4889    0.0        1
20505501      VOIDFJ    240050000      VELFJ      240050000
*
20505600      9F115     SUM        1.0       0.0        1
20505601      0.0       1.0        CNTRLVAR  54
20505602                1.0        CNTRLVAR  55
*
20505800      9G-121    MULT       0.79173   0.0        1
20505801      VOIDGJ    250020000      VELGJ      250020000
*
20505900      9F-121    MULT       0.79173   0.0        1
20505901      VOIDFJ    250020000      VELFJ      250020000
*
20506000      9121      SUM        1.0       0.0        1
20506001      0.0       1.0        CNTRLVAR  58
20506002                1.0        CNTRLVAR  59
*
20506200      9G-122    MULT       3.4889    0.0        1
20506201      VOIDGJ    262010000      VELGJ      262010000
*
20506300      9F-122    MULT       3.4889    0.0        1
20506301      VOIDFJ    262010000      VELFJ      262010000
*
20506400      9122      SUM        1.0       0.0        1
20506401      0.0       1.0        CNTRLVAR  62
20506402                1.0        CNTRLVAR  63
*
20506600      9G-B50    MULT       0.907133  0.0        1
20506601      VOIDGJ    301020000      VELGJ      301020000
*
20506700      9F-B50    MULT       0.907133  0.0        1
20506701      VOIDFJ    301020000      VELFJ      301020000
*
20506800      9B50      SUM        1.0       0.0        1
20506801      0.0       1.0        CNTRLVAR  66
20506802                1.0        CNTRLVAR  67
*
20507000      9G-B73    MULT       0.907133  0.0        1
20507001      VOIDGJ    350010000      VELGJ      350010000
*
20507100      9F-B73    MULT       0.907133  0.0        1
20507101      VOIDFJ    350010000      VELFJ      350010000
*
20507200      9B73      SUM        1.0       0.0        1
20507201      0.0       1.0        CNTRLVAR  70
20507202                1.0        CNTRLVAR  71
*
20507400      9G-B74    MULT       0.829577  0.0        1
20507401      VOIDGJ    350020000      VELGJ      350020000
*
20507500      9F-B74    MULT       0.829577  0.0
20507501      VOIDFJ    350020000      VELFJ      350020000
*
20507600      9B74      SUM        1.0       0.0        1
20507601      0.0       1.0        CNTRLVAR  74
20507602                1.0        CNTRLVAR  75
*
20507800      9G-B79    MULT       0.907133  0.0        1
20507801      VOIDGJ    363010000      VELGJ      363010000
*
```

```
20507900      ØF-279     MULT       0.907133  0.0        1
20507901      VOIDFJ     363010000       VELFJ      363010000
*
20508000      ØB79       SUM        1.0       0.0        1
20508001      0.0        1.0        CNTRLVAR  78
20508002                 1.0        CNTRLVAR  79
*
*20508200     ØG-IA3     MULT       0.46405   0.0        1  * W
*20508201     VOIDGJ     420010000       VELGJ      420010000 * W
*
*20508300     ØF-IA3     MULT       0.46405   0.0        1  * W
*20508301     VOIDFJ     420010000       VELFJ      420010000 * W
*
*20508400     ØCIA3      SUM        1.0       0.0        1 * W
*20508401     0.0        1.0        CNTRLVAR  82 * W
*20508402                1.0        CNTRLVAR  83 * W
*
20508600      ØG-LPIS    MULT       0.46405   0.0        1
20508601      VOIDGJ     411000000       VELGJ      411000000
*
20508700      ØF-LPIS    MULT       0.46405   0.0        1
20508701      VOIDFJ     411000000       VELFJ      411000000
*
20508800      ØCLPIS     SUM        1.0       0.0        1
20508801      0.0        1.0        CNTRLVAR  86
20508802                 1.0        CNTRLVAR  87
*
20509000      MBREAK     SUM        1.0       0.0        1
20509001      0.0        1.0        MFLOWJ    375000000
*
20509100      MFLSG1     SUM        1.0       0.0        1
20509101      0.0        1.0        MFLOWJ    635000000
*
20509200      MFLSG3     SUM        1.0       0.0        1
20509201      0.0        1.0        MFLOWJ    735000000
*
*
*  ==      PRESSURES       =   CTRL   100  --  149
*
*
*205XXX00     NAME       TYPE       COEFF     INIT-VAL  FLG
*
20510000      PTRIP      TRIPUNIT   1.0       0.0        1
20510001                 501
*
20510100      PDC435     SUM        1.0E-6    0.0        1
20510101      0.0        1.0        P         110080000
*
20510200      LOWLTD     SUM        9.75      0.0        1
20510201      0.0        1.0        CNTRLVAR  100
*
20510300      PDC435L    STDFNCTN   1.0       9.75       0
20510301                 MIN        CNTRLVAR  101
20510302                            CNTRLVAR  102
*
20510400      PUP13      SUM        1.0E-6    0.0        1
20510401      0.0        1.0        P         163010000
*
20510500      PLP573     SUM        1.0E-6    0.0        1
20510501      0.0        1.0        P         130010000
*
20510600      LOWLTD     SUM        9.64      0.0        1
```

```
20510601        0.0         1.0        CNTRLVAR  100
*
20510700        PLP578L     STDFNCTN   1.0       9.64       0
20510701                    MIN        CNTRLVAR  105
20510702                               CNTRLVAR  106
*
20510800        PVUH421     SUM        1.0E-6    0.0        1
20510801        0.0         1.0        P         194010000
*
20510900        PI1         SUM        1.0E-6    0.0        1
20510901        0.0         1.0        P         201020000
*
20511000        PPRZ        SUM        1.0E-6    0.0        1
20511001        0.0         1.0        P         999010000
*
20511100        PIS1117     SUM        1.0E-6    0.0        1
20511101        0.0         1.0        P         601010000
*
20511200        PI14        SUM        1.0E-6    0.0        1
20511201        0.0         1.0        P         240050000
*
20511300        LOWLTD      SUM        9.62      0.0        1
20511301        0.0         1.0        CNTRLVAR  100
*
20511400        PI14L       STDFNCTN   1.0       9.62       0
20511401                    MIN        CNTRLVAR  112
20511402                               CNTRLVAR  113
*
20511500        PI22        SUM        1.0E-6    0.0        1
20511501        0.0         1.0        P         2[illegible]010000
*
20511600        LOWLTD      SUM        3.52      0.0        1
20511601        0.0         1.0        CNTRLVAR  100
*
20511700        PI22L       STDFNCTN   1.0       3.52       0
20511701                    MIN        CNTRLVAR  115
20511702                               CNTRLVAR  116
*
20511800        PB50        SUM        1.0E-6    0.0        1
20511801        0.0         1.0        P         301020000
*
20511900        PBS1117     SUM        1.0E-6    0.0        1
20511901        0.0         1.0        P         701010000
*
20512000        PB74        SUM        1.0E-6    0.0        1
20512001        0.0         1.0        P         361010000
*
20512100        LOWLTD      SUM        9.55      0.0        1
20512101        0.0         1.0        CNTRLVAR  100
*
20512200        PB74L       STDFNCTN   1.0       9.55       0
20512201                    MIN        CNTRLVAR  120
20512202                               CNTRLVAR  121
*
20512300        PB79        SUM        1.0E-6    0.0        1
20512301        0.0         1.0        P         383020000
*
20512400        LOWLTD      SUM        9.62      0.0        1
20512401        0.0         1.0        CNTRLVAR  100
*
20512500        PB79L       STDFNCTN   1.0       9.62       0
20512501                    MIN        CNTRLVAR  1[illegible]
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20512502                               CNTRLVAR  124
*
20512600       PACUM     SUM        1.0E-6    0.0        1
20512601       0.0       1.0        P         420010000
*
*
*  **   DIFFERENTIAL PRESSURE ( KPA )   =   CTRL   150  --  199
*
*
*
20515000  LV029578   SUM        1.0E-3     0.0          1
20515001  0.0  1.0   P     101010000      -1.5351      RHO  101010000
20515002      -1.0   P     120010000      -0.3300      RHO  120010000
*
20515100  LV13H578   SUM        1.0E-3     0.0          1
20515101  0.0  1.0   P     163010000       0.8384      RHO  163010000
20515102      -1.0   P     120010000      -0.3300      RHO  120010000
*
20515200  LV421378   SUM        1.0E-3     0.0          1
20515201  0.0  1.0   P     194010000      -4.0506      RHO  194010000
20515202      -1.0   P     120010000      -0.3300      RHO  120010000
*
20515300  LV42113H   SUM        1.0E-3     0.0          1
20515301  0.0  1.0   P     194010000      -4.0506      RHO  194010000
20515302      -1.0   P     163010000      -0.8384      RHO  163010000
*
20515400  DVC29421   SUM        1.0E-3     0.0          1
20515401  0.0  1.0   P     101010000      -1.5351      RHO  101010000
20515402      -1.0   P     194010000      -4.0506      RHO  194010000
*
*
20515500  LIS1117    SUM        1.0E-3     0.0          1
20515501  0.0  1.0   P     603040000       6.9772      RHO  603040000
20515502      -1.0   P     602010000       2.7928      RHO  602010000
*
20515600  DV13A11    SUM        1.0E-3     0.0          1
20515601  0.0  1.0   P     163010000       0.83839     RHO  163010000
20515602      -1.0   P     201020000      -0.15582     RHO  201020000
*
20515700  DP113C     SUM        1.0E-3     0.0          1
20515701  0.0  1.0   P     201020000       0.15582     RHO  201020000
20515702      -1.0   P     202010000      -0.15582     RHO  202010000
*
20515800  DP13C5     SUM        1.0E-3     0.0          1
20515801  0.0  1.0   P     202010000       0.15502     RHO  202010000
20515802      -1.0   P     203010000      -0.03828     RHO  203010000
*
20515900  DP159      SUM        1.0E-3     0.0          1
20515901  0.0  1.0   P     203010000       0.03828     RHO  203010000
20515902      -1.0   P     240020000       2.06493     RHO  240020000
*
20516000  DP1914     SUM        1.0E-3     0.0          1
20516001  0.0  1.0   P     240020000      -2.06493     RHO  240020000
20516002      -1.0   P     240050000      -4.02085     RHO  240050000
*
20516100  DP11418    SUM        1.0E-3     0.0          1
20516101  0.0  1.0   P     240050000       4.02085     RHO  240050000
20516102      -1.0   P     240080000       1.92080     RHO  240080000
*
20516200  DP12118    SUM        1.0E-3     0.0          1
20516201  0.0  1.0   P     261010000      -0.45755     RHO  261010000
20516202      -1.0   P     240080000       1.92080     RHO  240080000
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*
20516300  DP12122    SUM        1.0E-3    0.0        1
20516301  0.0  1.0   P    261010000      -0.45766   RHO  261010000
20516302       -1.0  P    262010000       0.45766   RHO  262010000
*
20516400  DP122V29   SUM        1.0E-3    0.0        1
20516401  0.0  1.0   P    262010000      -0.45766   RHO  262010000
20516402       -1.0  P    101010000       1.53517   RHO  101010000
*
*
20516500  LBS1117    SUM        1.0E-3    0.0        1
20516501  0.0  1.0   P    703040000       6.9927    RHO  703040000
20516502       -1.0  P    702010000       3.4748    RHO  702010000
*
20516600  DV13B50    SUM        1.0E-3    0.0        1
20516601  0.0  1.0   P    163010000       0.83839   RHO  163010000
20516602       -1.0  P    301020000      -0.15532   RHO  301020000
*
20516700  DB5055     SUM        1.0E-3    0.0        1
20516701  0.0  1.0   P    301020000       0.15532   RHO  301020000
20516702       -1.0  P    301030000      -0.15532   RHO  301030000
*
20516800  DB5557     SUM        1.0E-3    0.0        1
20516801  0.0  1.0   P    301030000       0.15532   RHO  301030000
20516802       -1.0  P    301040000       0.33698   RHO  301040000
*
20516900  DB5762     SUM        1.0E-3    0.0        1
20516901  0.0  1.0   P    301040000      -0.33698   RHO  301040000
20516902       -1.0  P    340020000      -1.36552   RHO  340020000
*
20517000  DB6265     SUM        1.0E-3    0.0        1
20517001  0.0  1.0   P    340020000       1.36552   RHO  340020000
20517002       -0.5  P    340050000      -4.49859   RHO  340050000
20517003       -0.5  P    340060000      -5.64736   RHO  340060000
*
20517100  DB6573     SUM        1.0E-3    0.0        1
20517101  0.0  0.5   P    340050000       4.49859   RHO  340050000
20517102        0.5  P    340060000       5.64736   RHO  340060000
20517103       -1.0  P    340070000      -1.43195   RHO  340070000
*
20517200  DB7473     SUM        1.0E-3    0.0        1
20517201  0.0  1.0   P    361010000      -0.59230   RHO  361010000
20517202       -1.0  P    340070000      -1.43195   RHO  340070000
*
20517300  DB79V029   SUM        1.0E-3    0.0        1
20517301  0.0  1.0   P    363020000       0.22834   RHO  363020000
20517302       -1.0  P    101010000       1.53517   RHO  101010000
*
20517400  LPRZ158    SUM        1.0E-3    0.0        1
20517401  0.0  1.0   P    997030000      -0.05414   RHO  997030000
20517402       -1.0  P    999010000       2.02813   RHO  999010000
* ADDED FOLLOWING BY JDU
20517500  LV421160   SUM        1.0E-3    0.0        1
20517501  0.0  1.0   P    194010000      -4.0506    RHO  194010000
20517502       -1.0  P    191010000      -0.32556   RHO  191010000
*
20517600  LV442501   SUM        1.0E-3    0.0        1
20517601  0.0  1.0   P    150010000      -2.2712    RHO  150010000
20517602       -1.0  P    140010000       1.01940   RHO  140010000
*
20517700  LV134135   SUM        1.0E-3    0.0        1
20517701  0.0  1.0   P    163010000       0.83839   RHO  163010000
```

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20517702       -1.0  P    161010000      0.9450    RHO  161010000
*
20517800  LV105195   SUM       1.0E-3    0.0        1
20517801  0.0  1.0   P    161010000     -0.9450    RHO  161010000
20517802       -1.0  P    150050000      2.581     RHO  150050000
*
20517900  LV195278   SUM       1.0E-3    0.0        1
20517901  0.0  1.0   P    150050000     -2.581     RHO  150050000
20517902       -1.0  P    150040000      0.421     RHO  150040000
*
20518000  LV278361   SUM       1.0E-3    0.0        1
20518001  0.0  1.0   P    150040000     -0.421     RHO  150040000
20518002       -1.0  P    150030000     -1.641     RHO  150030000
*
20518100  LV360442   SUM       1.0E-3    0.0        1
20518101  0.0  1.0   P    150030000      1.641     RHO  150030000
20518102       -1.0  P    150010000      2.271     RHO  150010000
*
20518200  LV501578   SUM       1.0E-3    0.0        1
20518201  0.0  1.0   P    140010000     -1.9206    RHO  140010000
20518202       -1.0  P    120010000     -0.3308    RHO  120010000
*
*  **   WATER LEVELS ( CM )   *   CTRL   200  --  249
*
*
20520100   WLDMCR     DIV        10204.082 0.0       1
20520101   RHOF       120010000            CNTRLVAR  150
*
20520200   WLDMCR-1   SUM        1.0       0.0       1
20520201   -578.0     1.0        CNTRLVAR  201
*
20520300   WLDMCR-2   SUM        1.0       0.0       1
20520301   -578.0     10.30715   CNTRLVAR  150
*
20520400   WLDMCR-3   SUM        30.48     0.0        1
20520401   -19.086    0.875000   VOIDF     101010000
20520402              1.000000   VOIDF     102010000
20520403              2.260833   VOIDF     110010000
20520404              1.000833   VOIDF     110020000
20520405              2.000000   VOIDF     110030000
20520406              2.000000   VOIDF     110040000
20520407              2.000000   VOIDF     110050000
20520408              2.000000   VOIDF     110060000
20520409              2.000000   VOIDF     110070000
[illegible]0          1.465667   VOIDF     110080000
[illegible]1          1.207667   VOIDF     110090000
[illegible]2          0.962500   VOIDF     110100000
[illegible]13         0.721917   VOIDF     130010000
20[illegible]414      0.466667   VOIDF     120010000
*
20520600   WLCORE     DIV        10204.082 0.0       1
20520601   RHOF       120010000            CNTRLVAR  151
*
20520700   WLCORE-1   SUM        1.0       0.0       1
20520701   [illegible].0  1.0    CNTRLVAR  206
*
20520800   [illegible]RE-2  SUM  1.0       0.0       1
20520801   [illegible].0  10.30715  CNTRLVAR  151
*
20520900   WLCORE-3   SUM        30.48     0.0        1
20520901   -19.086    1.708333   VOIDF     163010000
20520902              2.260833   VOIDF     162010000
```

```
20520903              1.000833  VOIDF      161010000
20520904              2.000000  VOIDF      150060000
20520905              2.000000  VOIDF      150050000
20520906              2.000000  VOIDF      150040000
20520907              2.000000  VOIDF      150030000
20520908              2.000000  VOIDF      150020000
20520909              2.000000  VOIDF      150010000
20520910              1.635833  VOIDF      140010000
20520911              0.721917  VOIDF      130010000
20520912              0.466667  VOIDF      120010000
*
20521100  WLUPHD     DIV        10204.082 0.0        1
20521101  RHOF       163010000            CNTRLVAR  152
*
20521200  WLUPHD-1   SUM        1.0        0.0        1
20521201  -13.0      1.0        CNTRLVAR  211
*
20521300  WLUPHD-2   SUM        1.0        0.0        1
20521301  -13.0      10.30715   CNTPLVAR  152
*
20521400  WLUPHD-3   SUM        30.48      0.0        1
20521401  -1.0       2.880830   VOIDF      194010000
20521402             6.549167   VOIDF      183010000
20521403             5.466667   VOIDF      184010000
*
20521500  WLUPHD-4   SUM        30.48      0.0        1
20521501  5.12       2.880830   VOIDF      194010000
20521502             3.453333   VOIDF      193010000
20521503             1.965833   VOIDF      192010000
20521304             0.476667   VOIDF      191010000
*
20521600  WLVESL     DIV        10204.082 0.0        1
20521601  RHOF       120010000            CNTRLVAR  153
*
20521700  WLVESL-1   SUM        1.0        0.0        1
20521701  -578.0     1.0        CNTRLVAR  216
*
20521800  WLVESL-2   SUM        1.0        0.0        1
20521801  -578.0     10.30715   CNTPLVAR  153
*
20521900  WLVESL-3   SUM        30.48      0.0        1
20521901  -19.086    0.466667   VOIDF      120010000
20521902             0.721917   VOIDF      130010000
20521903             1.635833   VOIDF      140010000
20521904             2.000000   VOIDF      150010000
20521905             2.000000   VOIDF      150020000
20521906             2.000000   VOIDF      150030000
20521907             2.000000   VOIDF      150040000
20521908             2.000000   VOIDF      150050000
20521909             2.000000   VOIDF      150060000
20521910             1.000833   VOIDF      1610.  000
20521911             2.260833   VOIDF      162010000
20521912             1.708333   VOIDF      163010000
*
20522100  WLUPDM     DIV        10204.082 0.0        1
20522101  RHOF       101010000            CNTRLVAR  154
*
20522200  WLUPDM-1   SUM        1.0        0.0        1
20522201  +29.0      1.0        CNTPLVAR  221
*
20522300  WLUPDM-2   SUM        1.0        0.0        1
20522301  +29.0      10.30715   CNTPLVAR  154
```

```
*
20522400  WLUHDM-3  SUM        30.48     0.0        1
20522401  0.0       2.880830   VOIDF     194010000
20522402            3.453333   VOIDF     193010000
20522403            3.140583   VOIDF     181020000
20522404            3.546917   VOIDF     181010000
20522405            0.8750     VOIDF     101010000
*
20522600  WLISGD    DIV        10204.082 0.0        1
20522601  RHOF      603040000            CNTRLVAR  155
*
20522700  WLISGD-1  SUM        1.0       0.0        1
20522701  +50.0     1.0        CNTRLVAR  226
*
20522800  WLISGD-2  SUM        1.0       0.0        1
20522801  +50.0     10.30715   CNTRLVAR  155
*
20522900  WLISGD-3  SUM        30.48     0.0        1
20522901  0.0       5.9487500  VOIDF     602010000
20522902            7.4762500  VOIDF     603010000
20522903            7.9108334  VOIDF     603020000
20522904            7.9108334  VOIDF     603030000
20522905            7.9525000  VOIDF     603040000
*
20523100  WLIPDN    DIV        10204.082 0.0        1
20523101  RHOF      240050000            CNTRLVAR  160
*
20523200  WLIPDN-1  SUM        1.0       0.0        1
20523201  -263.0    1.0        CNTRLVAR  231
*
20523300  WLIPDN-2  SUM        1.0       0.0        1
20523301  -263.0    10.30715   CNTRLVAR  160
*
20523400  WLIPDN-3  SUM        30.48     0.0        1
20523401  -9.2200   3.666250   VOIDF     240020000
20523402            2.784170   VOIDF     240030000
20523403            3.875000   VOIDF     240040000
20523404            3.875000   VOIDF     240050000
*
20523600  WLIPUP    DIV        10204.082 0.0        1
20523601  RHOF      240050000            CNTRLVAR  161
*
20523700  WLIPUP-1  SUM        1.0       0.0        1
20523701  -263.0    1.0        CNTRLVAR  236
*
20523800  WLIPUP-2  SUM        1.0       0.0        1
20523801  -263.0    10.30715   CNTRLVAR  161
*
20523900  WLIPUP-3  SUM        30.48     0.0        1
20523901  -9.2200   5.512500   VOIDF     240060000
20523902            2.567500   VOIDF     240070000
*
20524100  WLBSGD    DIV        10204.082 0.0        1
20524101  RHOF      703040000            CNTRLVAR  165
*
20524200  WLBSGD-1  SUM        1.0       0.0        1
20524201  +50.0     1.0        CNTRLVAR  241
*
20524300  WLBSGD-2  SUM        1.0       0.0        1
20524301  +50.0     10.30715   CNTRLVAR  165
*
20524400  WLBSGD-3  SUM        30.48     0.0        1
```

```
20524401  0.0        6.8620870 VOIDF      702010000
20524402             6.6358363 VOIDF      703010000
20524403             7.9108333 VOIDF      703020000
20524404             7.8275000 VOIDF      703030000
20524405             7.9629167 VOIDF      703040000
*
20524600  WLBPDN     DIV       10204.082 0.0        1
20524601  RHOF       340050000           CNTRLVAR  170
*
20524700  WLBPDN-1   SUM       1.0       0.0        1
20524701  -287.0     1.0       CNTRLVAR  246
*
20524800  WLBPDN-2   SUM       1.0       0.0        1
20524801  -287.0     10.30715  CNTRLVAR  170
*
20524900  WLBPDN-3   SUM       30.48     0.0        1
20524901  -8.82893   2.301833  VOIDF     340020000
20524902             1.387917  VOIDF     340030000
20524903             4.850000  VOIDF     340040000
20524904             4.850000  VOIDF     340050000
*
20525100  WLBPUP     DIV       10204.082 0.0        1
20525101  R:         340060000           CNTRLVAR  171
*
20525200  WLBPUP-1   SUM       1.0       0.0        1
20525201  -287.0     1.0       CNTRLVAR  251
*
2?525300  WLBPUP-2   SUM       1.0       0.0        1
2 ,25301  -287.0     10.30715  CNTRLVAR  171
*
20525400  WLBPUP-3   SUM       30.48     0.0        1
20525401  -8.82893   6.383333  VOIDF     340060000
20525402             2.296667  VOIDF     340070000
*
20526100  WLPRZ      DIV       10204.082 0.0        1
20526101  RHOF       997050000           CNTRLVAR  174
*
20526200  WLPRZ-1    SUM       1.0       0.0        1
20526201  0.70833    1.0       CNTRLVAR  261
*
20526300  WLPRZ-2    SUM       1.0       0.0        1
20526301  0.70833    10.30715  CNTRLVAR  174
*
20526400  WLPRZ-3    SUM       30.48     0.0        1
20526401  0.70833    1.074583  VOIDF     997050000
20526402             1.074583  VOIDF     997040000
20526403             1.604167  VOIDF     997030000
20526404             0.583333  VOIDF     997020000
20526405             0.675000  VOIDF     997010000
20526406             0.217500  VOIDF     999050000
20526407             0.364306  VOIDF     999040000
20526408             0.728611  VOIDF     999030000
20526409             0.769748  VOIDF     999020000
20526410             1.880252  VOIDF     999010000
*
*
20527100  WLUCORE    SUM       30.48     0.0        1
20527101  -16.26167  2.000     VOIDF     150010000
20527102             2.000     VOIDF     150020000
20527103             2.000     VOIDF     150030000
20527104             2.000     VOIDF     150040000
20527105             2.000     VOIDF     150050000
```

```
20527106              2.000      VOIDF      150060000
*
20527200  WLIUTUP     SUM        30.48      0.0        1
20527201  6.851243    7.9525000  VOIDF      220010000
20527202              7.9108334  VOIDF      220020000
20527203              7.9108334  VOIDF      220030000
20527204              6.6008367  VOIDF      220040000
*
20527300  WLIUTDN     SUM        30.48      0.0        1
20527301  6.851243    7.95.5000  VOIDF      220080000
20527302              7.910 334  VOIDF      220070000
20527303              7.910 334  VOIDF      220060000
20527304              6.600 367  VOIDF      220050000
*
20527400  WLBUTUP     SUM        30.48      0.0        1
20527401  6.767667    7.9629167  VOIDF      320010000
20527402              7.8275000  VOIDF      320020000
20527403              7.9108334  VOIDF      320030000
20527404              6.6358363  VOIDF      320040000
*
20527500  WLBUTDN     SUM        30.48      0.0        1
20527501  6.767667    7.9629167  VOIDF      320080000
20527502              7.8275000  VOIDF      320070000
20527503              7.9108334  VOIDF      320060000
20527504              6.6358363  VOIDF      320050000
*
*
*  **  HEATED ROD TEMPERATURES     *  CTRL  300  --  399
*
*
*
20530100  RTC-01      SUM        1.0        0.0        1
20530101  0.0         1.0        HTTEMP     150000114
*
20530200  RTC-02      SUM        1.0        0.0        1
20530201  0.0         1.0        HTTEMP     150000214
*
20530300  RTC-03      SUM        1.0        0.0        1
20530301  0.0         1.0        HTTEMP     150000314
*
20530400  RTC-04      SUM        1.0        0.0        1
20530401  0.0         1.0        HTTEMP     150000414
*
20530500  RTC-05      SUM        1.0        0.0        1
20530501  0.0         1.0        HTTEMP     150000514
*
20530600  RTC-06      SUM        1.0        0.0        1
20530601  0.0         1.0        HTTEMP     150000614
*
20530700  RTC-07      SUM        1.0        0.0        1
20530701  0.0         1.0        HTTEMP     150000714
*
20530800  RTC-08      SUM        1.0        0.0        1
20530801  0.0         1.0        HTTEMP     150000814
*
20530900  RTC-09      SUM        1.0        0.0        1
20530901  0.0         1.0        HTTEMP     150000914
*
20531000  RTC-10      SUM        1.0        0.0        1
20531001  0.0         1.0        HTTEMP     150001014
*
20531100  RTC-11      SUM        1.0        0.0        1
```

```
20531101  0.0        1.0        HTTEMP     150001114
*
20531200  STC-12     SUM        1.0        0.0        1
20531201  0.0        1.0        HTTEMP     150001214
*
20532100  STC-01     SUM        1.0        0.0        1
20532101  0.0        1.0        HTTEMP     150000118
*
20532200  STC-02     SUM        1.0        0.0        1
20532201  0.0        1.0        HTTEMP     150000218
*
20532300  STC-03     SUM        1.0        0.0        1
20532301  0.0        1.0        HTTEMP     150000318
*
20532400  STC-04     SUM        1.0        0.0        1
20532401  0.0        1.0        HTTEMP     150000418
*
20532500  STC-05     SUM        1.0        0.0        1
20532501  0.0        1.0        HTTEMP     150000518
*
20532600  STC-06     SUM        1.0        0.0        1
20532601  0.0        1.0        HTTEMP     150000618
*
20532700  STC-07     SUM        1.0        0.0        1
20532701  0.0        1.0        HTTEMP     150000718
*
20532800  STC-08     SUM        1.0        0.0        1
20532801  0.0        1.0        HTTEMP     150000818
*
20532900  STC-09     SUM        1.0        0.0        1
20532901  0.0        1.0        HTTEMP     150000918
*
20533000  STC-10     SUM        1.0        0.0        1
20533001  0.0        1.0        HTTEMP     150001018
*
20533100  STC-11     SUM        1.0        0.0        1
20533101  0.0        1.0        HTTEMP     150001118
*
20533200  STC-12     SUM        1.0        0.0        1
20533201  0.0        1.0        HTTEMP     150001218
*
*--------------------------------------------------------------------*
****            CONTROL BLOCK FOR PRZ MASS (KG)                   ****
*--------------------------------------------------------------------*
*
*205XXX00     NAME       TYPE       COEFF      INIT-VAL   FLG
*
20591000      PRZMAS     SUM        1.0        0.0        1
20591001      0.0        0.01542270     RHO        999010000
20591002                 0.00631382     RHO        999020000
20591003                 0.00592746     RHO        999030000
20591004                 0.00303126     RHO        999040000
20591005                 0.00113599     RHO        999050000
20591006                 7.18357E-4     RHO        997010000
20591007                 2.32130E-4     RHO        997020000
20591008                 1.64575E-4     RHO        997030000
20591009                 9.33831E-5     RHO        997040000
20591010                 9.33831E-5     RHO        997050000
*
20599900      ZZZZ       TRIPUNIT 1.0      0.0        1
20599901                 501
*
```

```
20592100      PRZERR     SUM        1.0       0.0        1
20592101      10.1       -1.0       CNTRLVAR  910
*
20592500      PRZFW      SUM        2.2046    0.0        0
20592501      0.0        0.0        CNTRLVAR  921
*
*------------------------------------------------------------------*
****          CONTROL BLOCK FOR ILSG FW FLOWRATE               ****
*------------------------------------------------------------------*
*
20561000      ILSGOUT    SUM        1.0       1.35       1
20561001      0.0        2.2046     MFLOWJ    635000000
*
*20561100      ILSGOUT    SUM        1.0       1.35       1
*20561101      0.0        2.2046     MFLOWJ    610000000
*
*20561200      ILSGOUT    SUM        0.74074   0.0        1
*20561201      0.0        1.0        CNTRLVAR      610
*20561202                 -1.0       CNTRLVAR      611
*
********************************************************************
*
*          CONTROL BLOCK FOR STEAM VALVE OPERATION
*
********************************************************************
*
*20563000 PERR       SUM       -1.0      0.0       1
*20563001 6.4800E6   -1.0      P         601010000
*
*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 OPENVLV    MULT      1.0       0.0       1
*20563401 CNTRLVAR   630       CNTRLVAR  632
*
*20563500 CLOSVLV    MULT      1.0       0.0       1
*20563501 CNTRLVAR   630       CNTRLVAR  633
*                             *5.0E-9
*20563600 RATE       SUM       1.0E-9    0.0       0
*20563601 0.0        1.0       CNTRLVAR  634
*20563602            1.0       CNTRLVAR  635
*
*20563700 VLVPOSN    INTEGRAL  1.0       8.34180-2 0
*20563701 CNTRLVAR   636
*
*------------------------------------------------------------------*
****          CONTROL BLOCK FOR ILSG LEVEL                     ****
*------------------------------------------------------------------*
*
*205XXX00      NAME       TYPE       COEFF     INIT-VAL  FLG
*
20561600      ILSGDCL    SUM        30.46     0.0        1
20561601      0.0                   7.4762500 VOIDF      603010000
20561602                            7.9108334 VOIDF      603020000
20561603                            7.9108334 VOIDF      603030000
20561604                            7.9525000 VOIDF      603040000
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20561605                          5.9487500 VOIDF      602010000
*
20569100      IDELTL     SUM        1.0        0.0       1
20569101      1050.0     -1.0       CNTRLVAR   616
*           * 732.7
20569200      FACT1      STDFNCTN   0.1        0.0       1
20569201      ABS        CNTRLVAR        691
*
20569300      FACT1      STDFNCTN   1.0        1.0       1
20569301      MIN        CNTRLVAR        692
20569302                 CNTRLVAR        999
*                                  *1.00-5
2056? 00      FACT1      MULT       2.00-5     0.0       1
20569401                            CNTRLVAR   693
20569402                            RHO   603040000
20569403                            CNTRLVAR   691
*
*--------------------------------------------------------------------*
****          CONTROL BLOCK FOR BLSG FW FLOWRATE                  ****
*--------------------------------------------------------------------*
*
20571000      BLSGOUT    SUM        1.0        0.40      1
20571001      0.0        2.2046     MFLOWJ     735000000
*
*20571100      BLSGOUT    SUM        1.0        0.40      1
*20571101      0.0        2.2046     MFLOWJ     710000000
*
*20571200      BLSGOUT    SUM        3.125      0.0       1
*20571201      0.0        1.0        CNTRLVAR     710
*20571202                 -1.0       CNTRLVAR     711
*
*=====================================================================
*
*          CONTROL BLOCK FOR STEAM VALVE OPERATION
*
*=====================================================================
*
*20573000 PERR       SUM        -1.0       0.0       1
*20573001 7.53[illegible]  1.0     P          701010000
*
*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 OPENVLV    MULT       1.0        0.0       1
*20573401 CNTRLVAR   730        CNTRLVAR   732
*
*20573500 CLOSVLV    [illegible]  1.0      0.0       1
*20573501 CNTRLVAR              CNTRLVAR   733
*                             *5.0E-9
*20573600 RATE       SUM        5.0E-7     0.0       0
*20573601 0.0        1.0        CNTRLVAR   734
*20573602           1.0        CNTRLVAR   735
*
*20573700 VLVPOSN    INTEGRAL   1.0        2.3107E-2  0
*20573701 CNTRLVAR   736
*
```

```
*-----------------------------------------------------------------------*
****          CONTROL BLOCK FOR BLSG LEVEL                           ****
*-----------------------------------------------------------------------*
*
20571600      BLSGDCL    SUM        30.48       0.0         1
20571601      0.0             6.6358363 VOIDF       703010000
20571602                      7.9108333 VOIDF       703020000
20571603                      7.8275000 VOIDF       703030000
20571604                      7.9629167 VOIDF       703040000
20571605                      6.8620870 VOIDF       702010000
*
20579100      BDELTL     SUM        1.0         0.0         1
20579101      932.0      -1.0       CNTRLVAR   716
*           * 713.8
20579200      FACT1      STDFNCTN   0.2         0.0         1
20579201      ABS        CNTRLVAR       791
*
20579300      FACT1      STDFNCTN   1.0         1.0         1
20579301      MIN        CNTRLVAR       792
20579302                 CNTRLVAR       999
*                                  *1.00-5
20579400      FACT1      MULT       2.00-5      0.0         1
20579401                            CNTRLVAR   793
20579402                            RHO  703040000
20579403                            CNTRLVAR   791
*
*-----------------------------------------------------------------------*
****          CONTROL BLOCK FOR PUMPS                                ****
*-----------------------------------------------------------------------*
*
*                  ####   STEADY STATE   ####
*
*
** INTACT LOOP PUMP SPEED   ----   INPUT DESIRED FLOW RATE (KG/S)
*
*205XXX00       NAME       TYPE       COEFF      INIT-VAL  FLG
*
*20572000       ILMERR     SUM        1.0        0.0        1
*20572001       8.008      -1.0       CNTRLVAR   64
*
*20572500       ILPSPD     INTEGRAL   250.0      1693.76    0
*20572501       CNTRLVAR   720
*
** BROKEN LOOP PUMP SPEED   ----   INPUT DESIRED FLOW RATE (KG/S)
*
*20574000       BLMERR     SUM        1.0        0.0        1
*20574001       2.750      -1.0       CNTRLVAR   76
*
*20574500       BLPSPD     INTEGRAL   750.0      11000.0    0
*20574501       CNTRLVAR   740
*
*                  ####   TRANSIENT   ####
*
*
*                                  *1693.755
20572500      ILPMPSPD   FUNCTION   1733.6      0.0         1
20572501      TIME       0          250
*                                  *11095.0
20573500      BLPMPSPD   FUNCTION   11828.0     0.0         1
20573501      TIME       0          350
*
*-----------------------------------------------------------------------*
****          CONTROL BLOCK FOR HEAT LOSS                            ****
```

```
*----------------------------------------------------------------------*
*
20580000      HLSVUH     SUM       1.0        0.0       1
20580001      0.0        1.0E-3    0          800010000
*
20580100      HLSDNCR    SUM       1.0        0.0       1
20580101      0.0        1.0E-3    0          801010000
*
20580200      HLSPV      SUM       1.0        0.0       1
20580201      0.0        1.0E-3    0          802010000
*
20580300      HLSILP     SUM       1.0        0.0       1
20580301      0.0        1.0E-3    0          803010000
*
20580400      HLSBLP     SUM       1.0        0.0       1
20580401      0.0        1.0E-3    0          804010000
*
20580500      HLSISG     SUM       1.0        0.0       1
20580501      0.0        1.0E-3    0          805010000
*
20580600      HLSBSG     SUM       1.0        0.0       1
20580601      0.0        1.0E-3    0          806010000
*
*----------------------------------------------------------------------*
***     CONTROL VARIABLES FOR S/G HEAT TRANSFER ( KW )              ***
*----------------------------------------------------------------------*
*
*205XXX00      NAME       TYPE       COEFF      INIT-VAL  FLG
*
20585000      ILSGQ      SUM        -1.0E-3        0.0  1
20585001      0.0             1.0      Q          220010000
20585002                      1.0      Q          220020000
20585003                      1.0      Q          220030000
20585004                      1.0      Q          220040000
20585005                      1.0      Q          220050000
20585006                      1.0      Q          220060000
20585007                      1.0      Q          220070000
20585008                      1.0      Q          220080000
*
20585500      BLSGQ      SUM        -1.0E-3        0.0  1
20585501      0.0             1.0      Q          320010000
20585502                      1.0      Q          320020000
20585503                      1.0      Q          320030000
20585504                      1.0      Q          320040000
20585505                      1.0      Q          320050000
20585506                      1.0      Q          320060000
20585507                      1.0      Q          320070000
20585508                      1.0      Q          320080000
*
*----------------------------------------------------------------------*
***     CONTROL VARIABLES FOR CORE HEAT TRANSFER (KW)               ***
*----------------------------------------------------------------------*
*
*205XXX00      NAME       TYPE       COEFF        INIT-VAL  FLG
*
20586100      HTR-01     SUM        0.23607E-3     0.0  1
20586101      0.0             1.0      HTRNP      150000101
*
20586200      HTR-02     SUM        0.23607E-3     0.0  1
20586201      0.0             1.0      HTRNP      150000201
*
20586300      HTR-03     SUM        0.23607E-3     0.0  1
```

```
20586301      0.0               1.0          HTRNP      150000301
*
20586400      HTR-04    SUM          0.23607E-3         0.0  1
20586401      0.0               1.0          HTRNR      150000401
*
20586500      HTR-05    SUM          0.23607E-3         0.0  1
20586501      0.0               1.0          HTRNR      150000501
*
20586600      HTR-06    SUM          0.23607E-3         0.0  1
20586601      0.0               1.0          HTRNR      150000601
*
20586700      HTR-07    SUM          0.23607E-3         0.0  1
20586701      0.0               1.0          HTRNR      150000701
*
20586800      HTR-08    SUM          0.23607E-3         0.0  1
20586801      0.0               1.0          HTRNR      150000801
*
20586900      HTR-09    SUM          0.23607E-3         0.0  1
20586901      0.0               1.0          HTRNR      150000901
*
20587000      HTR-10    SUM          0.23607E-3         0.0  1
20587001      0.0               1.0          HTRNR      150001001
*
20587100      HTR-11    SUM          0.23607E-3         0.0  1
20587101      0.0               1.0          HTRNR      150001101
*
20587200      HTR-12    SUM          0.23607E-3         0.0  1
20587201      0.0               1.0          HTRNR      150001201
*
20588000      CORPWR    SUM          1.0                0.0  1
20588001      0.0               1.0          CNTRLVAR   861
20588002                        1.0          CNTRLVAR   862
20588003                        1.0          CNTRLVAR   863
20588004                        1.0          CNTRLVAR   864
20588005                        1.0          CNTRLVAR   865
20588006                        1.0          CNTRLVAR   866
20588007                        1.0          CNTRLVAR   867
20588008                        1.0          CNTRLVAR   868
20588009                        1.0          CNTRLVAR   869
20588010                        1.0          CNTRLVAR   870
20588011                        1.0          CNTRLVAR   871
20588012                        1.0          CNTRLVAR   872
*
*=========================================================================
*
****              EXPANDED EDIT/PLOT VARIABLES                        ****
*
*=========================================================================
20590100      CORPWR    SUM       1.0                  0.0  1
20590101  0.0       1.0    FWALF          163010000
*
20590200      CORPWR    SUM       1.0                  0.0  1
20590201  0.0       1.0    FWALG          163010000
*
20590300      CORPWR    SUM       1.0                  0.0  1
20590301  0.0       1.0    FWALF          164010000
*
20590400      CORPWR    SUM       1.0                  0.0  1
20590401  0.0       1.0    FWALG          164010000
*
20590500      CORPWR    SUM       1.0                  0.0  1
20590501  1.0       1.0    FWALF          165010000
```

```
*
20590600      CORPWR    SUM       1.0              0.0  1
20590601  0.0       1.0     FWALG          165010000
*
20590700      CORPWR    SUM       1.0              0.0  1
20590701  0.0       1.0     FIJ            164010000
*
20590800      CORPWR    SUM       1.0              0.0  1
20590801  0.0       1.0     FORMFJ         164010000
*
20590900      CORPWR    SUM       1.0              0.0  1
20590901  0.0       1.0     FORMGJ         164010000
*
20591000      CORPWR    SUM       1.0              0.0  1
20591001  0.0       1.0     FIJ            164020000
*
20591100      CORPWR    SUM       1.0              0.0  1
20591101  0.0       1.0     FORMFJ         164020000
*
20591200      CORPWR    SUM       1.0              0.0  1
20591201  0.0       1.0     FORMGJ         164020000
*
.END
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11. ABSTRACT (200 words or less)

This report presents the results of the RELAP5/MOD2 assessment utilizing a Semiscale intermediate break loss-of-coolant experiment S-IB-3. Comprehensive analysis with RELAP5/MOD2 is preformed to predict the transient thermal-hydraulic responses of the experiment. Test S-IB-3 is a 21.7%, communicative cold leg break LOCA experiment using Semiscale Mod-2A facility in 1982, for the principal objective to provide reference data for comparison of Semiscale test results to LOBI facility B-RIM test results. Through extensive comparison between test data and best-estimate RELAP5 calculations, the capabilities of RELAP5/MOD2 to predict the immediate break LOCA accident were assessed. Emphasis was located on the capability of the code to calculate core level depression and break flow rate during system blowdown, pump section liquid seals phenomena, and temperature excursions behavior etc., throughout the whole experiment. Besides some sensitivity studies involving the effect of steam generator secondary side pressure boundary, adjustment of two-phase discharge coefficient, intact loop pump coastdown behavior, and some interesting studies regarding break flow etc., were also investigated in this report.

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

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Experiment S-IB-3

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