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October 1, 1985

Director, Office of Nuclear Reactor Regulation
Attention: Mr. J. A. Zwolinski, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
NUREG-0737 Item II.D.1-Performance Testing of "see rept"
Relief and Safety Valves
San Onofre Nuclear Generating Station
Unit 1

References: 1. Letter, D. M. Crutchfield, NRC, to K. Baskin, SCE
NUREG-0737 Item II.D.1-Performance Testing of
Relief and Safety Valves, December 19, 1983

2. Letter, R. W. Krieger, SCE to D. M. Crutchfield, NRC,
NUREG-0737, Item II.D.1-Performance Testing of
Relief and Safety Valves, February 22, 1984

Reference 1 indicated that you had reviewed our December 2, 1982 and July 13, 1983 submittals and requested that we provide additional information regarding the performance testing of relief and safety valves. We responded in Reference 2 by stating that we would require additional time to prepare our responses and that a schedule would be provided after return to service from the seismic backfit outage. Accordingly, the additional information requested by Reference 1 is provided as an Enclosure to this letter. The information provided in the Enclosure should resolve the subject TMI Action Plan item for San Onofre Unit 1.

If you have any questions, please let me know.

Very truly yours,

M. O. Medford

A046
1/1

Enclosures

NOTE COMPANY NOTE 10.
MEB 2 CYS
PDR 1 CY
LPDR 1 CY
NSIC 1 CY
ORIG 6 CYS

Enclosure

RESPONSES TO NRC QUESTIONS ON

PRESSURIZER RELIEF AND SAFETY VALVE TESTING

SAN ONOFRE NUCLEAR GENERATING STATION

UNIT 1

The information provided below responds to the Request for Additional Information, TMI Action NUREG-0737 (II.D.1), Relief and Safety Valve Testing for San Onofre Unit 1, November 1983.

NRC Question No. 1

The submittal treats a steam flow discharge through the safety valves corresponding to a Locked Rotor event as the limiting overpressure transient. It does not discuss, though, whether single failures after the initiating event were considered that could lead to water flow through the valves. Provide such a discussion on single failures to show how the NUREG-0737 requirement that single failures be chosen so as to maximize dynamic loads on the safety/relief valves has been met.

SCE Response

The limiting overpressure transient that incurs safety valve actuation is the Loss of External Load event (Final Engineering Report and Safety Analysis (FERSA) 10.6). The Loss of External Load analysis assumes an initial core power of 103 percent of rated with no direct reactor trip on turbine trip. The pressurizer spray, power-operated relief valves and steam release to the atmosphere and condenser are assumed inoperable. The combined effect from these assumptions produces the greatest (fastest) reactor coolant system pressurization rate.

Since the peak pressure is observed within a few seconds of the transient initiation, single failures within the engineered safeguards systems would have little or no effect on the pressurization rate or observed peak pressure.

NRC Question No. 2

Overpressure transients cause the pressurizer sprays to activate which adds moisture to the steam volume. When the safety or relief valves open they would thus pass a steam-water mixture. Explain whether this effect was considered in selecting the transient that produces maximum loading on the system.

SCE Response

The operation of pressurizer spray will not increase the valve and discharge piping loads because the peak load occurs prior to the time when any wet steam due to entrained spray can reach the safety valve.

As mentioned in the response to Question 9, the maximum discharge piping loads occur upon valve opening. This means that the peak force in a given piping segment occurs when the initial pressure surge due to valve opening reaches that segment. The inlet piping for the safety valve and the pressurizer volume above the spray header will initially contain saturated steam. In order for any postulated wet steam to reach the discharge piping, the initial quantity of saturated steam must pass through the safety valve. For San Onofre Unit 1 this would take at least 0.0165 seconds after the valve initially opens. By the time the postulated wet steam reaches the valve, the valve is fully open and the initial pressure surge has already occurred. This is further substantiated by EPRI safety valve test data for steam to-water transition tests. In these tests the safety valve actuated on saturated steam, followed by a transition of saturated water after the valve opened. The peak loads occurred when the valve initially opened prior to the transition to water. Therefore, the operation of pressurizer spray will not result in discharge piping loads in excess of those values previously calculated.

As stated in the response to Question 7, the bending moments predicted to act on the safety valve discharge flange in the San Onofre piping analysis are significantly less than those measured during the test program. Therefore, the operability of the safety valves is not impaired by the calculated piping loads.

NRC Question No. 3

Results from the EPRI steam tests on the Crosby 3K6 safety valves indicate that blowdowns may exceed the 4% value from the valve specification, depending on the ring settings used (see related Question 6). If expected plant blowdowns do exceed 4%, these higher blowdowns could cause a rise in pressurizer water level such that water may reach the safety valve inlet line and result in a steam-water flow situation. Additionally, the pressure might be sufficiently decreased that adequate cooling might not be achieved for decay heat removal. Discuss these consequences of higher blowdowns if increased blowdowns are expected.

SCE Response

The impact on plant safety of pressurizer relief valve blowdowns in excess of 4% for San Onofre Unit 1 has been evaluated. The results of this evaluation show no adverse effects on plant safety.

Relief valve blowdowns in excess of that assumed in the San Onofre Nuclear Generating Station Unit 1 (SONGS 1) Final Engineering Report and Safety Analysis (FERSA) will have the following effects on the events in which relief valve actuation occurs:

a) Increased pressurizer water level during and following the valve blowdown;
b) Lower pressurizer pressure during and following valve blowdown;
c) Increased inventory loss through the relief valve.

The impact of the increased relief valve blowdowns with respect to the above effects was evaluated for the single SONGS 1 FERSA event in which relief valve actuation occurs (i.e., Loss of Load).

For the Loss of Load event, results from sensitivity analyses performed for 4 loop plants were used for the evaluation. It is felt that similar results would be found for 3 loop plants. These analyses investigated the effects of different blowdown rates on the Loss of Load event. The results showed only marginal increases in pressurizer water volume and the maximum pressurizer water levels were well below the level at which liquid relief would occur. Peak RCS pressures were shown to be unaffected by the increased blowdowns. The increased blowdowns did result in lower pressurizer pressure and increased RCS inventory loss; however, these had no adverse impact on the event and adequate decay heat removal was maintained.

NRC Question No. 4

In discussion on valve inlet fluid conditions for low temperature overpressurization transients, the submittal identifies expected fluid conditions for a water discharge transient. According to the Westinghouse report on valve inlet fluid conditions, however, the fluid conditions for cold overpressurization events vary between steam and water. To assure that the relief valves operate under all of these events, discuss the range of fluid conditions expected for the varying types of fluid discharge and identify the test data that demonstrate operability over the range of conditions. Verify that the fluid conditions were properly enveloped during the tests. Confirm that the high pressure steam tests demonstrate valve operability for the low pressure steam case for both opening and closing of the relief valve.

SCE Response

The maximum temperature and pressure conditions that can be achieved at the PORV inlet coincidently occur for steam bubble operation. Since pressure is normally maintained below the PORV setpoint, the maximum steam and saturated liquid pressure maintained in the pressurizer during startup and shutdown operations in anticipation of the cold overpressurization (COP) event would occur at the PORV setpoint. This pressure (P') and corresponding temperature (T') would be as follows:

Plant	P' (psig)	T' (deg F)
San Onofre Unit 1	500	470

Using these conditions, the potential worst case scenarios for PORV discharge during a COP event would be:

1. Discharge of saturated steam at $P \leq P'$ and $T \leq T'$ (steam in upper phase of pressurizer)

2. Discharge of saturated water at $P \leq P'$ and $T \leq T'$ (saturated water in pressurizer)

3. Discharge of subcooled water at P < P' and T < T' (mixing of colder RCS water with saturated pressurizer water)

4. Scenario 1 followed by Scenario 2

5. Scenario 2 followed by Scenario 3

6. Scenario 1 followed by Scenario 2 followed by Scenario 3.

EPRI test conditions for PORV's were chosen based on expected fluid conditions. Tests were limited but designed to confirm operability over a full range of expected inlet conditions. Steam, steam to water and water flow tests were conducted. Results of these tests can be found in EPRI report EPRI NP-2670-LD, Volume 9, Table IX-3. Although steam tests were conducted only at high pressures, it is expected that satisfactory performance would also result at the less severe lower pressures. This can be confirmed by the high pressure versus low pressure water tests where successful valve operation was observed.

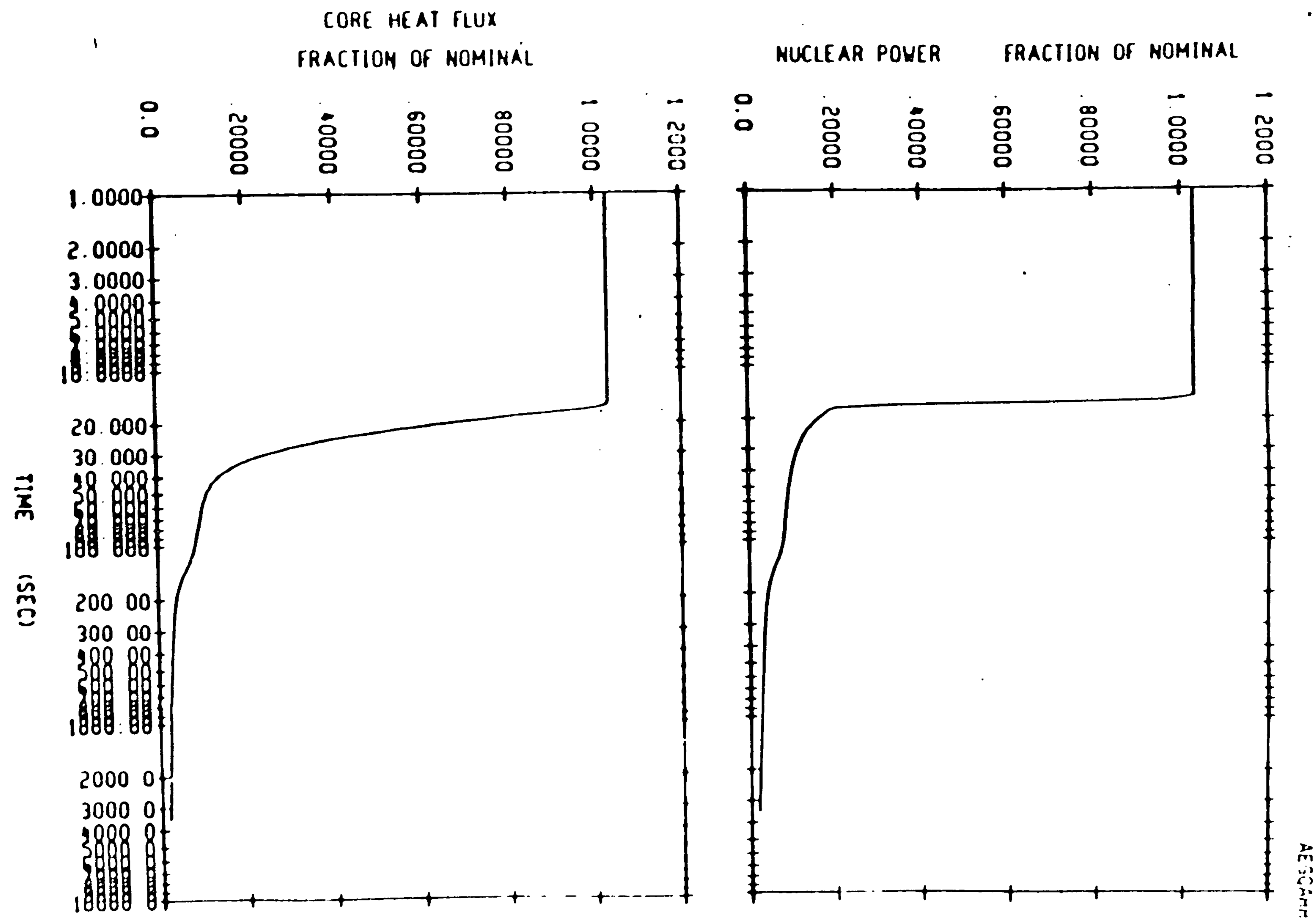
NRC Question No. 5

The Westinghouse valve inlet fluid conditions report stated that liquid discharge through both the safety and relief valves is predicted for an FSAR feedline break event. The Westinghouse report gave expected peak pressures and pressurization rates for some plants having an FSAR feedline break analysis. San Onofre 1 was not included in this list of plants having such an FSAR analysis. Nor does the submittal address the feedline break event. NUREG-0737, however, requires analysis of accidents and occurrences referenced in Regulatory Guide 1.70, Revision 2, and one of the accidents so required is the feedline break. Provide fluid pressure and pressurization rate, fluid temperature, valve flow rate, and the time duration for the feedline break event. Provide assurance that the valves passed water for a sufficient duration during the tests to cover this event and furnish an analysis which demonstrates safety of the safety/relief valve system for the feedline break event.

SCE Response

In response to post-TMI requirements, a feedline break analysis was performed and submitted to the NRC under the subject of Automatic Initiation of Auxiliary Feedwater Systems by letters dated March 6, 1981 and November 18, 1981. This analysis was reviewed and approved by the NRC as part of TMI Item No. II.E.1.1 and documented in NRC Amendment No. 65 dated October 2, 1982. The feedline break analysis was also reviewed and approved by the NRC as part of SEP Topic XV-6, Feedwater System Pipe Breaks Inside and Outside Containment (PWR), letter dated March 3, 1982 and XV-5, Loss of Normal Feedwater Flow, letter dated March 14, 1983.

The limiting feedline break analysis for San Onofre Unit 1 assumes auxiliary feedwater flowrate of 250 gpm and operator action time of 15 minutes after reactor trip. The appropriate plots of pressure, temperature and flowrates are attached. The defined "acceptable results" considered no bulk boiling in the primary system prior to the time of loop temperature turnaround, i.e., the time when the heat removal rate equals the heat input on the primary side. Note that the peak pressurizer water volume is approximately 1299 cubic feet and the pressurizer capacity is 1300 cubic feet. Based upon these results, the limiting feedline break transient does not result in a solid pressurizer; thus, water relief is not predicted.


CORE HEAT FLUX
FRACTION OF NOMINAL
NUCLEAR POWER
FRACTION OF NOMINAL
TIME (SEC)
0.0
.20000
.40000
.60000
.80000
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300.00
2000.0
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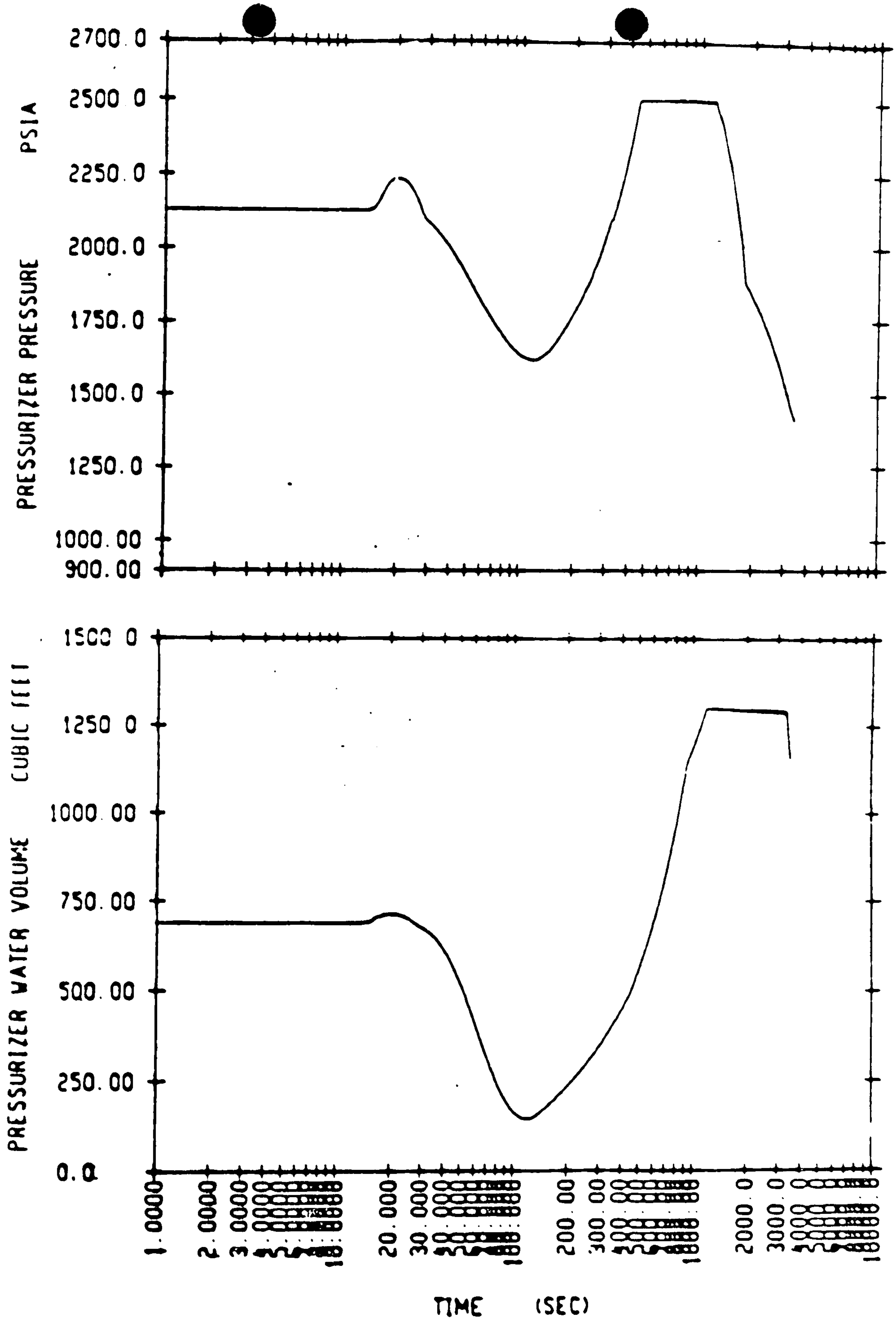


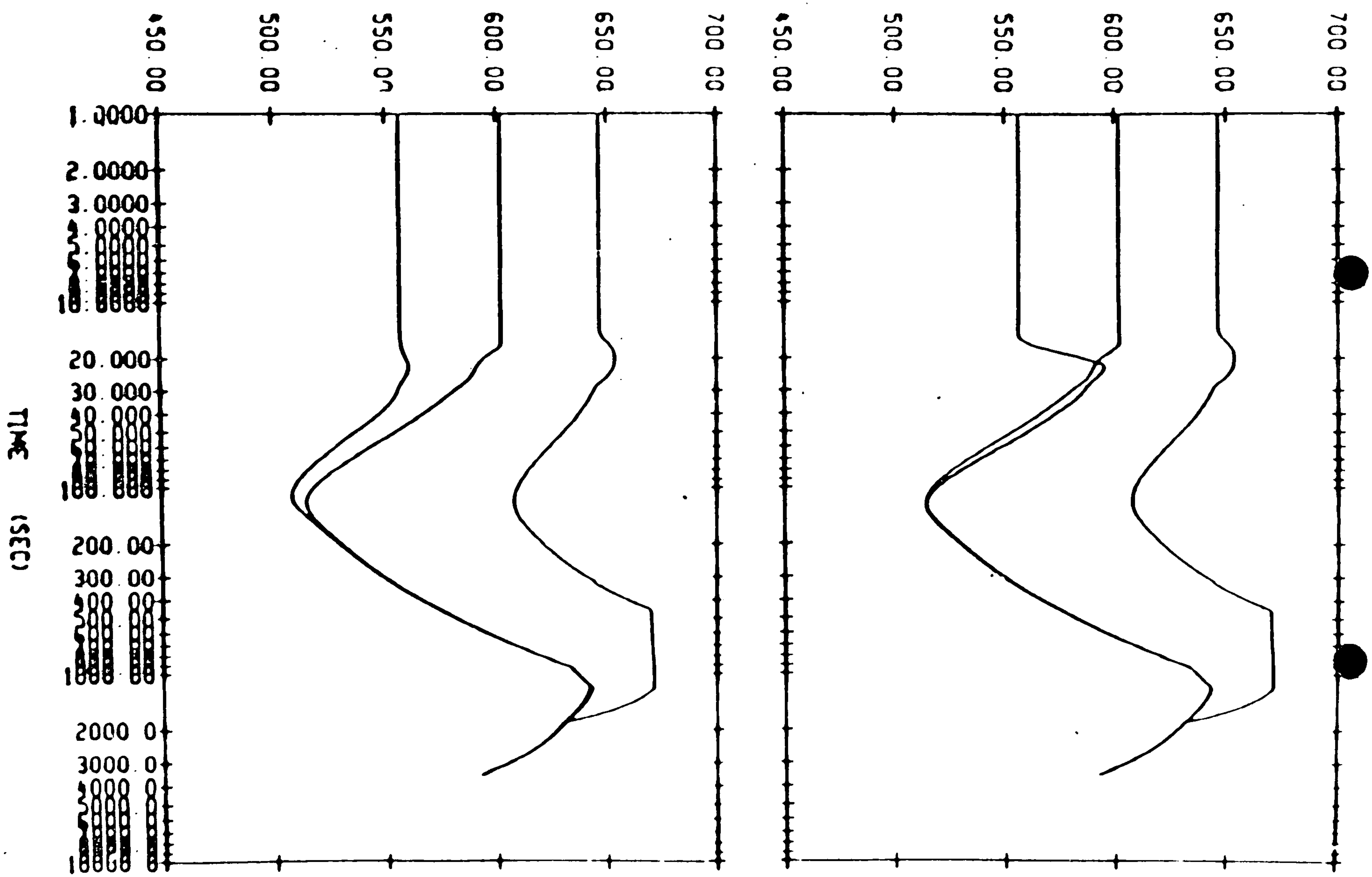
Feedline Rupture 250 gpm @ 15 min.

LOOP 2 TEMPERATURE(COLD HOT SAT)

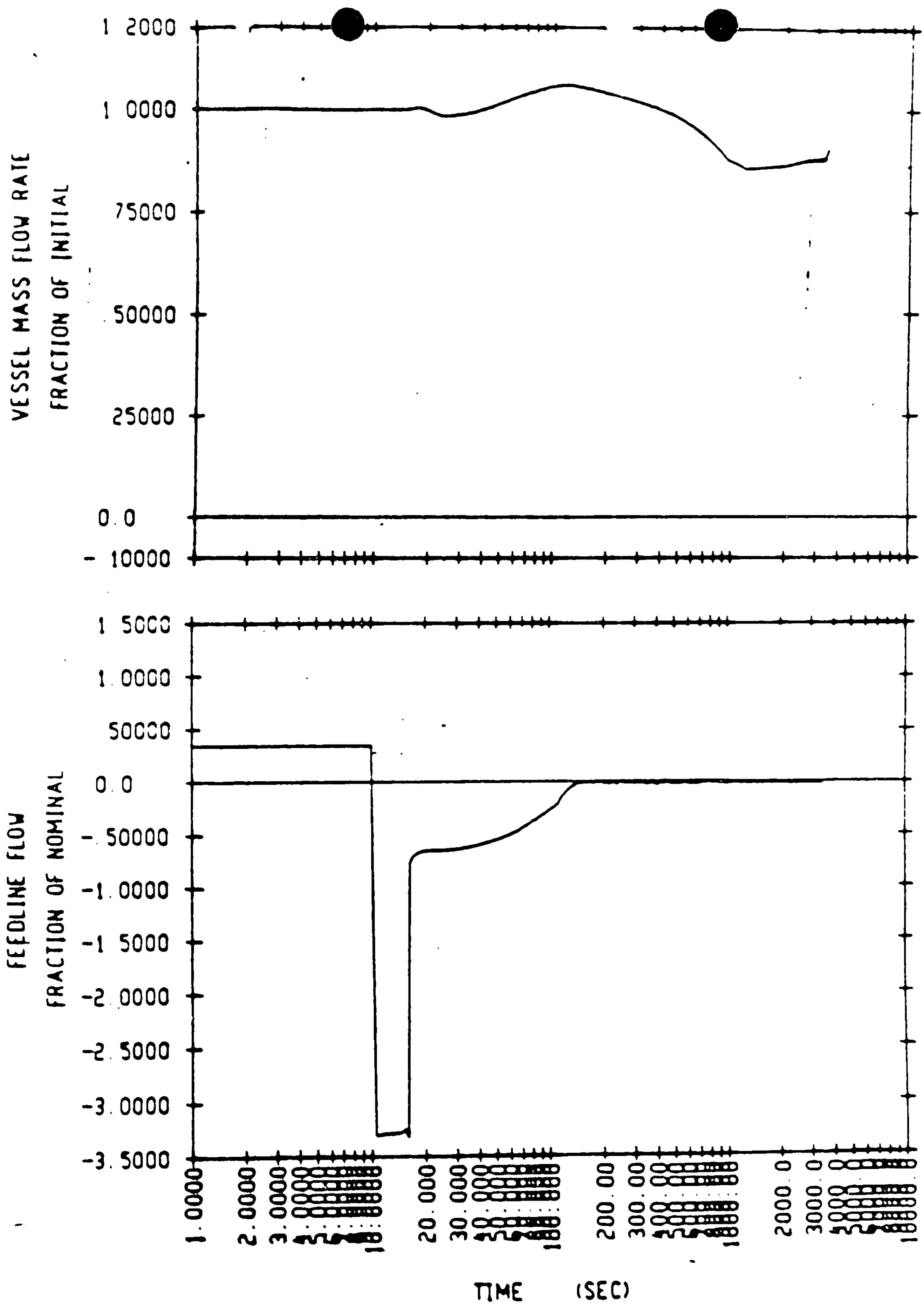
DEGREES F

LOOP 1 TEMPERATURE(COLD HOT SAT)

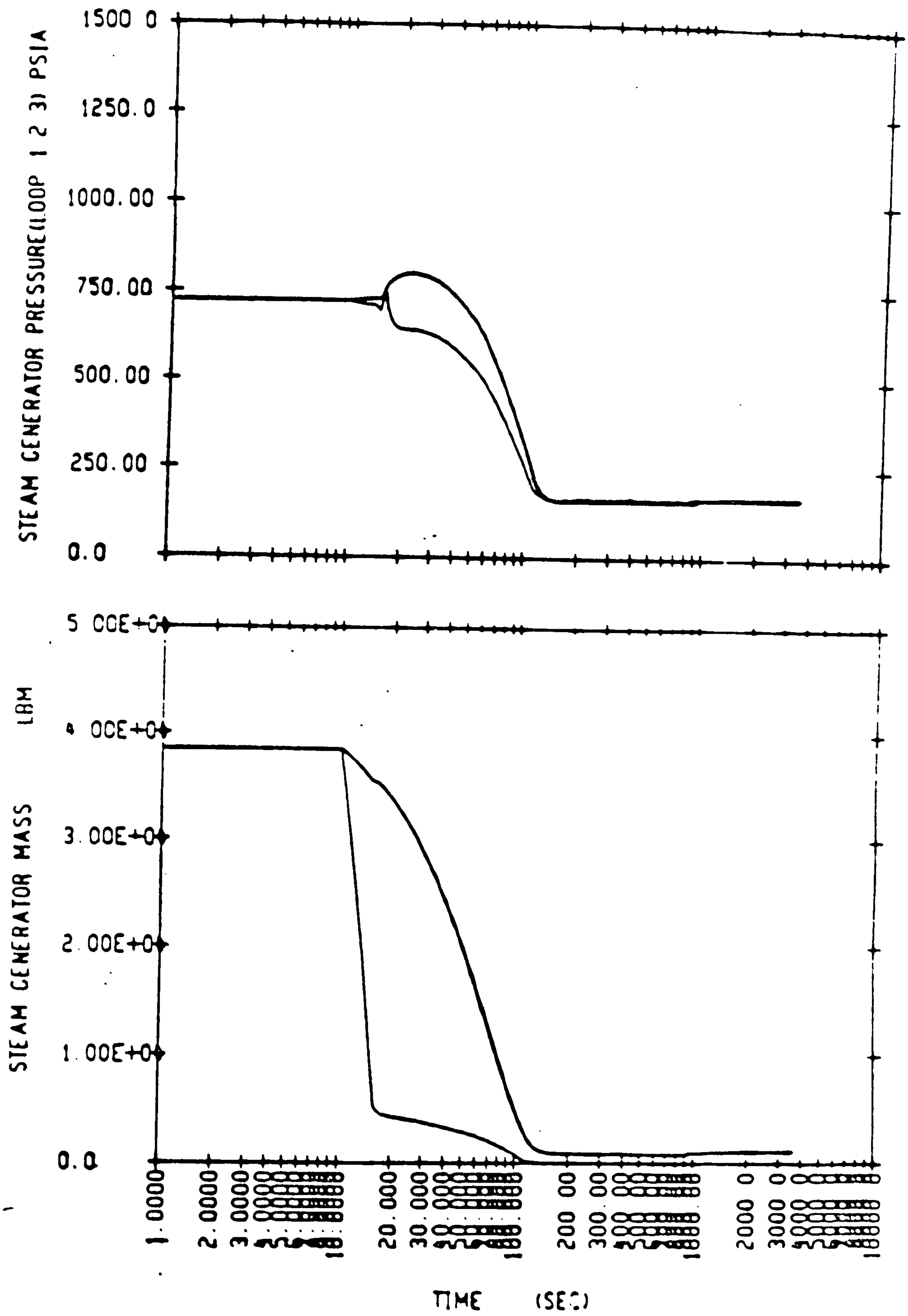
DEGREES F



Feedline Rupture 250 gpm @ 15 min.



Feedline Rupture 250 gpm @ 15 min.



Feedline Rupture 250 gpm @ 15 min.

NRC Question No. 6

In the EPRI steam tests on a Crosby 3K6 Safety Valve, which was a test with a valve mounted on a short inlet pipe configuration, the valve opened and closed with 10-11% blowdown at the valve vendor's recommended ring settings. The rings were adjusted and blowdown was decreased to 4-5%, which meets the valve specification value of 4%. The submittal does not provide evidence, though, as to what the expected blowdown at the plant will be. It only states that "as installed" ring adjustments are expected to produce stable valve operation with 4-5% blowdown. Identify the "as installed" ring settings and determine the expected backpressure, since this too affects the blowdown. Present a calculation for an expected blowdown value based on the plant ring settings and backpressure. If the blowdown falls outside the 4-5% range, evaluate valve performance for the expected blowdown value.

SCE Response

The following represents the current San Onofre Unit 1 Safety Valve ring settings as developed by Crosby during Production Testing:

Nozzle Ring	Adjusting Ring
-6	-115

Note: The above ring settings are used on each safety valve and are measured from the highest locked position.

Valve ring settings developed by the Crosby Production test methods should have performance characteristics similar to those test valves, that were operated at "as-shipped" ring settings. This is true even though the ring setting numbers may differ between valves. This difference is due to part tolerance stack up within the individual valve and different ring movement per-notch for each valve size.

It is believed that insufficient information is available to extrapolate ring settings for the purpose of predicting blowdowns, especially for valves not tested. Therefore, it is not appropriate to predict valve performance based upon ring setting values.

NRC Question No. 7

Thermal expansion of the pressurizer and inlet piping to the valve would be expected to induce loading on the inlet flange at the time the valve is required to lift. Evaluate the effect that this loading may have on valve operability.

SCE Response

Maximum expected bending moment induced in the Safety Valve Flanges for the San Onofre Unit 1 Safety Valves has been calculated to be 44,994 inch-pounds due to deadweight and thermal effects. Since this value is much less than the 161,500 in-lb moment for the 3K6 test valve and the 298,750 in lb moment for the 6M6 test valve, the above loadings will not have a detrimental effect on valve operability.

NRC Question No. 8

Since the Crosby 3K26 valve was not specifically tested in the EPRI program, results from tests on the Crosby 3K6 and 6N8 valves were used for comparison. Flow rate data were only obtained from tests on the Crosby 3K6. Provide further information on how the data for the Crosby 3K6 valve was extrapolated to verify that the plant safety valve will pass its rated flow, particularly with the ring settings as adjusted at the plant.

SCE Response

As noted in Table 4.4 of EPRI Report NP-2770-LD, Volume 6, the Crosby 6M6 test valve achieved rated flow for each of the tests reported at 3 percent accumulation regardless of the ring setting used in the test. A review of EPRI Tables 4-3 and 4-4 in Volume 5 of EPRI Report NP-2770-LD reveals that for steam tests of the 3K6 valve where blowdown was measured to be less than 10 percent, flow rates of 119-122 percent of rated flow at 3 percent accumulation were reported. The EPRI tables indicate that lower than rated flows occurred at blowdowns greater than 15 percent for the 3K6 valve. No flow data was collected for the 6N8 valve. Crosby production tests for the San Onofre Unit 1 valves indicate 4-5 percent blowdown with the "as-shipped" ring settings. These are the ring settings currently installed on the San Onofre Unit 1 Safety Valves. This is within the range of both the 3K6 and 6M6 tests where rated flow was achieved; therefore, rated flow can be expected for the San Onofre Unit 1 Safety Valves.

NRC Question No. 9

The submittal indicates that a simultaneous opening of the two safety valves was assumed to produce the highest loading on the discharge piping system. The experience of EG&G Idaho indicates that the maximum forces are obtained when the sequence of opening reach the common header simultaneously. Provide additional justification that a simultaneous opening of the valves is adequate.

SCE Response

Considering the similar geometry and total length of the discharge piping system for both safety valves, the assumption of a simultaneous valve opening was made to assure that the initial pressure waves from the two valves opening reach the common header simultaneously. Examining the input for the time history analysis indicates that a total wave force of 9000 lb. was used. This is equal to the sum of wave forces from both valves opening with a 4500 lb. contribution from each valve. Therefore, the case of maximum forces on common header has been considered.

NRC Question No. 10

To calculate the time-dependent forcing functions acting on the piping a simplified graphical solution technique was applied. This technique is based on an ideal gas assumption. High pressure steam, though, is not an ideal gas. How well the technique applies to PWR conditions has not been demonstrated. The authors of the paper on this technique did compare calculations with test data for steam at 995 psia and obtained a good comparison. Provide further comparisons or verification to show the validity of this technique for PWR steam discharges.

SCE Response

Intermountain Technologies, Inc. (ITI), in Idaho Falls, was asked to evaluate independently the hydrodynamic loads due to valve actuation on the discharge piping using RELAP 5/MOD 1 Code. The analysis was for saturated steam upstream of the safety valves without assuming an ideal gas. The results of ITI's report are shown in Figures C-1 through C-7. These results demonstrate that SCE's results using simplified graphic solutions based on an ideal-gas assumption show good comparison in force characteristics and conservative data in force magnitudes. The discrepancy in Figure C-7 is judged not to be of any significant consequence because of the significant margins in all other pipe segments.

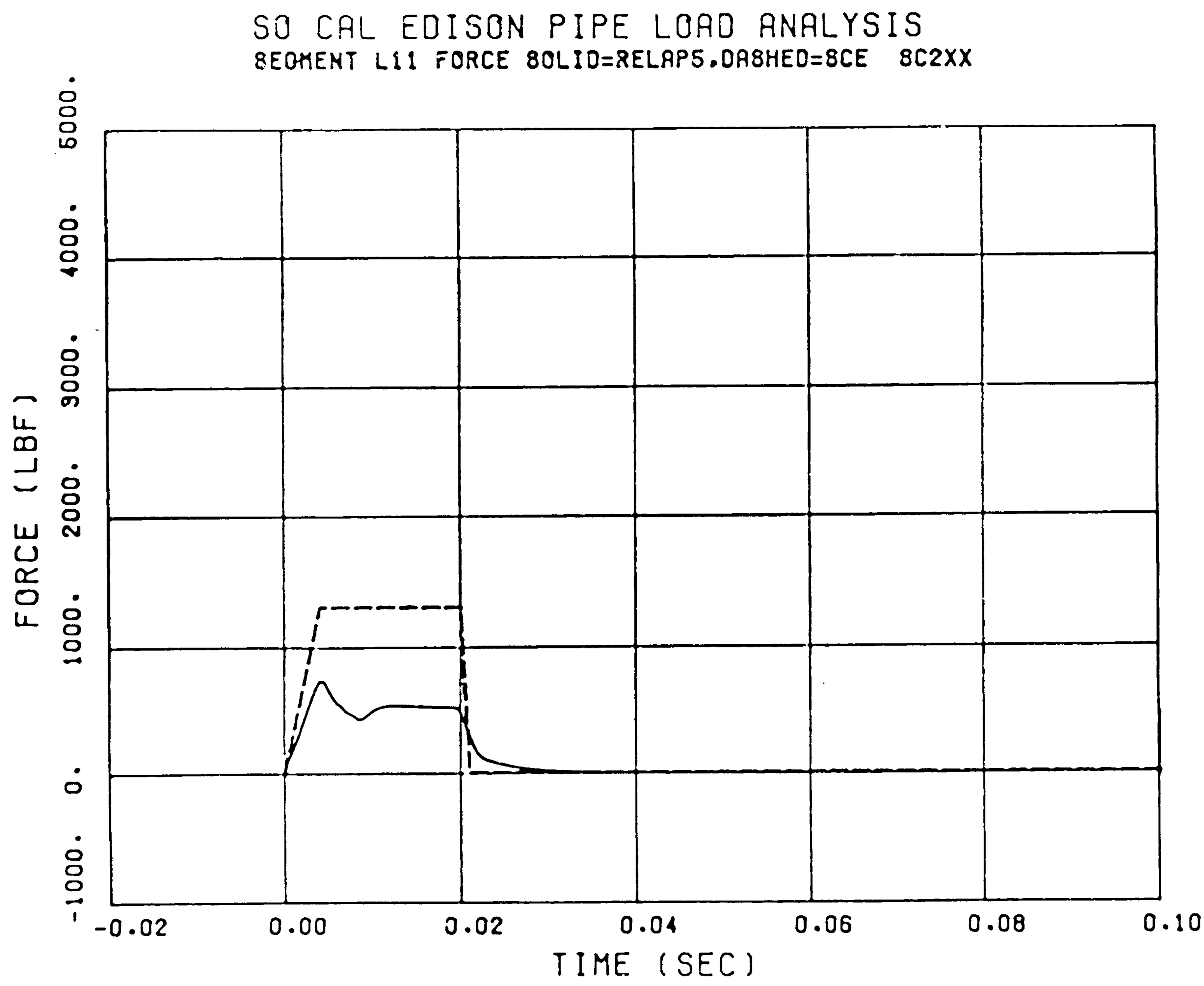


Figure C-1. Comparison between calculated hydrodynamic forcing functions on pipe segment L11 (RELAP5 isentropic flow case versus SCE).

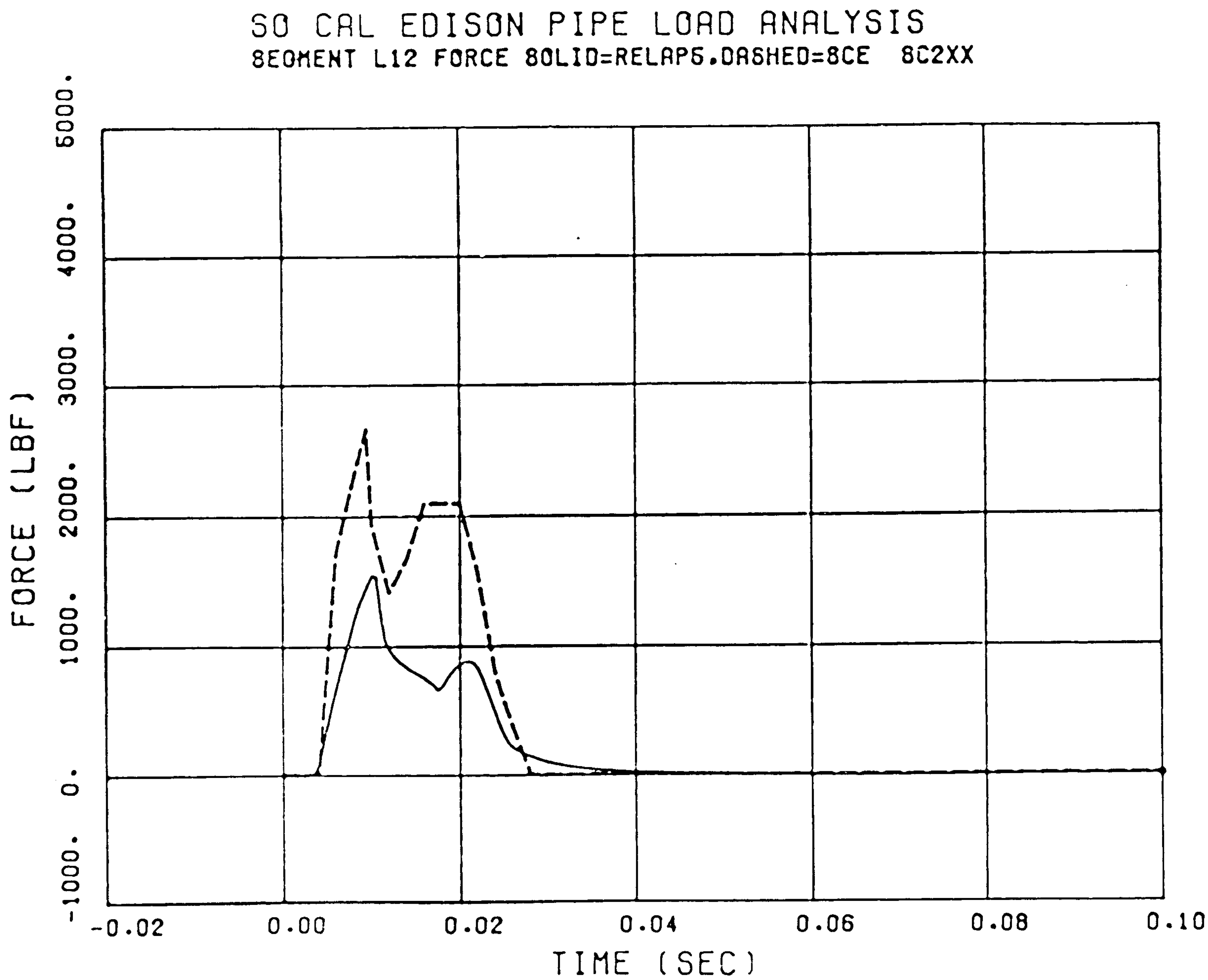


Figure C-2. Comparison between calculated hydrodynamic forcing functions on pipe segment L12 (RELAP5 isentropic flow case versus SCE).

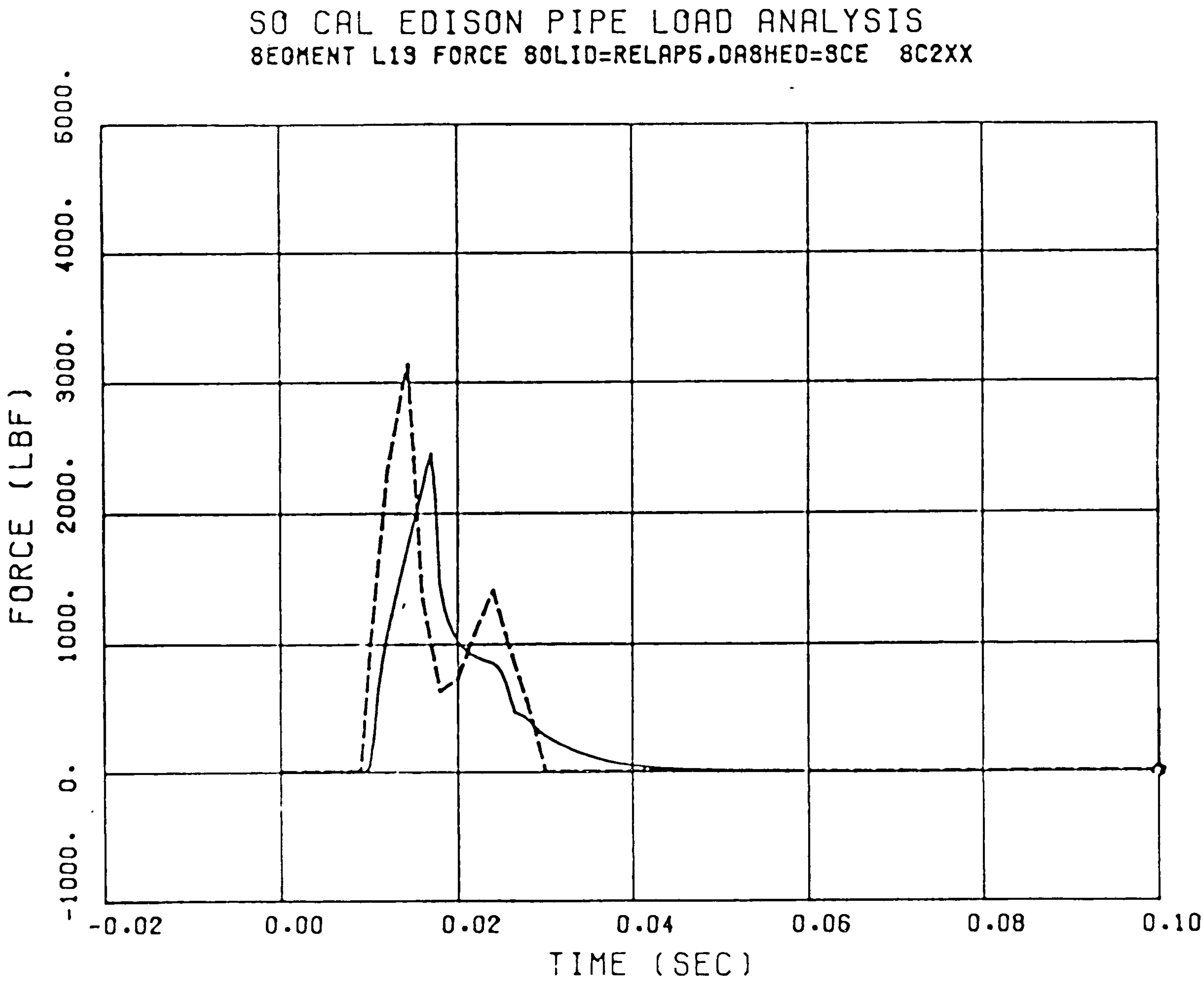


Figure C-3. Comparison between calculated hydrodynamic forcing functions on pipe segment L13 (RELAP5 isentropic flow case versus SCE).

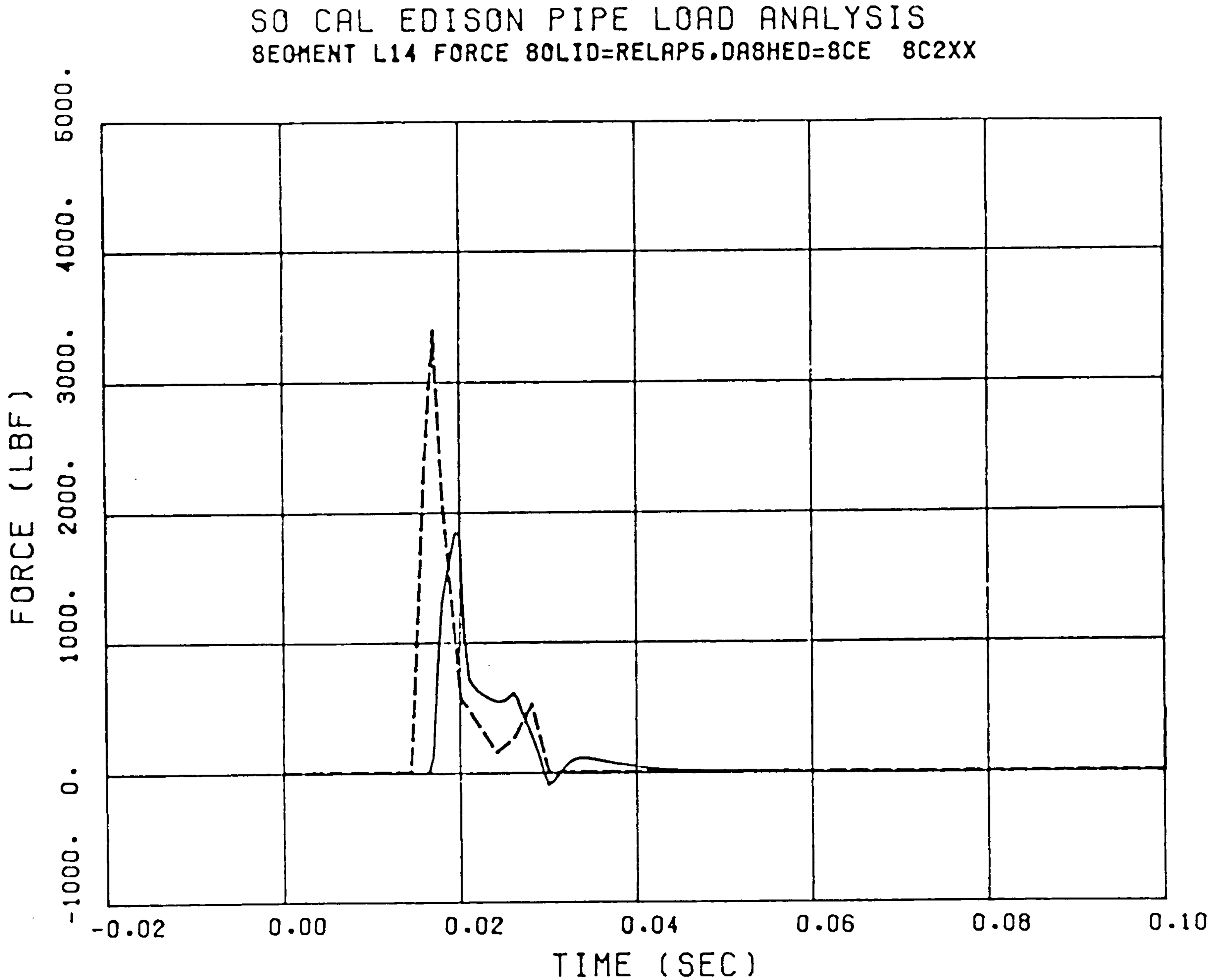


Figure C-4. Comparison between calculated hydrodynamic forcing functions on pipe segment L14 (RELAP5 isentropic flow case versus SCE).

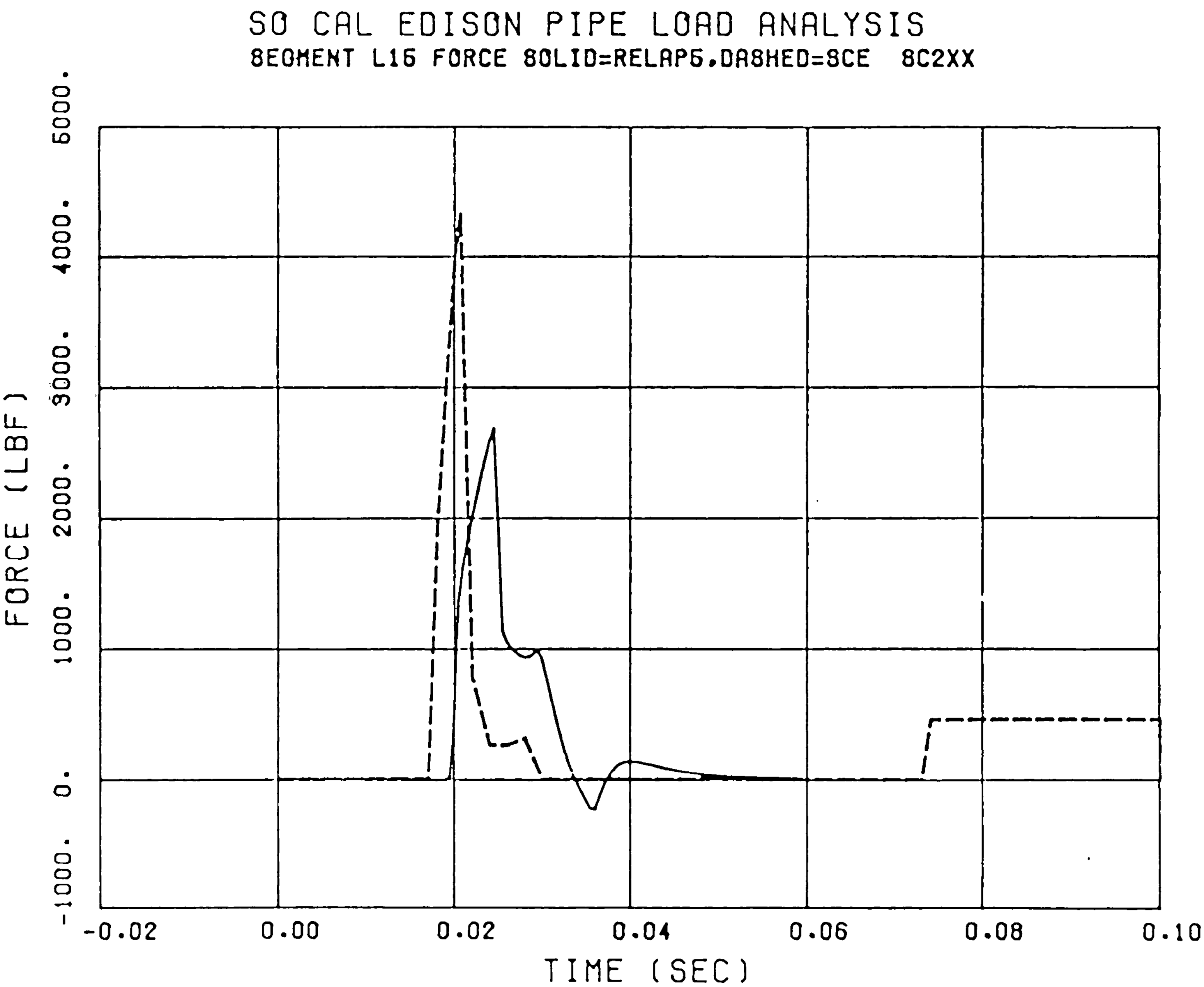


Figure C-5. Comparison between calculated hydrodynamic forcing functions on pipe segment L15 (RELAP5 isentropic flow case versus SCE).

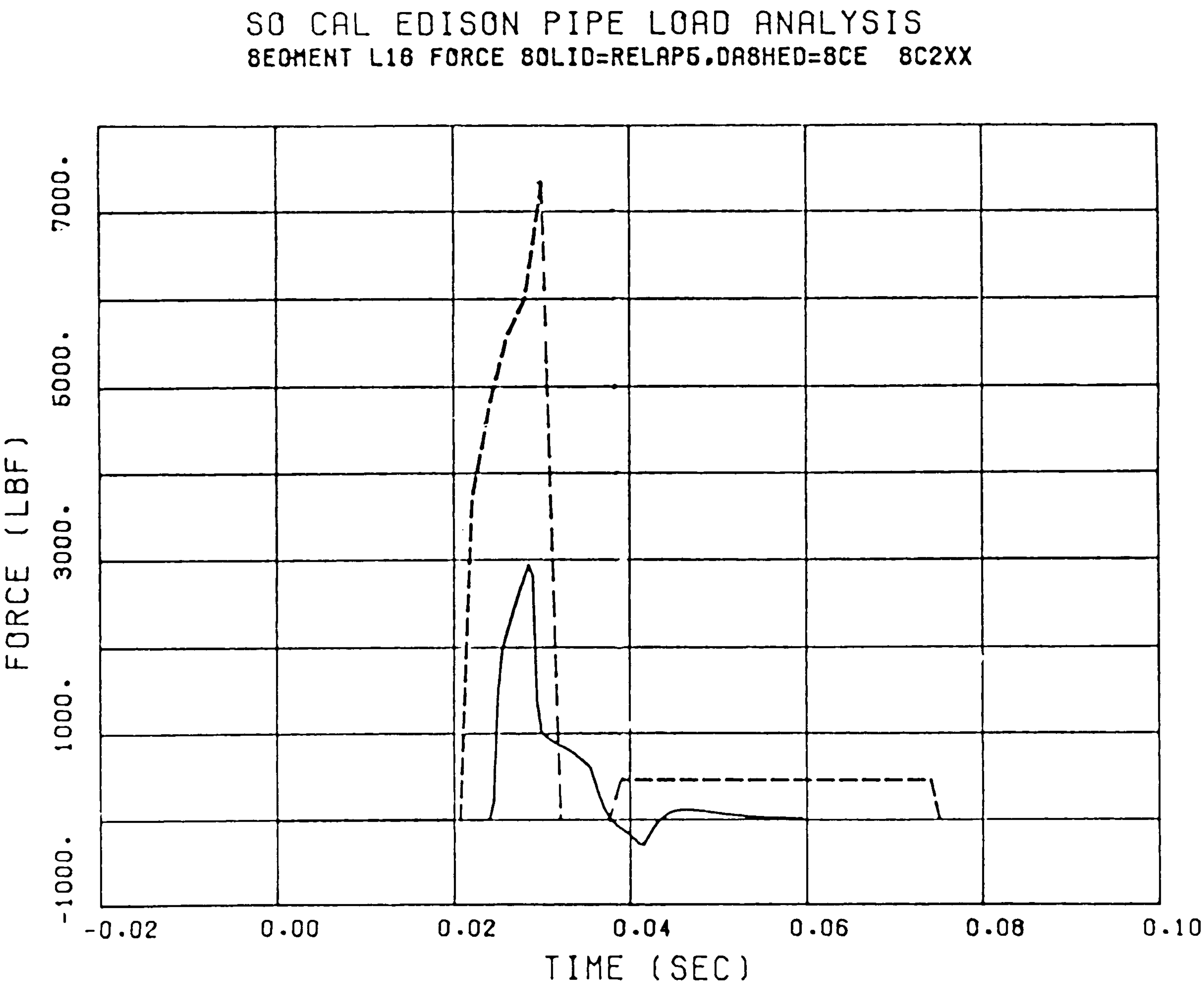


Figure C-6. Comparison between calculated hydrodynamic forcing functions on pipe segment L16 (RELAP5 isentropic flow case versus SCE).

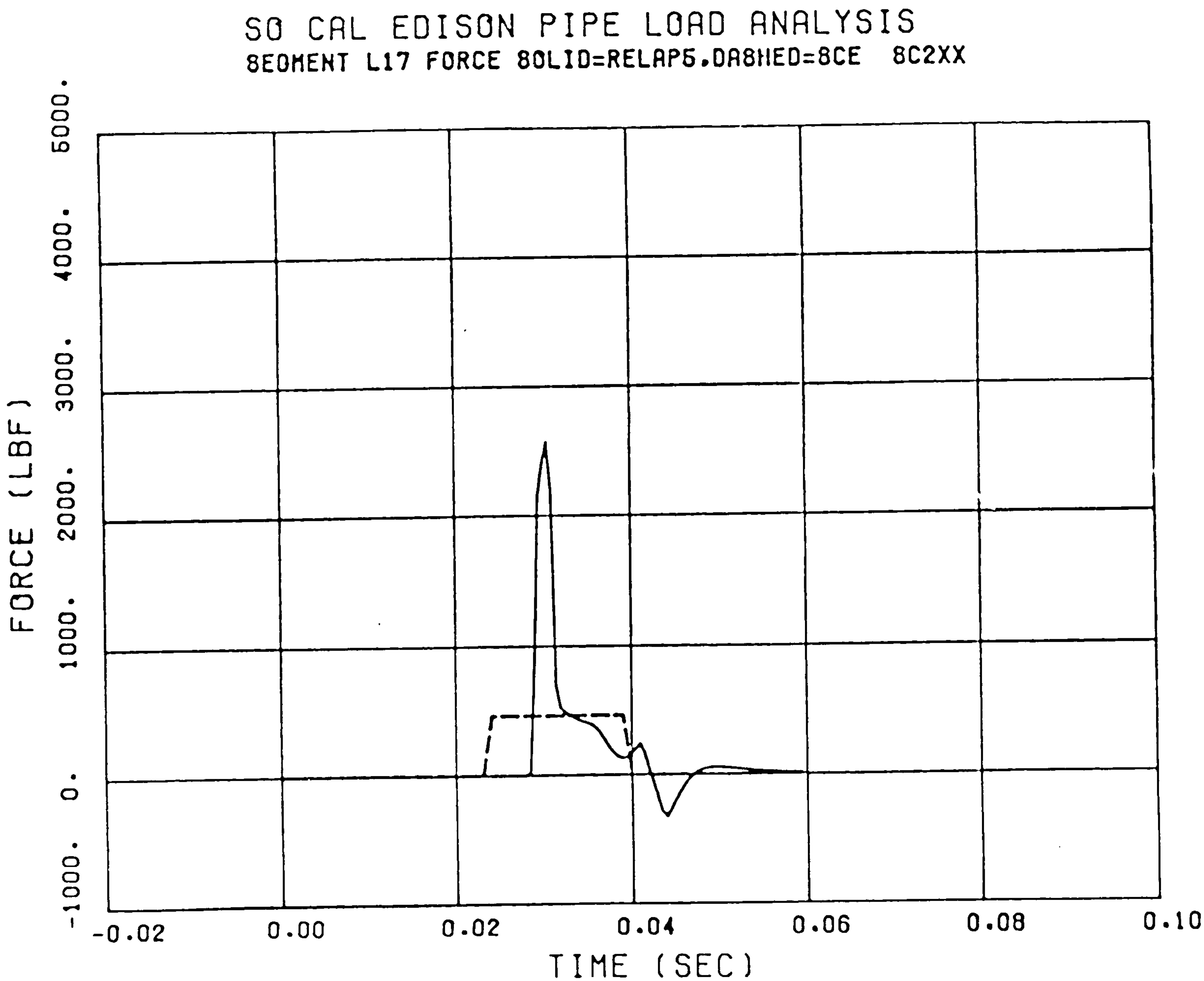


Figure C-7. Comparison between calculated hydrodynamic forcing functions on pipe segment L17 (RELAP5 isentropic flow case versus SCE).

NRC Question No. 11

Differences between the ideal conditions assumed in the thermal hydraulic analysis and the conditions likely to be found in downstream piping, i.e., condensed liquid, were not addressed in the submittal. A sweeping along of this condensed liquid could result in larger forces on the piping. Thus, provide justification for the assumption of ideal conditions. Additionally, a valve opening time of 20 msec was selected for the analysis, while pop times on the order of 10 msec occurred in tests on the 3K6 and 6N8 valves. Provide justification for this difference.

SCE Response

Water vapor could condense in the downstream piping, since the ambient temperature in the containment can be as high as 120^{o}F corresponding to a saturation pressure of approximately 2 psig, which is below the discharge piping system backpressure of 3 psig. However, judging from piping routing of the 10" common header, it is very unlikely for any significant amount of condensed liquid to be accumulated in the pipe because of relative shortness of horizontal segment. Further, due to the large upward thermal movement of the pressurizer nozzles, approximately 1.93", the 6" piping downstream of the valve tends to be sloping toward the header. Any significant amount of condensed liquid would be drained down to the pressure relief tank. Therefore, the water entrainment phenomenon is judged to be insignificant.

At the time of the analysis as presented in the submittal, a literature survey was conducted and the fastest opening time was found to be 20 msec. As of today, EPRI test data on Crosby 3K26 valve is not available. It is judged that conservatisms in the analysis, as evidenced in ITI's Relap V results should envelop any larger load due to a shorter opening time.

NRC Question No. 12

Some of the information needed to evaluate the structural analysis was not supplied in the submittal. So as to provide information on the stiffness values used to model the supports, the calculated values for loads on the supports, the time step used in forcing functions and similar information, provide a computer printout of input and output for the Locked Rotor saturated steam case analysis.

SCE Response

One copy of the computer printout of input and output for the Locked Rotor saturated steam case analysis is attached herewith. For easy reference, parameters of interest are summarized in the following:

1. Stiffness values of supports

   10^{10} lb/in translational

   10^{10} in-lb/rad rotational

2. Calculated values of support load

   Please see Table 3 in Enclosure 2 of the December 2, 1982 submittal.

3. Time step used in forcing functions

   0.0001 sec. was specified for integration steps.

NRC Question No. 13

The submittal does not make clear whether flexibility at the connection locations to the pressurizer and discharge tanks was considered in the development of the structural model. Explain how this flexibility was treated in the piping model.

SCE Response

The connection locations to the pressurizer and discharge tank were treated in the piping model as six springs with stiffness values of 10^{10} lb/in for three translational directions and 10^{10} in-lb/rad for three rotational directions.

NRC Question No. 14

Section 3.1, pg. C-8, of the submittal states that an opening of the PORV's does not require analysis because the PORV opening time is much slower than that of the safety valves. Thus, the safety/relief valve system was not analyzed for a PORV opening, and the PORV piping was ignored in the structural analysis. The PORV piping is, however, constructed of smaller size piping and is arranged in a different configuration from that of the safety valve piping. Additionally, the PORV piping ties into a header that is common with the safety valve piping, creating a complex interactive piping system. Thus, it is not obvious on the basis of relative opening times alone that the PORV piping can be ignored. Provide a more thorough evaluation of the safety of the PORV piping.

SCE Response

The PORV piping has been combined with the safety valve piping for the time history structural analysis since the submitting of SCE report on December 2, 1982. In addition to the valve actuation analysis, loading cases of seismic, thermal and weight have also been analyzed. Results of code criterion evaluation are listed in the attached tables.

Table PORV DISCHARGE PIPING STRESS EVALUATION

NODAL PT.	TYPE OF COMPONENT	PRESSURE STRESS S_{LP}	DEADWEIGHT LOAD, M_A (IN-#)	OCCASIONAL LOAD (IN-#) M_B			$S_{OL} = S_{LP} + .75\,i\,\frac{M_A + M_B}{Z_p}$ PSI	REMARKS
				OBE (M_{R1})	VALVE ACTUATION (M_{R2})	$M_B = \sqrt{M_{R1}^2 + M_{R2}^2}$		
100	4" NTEE SCH 40	2373	278	2129	9777	10006	5857	$S_{OL} < S_{ALLOW}$ ∴ SATISFACTORY
102	4" B.W. ELL SCH 40	2373	490	2508	7374	7788	4951	"
105	"	2373	697	842	9737	9773	5634	"
109	"	2373	546	904	12219	12252	6359	"
51	10" REINF. TEE SCH 40 te=.345	2373	2547	4335	33205	33486	25019	"
78	2" SW TEE SCH 160	4315	802	5427	3157	6278	11546	"
111	2" B.W. JT. SCH 160	4315	2113	4049	1604	4355	10921	"
117	2" BW JT SCH 40	1927	2615	4254	2349	4859	15249	"
119	4"x2" RED. SCH 40	1927	2135	3468	2728	4412	13597	"

DWG. NO.

NODAL PT	TYPE OF COMPONENT	PRESSURE STRESS S_{LP}	DEADWEIGHT LOAD, M_A (IN-#)	OCCASIONAL LOAD (IN-#) M_B: OBE (M_{R1})	VALVE ACTUATION (M_{R2})	$M_B = \sqrt{M_{R1}^2 + M_{R2}^2}$	$S_{OL} = S_{LP} + .75 i \frac{M_A + M_B}{Z_p}$ PSI	REMARKS
133	3" PRES. NOZ. SCH 160	4994	3098	14699	4737	15442	5000	$S_{OL} < S_{ALLOW}$ ∴ SATISFACTORY
75	2" SW REDUCING COUPLING SCH 160	4315	1119	8813	836	8852	14499	"
76	2" SW TEE SCH 160	4315	570	3832	959	3950	8931	"
76	"	4315	868	3845	1364	4079	9338	"
78	"	4315	1610	4327	2005	4768	10829	"
80	2" SW ELBOW SCH 160	4315	677	3639	1581	3967	9058	"
83	2" BW JT. SCH 160	4315	2320	6032	796	6084	12899	"
87	"	4315	1661	2794	920	2941	9015	"
89	2" BW JT. SCH 40	1927	779	1673	1160	2035	6950	"
91	4×2" RED. SCH 40	1927	144	2177	1570	2684	6977	"
97	4" BW ELL SCH 40	2373	96	1538	3090	3451	3989	"

$S_{ALLOW} = 1.8\,S_h$

$= 1.8(16760) = 30168$ PSI FOR A312 TP 316

$= 1.8(15000) = 27000$ PSI FOR A106 GR. B

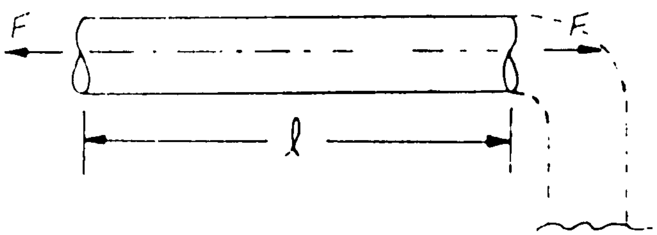
NRC Question No. 15

In the structural analysis only a net "wave" force was applied to each bounded segment of straight pipe. Applying only a wave force on a pipe segment, however, ignores axial extension that is caused by opposing blowdown forces acting at the ends of the segment. This axial extension induces bending moments on pipe segments adjacent to the bounded segment in question. Explain how such axial extension was accounted for in the analysis.

SCE Response

Based on experience in piping design, stresses and moments induced by "axial extension" on the bounded pipe segment or its adjacent segments are small when compared to the same quantities obtained from pipe flexibility analysis which treats piping segments as structural elements.

For clarity, the maximum pipe strain caused by axial extension is calculated for both 6" piping and 10" common header.



$$\epsilon = \frac{\delta}{l} = \frac{F}{A_m E}$$

Where

δ = pipe deflection due to the axial extension, in

l = length of piping, in

F = axial force, lb_f

A_m = cross section of piping, in

E = Young's modulus of the piping material, lb_f/in^2

From computer output, the largest axial piping reaction is at nodes 72 and 65 with values of $16{,}330^{lb}$ and $13{,}520^{lb}$, respectively. The corresponding pipe strains are:

$$\epsilon = \frac{16300}{5.58 \times 27.9 \times 10^6}$$

$= 0.0105\%$ for 6" pipe

$$\epsilon = \frac{13520}{11.91 \times 27.9 \times 10^6}$$

$= 0.0041\%$ for 10" pipe

These values for strain and resulting pipe deflections are small and acceptable.

NRC Question No. 16

The submittal does not discuss the method used for modeling the safety valves. Of particular concern is the portion of the valve that lies off the main axis of the piping. The flexibility of this part of the valve structure should be accounted for in the model if its natural frequencies could potentially be excited by piping or support motion. Describe the methods used to represent the valves in the piping model.

SCE Response

The method used to represent the valves in the piping model is to consider each as a piping segment with the same diameter and wall thickness as its connecting pipe. In this way, the flexibility of the whole valve is accounted for in the piping model. Therefore, its natural frequencies can be excited by piping motion and conservative results are obtained for dynamic loadings such as valve-actuation transients and seismic events.

NRC Question No. 17

Based on diagrams of the structural model that were provided in the submittal, the spacing between lumped masses appears to be far enough that the higher frequency response of the piping system will be precluded from the solution. Thus, though the solution time step (0.0001 s) is quite fine and would allow for contributions from the higher modes, the spacing between lumped masses would seem to eliminate these contributions. Explain how the nodal spacing in the piping model was established.

SCE Response

The nodal spacing in the piping was established based on the consideration that the entire response of the piping system at all frequencies under 33 Hertz should be included in the solution. It is noted that the figures provided with the December 2, 1982 submittal did not accurately indicate the linear distance between the nodes. However, the largest nodal spacing was 6.12' between nodes 46 and 73 for the 6" pipe and 4.90' between nodes 67 and 68 for the 10" common header. This nodal spacing is consistent with the above statement that the entire response of the piping system should be observed.

NRC Question No. 18

The submittal does not discuss the results of the stress analysis on the piping upstream of the safety valves. Identify the governing Code, the applicable criteria from the Code, and the load combinations used in the analysis of this portion of the piping. Also, provide an evaluation of the stresses relative to the Code requirements.

SCE Response

NUREG-0737 requested all operating plant owners to verify the designed performance of pressurizer safety/relief valves and the integrity of discharge piping. As concluded in several workshop meetings, all utility companies understood that the upstream piping was not in the scope. Therefore, no results of the stress analysis was discussed in the submittal. However, in analyzing the discharge piping, upstream piping was also included because a complete problem in piping stress analysis is from anchor (pressurizer nozzle) to anchor (relief tank nozzle).

The whole system was analyzed using ANSI B31.1 Code based on 10 CFR, Part 50. Load combinations consist of weight, thermal expansion, seismic and valve actuation loadings. A summary table of the upstream piping is attached.

SHEET OF SHEET

ENGINEERING DEPARTMENT

CALCULATION SHEET

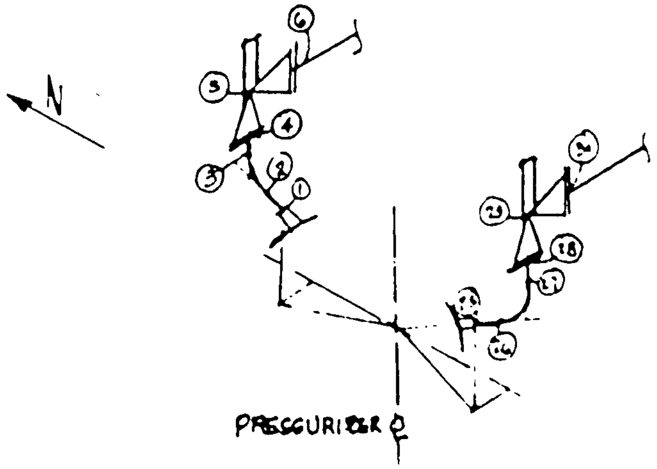
SUBJECT: S/R VALVE DISCHARGE PIPING (SONGS-1) DESIGN CALCULATION NO. DC ______ - ______

J.O. NO. 7764 MADE BY [signature] DATE 5/22/85 CHK. BY [signature] DATE 5/22/8

TABLE - R-1

VALVE-ACTUATION LOADS ON S/R VALVE UPSTREAM PIPING

NODAL PT.	PIPING REACTIONS						REMARKS
	FORCES (LBS.)			MOMENTS (IN-LBS)			
	F_{AXIAL}	F_Y	F_Z	$M_{TORSION}$	M_Y	M_Z	
1	1295	2559	2714	16430	25780	21460	3" PRESSURIZER NOZ.
2	1295	2559	2714	16430	19000	18040	
3	2681	2862	6253	6566	13440	16400	
4	2681	2823	625	6566	8722	9661	3" INLET FLANGE
5	2679	2823	572	6566	5151	36130	
6	2761	2676	463	5151	3840	20670	6" OUTLET FLANGE
25	808	1167	2281	38510	31400	22950	3" PRESSURIZER NOZ
26	807	1167	2281	38510	25620	19540	
27	818	2355	957	14790	25760	32850	
28	813	2299	853	14790	21420	24440	3" INLET FLANGE
29	813	2299	853	14790	18670	28100	
30	2193	808	633	18670	12680	24990	6" OUTLET FLANGE



DWG. NO.

SHEET OF SHEETS

ENGINEERING DEPARTMENT

CALCULATION SHEET

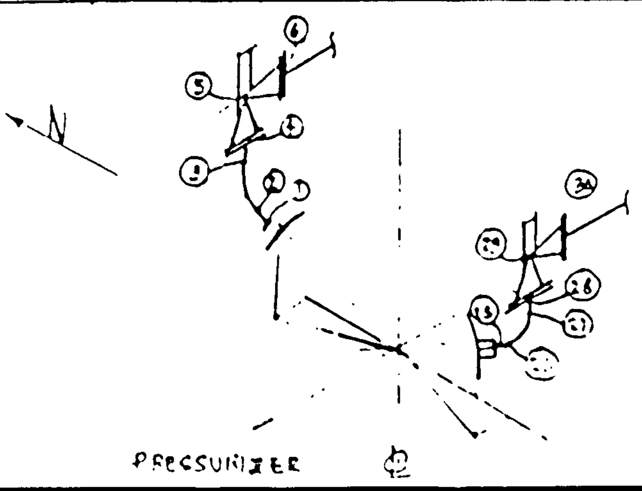
SUBJECT: S/R VALVE DISCHARGE PIPING (SONGS-1) DESIGN CALCULATION NO. DC ______ - ______

J.O. NO. 7764 MADE BY [signature] DATE 5/24/85 CHK. BY [signature] DATE 5/24/85

TABLE - R-2

DEADWEIGHT LOADS ON S/R VALVE UPSTREAM PIPING

NODAL PT	PIPING REACTIONS						REMARKS
	FORCES (LBS)			MOMENTS (IN-LBS)			
	F AXIAL	F_Y	F_Z	$M_{TORSION}$	M_Y	M_Z	
1	-269	-234	88	464	-793	-806	3" PRESSURIZER NOZ.
2	-266	-231	88	464	-574	-224	
3	-346	25	88	38	-455	158	
4	-332	-91	-4	38	-43	844	3" INLET FLANGE
5	-816	-91	-4	38	-76	1197	
6	91	179	-4	76	2	-517	6" OUTLET FLANGE
25	-413	-398	14	1025	-121	-765	3" PRESSURIZER NOZ
26	-410	-395	14	1025	-80	425	
27	-563	11	14	686	-738	1138	
28	-549	10	-14	686	1180	261	3" INLET FLANGE
29	-533	10	-14	686	1045	170	
30	-10	-37	-14	-1045	542	624	6" OUTLET FLANGE



DWG NO

ENGINEERING DEPARTMENT

CALCULATION SHEET

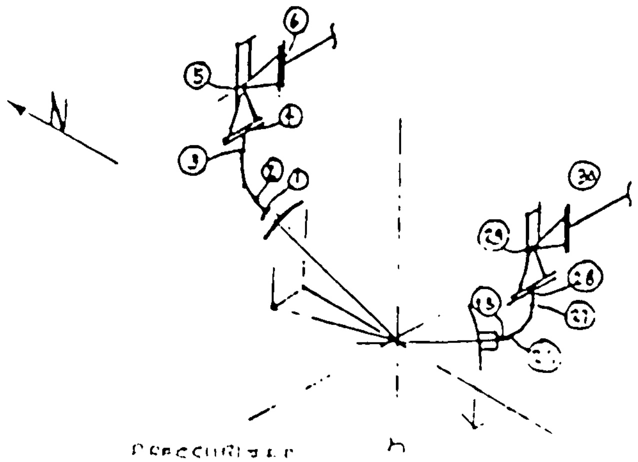
SUBJECT: S/R VALVE DISCHARGE PIPING (SONGS-1) DESIGN CALCULATION NO. DC – –

J.O. NO. 7764 MADE BY [signature] DATE 5/24/85 CHK. BY [signature] DATE 6/24/85

TABLE – R-3

THERMAL EXP (COLD) LOADS ON S/R VALVE UPSTREAM PIPING

NODAL PT	PIPING REACTIONS						REMARKS
	FORCES (LBS)			MOMENTS (IN-LBS)			
	F AXIAL	F_Y	F_Z	$M_{TORSION}$	M_Y	M_Z	
1	-1126	-554	792	18357	-32152	6727	3" PRESSURIZER NOZ.
2	-1126	-554	792	18357	-30171	8113	
3	-1188	404	793	-7315	-31796	8368	
4	-1188	-879	139	-7316	3121	-24852	3" INLET FLANGE
5	-1188	-879	139	-7316	4427	-16614	
6	879	-1188	139	-4427	-5923	-4733	6" OUTLET FLANGE
25	-1283	-300	-174	-12619	33022	35842	3" PRESSURIZER NOZ
26	-1283	-300	-174	-12619	32500	36743	
27	-1120	695	-174	13838	31355	36000	
28	-1120	-380	-607	13836	19042	-37493	3" INLET FLANGE
29	-1120	-380	-607	13836	13349	-33929	
30	380	-1120	-607	-13349	7763	-22733	6" OUTLET FLANGE



PRESSURIZER

SHEET OF SHEETS

ENGINEERING DEPARTMENT

CALCULATION SHEET

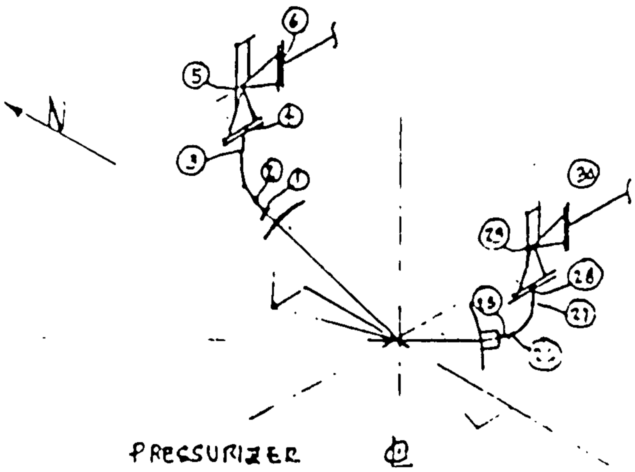
SUBJECT: S/R VALVE DISCHARGE PIPING (SONGS-1) DESIGN CALCULATION NO. DC ______ - ______

J.O. NO. 7764 MADE BY [signature] DATE 5/24/85 CHK. BY [signature] DATE 5/24/85

TABLE - R-4

THERMAL EXP (HOT) LOADS ON S/R VALVE UPSTREAM PIPING

NODAL PT	PIPING REACTIONS						REMARKS
	FORCES (LBS)			MOMENTS (IN-LBS)			
	F AXIAL	Fy	Fz	M TORSION	My	Mz	
1	-751	222	-624	-15976	-19240	30259	3" PRESSURIZER NOZ.
2	-751	222	-624	-15976	-20800	-2774	
3	-374	689	-624	-26828	-5415	26000	
4	-374	381	848	-26828	-17266	-17248	3" INLET FLANGE
5	-374	381	848	-26828	-9315	-20817	
6	-381	-374	848	9315	-18347	-17078	6" OUTLET FLANGE
25	248	-1007	204	-30959	3285	-16269	3" PRESSURIZER NOZ
26	248	-1007	.204	-30959	-13248	-5376	
27	-537	-887	205	-18859	25301	-9723	
28	-536	469	781	-18860	-9977	-25312	3" INLET FLANGE
29	-536	469	781	-18860	-2656	-29706	
30	-469	-536	781	2656	-11051	-29706	6" OUTLET FLANGE



PRESSURIZER

DWG. NO.

ENGINEERING DEPARTMENT

CALCULATION SHEET

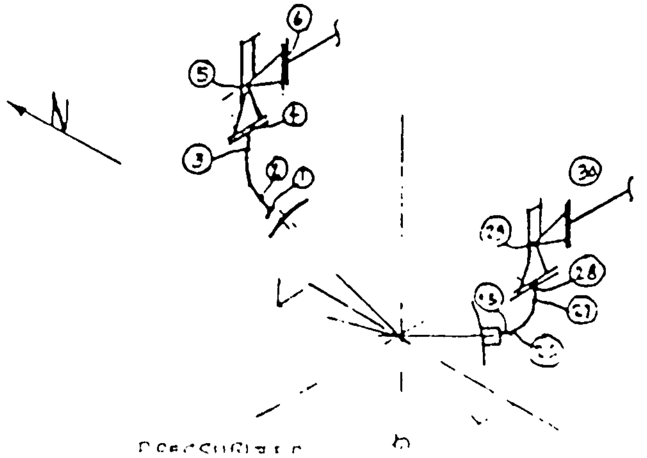
SUBJECT S/R VALVE DISCHARGE PIPING (SONGS-1) DESIGN CALCULATION NO. DC ______ - ______

J.O. NO. 7764 MADE BY [signature] DATE 5/24/85 CHK. BY [signature] DATE 5/24/85

TABLE - R - 5

SEISMIC (OBE) LOADS ON S/R VALVE UPSTREAM PIPING

NODAL PT	PIPING REACTIONS						REMARKS
	FORCES (LBS)			MOMENTS (IN-LBS)			
	F AXIAL	FY	FZ	M TORSION	MY	MZ	
1	178	203	178	1733	2213	4384	3" PRESSURIZER NOZ.
2	178	203	177	1733	1777	3880	
3	79	188	269	410	3266	1902	
4	79	186	266	410	911	479	3" INLET FLANGE
5	57	72	32	1697	410	1557	
6	55	74	21	1697	287	876	6" OUTLET FLANGE
25	167	231	181	2034	2557	4688	3" PRESSURIZER NOZ
26	167	231	181	2034	2017	4012	
27	51	191	274	662	3239	2130	
28	50	188	270	662	916	833	3" INLET FLANGE
29	36	39	24	1908	662	1662	
30	29	39	26	1908	594	1511	6" OUTLET FLANGE



PRESSURIZER

ENGINEERING DEPARTMENT

CALCULATION SHEET

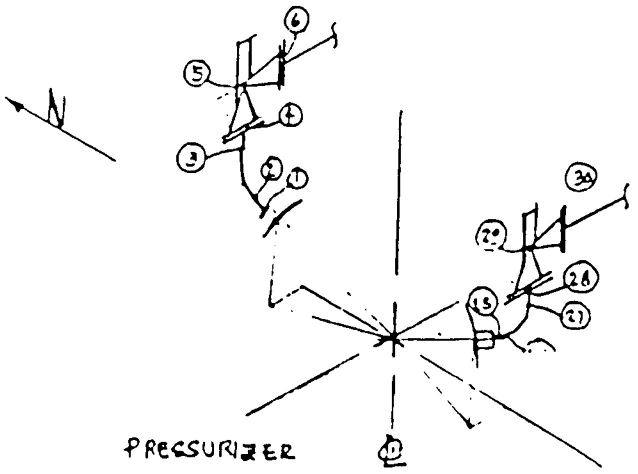
SUBJECT: S/R VALVE DISCHARGE PIPING (SONGS-1) DESIGN CALCULATION NO. DC ______ - ______

J.O. NO. 7764 MADE BY [signature] DATE 5/24/85 CHK. BY [signature] DATE 5/24/8_

TABLE - R-6

SEISMIC (DBE) LOADS ON S/R VALVE UPSTREAM PIPING

NODAL PT	PIPING REACTIONS: FORCES (LBS) F AXIAL	FY	FZ	MOMENTS (IN-LBS) M TORSION	MY	MZ	REMARKS
1	1062	1217	975	11520	12940	27510	3" PRESSURIZER NOZ.
2	1062	1216	975	11520	10500	24630	
3	456	1007	1612	3741	20840	11450	
4	456	1007	1612	3741	6726	3514	3" INLET FLANGE
5	470	420	228	9310	3741	7562	
6	459	432	163	931	275	365	6" OUTLET FLANGE
25	1274	1782	1267	13880	18570	35290	3" PRESSURIZER NOZ
26	1273	1782	1267	13880	14890	29950	
27	361	1320	2103	6128	24540	14590	
28	359	1311	2086	6128	6618	6036	3" INLET FLANGE
29	251	266	214	15240	6128	11940	
30	200	265	248	15240	4984	1096	6" OUTLET FLANGE



DWG. NO.

NRC Question No. 19

For piping downstream of the safety valves, the operating basis earthquake (OBE) loading was not combined with the dynamic loads from the safety or relief valve discharge. The rationale for not combining these loads was that the downstream piping is non-safety related and that the probability of a seismic event coinciding with a safety valve actuation is extremely low. According to the requirements of the governing ANSI B31.1 Code, however, the discharge transient loads and the earthquake loads should both be included in the stress calculation equation (Equation 12). Thus, though a simultaneous occurrence of these loads is not highly probable, they would be combined to meet governing criteria. In addition, a load combination in which safe shutdown earthquake (SSE) loads are combined with safety/relief valve fluid transient loads (as a faulted condition in Westinghouse report WCAP 10105) for the upstream piping should be considered. It is not clear whether the seismic loads mentioned in the submittal pertain to a safe shutdown earthquake. Present an assessment of the downstream piping whereby OBE loads are included. Verify that the load combinations on the upstream piping include a case in which SSE loads are combined with safety/relief valve loads. Identify the allowable stress limits used for this case.

SCE Response

Discharge piping system of the safety and relief valves in San Onofre Unit 1 is a closed system. It is an industry practice that the moments produced by valve actuation are not combined with seismic loading for a system of this nature.

However, responsive to your request, the results of combining OBE and valve actuation loadings are presented in the tables attached. The criterion as specified in Equation (12) of the governing ANSI B31.1 Code has been met.

Results of load combination on the upstream piping including the case in which SSE loads are combined with S/R valve loads are also attached. An allowable stress of $2.4S_h$ is used for this case.

Table Pressurizer S/R V Discharge Piping

NODE PT.	TYPE OF COMPONENT	S_{LP} PSI	M_A (WEIGHT) IN-LBS	OBE MOMENTS (IN-#)				VALVE ACTUATION MOMENTS (IN-#)				M_B $\sqrt{①^2+②^2}$ IN-LBS	EQUA. 12 $S_{LP} + .75 i \frac{M_A + M_B}{Z_p}$	REMARKS
				T_x	M_y	M_z	SRSS ①	M_x	M_y	M_z	SRSS ②			
1	3" STE. ... SCH 160	4994	1222	8475	11540	2032	14695	16430	25790	21460	37350	40139	19375	< 27000 psi ∴ SATISFACTORY
11	6" SCH 40 5D BEND	2957	626	437	959	[illegible]	2286	26260	4359	27640	38374	38442	7553	
12	"	2957	1244	1586	1746	1435	2760	[illegible]	[illegible]	20550	40004	40099	7820	
14	"	2957	1367	1586	1127	2597	3705	14900	35910	21166	41866	42030	8062	
15	"	2957	2534	571	1493	1258	2034	15860	21560	1357	31826	31891	7007	
20	"	2957	4129	826	1507	1587	2339	[illegible]	14270	33720	37532	37606	7867	
24	16" PRING TEE SCH 40 ...	2957	[illegible]	1035	1812	2385	3169	15350	65080	54220	[illegible]	66144	23850	
72	6" SCH 40 PIPE	2957	5649	[illegible]	1194	1910	2304	16330	30780	49790	[illegible]	[illegible]	10787	
25	3" ... SCH 160	[illegible]	1264	2034	2557	4663	5714	36510	3460	22350	54732	55030	24574	
32	6" SCH 40 ELL	2957	1544	1064	9.4	1655	2173	15810	13420	14910	2554	25633	8400	
36	6" SCH 40 5D BEND	2957	1185	675	1107	1749	2177	50500	23700	40270	51061	51108	9109	
37	"	2957	1835	1046	1519	1176	2405	16910	4110	26140	53296	53341	9455	

WHERE: $S_{LP} = \frac{PD}{4t}$, P = 500 PSI

M_B — RESULTANT MOMENTS DUE TO OBE & VALVE ACTUATION

i — STRESS INT. FACTOR

Z_p — PIPE SECTION MODULUS

ENGINEERING DEPARTMENT

CALCULATION SHEET

SUBJECT: S/P VALVE DISCHARGE PIPING (SONGS-1)

J.O. NO 7764 MADE BY A. ESCARIO DATE 5/20/85 CHK. BY [illegible] DATE 5/21/85

DESIGN CALCULATION NO. DC - SHEET OF SHEETS

NODE PT.	TYPE OF COMPONENT	S_{LP} PSI	M_A (WEIGHT) IN-LBS.	OBE MOMENTS (IN-#)				VALVE ACTUATION MOMENTS (IN-#)				M_B $\sqrt{①^2+②^2}$ IN-LBS	EQUA. 12 $S_{LP} + .75i \frac{M_A+M_B}{Z_p}$	REMARK.
				T_x	M_y	M_z	SRSS ①	M_x	M_y	M_z	SRSS ②			
39	6" SCH 40 90° BEND	2957	1465	1046	1601	1085	2203	18910	39270	[illegible]	50530	[illegible]	9079	< 27000 PSI [illegible]
45	"	2957	4451	-12	1792	1063	2203	10620	17550	58160	61671	61710	10740	
73	6" SCH 40 PIPE	2957	6515	882	976	225	1334	31420	26940	[illegible]	97842	[illegible]	14647	
43	6" BUTT TEE SCH 40 [illegible]	2957	2685	[illegible]	[illegible]	1221	2459	13500	40110	55330	76230	[illegible]	21637	
62	10" SCH 40 90° BEND	3681	5181	[illegible]	[illegible]	4191	6645	140400	183400	[illegible]	[illegible]	[illegible]	11978	
63	"	3681	3817	2961	4315	3343	6162	139700	148400	74980	217165	[illegible]	11074	
71	10" [illegible] SCH 40	3681	7842	[illegible]	1063	7778	[illegible]	66050	207600	147600	263146	[illegible]	12748	

WHERE: $S_{LP} = \frac{PD}{4t}$

M_A - RESULTANT MOMENTS DUE TO WEIGHT

M_B - RESULTANT MOMENTS DUE TO OBE & VALVE ACTUATION

ALLOWABLE STRESS = 1.8 S_h = 27000 PSI FOR A-106 GR B

i - STRESS INT. FACTOR

Z_p - PIPE SECTION MODULUS PSI.

ENGINEERING DEPARTMENT

CALCULATION SHEET

SUBJECT: S/S [illegible] PIPING SONGS-1

DESIGN CALCULATION NO. DC

MADE BY [illegible] DATE 5/28/85 CHK. BY [illegible] DATE [illegible]

Table Occasional Load Evaluation for Upstream Piping

NODAL PT	TYPE OF COMPONENTS	PRES. STRESS $S_{LP} = \frac{PD_o}{4t}$	DW STRESS $S_W = \frac{M_A}{Z_p}$	DYNAMIC LOAD (IN-LBS) SSE (M_{R1})	VALVE ACTUATION (M_{R2})	M_B $\sqrt{M_{R1}^2 + M_{R2}^2}$	COMBINED STRESS $S_p + .75i\left(S_W + \frac{M_B}{Z_p}\right)$	REMARKS
1	3" PRES. NOZ SCH. 160	4994	642	32510	37350	49516	22852	< 2.4 S_h = 40224 ∴ SATISFACTORY
2	3" L.R. ELL SCH 160	4994	454	29147	30925	42495	20223	"
3	3" L.R. ELL SCH 160	4994	347	24070	22196	32741	16725	"
4	3" FLG. JT.			7696	14578	16484		"
5	VALVE BODY			12564	37081	39151		"
6	6" PIPE SCH 40	2957	98	1037	21645	21665	5604	
25	3" PRES. NOZ SCH 160	4994	2643	42224	54732	69126	31672	
26	3" L.R. ELL SCH 160	4994	2443	36212	50211	61906	28962	"
27	3" L.R. ELL SCH. 160	4994	2293	29199	[illegible]	53047	25721	"
28	3" FLG JT.			10086	35705	37102		"
29	VALVE BODY			20306	36836	42062		"
30	6" PIPE SCH 40	2957	476	16071	33672	37310	7822	< 2.4 S_h = [illegible] ∴ SATISFACTORY

NOTE: $.75i \leq 1.0$

S_h = 16760 PSI @ 640°F (A312 TP316)

NRC Question No. 20

In the stress analysis of the piping system, only the stresses due to primary loads were evaluated. The secondary stresses, particularly due to thermal expansion, should also be considered in accordance with Equations 13 and 14 of the ANSI B31.1 Code. Provide an evaluation of these secondary stresses.

SCE Response

The secondary stresses due to thermal expansion were calculated for the San Onofre Unit 1 pressurizer safety/relief valve discharge piping in the return to service (RTS) task of 1984. A summary of thermal stresses for the most severe loading condition is attached. The maximum stress is 31,742 psi at the junction of RV 533 piping and common header. It is caused by the 1.93" upward movement of the pressurizer nozzle when upstream piping of the safety valve is at 640^{o}F and downstream 100^{o}F.

SECONDARY STRESSES EVALUATION

DATA PT.	COMPONENT TYPE & MAT'L.	OUTSIDE DIAMETER D_o	NOM. THICK. t_n	DESIGN PRES. P	DESIGN TEMP. CASE-1 / CASE-2	PIPE STRESSES W/ SIF APPLIED: LONG. PRES. STRESS (S_L)	WEIGHT STRESS (S_W)	THER. EXP. STRESS (S_E)	STRESS RATIO: $\frac{S_E}{S_A}$	$\frac{S_L+S_W+S_E}{S_A+S_h}$	REMARKS
1	3" PRES. NOZ. A-312 TP-316	3.5	.437	2500	640 / 640	5005	425	13633 / 13068	0.49	0.43	PASSED
2	3" SCH.160 ELL A-312 TP-316	3.5	.437	2500	640 / 640	5005	268	13761 / 12385	0.50	0.43	"
22	6" 5D BEND SCH 40 A-106 GR B	6.625	.28	500	470 / 100	2957	650	13673 / 3876	0.61	0.46	"
24	10" RTEE SCH 40 A-106 GR. B	10.75	.365	500	470 / 100	3681	526	18795 / 4833	0.84	0.61	"
25	3" PRES. NOZ. A-312 TP-316	3.5	.437	2500	640 / 640	5005	446	12199 / 17483	0.63	0.52	"
26	3" SCH 160 ELL A-312 TP-316	3.5	.437	2500	640 / 640	5005	386	11773 / 17591	0.64	0.52	"
32	6" SCH 40 ELL A-106 GR. B	6.625	.28	500	470 / 100	2957	310	7454 / 11479	0.51	0.39	"
49	10" RTEE SCH 40 A-312 TP-316	10.75	.365	500	470 / 100	3681	617	26717 / 4449	0.96	0.70	"

WHERE:

$S_A = f(1.25 S_c + .25 S_h)$

$f = 1.0$

S_c – MAT'L ALLOW. @ COLD TEMP.

S_h – MAT'L ALLOW. @ HOT TEMP.

$S_L = \frac{P D_o}{4 t_n}$

$S_W = \frac{.75 i M_A}{Z}$

$S_E = \frac{i M_c}{Z}$

	PIPE MATERIALS: A-312 TP 316	A-106 GR B	A-234 WPB
S_c	18800	15000	17500
S_h	1676 @ 640°F	15000 @ 470°F	17500 @ 470°F
S_A	27690	22500	26250
$S_A + S_h$	44450	37500	43750

SEE POWER PIPING CODE (ANSI/ASME B31.1 1980 SECTION 104) FOR DEFINITION OF OTHER NOTATION.

ENGINEERING DEPARTMENT
CALCULATION SHEET

SUBJECT S/R VALVE DISCH. PIPING (SONGS-1)
J.O. NO.
DESIGN CALCULATION NO. DC
MADE BY A ESCARIO DATE 5/13/85
CHK. BY [signature] DATE 5/13/85

DWG. NO.

ENGINEERING DEPARTMENT
CALCULATION SHEET

SUBJECT: S/R VALVE DISCH. PIPING (SONGS-1)
J.O. NO.
MADE BY A. ESCARIO DATE 5/13/85
DESIGN CALCULATION NO. DC
CHK BY [illegible] DATE 5/13/85

SECONDARY STRESSES EVALUATION

DATA PT.	COMPONENT TYPE & MAT'L.	OUTSIDE DIAMETER D_o	NOM. THICK. t_n	DESIGN PRES. P	DESIGN TEMP. CASE-1 / CASE-2	PIPE STRESSES W/ SIF APPLIED: LONG. PRES. STRESS (S_L)	WEIGHT STRESS (S_W)	THER. EXP. STRESS (S_E)	STRESS RATIO: $\frac{S_E}{S_A}$	$\frac{S_L+S_W+S_E}{S_A+S_h}$	REMARKS
24	10" STEEL SCH-40 A-106 GR B	10.75	.365	500	470 / 100	3681	75	31742 / 6159	1.41	0.95	PASSED
60	10" SCH. 40 ELL A-106 GR B	10.75	.365	500	470 / 100	3681	285	14653 / 4659	0.65	0.50	"
75	SOCKET WELD A-312 TP 316	2.375	.343	2500	640 / 640	4327	1143	20499 / 24736	0.89	0.68	"
76	SOCKET WELD A-312 TP 316	2.375	.343	2500	640 / 640	4327	887	18322 / 23463	0.85	0.65	"
78	SOCKET WELD A-312 TP 316	2.375	.343	2500	640 / 640	4327	1894	27838 / 29929	1.08	0.813	"
80	SOCKET WELD A-312 TP 316	2.375	.343	2500	640 / 640	4327	692	20647 / 21937	0.79	0.606	"
83	SOCKET WELD A-312 TP 316	2.375	.343	2500	640 / 640	4327	3378	13795 / 14140	0.51	0.49	"
91	4"x2" CONC. RED A-234 WPB	4.5 / 2.375	.237 / .154	500	470 / 100	2373 / 1927	257	11224 / 16533	0.63	0.44	"

WHERE:

$S_A = f(1.25 S_c + .25 S_h)$

$f = 1.0$

S_c – MAT'L ALLOW @ COLD TEMP.

S_h – MAT'L ALLOW. @ HOT TEMP.

$S_L = \frac{P D_o}{4 t_n}$

$S_W = \frac{.75\, i\, M_A}{Z}$

$S_E = \frac{i\, M_c}{Z}$

	PIPE MATERIALS		
	A-312 TP 316	A-106 GR B	A-234 WPB
S_c	18800	15000	17500
S_h	16760 @ 640°F	15000 @ 470°F	17500 @ 470°F
S_A	27690	22500	26250
$S_A + S_h$	44450	37500	43750

SEE POWER PIPING CODE (ANSI/ASME B31.1 1980 SECTION 104) FOR DEFINITION OF OTHER NOTATION.

```
*A START JOB 7399 SCE8490LC 1     001 001 REMOTE12 CHEN     ROOM E215   7.58.05 AM 03 MAY 84 R12.PR1   0081 START A*
*A START JOB 7399 SCE8490LC 1     001 001 REMOTE12 CHEN     ROOM E215   7.58.05 AM 03 MAY 84 R12.PR1   0081 START A*
*A START JOB 7399 SCE8490LC 1     001 001 REMOTE12 CHEN     ROOM E215   7.58.05 AM 03 MAY 84 R12.PR1   0081 START A*
*A START JOB 7399 SCE8490LC 1     001 001 REMOTE12 CHEN     ROOM E215   7.58.05 AM 03 MAY 84 R12.PR1   0081 START A*
*A START JOB 7399 SCE8490LC 1     001 001 REMOTE12 CHEN     ROOM E215   7.58.05 AM 03 MAY 84 R12.PR1   0081 START A*
*A START JOB 7399 SCE8490LC 1     001 001 REMOTE12 CHEN     ROOM E215   7.58.05 AM 03 MAY 84 R12.PR1   0081 START A*
```

SONGS 1

Pressurizer

S/V Discharge Piping

NEWS

Valve-Actuation

Time-History

Analysis

1. 1% Damping
2. with 2 snubbers removed

FOR THE ENGINEERING POD PLEASE CALL PAX 24446
FOR DATA PROCESSING POD PLEASE CALL PAX 26075
THE USER COMPUTING CENTER NUMBER IS PAX 26559

J E S 2   J O B   L O G -- S Y S T E M   A C 6 1 -- N O D E   R S M 0 2

```
01.21.09 JOB 7399 $HASP373 SCE840LC STARTED - INIT 12 - CLASS C - SYS AC61
01.21.09 JOB 7399  JOB  SCE840LC STARTED    LMT=00:30:00 01.21.09  3 MAY 84
01.21.10 JOB 7399  STEP PROCUSE  SCE840LC   CPU 00:00:00 01.21.10 CC=0000
01.21.11 JOB 7399  STEP INFO     SCE840LC   CPU 00:00:00 01.21.11 CC=0000
01.21.13 JOB 7399 *IEF233A M 588,PRIVAT,SL,SCE840LC,GO,PLOT.NONE
01.21.20 JOB 7399  $HASP375 SCE840LC ESTIMATED LINES EXCEEDED
01.30.18 JOB 7399  $HASP375 SCE840LC ESTIMATE EXCEEDED BY      10,000 LINES
01.30.54 JOB 7899  $HASP375 SCE840LC ESTIMATE EXCEEDED BY      20,000 LINES
01.31.28 JOB 7399  $HASP375 SCE840LC ESTIMATE EXCEEDED BY      30,000 LINES
01.31.33 JOB 7399  IEF234E K 588,,PVT,SCE840LC,GO
01.31.38 JOB 7399  STEP GO       SCE840LC   CPU 00:07:45 01.31.39 CC=0000
01.31.38 JOB 7399  JOB  SCE840LC ENDED      CPU 00:07:45 01.31.39  3 MAY 84
01.31.39 JOB 7399 &$HASP395 SCE840LC ENDED
```

------ JES2 JOB STATISTICS ------

```
 03 MAY 84 JOB EXECUTION DATE

       345 CARDS READ

    33,337 SYSOUT PRINT RECORDS

         0 SYSOUT PUNCH RECORDS

 3,635,881 SYSOUT SPOOL BYTES

     10.50 MINUTES EXECUTION TIME
```

```
1    //SCE340LC JOB (7533376930,E215),CHEN,CLASS=C,TIME=30,REGION=2043K,     JOB 7899
     // MSGLEVEL=1,MSGCLASS=A
     ***XEQ RSM02                               SCE GENERATED STATEMENT
     ***JOBPARM SYSAFF=(AC81,5031)              SCE GENERATED STATEMENT
     ***LOGONID  ECMECH     $ACF1773 LOGONID SUCCESSFULLY SCANNED
     ***PASSWORD  $ACF177C PASSWORD(S) SUCCESSFULLY SCANNED
     ***ROUTE  PRINT REMOTE12
2    //GO EXEC    SCE9947,GPGM=P947
3    XXSCER947    PROC  GPGM=P947,GTIME=30,PRCLASS=A,PLOTNAM=NONE
     ***
     ***          SAP V2 - PAP V2 - PIPING ANALYSIS PROGRAM
     ***
4    XXPROGUSE    EXEC  PGM=P050,PARM=&GPGM
5    XXSTEPLIB    DD    DSN=SCE.PROD.LOAD,DISP=SHR
6    XXFT01F001   DD    DSN=SCE.PROGUSE.DATA,DISP=SHR
7    XXFT06F001   DD    SYSOUT=&PRCLASS
     ***
8    XXINFO       EXEC  PGM=IEBGENER
9    XXSYSPRINT   DD    DUMMY
10   XXSYSIN      DD    DUMMY
11   XXSYSUT1     DD    DSN=SCE.INFO.DATA,DISP=SHR
12   XXSYSUT2     DD    SYSOUT=&PRCLASS,DCB=(RECFM=FA,BLKSIZE=80)
     ***
13   XXGO         EXEC  PGM=&GPGM,TIME=&GTIME
14   XXSTEPLIB    DD    DSN=SCE.PROD.LOAD,DISP=SHR
15   XXFT01F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
16   XXFT02F001   DD    UNIT=SYSDA,SPACE=(CYL,(50,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
17   XXFT03F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
18   XXFT04F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5),RLSE),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
19   XXFT05F001   DD    DDNAME=SYSIN
20   XXFT06F001   DD    SYSOUT=&PRCLASS
21   XXFT07F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
22   XXFT08F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
23   XXFT08F002   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
24   XXFT09F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
25   XXFT10F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
26   XXFT11F001   DD    SYSOUT=8,
     XX           DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
27   XXFT12F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
28   XXFT13F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
29   XXFT14F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
30   XXFT15F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
31   XXFT21F001   DD    UNIT=TAPED,DISP=(NEW,KEEP),DCB=DEN=3,LABEL=RETPD=5,
     XX           DSN=PLOT.&PLOTNAM
32   XXFT22F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
     XX           DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)
33   XXFT23F001   DD    UNIT=SYSDA,SPACE=(CYL,(20,5)),
```

```
XX            DCB=(RECFM=VBS,LRECL=1284,BLKSIZE=17980,BUFNO=2)              00000530
*** LAST PROCEDURE UPDATE PERFORMED APRIL      26, 1984.                    00000540
34      //GO.SYSIN DD *
```

```
STMT NO. MESSAGE
    4       IEF653I SUBSTITUTION JCL - PGM=P050,PARM=P947
    7       IEF653I SUBSTITUTION JCL - SYSOUT=A
   12       IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FA,BLKSIZE=80)
   13       IEF653I SUBSTITUTION JCL - PGM=P947,TIME=30
   23       IEF653I SUBSTITUTION JCL - SYSOUT=A
   31       IEF653I SUBSTITUTION JCL - DSN=PLOT.NONE
IEF236I ALLOC. FOR SCE840LC PROGUSE GO
IEF237I 7AA  ALLOCATED TO STEPLIB
IEF237I 7AA  ALLOCATED TO SYS00004
IEF237I 7C4  ALLOCATED TO FT01F001
IEF237I JES2 ALLOCATED TO FT06F001
IEF142I SCE840LC PROGUSE GO - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SCE.PROD.LOAD                                  KEPT
IEF285I   VOL SER NOS= SCE003.
IEF285I   SYSCTLG.VSCE003                                KEPT
IEF285I   VOL SER NOS= SCE003.
IEF285I   SCE.PROGUSE.DATA                               KEPT
IEF285I   VOL SER NOS= SCE004.
IEF285I   JES2.JOB07899.S00102                           SYSOUT
IEF373I STEP /PROGUSE / START 84124.0121
IEF374I STEP /PROGUSE / STOP  84124.0121 CPU    0MIN 00.12SEC SRB    0MIN 00.01SEC VIRT   136K SYS   244K EXT      0K SYS    3852K

*************************************************************************************************************************
* STEP END STATISTICS FOR STEP *** PROGUSE   *** PROGRAM NAME *** P050     ***                          0000 COND CODE *
*                                                                                                                       *
*   01:21:09 STARTED         01:21:10 ENDED           00:00:01 ELAPSED         00:00:01 NET TIME       21.8 OPACITY     *
*     136K VIRT CORE USED     2048K VIRT REQD                                                            105 DSP PRTY   *
*                                                                                                             SEL PRTY  *
*   BASIC CHARGES- CPU TIME          -           .12 SECONDS     AT    .05000 $/SEC    =          .01                  *
*                  VOLUNTARY WAIT    -           .43 SECONDS     AT    .00000 $/SEC    =          .00                  *
*                                                                  BASIC SUB- TOTAL    =          .01*                 *
*                                                                                                                       *
*   DEVICE CHARGES-DEVICE       UNIT     ---------EXCP----------      ------OCCUP------                                 *
*                  TYPE         ADDR        NUMBER      $ EACH        NET SEC    $/SEC                                  *
*                                                                                                                       *
*                  3380         07AA             5      .00020         .55     .00000                                   *
*                  3380         07AA                    .00020         .00     .00000                                   *
*                  3380         07C4             3      .00020         .55     .00000                                   *
*                                                                                                                       *
*                  DEVICE     -------MOUNTING--------      ---EXCP---      --OCCUP---                                   *
*                  CLASS      NUM     SEA     CHARGE        CHARGE          CHARGE                                      *
*                                                                                                                       *
*                  DASD       00      2.00      .00            .00             .00     =          .00                  *
*                  TAPE       00      1.00      .00            .00             .00     =          .00                  *
*                  U/R                                         .00             .00     =          .00                  *
*                  OTHER                                       .00             .00     =          .00                  *
*                                                                 DEVICE SUB- TOTAL    =          .00*                 *
*                                                                                                                       *
*   STEP SUB- TOTAL          .01 X    1.00 PRIORITY AND SHIFT FACTOR =    STEP TOTAL   =         $.01*                 *
*                                                                                                                       *
*************************************************************************************************************************

IEF236I ALLOC. FOR SCE840LC INFO GO
IEF237I DMY  ALLOCATED TO SYSPRINT
IEF237I DMY  ALLOCATED TO SYSIN
IEF237I 7C4  ALLOCATED TO SYSUT1
```

```
IEF237I 7AA  ALLOCATED TO SYS00006
IEF237I JES2 ALLOCATED TO SYSUT2
IEF142I SCE840LC INFO GO - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SCE.INFO.DATA                                     KEPT
IEF285I   VOL SER NOS= SCE004.
IEF285I   SYSCTLG.VSCE003                                   KEPT
IEF285I   VOL SER NOS= SCE003.
IEF285I   JES2.JOB07399.S00103                              SYSOUT
IEF373I STEP /INFO     / START 84124.0121
IEF374I STEP /INFO     / STOP  84124.0121 CPU    0MIN 00.07SEC SRB    0MIN 00.00SEC VIRT    44K SYS   256K EXT       0K SYS    8952K

STEP END STATISTICS FOR STEP *** INFO      *** PROGRAM NAME *** IEBGENER ***                    0000 COND CODE

  01:21:11 STARTED          01:21:11 ENDED           00:00:01 ELAPSED          00:00:00 NET TIME      18.4 OPACITY
     44K VIRT CORE USED        2048K VIRT REQD                                                         105 DSP PRTY
                                                                                                           SEL PRTY

  BASIC CHARGES- CPU TIME           -          .07 SECONDS    AT   .05000 $/SEC    =          .00
                 VOLUNTARY WAIT     -          .31 SECONDS    AT   .00000 $/SEC    =          .00
                                                                BASIC SUB- TOTAL   =          .00*

  DEVICE CHARGES-DEVICE      UNIT      ---------EXCP---------      ------OCCUP------
                 TYPE        ADDR         NUMBER       $ EACH       NET SEC     $/SEC

                 3380        07C4              2      .00020            .38    .00000
                 3380        07AA                     .00020            .38    .00000

                 DEVICE    ------MOUNTING-------     ---EXCP---      --OCCUP---
                 CLASS     NUM      SEA     CHARGE     CHARGE          CHARGE

                 DASD      00      2.00       .00         .00             .00    =          .00
                 TAPE      00      1.00       .00         .00             .00    =          .00
                 U/R                                      .00             .00    =          .00
                 OTHER                                    .00             .00    =          .00
                                                           DEVICE SUB- TOTAL     =          .00*

  STEP SUB- TOTAL         .00 X   1.00 PRIORITY AND SHIFT FACTOR =   STEP TOTAL  =         $.00*

IEF236I ALLOC. FOR SCE840LC GO GO
IEF237I 7AA  ALLOCATED TO STEPLIB
IEF237I 7AA  ALLOCATED TO SYS00008
IEF237I 220  ALLOCATED TO FT01F001
IEF237I A40  ALLOCATED TO FT02F001
IEF237I 12F  ALLOCATED TO FT03F001
IEF237I 850  ALLOCATED TO FT04F001
IEF237I JES2 ALLOCATED TO FT05F001
IEF237I JES2 ALLOCATED TO FT06F001
IEF237I A51  ALLOCATED TO FT07F001
IEF237I 840  ALLOCATED TO FT08F001
IEF237I A51  ALLOCATED TO FT08F002
IEF237I 12F  ALLOCATED TO FT09F001
IEF237I A51  ALLOCATED TO FT10F001
IEF237I JES2 ALLOCATED TO FT11F001
IEF237I A40  ALLOCATED TO FT12F001
IEF237I 840  ALLOCATED TO FT13F001
IEF237I 840  ALLOCATED TO FT14F001
IEF237I 220  ALLOCATED TO FT15F001
```

```
IEF237I S8?   ALLOCATED TO FT21F001
IEF237I A4?   ALLOCATED TO FT22F001
IEF237I 85?   ALLOCATED TO FT23F001
IEF142I SCE840LC GO GO - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SCE.PROD.LOAD                                 KEPT
IEF285I   VOL SER NOS= SCE003.
IEF285I   SYSCTLG.VSCE003                               KEPT
IEF285I   VOL SER NOS= SCE003.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000001      DELETED
IEF285I   VOL SER NOS= SCRA05.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000002      DELETED
IEF285I   VOL SER NOS= SCRA03.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000003      DELETED
IEF285I   VOL SER NOS= SCRA06.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000004      DELETED
IEF285I   VOL SER NOS= SCRA01.
IEF285I   JES2.J0807899.SI0101                          SYSIN
IEF285I   JES2.J0807899.S00104                          SYSOUT
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000005      DELETED
IEF285I   VOL SER NOS= SCRA04.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000006      DELETED
IEF285I   VOL SER NOS= SCRA02.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000007      DELETED
IEF285I   VOL SER NOS= SCRA04.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000008      DELETED
IEF285I   VOL SER NOS= SCRA06.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000009      DELETED
IEF285I   VOL SER NOS= SCRA04.
IEF285I   JES2.J0807899.S00105                          SYSOUT
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000010      DELETED
IEF285I   VOL SER NOS= SCRA03.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000011      DELETED
IEF285I   VOL SER NOS= SCRA02.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000012      DELETED
IEF285I   VOL SER NOS= SCRA02.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000013      DELETED
IEF285I   VOL SER NOS= SCRA05.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000014      DELETED
IEF285I   VOL SER NOS= SCRA03.
IEF285I   SYS84124.T012109.RA000.SCE840LC.R0000015      DELETED
IEF285I   VOL SER NOS= SCRA01.
IEF373I STEP /GO      / START 84124.0121
IEF374I STEP /GO      / STOP  84124.0131 CPU    7MIN 45.07SEC SRB    0MIN 06.18SEC VIRT  1152K SYS   344K EXT       0K SYS    8852K

**********************************************************************************************************************
*  STEP END STATISTICS FOR STEP *** GO        *** PROGRAM NAME *** P947     ***                       0000 COND CODE  *
*                                                                                                                    *
*    01:21:12 STARTED          01:31:39 ENDED          00:10:27 ELAPSED          00:10:23 NET TIME      74.6 OPACITY  *
*     1152K VIRT CORE USED      2048K VIRT REQD                                                        105 DSP PRTY  *
*                                                                                                          SEL PRTY  *
*    BASIC CHARGES- CPU TIME          -          465.07 SECONDS    AT    .05000 $/SEC    =        23.25             *
*                  VOLUNTARY WAIT     -          157.64 SECONDS    AT    .00000 $/SEC    =          .00             *
*                                                                    BASIC SUB- TOTAL    =        23.25*            *
*                                                                                                                    *
*    DEVICE CHARGES-DEVICE     UNIT     ---------EXCP---------     ------OCCUP------                                *
*                   TYPE       ADDR       NUMBER       $ EACH      NET SEC     $/SEC                                 *
*                                                                                                                    *
*                   3330       07AA           91       .00020      622.71     .00000                                 *
*                   3380       07AA                    .00020         .00     .00000                                 *
```

3380	0220	17	.00020	622.71	.00000
3380	0A40	5,314	.00020	622.71	.00000
3380	012F	75	.00020	622.71	.00000
3380	0850	47	.00020	622.71	.00000
3380	0451	3,870	.00020	622.71	.00000
3380	0840	21	.00020	622.71	.00000
3380	0451		.00020	.00	.00000
3380	012F	6	.00020	.00	.00000
3380	0451		.00020	.00	.00000
3380	0A40		.00020	.00	.00000
3380	0840	1	.00020	.00	.00000
3380	0840		.00020	.00	.00000
3380	0220		.00020	.00	.00000
3420	0535		.00010	622.71	.00000
3380	0A40		.00020	.00	.00000
3380	0850		.00020	.00	.00000

DEVICE CLASS	------MOUNTING------- NUM	SEA	CHARGE	---EXCP--- CHARGE	--OCCUP--- CHARGE		
DASD	00	2.00	.00	1.89	.00	=	1.89
TAPE	00	1.00	.00	.00	.00	=	.00
U/R				.00	.00	=	.00
OTHER				.00	.00	=	.00
					DEVICE SUB- TOTAL	=	1.89*

STEP SUB- TOTAL 25.14 X 1.00 PRIORITY AND SHIFT FACTOR = STEP TOTAL = $25.14*

IEF375I JOB /SCE840LC/ START 84124.0121
IEF376I JOB /SCE840LC/ STOP 84124.0131 CPU 7MIN 45.26SEC SRB 0MIN 06.19SEC

JOB PERFORMANCE ANALYSIS AND CHARGES FOR USE OF SO CAL EDISON COMPANY SYSID-AO VS/2 RELEASE-03.8 MODEL- 84

JOBNAME - SCE840LC ACCOUNT NO. - 7838876900 DATE - 3 MAY 84 JOB CLASS - C 74.6 OPACITY
01:21:09 STARTED 01:31:39 ENDED 00:10:30 ELAPSED 00:10:24 NET TIME JOB PRTY
JAS RELEASE 1.0.0

BASIC CHARGES-	CPU TIME	-	465.26 SECONDS	AT	.05000 $/SEC	=	23.26
	VOLUNTARY WAIT	-	158.38 SECONDS	AT	.00000 $/SEC	=	.00
					BASIC SUB- TOTAL	=	23.26*

DEVICE CHARGES-DEVICE CLASS	------MOUNTING------- NUM	SEA	CHARGE	---EXCP--- CHARGE	--OCCUP--- CHARGE		
DASD	00	2.00	.00	1.89	.00	=	1.89
TAPE	00	1.00	.00	.00	.00	=	.00
U/R				.00	.00	=	.00
OTHER				.00	.00	=	.00
					DEVICE SUB- TOTAL	=	1.89*

PRIORITY AND SHIFT TOTAL = .00 JOB TOTAL = 25.15 JOB CHARGE = $25.15*

```
PPPPPPPPPPP      AAAAAAAAAA     PPPPPPPPPPP               VV          VV
PPPPPPPPPPPP    AAAAAAAAAAAA    PPPPPPPPPPPP              VV          VV
PP        PP    AA        AA    PP        PP               VV        VV
PP        PP    AA        AA    PP        PP               VV        VV
PP        PP    AA        AA    PP        PP                VV      VV
PPPPPPPPPPPP    AAAAAAAAAAAA    PPPPPPPPPPPP                VV      VV
PPPPPPPPPPP     AAAAAAAAAAAA    PPPPPPPPPPP                  VV    VV
PP              AA        AA    PP                           VV    VV
PP              AA        AA    PP                            VVVV
PP              AA        AA    PP                            VVVV
PP              AA        AA    PP                             VV
PP              AA        AA    PP                             VV
```

USC VERSION TWO , OCTOBER 1977
SCE VERSION PAP1 , JUNE 23 1981

05/03/84 01:21:15

SONGS ONE S/R VALVE DISCHARGE PIPING TIME HISTORY ANALYSIS

C O N T R O L   I N F O R M A T I O N

```
     NUMBER OF NODAL POINTS      =    73
     NUMBER OF ELEMENT TYPES     =     1
     NUMBER OF LOAD CASES        =     0
     NUMBER OF FREQUENCIES       =     1
     ANALYSIS CODE (NDYN)        =     4
        EQ.0,  STATIC
        EQ.1,  MODAL EXTRACTION
        EQ.2,  FORCED RESPONSE
        EQ.3,  RESPONSE SPECTRUM
        EQ.4,  DIRECT INTEGRATION
        EQ.5,  FREQUENCY RESPONSE
        EQ.6,  BUCKLING ANALYSIS
     SOLUTION MODE (MODEX)       =     0
        EQ. 0,  EXECUTION
        EQ. 1,  DATA CHECK
        EQ.-1,  EXECUTION & COMBINE BOUNDRY LOADS
     NUMBER OF SUBSPACE
     ITERATION VECTORS (NAD)     =     0
     EQUATIONS PER BLOCK         =     0
     TAPE10 SAVE FLAG (N10SV)    =     0
     GRAVITATIONAL CONSTANT      =   386.40
     TOTAL BLANK COMMON (MTOT)=20000
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BANDWIDTH MINIMIZATION IS REQUESTED

REQUIRED BLANK COMMON FOR THIS STEP=   877

NODAL POINT INPUT DATA

NODE NUMBER	BOUNDARY CONDITION CODES X	Y	Z	XX	YY	ZZ	NODAL POINT COORDINATES X	Y	Z		T
1	1	1	1	1	1	1	2.935	-23.398	-0.954	0	470.000
2	0	0	0	0	0	0	1.254	-21.631	-0.407	0	470.000
3	0	0	0	0	0	0	0.0	-18.449	0.0	0	470.000
4	0	0	0	0	0	0	0.0	-9.375	0.0	0	470.000
5	0	0	0	0	0	0	0.0	0.0	0.0	0	470.000
6	0	0	0	0	0	0	0.0	0.0	-10.000	0	470.000
7	0	1	0	0	0	0	0.0	0.0	-33.500	0	470.000
8	0	0	0	0	0	0	0.0	-30.000	-63.500	0	470.000
9	0	0	0	0	0	0	0.0	-31.000	-63.500	0	470.000
10	1	0	1	0	0	0	0.0	-48.063	-63.500	0	470.000
11	0	0	0	0	0	0	0.0	-82.500	-63.500	0	470.000
12	0	0	0	0	0	0	30.000	-112.500	-63.500	0	470.000
13	0	0	0	0	0	0	85.438	-112.500	-63.500	0	470.000
14	0	0	0	0	0	0	100.813	-112.500	-63.500	0	470.000
15	0	0	0	0	0	0	130.812	-112.500	-33.500	0	470.000
16	1	1	1	0	0	0	130.812	-112.500	-23.500	0	470.000
17	0	0	0	0	0	0	130.812	-112.500	-17.926	0	470.000
18	0	0	0	0	0	0	122.025	-112.500	3.287	0	470.000
19	0	0	0	0	0	0	83.938	-112.500	41.375	0	470.000
20	0	0	0	0	0	0	69.599	-112.500	55.713	0	470.000
21	0	0	0	0	0	0	48.386	-112.500	64.500	0	470.000
22	0	0	0	0	0	0	-25.761	-112.500	64.500	0	470.000
23	0	0	0	0	0	0	-46.974	-112.500	55.713	0	470.000
24	0	0	0	0	0	0	-69.188	-112.500	33.500	0	470.000
25	1	1	1	1	1	1	66.479	-23.752	-1.063	0	470.000
26	0	0	0	0	0	0	68.497	-21.631	-0.407	0	470.000

27	0	0	0	0	0	0	59.750	-12.449	0.0	0	470.000
28	0	0	0	0	0	0	59.750	-9.375	0.0	0	470.000
29	0	0	0	0	0	0	59.750	0.0	0.0	0	470.000
30	0	0	0	0	0	0	59.750	0.0	-10.000	0	470.000
31	0	0	0	0	0	0	59.750	0.0	-37.500	0	470.000
32	0	0	0	0	0	0	43.750	0.0	-63.500	0	470.000
33	0	0	0	0	0	0	41.875	0.0	-63.500	0	470.000
34	0	1	0	0	0	0	11.875	-30.000	-63.500	0	470.000
35	1	0	1	0	0	0	11.875	-43.063	-63.500	0	470.000
36	0	0	0	0	0	0	11.875	-64.500	-63.500	0	470.000
37	0	0	0	0	0	0	41.875	-94.500	-63.500	0	470.000
38	0	0	0	0	0	0	72.313	-94.500	-63.500	0	470.000
39	0	0	0	0	0	0	100.313	-94.500	-63.500	0	470.000
40	0	0	0	0	0	0	130.812	-94.500	-33.500	0	470.000
41	1	1	1	0	0	0	130.812	-94.500	-23.500	0	470.000
42	0	0	0	0	0	0	130.812	-94.500	-17.925	0	470.000
43	0	0	0	0	0	0	122.025	-94.500	3.287	0	470.000
44	0	0	0	0	0	0	90.063	-94.500	35.250	0	470.000
45	0	0	0	0	0	0	69.599	-94.500	55.713	0	470.000
46	0	0	0	0	0	0	48.386	-94.500	64.500	0	470.000
47	0	0	0	0	0	0	-25.761	-94.500	64.500	0	470.000
48	0	0	0	0	0	0	-46.974	-94.500	55.713	0	470.000
49	0	0	0	0	0	0	-69.188	-94.500	33.500	0	470.000
50	0	0	0	0	0	0	-69.188	-103.500	33.500	0	470.000
51	0	0	0	0	0	0	-69.188	-125.500	33.500	0	470.000
52	0	1	1	0	0	0	-69.188	-133.500	33.500	0	470.000
53	0	0	0	0	0	0	-69.188	-133.789	33.500	0	470.000
54	0	0	0	0	0	0	-54.543	-169.145	33.500	0	470.000
55	0	0	0	0	0	0	-29.832	-193.855	33.500	0	470.000
56	0	0	0	0	0	0	-15.188	-229.211	33.500	0	470.000
57	0	1	0	0	0	0	-15.188	-230.500	33.500	0	470.000
58	1	0	1	0	0	0	-15.188	-324.500	33.500	0	470.000
59	0	0	0	0	0	0	-15.188	-331.500	33.500	0	470.000
60	0	0	0	0	0	0	-25.761	-346.500	44.107	0	470.000
61	0	0	0	0	0	0	-34.543	-346.500	52.855	0	470.000
62	0	0	0	0	0	0	-49.188	-346.500	88.211	0	470.000
63	0	0	0	0	0	0	-49.188	-346.500	142.500	0	470.000
64	0	0	0	0	0	0	-49.188	-396.500	192.500	0	470.000
65	1	1	1	0	0	0	-49.188	-442.500	192.500	0	470.000
66	0	0	0	0	0	0	-49.188	-449.500	192.500	0	470.000
67	0	0	0	0	0	0	-3.872	-499.500	171.369	0	470.000
68	0	0	0	0	0	0	49.438	-499.500	146.510	0	470.000
69	0	0	0	0	0	0	53.122	-499.500	144.792	0	470.000
70	0	0	0	0	0	0	98.438	-549.500	123.661	0	470.000
71	1	1	1	1	1	1	98.438	-556.375	123.661	0	470.000
72	1	1	1	0	0	0	-25.000	-112.500	64.500	0	470.000
73	1	1	1	0	0	0	-25.000	-94.500	64.500	0	470.000

GENERATED NODAL DATA

NODE NUMBER	BOUNDARY CONDITION CODES X	Y	Z	XX	YY	ZZ	NODAL POINT COORDINATES X	Y	Z	T
1	1	1	1	1	1	1	2.935	-23.398	-0.954	470.000
2	0	0	0	0	0	0	1.254	-21.631	-0.407	470.000
3	0	0	0	0	0	0	0.0	-18.449	0.0	470.000
4	0	0	0	0	0	0	0.0	-9.375	0.0	470.000
5	0	0	0	0	0	0	0.0	0.0	0.0	470.000
6	0	0	0	0	0	0	0.0	0.0	-10.000	470.000
7	0	1	0	0	0	0	0.0	0.0	-37.500	470.000
8	0	0	0	0	0	0	0.0	-30.000	-63.500	470.000
9	0	0	0	0	0	0	0.0	-31.000	-63.500	470.000
10	1	0	1	0	0	0	0.0	-48.063	-63.500	470.000
11	0	0	0	0	0	0	0.0	-82.500	-63.500	470.000
12	0	0	0	0	0	0	30.000	-112.500	-63.500	470.000
13	0	0	0	0	0	0	85.438	-112.500	-63.500	470.000
14	0	0	0	0	0	0	100.813	-112.500	-63.500	470.000
15	0	0	0	0	0	0	130.812	-112.500	-33.500	470.000
16	1	1	1	0	0	0	130.812	-112.500	-23.500	470.000
17	0	0	0	0	0	0	130.812	-112.500	-17.926	470.000
18	0	0	0	0	0	0	122.025	-112.500	3.287	470.000
19	0	0	0	0	0	0	83.938	-112.500	41.375	470.000
20	0	0	0	0	0	0	69.599	-112.500	55.713	470.000
21	0	0	0	0	0	0	48.386	-112.500	64.500	470.000
22	0	0	0	0	0	0	-25.761	-112.500	64.500	470.000
23	0	0	0	0	0	0	-46.974	-112.500	55.713	470.000
24	0	0	0	0	0	0	-69.188	-112.500	33.500	470.000
25	1	1	1	1	1	1	66.479	-23.752	-1.063	470.000
26	0	0	0	0	0	0	68.497	-21.631	-0.407	470.000
27	0	0	0	0	0	0	69.750	-18.449	0.0	470.000
28	0	0	0	0	0	0	69.750	-9.375	0.0	470.000
29	0	0	0	0	0	0	69.750	0.0	0.0	470.000
30	0	0	0	0	0	0	69.750	0.0	-10.000	470.000
31	0	0	0	0	0	0	69.750	0.0	-37.500	470.000
32	0	0	0	0	0	0	43.750	0.0	-63.500	470.000
33	0	0	0	0	0	0	41.875	0.0	-63.500	470.000
34	0	1	0	0	0	0	11.875	-30.000	-63.500	470.000
35	1	0	1	0	0	0	11.875	-48.063	-63.500	470.000
36	0	0	0	0	0	0	11.875	-64.500	-63.500	470.000
37	0	0	0	0	0	0	41.875	-94.500	-63.500	470.000
38	0	0	0	0	0	0	72.813	-94.500	-63.500	470.000
39	0	0	0	0	0	0	100.813	-94.500	-63.500	470.000
40	0	0	0	0	0	0	130.812	-94.500	-33.500	470.000
41	1	1	1	0	0	0	130.812	-94.500	-23.500	470.000
42	0	0	0	0	0	0	130.812	-94.500	-17.926	470.000
43	0	0	0	0	0	0	122.025	-94.500	3.287	470.000
44	0	0	0	0	0	0	90.063	-94.500	35.250	470.000
45	0	0	0	0	0	0	69.599	-94.500	55.713	470.000
46	0	0	0	0	0	0	48.386	-94.500	64.500	470.000
47	0	0	0	0	0	0	-25.761	-94.500	64.500	470.000
48	0	0	0	0	0	0	-46.974	-94.500	55.713	470.000
49	0	0	0	0	0	0	-69.188	-94.500	33.500	470.000
50	0	0	0	0	0	0	-69.188	-103.500	33.500	470.000
51	0	0	0	0	0	0	-69.188	-125.500	33.500	470.000
52	0	1	1	0	0	0	-69.188	-133.500	33.500	470.000
53	0	0	0	0	0	0	-69.188	-133.789	33.500	470.000
54	0	0	0	0	0	0	-54.543	-169.145	33.500	470.000
55	0	0	0	0	0	0	-29.832	-193.855	33.500	470.000
56	0	0	0	0	0	0	-15.186	-229.211	33.500	470.000

57	0	1	0	0	0	0	-15.188	-23[illegible].500	33.500	470.000
58	1	0	1	0	0	0	-15.188	-324.500	33.500	470.000
59	0	0	0	0	0	0	-15.188	-331.500	33.500	470.000
60	0	0	0	0	0	0	-25.741	-346.500	44.107	470.000
61	0	0	0	0	0	0	-34.543	-346.500	52.855	470.000
62	0	0	0	0	0	0	-49.188	-346.500	[illegible]8.211	470.000
63	0	0	0	0	0	0	-49.188	-346.500	142.500	470.000
64	0	0	0	0	0	0	-49.188	-396.500	192.500	470.000
65	1	1	1	0	0	0	-49.188	-442.500	192.500	470.000
66	0	0	0	0	0	0	-49.188	-449.500	192.500	470.000
67	0	0	0	0	0	0	-3.672	-499.500	171.369	470.000
68	0	0	0	0	0	0	49.438	-499.500	146.510	470.000
69	0	0	0	0	0	0	53.122	-499.500	144.792	470.000
70	0	0	0	0	0	0	96.438	-549.500	123.661	470.000
71	1	1	1	1	1	1	98.438	-556.375	123.661	470.000
72	1	1	1	0	0	0	-25.000	-112.500	64.500	470.000
73	1	1	1	0	0	0	-25.000	-94.500	64.500	470.000

EQUATION NUMBERS

N	X	Y	Z	XX	YY	ZZ
1	0	0	0	0	0	0
2	1	2	3	4	5	6
3	7	8	9	10	11	12
4	13	14	15	16	17	18
5	19	20	21	22	23	24
6	25	26	27	28	29	30
7	31	0	32	33	34	35
8	36	37	38	39	40	41
9	42	43	44	45	46	47
10	0	48	0	49	50	51
11	52	53	54	55	56	57
12	58	59	60	61	62	63
13	64	65	66	67	68	69
14	70	71	72	73	74	75
15	76	77	78	79	80	81
16	0	0	0	82	83	84
17	85	86	87	88	89	90
18	91	92	93	94	95	96
19	97	98	99	100	101	102
20	103	104	105	106	107	108
21	109	110	111	112	113	114
22	115	116	117	118	119	120
23	121	122	123	124	125	126
24	127	128	129	130	131	132
25	0	0	0	0	0	0
26	133	134	135	136	137	138
27	139	140	141	142	143	144
28	145	146	147	148	149	150
29	151	152	153	154	155	156
30	157	158	159	160	161	162
31	163	164	165	166	167	168
32	169	170	171	172	173	174
33	175	176	177	178	179	180
34	181	0	182	183	184	185
35	0	186	0	187	188	189
36	190	191	192	193	194	195
37	196	197	198	199	200	201
38	202	203	204	205	206	207
39	208	209	210	211	212	213
40	214	215	216	217	218	219
41	0	0	0	220	221	222
42	223	224	225	226	227	228
43	229	230	231	232	233	234
44	235	236	237	238	239	240
45	241	242	243	244	245	246
46	247	248	249	250	251	252
47	253	254	255	256	257	258
48	259	260	261	262	263	264
49	265	266	267	268	269	270
50	271	272	273	274	275	276
51	277	278	279	280	281	282
52	283	0	0	284	285	286
53	287	288	289	290	291	292
54	293	294	295	296	297	298
55	299	300	301	302	303	304
56	305	306	307	308	309	310
57	311	0	312	313	314	315
58	0	316	0	317	318	319

59	320	321	322	323	324	325
60	326	327	328	329	330	331
61	332	333	334	335	336	337
62	338	339	340	341	342	343
63	344	345	346	347	348	349
64	350	351	352	353	354	355
65	0	0	0	356	357	358
66	359	360	361	362	363	364
67	365	366	367	368	369	370
68	371	372	373	374	375	376
69	377	378	379	380	381	382
70	383	384	385	386	387	388
71	0	0	0	0	0	0
72	0	0	0	389	390	391
73	0	0	0	392	393	394

P I P E   E L E M E N T   I N P U T   D A T A

C O N T R O L   I N F O R M A T I O N

REQUIRED BLANK COMMON FOR THIS STEP= 734

NUMBER OF PIPE ELEMENTS	=	72
NUMBER OF MATERIAL SETS	=	1
MAXIMUM NUMBER OF MATERIAL TEMPERATURE INPUT POINTS	=	1
NUMBER OF SECTION PROPERTY SETS	=	3
NUMBER OF BRANCH POINT NODES	=	0
MAXIMUM NUMBER OF TANGENTS COMMON TO A BRANCH POINT	=	4
FLAG FOR NEGLECTING AXIAL DEFORMATIONS IN BEND ELEMENTS (EQ.1, NEGLECT)	=	0

M A T E R I A L   P R O P E R T Y   T A B L E S

MATERIAL NUMBER = (1)
NUMBER OF
TEMPERATURE POINTS = (1)
IDENTIFICATION = (CARBON STEEL)

POINT NUMBER	TEMPERATURE	YOUNG*S MODULUS	POISSON*S RATIO	THERMAL EXPANSION
1	470.00	27900000.0	0.300	0.696D-05

S E C T I O N   P R O P E R T Y   T A B L E

SECTION NUMBER	OUTSIDE DIAMETER	WALL THICKNESS	SHAPE FACTOR FOR SHEAR	WEIGHT/ UNIT LENGTH	MASS/ UNIT LENGTH	D E S C R I P T I O N
1	6.625	0.2800	0.0	0.1581D+01	0.4092D-02	
2	10.750	0.3650	0.0	0.3375D+01	0.8734D-02	
3	3.500	0.4380	0.0	0.1442D+01	0.3732D-02	

E L E M E N T   L O A D   C A S E   M U L T I P L I E R S

	CASE A	CASE B	CASE C	CASE D
X-DIRECTION GRAVITY	0.0	0.0	0.0	0.0
Y-DIRECTION GRAVITY	0.0	0.0	0.0	0.0
Z-DIRECTION GRAVITY	0.0	0.0	0.0	0.0
THERMAL DISTORTION	0.0	0.0	0.0	0.0
PRESSURE DISTORTION	0.0	0.0	0.0	0.0

PIPE ELEMENT INPUT DATA

ELEMENT NUMBER	ELEMENT TYPE	NODE -I	NODE -J	MATL. NUMBER	SECTION NUMBER	REFERENCE TEMPERATURE (BEND RADIUS)	INTERNAL PRESSURE (THIRD POINT)	DIRECTION COSINES A(YX) (X3-ORDINATE)	A(YY) (Y3-ORDINATE)	A(YZ) (Z3-ORDINATE)	NODE INCREMENT (WALL FRACTION)	INPUT TAG	BAND
1	TANGT	1	2	1	3	70.00	100.00	0.0	0.0	0.0	1	II	[illegible]
2	BEND	2	3	1	3	70.00	100.00					IC	12
						(4.500)	( )	(0.0)	(-20.313)	(0.0)	(3.0000)		
3	TANGT	3	4	1	3	70.00	100.00	0.0	0.0	0.0	1	II	12
4	TANGT	4	5	1	3	70.00	100.00	0.0	0.0	0.0	1	II	12
5	TANGT	5	6	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
6	TANGT	6	7	1	1	70.00	100.00	0.0	0.0	0.0	1	II	11
7	BEND	7	8	1	1	70.00	100.00					IC	11
						(30.000)	( )	(0.0)	(0.0)	(-63.500)	(3.0000)		
8	TANGT	8	9	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
9	TANGT	9	10	1	1	70.00	100.00	0.0	0.0	0.0	1	II	10
10	TANGT	10	11	1	1	70.00	100.00	0.0	0.0	0.0	1	II	10
11	BEND	11	12	1	1	70.00	100.00					IC	12
						(30.000)	( )	(0.0)	(-112.500)	(-63.500)	(3.0000)		
12	TANGT	12	13	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
13	TANGT	13	14	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
14	BEND	14	15	1	1	70.00	100.00					IC	12
						(30.000)	( )	(130.812)	(-112.500)	(-63.500)	(3.0000)		
15	TANGT	15	16	1	1	70.00	100.00	0.0	0.0	0.0	1	II	9
16	TANGT	16	17	1	1	70.00	100.00	0.0	0.0	0.0	1	II	9
17	BEND	17	18	1	1	70.00	100.00					IC	12
						(30.000)	( )	(130.812)	(-112.500)	(-5.500)	(3.0000)		
18	TANGT	18	19	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
19	TANGT	19	20	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
20	BEND	20	21	1	1	70.00	100.00					IC	12
						(30.000)	( )	(60.813)	(-112.500)	(64.500)	(3.0000)		
21	TANGT	21	72	1	1	70.00	100.00	0.0	0.0	0.0	1	II	283
22	BEND	22	23	1	1	70.00	100.00					IC	12
						(30.000)	( )	(-38.188)	(-112.500)	(64.500)	(3.0000)		
23	TANGT	23	24	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
24	TANGT	25	26	1	3	70.00	100.00	0.0	0.0	0.0	1	II	6
25	BEND	26	27	1	3	70.00	100.00					IC	12
						(4.500)	( )	(69.750)	(-20.313)	(0.0)	(3.0000)		
26	TANGT	27	28	1	3	70.00	100.00	0.0	0.0	0.0	1	II	12
27	TANGT	28	29	1	3	70.00	100.00	0.0	0.0	0.0	1	II	12
28	TANGT	29	30	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
29	TANGT	30	31	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
30	BEND	31	32	1	1	70.00	100.00					IC	12
						(30.000)	( )	(69.750)	(0.0)	(-63.500)	(3.0000)		
31	TANGT	32	33	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
32	BEND	33	34	1	1	70.00	100.00					IC	11
						(26.000)	( )	(11.875)	(0.0)	(-63.500)	(3.0000)		

P I P E   E L E M E N T   I N P U T   D A T A

ELEMENT NUMBER	ELEMENT TYPE	NODE -I	NODE -J	MATL. NUMBER	SECTION NUMBER	REFERENCE TEMPERATURE (BEND RADIUS)	INTERNAL PRESSURE (THIRD POINT)	DIRECTION COSINES A(YX) (X3-ORDINATE)	A(YY) (Y3-ORDINATE)	A(YZ) (Z3-ORDINATE)	NODE INCREMENT (WALL FRACTION)	INPUT TAG	BAND
33	TANGT	34	35	1	1	70.00	100.00	0.0	0.0	0.0	1	II	[illegible]
34	TANGT	35	36	1	1	70.00	100.00	0.0	0.0	0.0	1	II	1[illegible]
35	BEND	36	37	1	1	70.00	100.00					IC	
						(30.000)	( )	(11.875)	(-94.500)	(-63.500)	(3.0000)		12
36	TANGT	37	38	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
37	TANGT	38	39	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
38	BEND	39	40	1	1	70.00	100.00					IC	
						(30.000)	( )	(130.812)	(-94.500)	(-63.500)	(3.0000)		12
39	TANGT	40	41	1	1	70.00	100.00	0.0	0.0	0.0	1	II	9
40	TANGT	41	42	1	1	70.00	100.00	0.0	0.0	0.0	1	II	9
41	BEND	42	43	1	1	70.00	100.00					IC	
						(30.000)	( )	(130.812)	(-94.500)	(-5.500)	(3.0000)		12
42	TANGT	43	44	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
43	TANGT	44	45	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
44	BEND	45	46	1	1	70.00	100.00					IC	
						(30.000)	( )	(60.813)	(-94.500)	(64.500)	(3.0000)		12
45	TANGT	46	73	1	1	70.00	100.00	0.0	0.0	0.0	1	II	148
46	BEND	47	48	1	1	70.00	100.00					IC	
						(30.000)	( )	(-38.188)	(-94.500)	(64.500)	(3.0000)		12
47	TANGT	48	49	1	1	70.00	100.00	0.0	0.0	0.0	1	II	12
48	TANGT	49	50	1	2	70.00	100.00	0.0	0.0	0.0	1	II	12
49	TANGT	50	24	1	2	70.00	100.00	0.0	0.0	0.0	1	II	153
50	TANGT	24	51	1	2	70.00	100.00	0.0	0.0	0.0	1	II	156
51	TANGT	51	52	1	2	70.00	100.00	0.0	0.0	0.0	1	II	10
52	TANGT	52	53	1	2	70.00	100.00	0.0	0.0	0.0	1	II	10
53	BEND	53	54	1	2	70.00	100.00					IC	
						(50.000)	( )	(-69.188)	(-154.500)	(33.500)	(3.0000)		12
54	TANGT	54	55	1	2	70.00	100.00	0.0	0.0	0.0	1	II	12
55	BEND	55	56	1	2	70.00	100.00					IC	
						(50.000)	( )	(-15.188)	(-208.500)	(33.500)	(3.0000)		12
56	TANGT	56	57	1	2	70.00	100.00	0.0	0.0	0.0	1	II	11
57	TANGT	57	58	1	2	70.00	100.00	0.0	0.0	0.0	1	II	9
58	TANGT	58	59	1	2	70.00	100.00	0.0	0.0	0.0	1	II	10
59	BEND	59	60	1	2	70.00	100.00					IC	
						(15.000)	( )	(-15.188)	(-346.500)	(33.500)	(3.0000)		12
60	TANGT	60	61	1	2	70.00	100.00	0.0	0.0	0.0	1	II	12
61	BEND	61	62	1	2	70.00	100.00					IC	
						(50.000)	( )	(-49.188)	(-346.500)	(67.500)	(3.0000)		12
62	TANGT	62	63	1	2	70.00	100.00	0.0	0.0	0.0	1	II	12
63	BEND	63	64	1	2	70.00	100.00					IC	
						(50.000)	( )	(-49.188)	(-346.500)	(192.500)	(3.0000)		12

B A N D W I D T H   M I N I M I Z A T I O N

MINBND (BANDWIDTH CONTROL PARAMETER)= 1

REQUIRED BLANK COMMON FOR THIS STEP= 406

REQUIRED BLANK COMMON FOR THIS STEP= 706

EQUATION NUMBERS AFTER BANDWIDTH MINIMIZATION

NODE	SEQUENCE	X	Y	Z	XX	YY	ZZ
1	71	0	0	0	0	0	0
2	70	389	390	391	392	393	394
3	69	383	384	385	386	387	388
4	68	377	378	379	380	381	382
5	67	371	372	373	374	375	376
6	66	365	366	367	368	369	370
7	65	360	0	361	362	363	364
8	64	354	355	356	357	358	359
9	63	348	349	350	351	352	353
10	62	0	344	0	345	346	347
11	61	338	339	340	341	342	343
12	60	332	333	334	335	336	337
13	59	326	327	328	329	330	331
14	58	320	321	322	323	324	325
15	57	314	315	316	317	318	319
16	56	0	0	0	311	312	313
17	55	305	306	307	308	309	310
18	54	299	300	301	302	303	304
19	53	293	294	295	296	297	298
20	52	287	288	289	290	291	292
21	51	281	282	283	284	285	286
22	49	272	273	274	275	276	277
23	48	266	267	268	269	270	271
24	47	260	261	262	263	264	265
25	72	0	0	0	0	0	0
26	1	1	2	3	4	5	6
27	2	7	8	9	10	11	12
28	3	13	14	15	16	17	18
29	4	19	20	21	22	23	24
30	5	25	26	27	28	29	30
31	6	31	32	33	34	35	36
32	8	43	44	45	46	47	48
33	10	55	56	57	58	59	60
34	12	67	0	68	69	70	71
35	14	0	78	0	79	80	81
36	16	88	89	90	91	92	93
37	18	97	98	99	100	101	102
38	20	109	110	111	112	113	114
39	22	121	122	123	124	125	126
40	24	133	134	135	136	137	138
41	26	0	0	0	145	146	147
42	28	154	155	156	157	158	159
43	30	166	167	168	169	170	171
44	32	176	177	178	179	180	181
45	34	187	188	189	190	191	192
46	36	199	200	201	202	203	204
47	40	220	221	222	223	224	225
48	42	232	233	234	235	236	237
49	44	242	243	244	245	246	247

P I P E   E L E M E N T   I N P U T   D A T A

ELEMENT NUMBER	ELEMENT TYPE	NODE -I	NODE -J	MATL. NUMBER	SECTION NUMBER	REFERENCE TEMPERATURE (BEND RADIUS)	INTERNAL PRESSURE (THIRD POINT)	DIRECTION COSINES A(YX) (X3-ORDINATE)	A(YY) (Y3-ORDINATE)	A(YZ) (Z3-ORDINATE)	NODE INCREMENT (WALL FRACTION)	INPUT TAG	BAND
64	TANGT	64	65	1	2	70.00	100.00	0.0	0.0	0.0	1	II	[illegible]
65	TANGT	65	66	1	2	70.00	100.00	0.0	0.0	0.0	1	II	[illegible]
66	BEND	66	67	1	2	70.00	100.00					IC	
						(50.000)	( )	(-49.186)	(-499.500)	(192.500)	(3.0000)		12
67	TANGT	67	68	1	2	70.00	100.00	0.0	0.0	0.0	1	II	12
68	TANGT	68	69	1	2	70.00	100.00	0.0	0.0	0.0	1	II	12
69	BEND	69	70	1	2	70.00	100.00					IC	
						(50.000)	( )	(96.436)	(-499.500)	(123.661)	(3.0000)		12
70	TANGT	70	71	1	2	70.00	100.00	0.0	0.0	0.0	1	II	6
71	TANGT	72	22	1	1	70.00	100.00	0.0	0.0	0.0	1	II	277
72	TANGT	73	47	1	1	70.00	100.00	0.0	0.0	0.0	1	II	142

[illegible]	[illegible]	[illegible]	255	25[illegible]	257	25[illegible]	259
51	[illegible]	24[illegible]	24[illegible]	25[illegible]	251	252	253
52	43	23[illegible]	[illegible]	[illegible]	239	240	241
53	41	22[illegible]	227	228	229	230	231
54	[illegible]	21[illegible]	215	216	217	21[illegible]	219
55	[illegible]7	20[illegible]	20[illegible]	207	208	20[illegible]	21[illegible]
56	[illegible]	1[illegible]	1[illegible]	195	196	197	193
57	[illegible]	1[illegible]2	[illegible]	1[illegible]	184	185	18[illegible]
58	[illegible]1	[illegible]	172	[illegible]	173	174	175
59	29	15[illegible]	161	152	163	164	16[illegible]
60	27	145	149	15[illegible]	151	152	153
61	25	13[illegible]	140	141	142	143	144
62	23	127	128	12[illegible]	130	131	132
63	21	115	116	117	118	119	120
64	19	103	104	105	106	107	1[illegible]3
65	17	[illegible]	0	0	94	95	96
66	15	82	83	84	85	86	87
67	13	72	73	74	75	76	77
68	11	61	62	63	64	65	66
69	9	49	50	51	52	53	54
70	7	37	36	39	40	41	42
71	75	0	0	0	0	0	0
72	50	0	0	0	278	279	280
73	38	0	0	0	211	212	213

BANDWIDTH PRIOR TO RESEQUENCING= 283
BANDWIDTH AFTER RESEQUENCING = 18

BANDWIDTH MINIMIZATION TIME LOG

READ FILE AND SET UP MINIMIZATION= 0.03
PERFORM THE MINIMIZATION = 0.01
REWRITE THE DATA FILES = 0.35

TOTAL FOR MINIMIZATION = 0.40

REQUIRED BLANK COMMON FOR THIS STEP= 1446

E Q U A T I O N   P A R A M E T E R S

```
TOTAL NUMBER OF EQUATIONS          =  394
BANDWIDTH                          =   15
NUMBER OF EQUATIONS IN A BLOCK     =  394
NUMBER OF BLOCKS                   =    1
```

N O D A L   L O A D S   (S T A T I C)   O R   M A S S E S   (D Y N A M I C)

NODE NUMBER	LOAD CASE	X-AXIS FORCE	Y-AXIS FORCE	Z-AXIS FORCE	X-AXIS MOMENT	Y-AXIS MOMENT	Z-AXIS MOMENT

ALL EQUATIONS HAVE STIFFNESS ATTACHED

STRUCTURE LOAD CASE	ELEMENT LOAD MULTIPLIERS A	B	C	D
1	0.0	0.0	0.0	0.0

S T E P - B Y - S T E P   S O L U T I O N   C O N T R O L   I N F O R M A T I O N

```
    NUMBER OF TIME VARYING FUNCTIONS   =    20

    GROUND MOTION INDICATOR            =     0
        EQ.0, NONE
        GT.0, READ ACCELERATION INPUT

    NUMBER OF ARRIVAL TIMES            =     0
        EQ.0, ALL FUNCTIONS ARRIVE
              AT TIME ZERO

    NUMBER OF SOLUTION TIME STEPS      =15000

    OUTPUT (PRINT) INTERVAL            =    10

    SOLUTION TIME INCREMENT            =     0.10000-03

    MASS-     PROPORTIONAL DAMPING
    COEFFICIENT (ALPHA)                =     0.0

    STIFFNESS-PROPORTIONAL DAMPING
    COEFFICIENT (BETA)                 =     0.53000-04


STIFFNESS MATRIX PARAMETERS

        MINIMUM NON-ZERO DIAGONAL ELEMENT= 1.0110+05
        MAXIMUM DIAGONAL ELEMENT         = 1.6190+10
        MAXIMUM/MINIMUM                  = 1.6000+05
        AVERAGE DIAGONAL ELEMENT         = 4.7660+08
        DENSITY OF THE MATRIX            = 24.4 PCT.

REQUIRED BLANK COMMON FOR THIS STEP=   1227

REQUIRED BLANK COMMON FOR THIS STEP=  16199
```

D Y N A M I C   L O A D   I N P U T

NODE NUMBER	DEGREE OF FREEDOM	FUNCTION REFERENCE	ARRIVAL TIME NUMBER	FUNCTION MULTIPLIER
7	3	1	1	0.10000+01
7	3	13	1	0.10000+01
11	2	2	1	0.10000+01
11	2	12	1	0.10000+01
14	1	3	1	0.10000+01
14	1	11	1	0.10000+01
17	3	4	1	0.10000+01
17	3	10	1	0.10000+01
20	1	5	1	-0.10000+01
20	1	9	1	-0.10000+01
20	3	5	1	0.10000+01
20	3	9	1	0.10000+01
22	1	6	1	0.10000+01
22	1	8	1	0.10000+01
24	1	7	1	0.10000+01
26	3	7	1	0.10000+01
31	3	1	1	0.10000+01
31	3	13	1	0.10000+01
33	1	1	1	0.10000+01
33	1	13	1	0.10000+01
36	2	2	1	0.10000+01
36	2	12	1	0.10000+01
39	1	3	1	0.10000+01
39	1	11	1	0.10000+01
42	3	4	1	0.10000+01
42	3	10	1	0.10000+01
45	1	5	1	-0.10000+01
45	1	9	1	-0.10000+01
45	3	5	1	0.10000+01
45	3	9	1	0.10000+01
47	1	6	1	0.10000+01
47	1	8	1	0.10000+01
49	1	7	1	0.10000+01
49	3	7	1	0.10000+01
53	2	14	1	0.10000+01
55	1	15	1	0.10000+01
55	2	15	1	-0.10000+01
59	2	16	1	0.10000+01
61	1	17	1	-0.10000+01
61	3	17	1	0.10000+01
63	3	18	1	0.10000+01
66	2	19	1	0.10000+01
68	1	20	1	0.90600+00
68	3	20	1	-0.42300+00

REQUIRED BLANK COMMON FOR THIS STEP= 15762

A R R I V A L   T I M E   V A L U E S

INPUT ORDER	ARRIVAL TIME VALUE

```
T I M E   F U N C T I O N   D A T A


 TIME FUNCTION NUMBER = (   1)

    NUMBER OF POINTS   = (   5)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F 1                                         )

       INPUT          TIME     FUNCTION
       ORDER         VALUE        VALUE


REQUIRED BLANK COMMON FOR THIS STEP=     221
            1  0.0          0.0
            2  0.40000-02   0.13050+04
            3  0.80000-02   0.13050+04
            4  0.20000-01   0.13050+04
            5  0.21000-01   0.0

 TIME FUNCTION NUMBER = (   2)

    NUMBER OF POINTS   = (  15)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F2                                          )

       INPUT          TIME     FUNCTION
       ORDER         VALUE        VALUE


REQUIRED BLANK COMMON FOR THIS STEP=     621
            1  0.0          0.0
            2  0.40000-02   0.0
            3  0.60000-02   0.17230+04
            4  0.80000-02   0.22970+04
            5  0.94000-02   0.22630+04
            6  0.10000-01   0.19310+04
            7  0.12000-01   0.14100+04
            8  0.14000-01   0.16700+04
            9  0.16000-01   0.20880+04
           10  0.20000-01   0.20880+04
           11  0.22000-01   0.15660+04
           12  0.24000-01   0.78300+03
           13  0.26000-01   0.36500+03
           14  0.28000-01   0.0
           15  0.15000+01   0.0

 TIME FUNCTION NUMBER = (   3)

    NUMBER OF POINTS   = (  14)
    SCALE FACTOR       = (  0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F3                                          )

       INPUT          TIME     FUNCTION
       ORDER         VALUE        VALUE
```

```
REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0           0.0
          2   0.94000-02    0.0
          3   0.10000-01    0.38730+03
          4   0.12500-01    0.22970+04
          5   0.14000-01    0.33260+04
          6   0.14400-01    0.31320+04
          7   0.16000-01    0.13570+04
          8   0.20000-01    0.73100+03
          9   0.22000-01    0.10950+04
         10   0.24000-01    0.14090+04
         11   0.26000-01    0.94000+03
         12   0.28000-01    0.52000+03
         13   0.30000-01    0.0
         14   0.15000+01    0.0

 TIME FUNCTION NUMBER = (   6)

    NUMBER OF POINTS   = ( 12)
    SCALE FACTOR       = (  0.10000+01)
    DESCRIPTION        = (FORCING FUNTION F6                                            )

       INPUT        TIME      FUNCTION
       ORDER       VALUE         VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0           0.0
          2   0.14400-01    0.0
          3   0.16000-01    0.24010+04
          4   0.17000-01    0.33930+04
          5   0.18000-01    0.20880+04
          6   0.20000-01    0.57600+03
          7   0.22000-01    0.36500+03
          8   0.24000-01    0.15700+03
          9   0.26000-01    0.26100+03
         10   0.28000-01    0.52200+03
         11   0.30000-01    0.0
         12   0.15000+01    0.0

 TIME FUNCTION NUMBER = (   5)

    NUMBER OF POINTS   = ( 11)
    SCALE FACTOR       = (  0.70700+00)
    DESCRIPTION        = (FORCING FUNCTION F5                                           )

       INPUT        TIME      FUNCTION
       ORDER       VALUE         VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0           0.0
          2   0.17000-01    0.0
          3   0.18000-01    0.19310+04
          4   0.20000-01    0.40190+04
          5   0.20600-01    0.43320+04
          6   0.22000-01    0.78100+03
          7   0.24000-01    0.26100+03
```

```
          8  0.26000-01  0.26100+03
          9  0.28000-01  0.31300+03
         10  0.30000-01  0.0
         11  0.15000+01  0.0

 TIME FUNCTION NUMBER = (   6)

    NUMBER OF POINTS   = (   9)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F6                                          )

      INPUT         TIME     FUNCTION
      ORDER        VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1  0.0         0.0
          2  0.20600-01  0.0
          3  0.22000-01  0.37060+04
          4  0.24000-01  0.48020+04
          5  0.26000-01  0.55850+04
          6  0.28000-01  0.60030+04
          7  0.30000-01  0.73600+04
          8  0.40000-01  0.73600+04
          9  0.15000+01  0.0

 TIME FUNCTION NUMBER = (   7)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = ( -0.70700+00)
    DESCRIPTION        = (FORCING FUNCTION F M                                         )

      INPUT         TIME     FUNCTION
      ORDER        VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1  0.0         0.0
          2  0.23600-01  0.0
          3  0.23700-01  0.46000+03
          4  0.39200-01  0.46000+03
          5  0.39300-01  0.0
          6  0.10000+00  0.0
          7  0.15000+01  0.0

 TIME FUNCTION NUMBER = (   8)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F G                                         )

      INPUT         TIME     FUNCTION
      ORDER        VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1  0.0         0.0
```

```
          2   0.39100D-01   0.0
          3   0.39200D-01   0.46000+03
          4   0.74200D-01   0.46000+03
          5   0.74300D-01   0.0
          6   0.10000+00    0.0
          7   0.15000+01    0.0

 TIME FUNCTION NUMBER = (   9)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = (   0.70700+00)
    DESCRIPTION        = (FORCING FUNCTION F E                                    )

       INPUT          TIME      FUNCTION
       ORDER          VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0           0.0
          2   0.74100D-01   0.0
          3   0.74200D-01   0.46000D+03
          4   0.10900D+00   0.46000D+03
          5   0.10910D+00   0.0
          6   0.20000D+00   0.0
          7   0.15000D+01   0.0

 TIME FUNCTION NUMBER = ( 10)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = (   0.10000D+01)
    DESCRIPTION        = (FORCING FUNCTION F D                                    )

       INPUT          TIME      FUNCTION
       ORDER          VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0           0.0
          2   0.10890D+00   0.0
          3   0.10900D+00   0.46000D+03
          4   0.12900D+00   0.46000D+03
          5   0.12910D+00   0.0
          6   0.20000D+00   0.0
          7   0.15000D+01   0.0

 TIME FUNCTION NUMBER = ( 11)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = (   0.10000D+01)
    DESCRIPTION        = (FORCING FUNCTION F C                                    )

       INPUT          TIME      FUNCTION
       ORDER          VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0           0.0
```

```
          2   0.12890+00   0.0
          3   0.12900+00   0.46000+03
          4   0.17500+00   0.46000+03
          5   0.17510+00   0.0
          6   0.20000+00   0.0
          7   0.15000+01   0.0

 TIME FUNCTION NUMBER = ( 12)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F B                                      )

       INPUT          TIME      FUNCTION
       ORDER         VALUE         VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0            0.0
          2   0.17490+00     0.0
          3   0.17500+00     0.46000+03
          4   0.21500+00     0.46000+03
          5   0.21510+00     0.0
          6   0.30000+00     0.0
          7   0.15000+01     0.0

 TIME FUNCTION NUMBER = ( 13)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F A                                      )

       INPUT          TIME      FUNCTION
       ORDER         VALUE         VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0            0.0
          2   0.21490+00     0.0
          3   0.21500+00     0.46000+03
          4   0.23500+00     0.46000+03
          5   0.23510+00     0.0
          6   0.30000+00     0.0
          7   0.15000+01     0.0

 TIME FUNCTION NUMBER = ( 14)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F K                                      )

       INPUT          TIME      FUNCTION
       ORDER         VALUE         VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0            0.0
```

```
        2   0.23600-01   0.0
        3   0.23700-01   0.90000+04
        4   0.25700-01   0.90000+04
        5   0.25900-01   0.0
        6   0.10000+00   0.0
        7   0.15000+01   0.0

 TIME FUNCTION NUMBER = ( 15)

    NUMBER OF POINTS   = (    7)
    SCALE FACTOR       = (   0.70700+00)
    DESCRIPTION        = (FORCING FUNCTION F L                                          )

       INPUT          TIME     FUNCTION
       ORDER         VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
        1   0.0          0.0
        2   0.25600-01   0.0
        3   0.25700-01   0.90000+04
        4   0.29300-01   0.90000+04
        5   0.29400-01   0.0
        6   0.10000+00   0.0
        7   0.15000+01   0.0

 TIME FUNCTION NUMBER = ( 16)

    NUMBER OF POINTS   = (    7)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F M                                          )

       INPUT          TIME     FUNCTION
       ORDER         VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
        1   0.0          0.0
        2   0.29200-01   0.0
        3   0.29300-01   0.90000+04
        4   0.31600-01   0.90000+04
        5   0.31700-01   0.0
        6   0.10000+00   0.0
        7   0.15000+01   0.0

 TIME FUNCTION NUMBER = ( 17)

    NUMBER OF POINTS   = (    7)
    SCALE FACTOR       = (   0.70700+00)
    DESCRIPTION        = (FORCING FUNCTION F N                                          )

       INPUT          TIME     FUNCTION
       ORDER         VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
        1   0.0          0.0
```

```
          2   0.31500-01   0.0
          3   0.31600-01   0.90000+04
          4   0.37500-01   0.90000+04
          5   0.37600-01   0.0
          6   0.10000+00   0.0
          7   0.15000+01   0.0

 TIME FUNCTION NUMBER = ( 18)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = (   0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F P                                              )

       INPUT         TIME     FUNCTION
       ORDER        VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0          0.0
          2   0.37400-01   0.0
          3   0.37500-01   0.90000+04
          4   0.44700-01   0.90000+04
          5   0.44300-01   0.0
          6   0.10000+00   0.0
          7   0.15000+01   0.0

 TIME FUNCTION NUMBER = ( 19)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = ( -0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F Q                                              )

       INPUT         TIME     FUNCTION
       ORDER        VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0          0.0
          2   0.44600-01   0.0
          3   0.44700-01   0.90000+04
          4   0.52400-01   0.90000+04
          5   0.52500-01   0.0
          6   0.10000+00   0.0
          7   0.15000+01   0.0

 TIME FUNCTION NUMBER = ( 20)

    NUMBER OF POINTS   = (   7)
    SCALE FACTOR       = (   0.10000+01)
    DESCRIPTION        = (FORCING FUNCTION F R                                              )

       INPUT         TIME     FUNCTION
       ORDER        VALUE        VALUE

REQUIRED BLANK COMMON FOR THIS STEP=     621
          1   0.0          0.0
```

```
  2   0.52300-01  0.0
  3   0.52450-01  0.90000+04
  4   0.55100-01  0.90000+04
  5   0.55200-01  0.0
  6   0.10000+00  0.0
  7   0.15000+01  0.0
REQUIRED BLANK COMMON FOR THIS STEP=  17169
```

D I S P L A C E M E N T   C O M P O N E N T   O U T P U T   R E Q U E S T S

CODE FOR OUTPUT TYPE = 1
EQ.1, HISTORY TABLE
EQ.2, PRINTER PLOT
EQ.3, MAXIMA ONLY
PRINTER PLOT SPACING = C

NODE NUMBER	DISPLACEMENT COMPONENT *	*	*	*	*	*
5	1	2	3	0	0	0
11	1	3	0	0	0	0
14	1	2	0	0	0	0
29	1	2	3	0	0	0
36	1	3	0	0	0	0
39	1	2	0	0	0	0
0	0	0	0	0	0	0

S T R E S S   C O M P O N E N T   O U T P U T   R E Q U E S T S

CODE FOR OUTPUT TYPE = 1
EQ.1, HISTORY TABLE
EQ.2, PRINTER PLOT
EQ.3, MAXIMA ONLY
PRINTER PLOT SPACING = 0

E L E M E N T   T Y P E   (12)

ELEMENT NUMBER	DESIRED ELEMENT STRESS COMPONENTS *	*	*	*	*	*	*	*	*	*	*	*
1	1	2	3	4	5	6	0	0	0	0	0	0
8	7	9	0	0	0	0	0	0	0	0	0	0
9	1	2	8	9	0	0	0	0	0	0	0	0
10	2	3	10	11	12	0	0	0	0	0	0	0
12	4	5	6	7	0	0	0	0	0	0	0	0
13	1	10	11	12	0	0	0	0	0	0	0	0
14	10	11	12	0	0	0	0	0	0	0	0	0
15	7	8	9	0	0	0	0	0	0	0	0	0
16	1	2	3	0	0	0	0	0	0	0	0	0
19	7	8	9	10	11	12	0	0	0	0	0	0
21	7	8	9	10	11	12	0	0	0	0	0	0
23	7	8	9	10	11	12	0	0	0	0	0	0
24	1	2	3	4	5	6	0	0	0	0	0	0
30	7	8	9	10	11	12	0	0	0	0	0	0
32	7	8	0	0	0	0	0	0	0	0	0	0
33	1	8	9	0	0	0	0	0	0	0	0	0
34	2	3	0	0	0	0	0	0	0	0	0	0
35	1	4	5	6	0	0	0	0	0	0	0	0
36	4	5	6	7	0	0	0	0	0	0	0	0
37	1	10	11	12	0	0	0	0	0	0	0	0
39	4	5	6	7	8	9	0	0	0	0	0	0
40	1	2	3	0	0	0	0	0	0	0	0	0
43	7	8	9	10	11	12	0	0	0	0	0	0
45	7	8	9	10	11	12	0	0	0	0	0	0
47	7	8	9	10	11	12	0	0	0	0	0	0
51	7	8	9	0	0	0	0	0	0	0	0	0
52	1	2	3	0	0	0	0	0	0	0	0	0
56	7	0	0	0	0	0	0	0	0	0	0	0
57	1	8	9	0	0	0	0	0	0	0	0	0
58	2	3	0	0	0	0	0	0	0	0	0	0
62	4	5	6	10	11	12	0	0	0	0	0	0
64	7	8	9	0	0	0	0	0	0	0	0	0
65	1	2	3	0	0	0	0	0	0	0	0	0
70	7	8	9	10	11	12	0	0	0	0	0	0
71	1	2	3	4	5	6	0	0	0	0	0	0
72	1	2	3	4	5	6	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

REQUIRED BLANK COMMON FOR THIS STEP= 15286

E Q U A T I O N   P A R A M E T E R S

```
    TOTAL NUMBER OF EQUATIONS         =  394
    1/2 EQUATION BANDWIDTH            =   18
    NUMBER OF EQUATIONS PER BLOCK     =  394
    TOTAL NUMBER OF EQUATION BLOCKS   =    1
    NUMBER OF COUPLING BLOCKS         =    0
```

REQUIRED BLANK COMMON FOR THIS STEP= 15285

REQUIRED BLANK COMMON FOR THIS STEP= 10064

DISPLACEMENT TIME HISTORY

OUTPUT SET = 1

NODE NUMBER - (COMPONENT NUMBER)

TIME	5-(1)	5-(2)	5-(3)	11-(1)	11-(3)	14-(1)	14-(2)	20-(1)
0.00100	1.4460-07	4.0340-06	-1.7790-04	-2.0140-07	3.0220-07	1.4230-06	-3.3360-06	5.7360-07
0.00200	2.2290-07	2.7680-05	-1.3260-03	-1.3620-05	3.1460-05	2.4510-05	-1.0740-05	1.1260-04
0.00300	-2.9650-05	9.2710-05	-3.9820-03	-1.0360-04	3.0270-04	2.9640-05	2.2250-06	6.5170-04
0.00400	-1.0470-05	1.9350-04	-6.1960-03	-3.2370-04	1.2150-03	1.0360-04	4.0450-05	1.9560-03
0.00500	-2.8910-05	3.4060-04	-1.3330-02	-6.9380-04	3.0920-03	2.4320-04	1.6960-04	4.2060-03
0.00600	-3.1970-05	5.2510-04	-1.8180-02	-1.5520-03	5.3940-03	5.5330-04	3.9740-04	6.3690-03
0.00700	8.3450-05	7.3130-04	-2.2100-02	-3.0510-03	3.7930-03	1.3300-03	9.3420-04	5.8550-03
0.00800	3.5480-04	9.5720-04	-2.5090-02	-4.2630-03	1.0380-02	2.2900-03	1.9680-03	8.3410-03
0.00900	7.3270-04	1.1710-03	-2.7810-02	-4.1300-03	9.7420-03	3.3260-03	3.1850-03	5.9400-03
0.01000	1.4090-03	1.3560-03	-3.0640-02	-2.3200-03	7.1680-03	4.4330-03	3.9750-03	2.3990-04
0.01100	2.6770-03	1.5230-03	-3.3320-02	9.4480-04	4.1200-03	6.6610-03	3.6940-03	-7.2290-03
0.01200	5.2150-03	1.6580-03	-3.5160-02	5.9460-03	2.3550-03	1.0800-02	1.4910-03	-1.4750-02
0.01300	7.5350-03	1.7150-03	-3.5340-02	1.1700-02	2.8160-03	1.7240-02	-3.2640-03	-2.0650-02
0.01400	8.7340-03	1.6610-03	-3.3460-02	1.7210-02	5.2330-03	2.6100-02	-9.8480-03	-2.3760-02
0.01500	8.2070-03	1.4320-03	-2.9810-02	2.2560-02	8.5220-03	3.7140-02	-1.7000-02	-2.4030-02
0.01600	5.7510-03	1.2180-03	-2.5160-02	2.8600-02	1.1500-02	4.9030-02	-2.3590-02	-2.2270-02
0.01700	1.7090-03	8.9360-04	-2.0590-02	3.4620-02	1.3490-02	6.0480-02	-2.8190-02	-1.9750-02
0.01800	-2.7630-03	5.9580-04	-1.7020-02	4.0920-02	1.4360-02	7.1240-02	-2.9470-02	-1.7800-02
0.01900	-6.5570-03	4.0710-04	-1.5110-02	4.8380-02	1.4030-02	8.1140-02	-2.7590-02	-1.7460-02
0.02000	-9.6710-03	3.2550-04	-1.5110-02	5.6080-02	1.1890-02	9.0090-02	-2.3210-02	-1.9080-02
0.02100	-1.2770-02	3.0620-04	-1.6030-02	6.2910-02	7.2570-03	9.7980-02	-1.6390-02	-2.2340-02
0.02200	-1.6370-02	2.4220-04	-1.4710-02	6.8210-02	-2.2000-04	1.0480-01	-7.7790-03	-2.6930-02
0.02300	-2.0740-02	7.2230-05	-1.1050-02	7.2480-02	-1.0450-02	1.1020-01	1.4740-03	-3.2600-02
0.02400	-2.5640-02	-1.6840-04	-5.9990-03	7.5330-02	-2.2440-02	1.1410-01	1.0880-02	-3.8720-02
0.02500	-2.9810-02	-4.4940-04	-9.7080-04	7.6710-02	-3.3790-02	1.1590-01	2.0360-02	-4.4350-02
0.02600	-3.1690-02	-6.5470-04	3.3270-03	7.6550-02	-4.2000-02	1.1500-01	2.9290-02	-4.8020-02
0.02700	-3.0850-02	-7.7150-04	6.4140-03	7.4220-02	-4.5690-02	1.1120-01	3.7560-02	-4.8980-02
0.02800	-2.8270-02	-8.2640-04	8.3220-03	6.9640-02	-4.5780-02	1.0480-01	4.5580-02	-4.6770-02
0.02900	-2.5270-02	-8.8000-04	9.4510-03	6.2990-02	-4.5090-02	9.6290-02	5.3030-02	-4.2010-02
0.03000	-2.2420-02	-9.5670-04	1.0520-02	5.4420-02	-4.6770-02	8.6380-02	5.9730-02	-3.5760-02
0.03100	-1.9440-02	-1.0390-03	1.2500-02	4.4100-02	-5.2770-02	7.5830-02	6.5950-02	-2.9060-02
0.03200	-1.5620-02	-1.0970-03	1.6120-02	3.2590-02	-6.2670-02	6.5310-02	7.1770-02	-2.3010-02
0.03300	-1.0430-02	-1.0910-03	2.1440-02	2.1310-02	-7.4070-02	5.5020-02	7.6900-02	-1.8000-02
0.03400	-3.8010-03	-1.0010-03	2.7390-02	1.1380-02	-8.3720-02	4.4890-02	8.1500-02	-1.4130-02
0.03500	3.7870-03	-8.1110-04	3.2050-02	3.4080-03	-8.8900-02	3.4730-02	8.5660-02	-1.1620-02
0.03600	1.1490-02	-5.2250-04	3.3290-02	-2.2730-03	-8.8170-02	2.4260-02	8.8810-02	-1.1230-02
0.03700	1.8240-02	-1.5790-04	2.9700-02	-6.1950-03	-8.1410-02	1.3490-02	9.0140-02	-1.3810-02
0.03800	2.3130-02	2.4660-04	2.1360-02	-9.6060-03	-6.9430-02	2.8220-03	8.8960-02	-1.9180-02
0.03900	2.5610-02	6.3830-04	9.8830-03	-1.3480-02	-5.3610-02	-7.1870-03	8.4790-02	-2.5480-02
0.04000	2.5280-02	9.4820-04	-2.0870-03	-1.8150-02	-3.5660-02	-1.6020-02	7.7430-02	-2.9650-02
0.04100	2.2000-02	1.0990-03	-1.1840-02	-2.3250-02	-1.7490-02	-2.3360-02	6.7350-02	-2.9140-02
0.04200	1.6350-02	1.0530-03	-1.7450-02	-2.7660-02	-8.3860-04	-2.9120-02	5.5390-02	-2.3370-02
0.04300	9.7610-03	8.3820-04	-1.8300-02	-3.0160-02	1.3150-02	-3.3370-02	4.2220-02	-1.3850-02
0.04400	3.8690-03	5.2520-04	-1.5110-02	-2.9980-02	2.4270-02	-3.6260-02	2.8340-02	-2.9660-03
0.04500	-2.4810-04	1.9600-04	-9.5000-03	-2.7240-02	3.3200-02	-3.8010-02	1.4030-02	7.2420-03
0.04600	-2.4530-03	-8.6720-05	-3.5410-03	-2.2880-02	4.1170-02	-3.8840-02	-6.7660-04	1.5730-02
0.04700	-3.4670-03	-2.9030-04	8.8310-04	-1.8220-02	4.9340-02	-3.9030-02	-1.5650-02	2.2310-02
0.04800	-4.4110-03	-4.1260-04	2.4670-03	-1.4600-02	5.8330-02	-3.8930-02	-3.0410-02	2.7140-02
0.04900	-6.0630-03	-4.6240-04	7.3330-04	-1.2830-02	6.9050-02	-3.8760-02	-4.4090-02	3.0340-02
0.05000	-8.2270-03	-4.3280-04	-3.9430-03	-1.2910-02	7.7820-02	-3.8870-02	-5.5700-02	3.1850-02
0.05100	-9.8010-03	-3.0150-04	-1.0530-02	-1.4110-02	8.6640-02	-3.9200-02	-6.4200-02	3.1590-02
0.05200	-9.7140-03	-5.4580-05	-1.7680-02	-1.5460-02	9.3240-02	-3.9560-02	-6.8900-02	2.9810-02
0.05300	-6.7390-03	2.8900-04	-2.4050-02	-1.6080-02	9.6290-02	-3.9760-02	-6.9690-02	2.7480-02

0.05400	-1.6450-03	6.7260-04	-3.3010-02	-1.5730-02	9.4590-02	-3.9660-02	-6.7150-02	2.6260-02
0.05500	5.9770-03	1.0150-03	-3.3560-02	-1.4960-02	8.7480-02	-3.9390-02	-6.2290-02	2.7820-02
0.05600	9.3260-03	1.2420-03	-2.9930-02	-1.4760-02	7.5330-02	-3.9220-02	-5.6360-02	3.3040-02
0.05700	1.2970-02	1.3000-03	-2.6410-02	-1.6020-02	5.9560-02	-3.9460-02	-5.0470-02	4.1350-02
0.05800	1.4470-02	1.1340-03	-2.0490-02	-1.8990-02	4.2260-02	-4.0260-02	-4.5280-02	5.0950-02
0.05900	1.4210-02	9.2910-04	-1.2930-02	-2.3130-02	2.5490-02	-4.1500-02	-4.0300-02	5.9070-02
0.06000	1.5040-02	5.0130-04	-4.7890-03	-2.7220-02	1.0540-02	-4.2800-02	-3.6510-02	6.3160-02
0.06100	1.1360-02	2.6760-04	2.8720-03	-2.9950-02	-2.3150-03	-4.3530-02	-3.2120-02	6.1530-02
0.06200	1.1110-02	-1.0560-05	9.2410-03	-3.0490-02	-1.3560-02	-4.2990-02	-2.6870-02	5.3930-02
0.06300	1.0760-02	-2.3270-04	1.3980-02	-2.8720-02	-2.3800-02	-4.0550-02	-2.0300-02	4.1760-02
0.06400	1.0340-02	-3.7760-04	1.7210-02	-2.5220-02	-3.3310-02	-3.5750-02	-1.4250-02	2.7660-02
0.06500	9.1920-03	-4.6790-04	1.9210-02	-2.0760-02	-4.1620-02	-2.8450-02	-7.8430-03	1.4550-02
0.06600	6.9390-03	-5.1980-04	2.0170-02	-1.5470-02	-4.8500-02	-1.9680-02	-2.2840-03	4.5470-03
0.06700	3.7260-03	-5.3620-04	1.9940-02	-1.0540-02	-5.3690-02	-7.5080-03	1.8530-03	-1.7310-03
0.06800	2.2590-04	-5.0570-04	1.8240-02	-4.2640-03	-5.6130-02	5.0850-03	4.2280-03	-5.0700-03
0.06900	-2.7020-03	-4.1550-04	1.4890-02	3.5490-03	-5.6220-02	1.8310-02	4.7030-03	-6.9590-03
0.07000	-4.6680-03	-2.6820-04	1.0180-02	1.3190-02	-5.3950-02	3.1650-02	3.2910-03	-8.7710-03
0.07100	-5.0650-03	-9.0700-05	4.9190-03	2.4300-02	-4.9660-02	4.4650-02	1.1550-04	-1.1260-02
0.07200	-5.1110-03	9.8350-05	2.7710-04	3.5890-02	-4.3770-02	5.6940-02	-4.6100-03	-1.4540-02
0.07300	-5.5900-03	1.5370-04	-2.6990-03	4.6640-02	-3.6880-02	6.5110-02	-1.0610-02	-1.8280-02
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0.07600	-1.5440-02	-2.5470-04	9.2380-05	6.4220-02	-1.6520-02	9.0020-02	-3.1960-02	-2.9370-02
0.07700	-2.0360-02	-5.1500-04	2.5690-03	6.4750-02	-1.0830-02	9.1860-02	-3.8270-02	-3.2650-02
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0.08000	-2.7960-02	-9.6360-04	3.9050-03	5.6810-02	4.2200-03	7.7830-02	-4.7600-02	-3.7230-02
0.08100	-2.7100-02	-9.4790-04	2.5290-03	5.1350-02	7.8880-03	6.7170-02	-4.6710-02	-3.6050-02
0.08200	-2.4990-02	-8.7270-04	1.1620-03	4.4100-02	1.0010-02	5.4300-02	-4.3730-02	-3.3900-02
0.08300	-2.1990-02	-7.5720-04	2.6010-04	3.4950-02	1.0260-02	3.9910-02	-3.8680-02	-3.1180-02
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0.08700	7.9750-05	1.5530-04	-1.8880-03	-1.1270-02	9.7000-04	-2.1660-02	5.1920-04	-1.4600-02
0.08800	8.1560-03	4.9160-04	-3.9960-03	-2.2610-02	3.4910-05	-3.6440-02	1.3120-02	-8.9810-03
0.08900	1.6100-02	8.0850-04	-6.6130-03	-3.3550-02	7.5560-04	-5.0440-02	2.5290-02	-4.0810-03
0.09000	2.2900-02	1.0490-03	-8.9790-03	-4.4090-02	3.0130-03	-6.3160-02	3.6100-02	-2.9330-04
0.09100	2.7780-02	1.1690-03	-1.0220-02	-5.3960-02	6.2640-03	-7.3950-02	4.4900-02	2.0460-03
0.09200	3.0580-02	1.1350-03	-9.6900-03	-6.2470-02	9.6950-03	-8.2120-02	5.1410-02	2.9260-03
0.09300	3.1690-02	1.0290-03	-7.1930-03	-6.8720-02	1.2520-02	-8.7120-02	5.5810-02	2.6530-03
0.09400	3.1760-02	8.3540-04	-3.0870-03	-7.1780-02	1.4300-02	-8.8700-02	5.8610-02	1.7900-03
0.09500	3.1240-02	6.2250-04	1.8150-03	-7.1130-02	1.5180-02	-8.6880-02	6.0440-02	1.0460-03
0.09600	3.0190-02	4.2890-04	6.4350-03	-6.6850-02	1.5900-02	-8.1990-02	6.1860-02	1.1010-03
0.09700	2.8200-02	2.7540-04	9.6570-03	-5.9630-02	1.7380-02	-7.4530-02	6.3180-02	2.4510-03
0.09800	2.4730-02	1.6830-04	1.0540-02	-5.0560-02	2.0370-02	-6.5040-02	6.4350-02	5.2730-03
0.09900	1.9430-02	1.0630-04	8.5510-03	-4.0790-02	2.4960-02	-5.4030-02	6.5100-02	9.3400-03
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0.10100	4.6090-03	9.4990-05	-3.2480-03	-2.2030-02	3.5980-02	-2.9040-02	6.3710-02	1.8150-02
0.10200	-3.7410-03	1.2180-04	-1.0980-02	-1.3200-02	4.0040-02	-1.5640-02	6.1010-02	2.0690-02
0.10300	-1.1020-02	1.4230-04	-1.7760-02	-4.2590-03	4.1760-02	-2.0150-03	5.6900-02	2.0640-02
0.10400	-1.6620-02	1.3230-04	-2.1920-02	5.1780-03	4.0500-02	1.1530-02	5.1500-02	1.7620-02
0.10500	-2.0080-02	7.4790-05	-2.2330-02	1.5130-02	3.6200-02	2.4640-02	4.4980-02	1.1960-02
0.10600	-2.1340-02	-3.4280-05	-1.8790-02	2.5150-02	2.9000-02	3.6890-02	3.7520-02	4.6430-03
0.10700	-2.0760-02	-1.6590-04	-1.2050-02	3.4450-02	1.9360-02	4.7900-02	2.9310-02	-2.8190-03
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0.10900	-1.6780-02	-5.3440-04	4.7010-03	4.7420-02	-4.4000-03	6.4770-02	1.1930-02	-1.1680-02
0.11000	-1.4710-02	-6.8090-04	1.1390-02	5.0100-02	-1.6650-02	7.0070-02	3.8830-03	-1.0890-02
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0.11300	-1.0230-02	-7.5540-04	1.6350-02	4.5450-02	-4.5660-02	7.1870-02	-9.2950-03	5.7870-03

0.11400	[illegible]	-6.5960-04	1.4490-02	4.1740-02	-5.2490-02	6.3270-02	-8.6910-03	9.9760-03
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0.15100	1.1120-02	4.5390-04	1.1110-03	1.4550-04	-3.4270-02	1.4890-02	5.9010-02	2.1620-02
0.15200	9.0910-03	4.2600-04	6.4840-04	8.7360-03	-3.7950-02	2.9900-02	7.5070-02	2.4860-02
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0.17200	1.7380-03	9.9840-06	7.7270-03	2.3300-02	-4.0670-02	4.1360-02	3.5400-02	-4.2590-02
0.17300	3.1790-03	-6.1620-05	9.2680-03	1.3310-02	-3.5660-02	2.6690-02	2.9180-02	-4.5370-02

0.17400	4.2330-03	-1.1790-04	9.5380-03	3.6410-03	-2.8790-02	1.2150-02	2.3540-02	-4.5390-02
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0.17600	5.5110-03	-1.0920-04	6.6250-03	-1.3340-02	-9.7800-03	-1.5260-02	1.6010-02	-3.9930-02
0.17700	5.3410-03	-4.3440-05	3.7390-03	-2.1040-02	9.2360-04	-2.7810-02	1.3430-02	-3.4410-02
0.17800	6.1100-03	5.7090-05	3.5590-04	-2.8050-02	1.1240-02	-3.9100-02	1.1760-02	-2.8220-02
0.17900	6.3360-03	1.6570-04	-3.3760-03	-3.3650-02	2.0510-02	-4.9000-02	1.0490-02	-2.2190-02
0.18000	6.6190-03	3.2500-04	-7.2110-03	-3.8080-02	2.8460-02	-5.7230-02	9.0150-03	-1.6900-02
0.18100	7.4190-03	4.3340-04	-1.0360-02	-4.1470-02	3.5260-02	-6.3780-02	7.0320-03	-1.2740-02
0.18200	9.0600-03	6.6220-04	-1.4130-02	-4.3900-02	4.1350-02	-6.8780-02	4.1530-03	-9.8510-03
0.18300	1.1140-02	8.3350-04	-1.6740-02	-4.5720-02	4.7090-02	-7.2350-02	-3.4980-04	-8.0180-03
0.18400	1.2910-02	9.5090-04	-1.8560-02	-4.6940-02	5.2620-02	-7.4660-02	-6.5960-03	-6.7130-03
0.18500	1.4020-02	9.9630-04	-1.9540-02	-4.7530-02	5.7810-02	-7.5760-02	-1.4570-02	-5.1900-03
0.18600	1.4600-02	9.7860-04	-1.9560-02	-4.7470-02	6.2320-02	-7.5610-02	-2.4310-02	-2.7670-03
0.18700	1.4380-02	9.1380-04	-1.8680-02	-4.6450-02	6.5720-02	-7.4130-02	-3.5420-02	9.6740-04
0.18800	1.4990-02	8.1940-04	-1.6950-02	-4.4470-02	6.7560-02	-7.1350-02	-4.7370-02	6.0510-03
0.18900	1.5010-02	7.1260-04	-1.4550-02	-4.1360-02	6.7510-02	-6.7310-02	-5.9630-02	1.2130-02
0.19000	1.4860-02	6.1050-04	-1.1780-02	-3.7080-02	6.5400-02	-6.2180-02	-7.1470-02	1.8630-02
0.19100	1.4110-02	5.1140-04	-9.0220-03	-3.1880-02	6.1300-02	-5.6130-02	-8.2210-02	2.4860-02
0.19200	1.2350-02	4.1250-04	-6.7240-03	-2.6010-02	5.5490-02	-4.9380-02	-9.1430-02	3.0170-02
0.19300	9.6210-03	3.2710-04	-5.2850-03	-1.9690-02	4.8370-02	-4.2150-02	-9.8380-02	3.4080-02
0.19400	6.3090-03	2.7510-04	-4.9680-03	-1.3290-02	4.0410-02	-3.4540-02	-1.0440-01	3.6430-02
0.19500	2.8160-03	2.6640-04	-5.7920-03	-7.0380-03	3.1970-02	-2.6690-02	-1.0790-01	3.7390-02
0.19600	-6.7760-04	2.8850-04	-7.5090-03	-9.2730-04	2.3350-02	-1.8750-02	-1.0960-01	3.7380-02
0.19700	-4.1000-03	3.1660-04	-9.5800-03	4.9820-03	1.4780-02	-1.0830-02	-1.0950-01	3.6860-02
0.19800	-7.3110-03	3.2730-04	-1.1310-02	1.0580-02	6.4410-03	-3.0140-03	-1.0780-01	3.6210-02
0.19900	-1.0100-02	3.0370-04	-1.2010-02	1.5790-02	-1.5040-03	4.5860-03	-1.0460-01	3.5600-02
0.20000	-1.2280-02	2.3700-04	-1.1200-02	2.0450-02	-8.9930-03	1.1880-02	-1.0030-01	3.5050-02
0.20100	-1.3630-02	1.2990-04	-8.7810-03	2.4420-02	-1.6070-02	1.8790-02	-9.4980-02	3.4560-02
0.20200	-1.4030-02	-3.2130-06	-4.9920-03	2.7600-02	-2.2810-02	2.5230-02	-8.8680-02	3.4160-02
0.20300	-1.3520-02	-1.4720-04	-3.6320-04	2.9930-02	-2.9280-02	3.1110-02	-8.1440-02	3.3950-02
0.20400	-1.2400-02	-2.9140-04	4.4610-03	3.1430-02	-3.5330-02	3.6290-02	-7.3190-02	3.3960-02
0.20500	-1.0990-02	-4.2400-04	8.8770-03	3.2090-02	-4.0670-02	4.0630-02	-6.3810-02	3.4090-02
0.20600	-9.4070-03	-5.2600-04	1.2410-02	3.1960-02	-4.4850-02	4.4040-02	-5.3230-02	3.4050-02
0.20700	-7.6630-03	-5.7710-04	1.4750-02	3.1110-02	-4.7510-02	4.6410-02	-4.1420-02	3.3420-02
0.20800	-5.8050-03	-5.6730-04	1.5710-02	2.9700-02	-4.8480-02	4.7720-02	-2.8480-02	3.1840-02
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0.21000	-2.2950-03	-3.7940-04	1.3380-02	2.5900-02	-4.5800-02	4.7220-02	-3.3280-04	2.5460-02
0.21100	-9.5280-04	-2.2920-04	1.0450-02	2.3750-02	-4.2710-02	4.5530-02	1.3970-02	2.1100-02
0.21200	-9.1050-05	-7.1020-05	6.8400-03	2.1400-02	-3.8790-02	4.2950-02	2.7650-02	1.6510-02
0.21300	2.1730-04	7.1290-05	3.0790-03	1.8790-02	-3.4210-02	3.9500-02	4.0080-02	1.2070-02
0.21400	3.1570-05	1.7970-04	-3.0180-04	1.5830-02	-2.9100-02	3.5200-02	5.0710-02	8.0880-03
0.21500	-5.0200-04	2.4260-04	-2.8730-03	1.2490-02	-2.3640-02	3.0150-02	5.9170-02	4.6620-03
0.21600	-1.2340-03	2.6280-04	-5.1920-03	8.9260-03	-1.8060-02	2.4470-02	6.5230-02	1.7370-03
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0.21900	-3.0030-03	1.0360-04	-8.2350-03	-1.6210-03	-7.8600-05	5.9340-03	6.9020-02	-4.6550-03
0.22000	-2.7390-03	1.5760-05	-6.5050-03	-5.3250-03	6.2690-03	2.9330-04	6.6620-02	-7.8990-03
0.22100	-2.0660-03	-7.7440-05	-3.9830-03	-8.7400-03	1.1940-02	-4.8200-03	6.3350-02	-1.3200-02
0.22200	-1.1330-03	-1.4540-04	-1.5000-03	-1.1550-02	1.6420-02	-9.4080-03	5.9830-02	-2.0960-02
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0.22500	4.6110-03	3.8480-05	-2.1500-03	-1.6510-02	2.6080-02	-2.0370-02	5.2210-02	-5.1870-02
0.22600	7.0730-03	2.4160-04	-5.5520-03	-1.7840-02	2.9540-02	-2.3390-02	5.1300-02	-6.0290-02
0.22700	9.0160-03	4.6630-04	-9.8680-03	-1.9330-02	3.2730-02	-2.6260-02	5.1280-02	-6.5870-02
0.22800	1.0110-02	6.6690-04	-1.4380-02	-2.0980-02	3.4820-02	-2.8910-02	5.2110-02	-6.8430-02
0.22900	1.0280-02	8.1560-04	-1.8190-02	-2.2610-02	3.5090-02	-3.1210-02	5.3630-02	-6.8390-02
0.23000	9.7540-03	8.9150-04	-2.0540-02	-2.4030-02	3.3360-02	-3.2890-02	5.5550-02	-6.6530-02
0.23100	8.9900-03	8.9740-04	-2.0880-02	-2.4980-02	2.9920-02	-3.3720-02	5.7520-02	-6.3610-02
0.23200	8.3550-03	8.4300-04	-1.9130-02	-2.5300-02	2.5270-02	-3.3560-02	5.9230-02	-6.0210-02
0.23300	7.8600-03	7.3170-04	-1.5660-02	-2.4930-02	1.9920-02	-3.2440-02	6.0480-02	-5.6780-02

0.23400	7.2410-03	5.6670-04	-1.1170-02	-2.3320-02	1.4250-02	-3.0510-02	6.1330-02	-5.3650-02
0.23500	6.2210-03	3.5540-04	-6.4450-03	-2.2300-02	8.6950-03	-2.7900-02	6.0770-02	-5.0950-02
0.23600	5.0020-03	1.3330-04	-1.4360-03	-2.0430-02	3.5850-03	-2.4630-02	5.9640-02	-4.8500-02
0.23700	3.6070-03	-1.0530-04	3.3530-03	-1.8340-02	-5.2380-04	-2.0620-02	5.7710-02	-4.6150-02
0.23800	2.3090-03	-3.1250-04	8.5650-03	-1.5570-02	-4.2500-03	-1.5790-02	5.5060-02	-4.3460-02
0.23900	1.2920-03	-4.5680-04	1.1830-02	-1.2330-02	-7.9600-03	-1.0060-02	5.1860-02	-4.0100-02
0.24000	6.6570-04	-5.2450-04	1.3130-02	-8.9360-03	-1.2000-02	-3.4640-03	4.8400-02	-3.5230-02
0.24100	3.6940-04	-5.0390-04	1.2640-02	-4.3210-03	-1.6330-02	3.8600-03	4.4700-02	-2.8160-02
0.24200	2.1450-04	-4.2600-04	1.0810-02	9.2990-04	-2.0430-02	1.1680-02	4.0710-02	-1.8690-02
0.24300	7.9120-06	-3.0570-04	8.4170-03	6.5250-03	-2.3920-02	1.9560-02	3.6240-02	-7.1140-03
0.24400	-3.7060-04	-1.7350-04	6.0040-03	1.2160-02	-2.6460-02	2.7500-02	3.0970-02	5.3150-03
0.24500	-1.0110-03	-5.1010-05	3.8760-03	1.7560-02	-2.8110-02	3.4870-02	2.4580-02	1.7110-02
0.24600	-1.9910-03	4.3550-05	2.0960-03	2.2980-02	-2.9110-02	4.1520-02	1.6770-02	2.6830-02
0.24700	-3.3210-03	9.2730-05	6.3870-04	2.8020-02	-2.9660-02	4.7200-02	7.3300-03	3.3660-02
0.24800	-4.9280-03	9.4680-05	-3.8260-04	3.2550-02	-2.9750-02	5.1740-02	-3.7580-03	3.7690-02
0.24900	-6.7380-03	4.4070-05	-7.6840-04	3.6360-02	-2.9240-02	5.4960-02	-1.6300-02	3.9570-02
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0.25400	-1.6700-02	-7.2060-04	8.4900-03	3.9020-02	-1.9440-02	4.7760-02	-8.2950-02	3.9450-02
0.25500	-1.7370-02	-8.0800-04	9.9960-03	3.6480-02	-1.7230-02	4.2070-02	-9.2920-02	3.9640-02
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0.25800	-1.3490-02	-5.5830-04	6.0540-03	2.3700-02	-7.6140-03	1.8770-02	-1.1100-01	4.4990-02
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0.26100	-3.6600-03	1.7540-04	-6.6440-03	4.4930-03	9.5410-03	-1.1290-02	-1.1190-01	4.8990-02
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0.26300	4.4900-03	6.3000-04	-1.3140-02	-9.7690-03	2.1800-02	-3.1700-02	-1.0540-01	4.2220-02
0.26400	8.4540-03	7.8130-04	-1.4560-02	-1.6730-02	2.7290-02	-4.1240-02	-1.0080-01	3.6020-02
0.26500	1.1920-02	8.6170-04	-1.4640-02	-2.3430-02	3.2230-02	-5.0170-02	-9.5340-02	2.9050-02
0.26600	1.4610-02	8.6770-04	-1.3550-02	-2.9780-02	3.6750-02	-5.8420-02	-8.9200-02	2.2280-02
0.26700	1.6370-02	8.0800-04	-1.1630-02	-3.5740-02	4.1050-02	-6.5880-02	-8.2430-02	1.6480-02
0.26800	1.7190-02	7.0190-04	-9.3480-03	-4.1170-02	4.5220-02	-7.2380-02	-7.5040-02	1.2050-02
0.26900	1.7200-02	5.7500-04	-7.2000-03	-4.5840-02	4.9200-02	-7.7670-02	-6.6990-02	9.1140-03
0.27000	1.6590-02	4.5210-04	-5.6190-03	-4.9470-02	5.2690-02	-8.1500-02	-5.8230-02	7.5370-03
0.27100	1.5550-02	3.5300-04	-4.8650-03	-5.1810-02	5.5360-02	-8.3650-02	-4.8700-02	7.0020-03
0.27200	1.4270-02	2.9000-04	-4.9700-03	-5.2710-02	5.6940-02	-8.4000-02	-3.8410-02	6.9990-03
0.27300	1.2920-02	2.6830-04	-5.7740-03	-5.2170-02	5.7370-02	-8.2490-02	-2.7450-02	6.8680-03
0.27400	1.1600-02	2.8550-04	-7.0160-03	-5.0330-02	5.6720-02	-7.9150-02	-1.6040-02	5.8920-03
0.27500	1.0370-02	3.3290-04	-8.4560-03	-4.7330-02	5.5140-02	-7.4050-02	-4.4930-03	3.4400-03
0.27600	9.2320-03	3.9740-04	-9.9190-03	-4.3330-02	5.2630-02	-6.7330-02	6.8220-03	-8.7570-04
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0.27800	7.2130-03	5.2080-04	-1.2420-02	-3.2890-02	4.4610-02	-4.9740-02	2.7320-02	-1.4450-02
0.27900	6.3360-03	5.5120-04	-1.3050-02	-2.6760-02	3.8500-02	-3.9350-02	3.5980-02	-2.2110-02
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0.28100	4.5970-03	4.8300-04	-1.1380-02	-1.3670-02	2.3460-02	-1.6720-02	4.9750-02	-3.3420-02
0.28200	3.5150-03	3.6780-04	-8.5600-03	-7.0310-03	1.4710-02	-5.0340-03	5.5200-02	-3.5580-02
0.28300	2.1570-03	2.0110-04	-4.4610-03	-4.3770-04	5.3470-03	6.5940-03	6.0100-02	-3.5500-02
0.28400	5.1350-04	-1.6270-06	4.8440-04	6.0900-03	-4.6130-03	1.7990-02	6.4780-02	-3.3980-02
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0.28900	-9.2910-03	-7.5770-04	1.7650-02	3.4930-02	-5.7080-02	6.7130-02	9.2090-02	-3.2940-02
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0.29100	-1.3370-02	-7.8440-04	1.7010-02	4.2350-02	-7.1890-02	8.0390-02	1.0430-01	-3.8240-02
0.29200	-1.4990-02	-7.5640-04	1.5830-02	4.5050-02	-7.6870-02	8.5190-02	1.0960-01	-4.0420-02
0.29300	-1.6010-02	-7.0970-04	1.4520-02	4.7130-02	-8.0330-02	8.8770-02	1.1380-01	-4.1620-02

0.29400	-1.6230-02	-6.5420-04	1.3360-02	4.8510-02	-8.2440-02	9.1170-02	1.1650-01	-4.0690-02
0.29500	-1.5370-02	-6.0330-04	1.2610-02	4.9420-02	-8.3310-02	9.2390-02	1.1740-01	-3.7950-02
0.29600	-1.4960-02	-5.7110-04	1.2440-02	4.9450-02	-8.2950-02	9.2360-02	1.1610-01	-3.3340-02
0.29700	-1.3800-02	-5.6570-04	1.2920-02	4.8560-02	-8.1250-02	9.0960-02	1.1260-01	-2.7370-02
0.29800	-1.2520-02	-5.8970-04	1.3950-02	4.6650-02	-7.8150-02	8.8090-02	1.0690-01	-2.0800-02
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0.30100	-8.2620-03	-6.3690-04	1.7090-02	3.5560-02	-5.9460-02	7.0480-02	7.8310-02	-4.3500-03
0.30200	-6.6440-03	-6.7140-04	1.6780-02	3.0770-02	-5.0600-02	6.1940-02	6.6780-02	-2.1260-04
0.30300	-4.9870-03	-6.1370-04	1.5320-02	2.5730-02	-4.0910-02	5.2360-02	5.3970-02	3.1420-03
0.30400	-3.3980-03	-5.1450-04	1.2740-02	2.0510-02	-3.0670-02	4.1900-02	4.0620-02	6.4150-03
0.30500	-1.9410-03	-3.7990-04	9.2760-03	1.5080-02	-2.0030-02	3.0690-02	2.6970-02	9.9250-03
0.30600	-7.0760-04	-2.2070-04	5.2360-03	9.4120-03	-9.2780-03	1.8890-02	1.3170-02	1.3810-02
0.30700	3.0460-04	-4.9200-05	9.4620-04	3.5270-03	1.6340-03	6.6320-03	-6.5390-04	1.8020-02
0.30800	1.1450-03	1.2280-04	-3.3400-03	-2.4970-03	1.2500-02	-5.9160-03	-1.4430-02	2.2610-02
0.30900	1.9120-03	2.8550-04	-7.4420-03	-5.5350-03	2.3090-02	-1.8550-02	-2.8100-02	2.6740-02
0.31000	2.7200-03	4.3070-04	-1.1200-02	-1.4480-02	3.3160-02	-3.1020-02	-4.1610-02	3.0790-02
0.31100	3.6570-03	5.5130-04	-1.4420-02	-2.0270-02	4.2450-02	-4.3080-02	-5.4960-02	3.4280-02
0.31200	4.7440-03	6.4020-04	-1.6380-02	-2.5900-02	5.0780-02	-5.4470-02	-6.7990-02	3.6920-02
0.31300	5.9380-03	6.9110-04	-1.9360-02	-3.1340-02	5.8040-02	-6.4930-02	-8.0610-02	3.8410-02
0.31400	7.1710-03	7.0200-04	-1.8710-02	-3.6520-02	6.4190-02	-7.4240-02	-9.2530-02	3.8480-02
0.31500	8.4130-03	6.7810-04	-1.8010-02	-4.1240-02	6.9180-02	-8.2190-02	-1.0340-01	3.7000-02
0.31600	9.7020-03	6.3320-04	-1.6520-02	-4.5290-02	7.3000-02	-8.8630-02	-1.1290-01	3.4040-02
0.31700	1.1120-02	5.8700-04	-1.4670-02	-4.8420-02	7.5620-02	-9.3440-02	-1.2060-01	2.9880-02
0.31800	1.2690-02	5.5890-04	-1.2950-02	-5.0470-02	7.7070-02	-9.6570-02	-1.2610-01	2.4970-02
0.31900	1.4350-02	5.6140-04	-1.1770-02	-5.1390-02	7.7400-02	-9.8010-02	-1.2930-01	1.9850-02
0.32000	1.5860-02	5.9590-04	-1.1370-02	-5.1270-02	7.6660-02	-9.7810-02	-1.3010-01	1.4990-02
0.32100	1.6920-02	6.5300-04	-1.1760-02	-5.0240-02	7.4890-02	-9.6040-02	-1.2850-01	1.0700-02
0.32200	1.7270-02	7.1750-04	-1.2750-02	-4.8470-02	7.2060-02	-9.2780-02	-1.2470-01	7.0990-03
0.32300	1.6780-02	7.7310-04	-1.4020-02	-4.6050-02	6.8120-02	-8.8120-02	-1.1880-01	4.1760-03
0.32400	1.5510-02	8.0680-04	-1.5160-02	-4.3000-02	6.2990-02	-8.2130-02	-1.1120-01	1.8370-03
0.32500	1.3650-02	8.0940-04	-1.5800-02	-3.9270-02	5.6650-02	-7.4920-02	-1.0240-01	-3.9850-05
0.32600	1.1410-02	7.7420-04	-1.5630-02	-3.4800-02	4.9210-02	-6.6570-02	-9.2610-02	-1.6170-03
0.32700	8.9810-03	6.9670-04	-1.4480-02	-2.9590-02	4.0860-02	-5.7210-02	-8.2300-02	-3.1020-03
0.32800	6.4480-03	5.7510-04	-1.2290-02	-2.3740-02	3.1880-02	-4.7000-02	-7.1840-02	-4.7260-03
0.32900	3.8550-03	4.1230-04	-9.1800-03	-1.7430-02	2.2600-02	-3.6100-02	-6.1520-02	-6.6570-03
0.33000	1.2390-03	2.1760-04	-5.3860-03	-1.0890-02	1.3320-02	-2.4680-02	-5.1540-02	-8.9020-03
0.33100	-1.3240-03	6.4930-06	-1.2540-03	-4.3090-03	4.2360-03	-1.2880-02	-4.1980-02	-1.1230-02
0.33200	-3.7180-03	-2.0130-04	2.8280-03	2.2110-03	-4.5020-03	-8.0620-04	-3.2820-02	-1.3190-02
0.33300	-5.8050-03	-3.8530-04	6.4910-03	8.6440-03	-1.2820-02	1.1230-02	-2.3910-02	-1.4220-02
0.33400	-7.4660-03	-5.2860-04	9.4500-03	1.5020-02	-2.0680-02	2.3230-02	-1.5070-02	-1.3850-02
0.33500	-8.6340-03	-6.2010-04	1.1540-02	2.1330-02	-2.8030-02	3.4960-02	-6.1520-03	-1.1870-02
0.33600	-9.3230-03	-6.5680-04	1.2720-02	2.7530-02	-3.4780-02	4.6120-02	2.9310-03	-8.3990-03
0.33700	-9.6300-03	-6.4360-04	1.3050-02	3.3450-02	-4.0840-02	5.6530-02	1.2140-02	-3.9320-03
0.33800	-9.7200-03	-5.9220-04	1.2680-02	3.8890-02	-4.6100-02	6.5900-02	2.1340-02	8.2920-04
0.33900	-9.7830-03	-5.1910-04	1.1790-02	4.3620-02	-5.0490-02	7.4000-02	3.0300-02	5.1330-03
0.34000	-9.9830-03	-4.4200-04	1.0560-02	4.7450-02	-5.3940-02	8.0620-02	3.8780-02	8.3480-03
0.34100	-1.0410-02	-3.7710-04	9.2400-03	5.0260-02	-5.6450-02	8.5580-02	4.6540-02	1.0080-02
0.34200	-1.1050-02	-3.3670-04	8.0560-03	5.1980-02	-5.8010-02	8.8740-02	5.3420-02	1.0230-02
0.34300	-1.1840-02	-3.2810-04	7.2500-03	5.2580-02	-5.8610-02	9.0010-02	5.9340-02	8.9540-03
0.34400	-1.2660-02	-3.5400-04	7.0180-03	5.2060-02	-5.8290-02	8.9360-02	6.4290-02	6.6600-03
0.34500	-1.3400-02	-4.1180-04	7.4550-03	5.0420-02	-5.7100-02	8.6810-02	6.8320-02	3.8890-03
0.34600	-1.3970-02	-4.9440-04	8.5150-03	4.7660-02	-5.5100-02	8.2470-02	7.1530-02	1.2330-03
0.34700	-1.4300-02	-5.8910-04	9.9930-03	4.3830-02	-5.2420-02	7.6490-02	7.4040-02	-7.8300-04
0.34800	-1.4270-02	-6.7920-04	1.1560-02	3.8990-02	-4.9150-02	6.9070-02	7.5990-02	-1.8100-03
0.34900	-1.3770-02	-7.4550-04	1.2830-02	3.3240-02	-4.5370-02	6.0440-02	7.7510-02	-1.7600-03
0.35000	-1.2680-02	-7.6990-04	1.3460-02	2.6750-02	-4.1080-02	5.0820-02	7.8700-02	-8.3260-04
0.35100	-1.0920-02	-7.3960-04	1.3200-02	1.9710-02	-3.6230-02	4.0430-02	7.9680-02	5.3590-04
0.35200	-8.4600-03	-6.4930-04	1.1960-02	1.2320-02	-3.0760-02	2.9470-02	8.0470-02	1.7870-03
0.35300	-5.3770-03	-5.0280-04	9.8170-03	4.7890-03	-2.4650-02	1.8180-02	8.1060-02	2.3940-03

0.35400	-1.3130-03	-3.1130-04	6.9630-03	-2.6910-03	-1.7990-02	6.3140-03	6.1350-02	2.3050-03
0.35500	2.0420-03	-7.1490-05	3.6760-03	-9.9560-03	-1.0940-02	-4.3700-03	6.1170-02	5.3400-04
0.35600	5.9520-03	1.3560-04	2.7350-04	-1.6870-02	-3.7650-03	-1.5090-02	8.0300-02	-1.3330-03
0.35700	9.6770-03	3.5220-04	-2.9310-03	-2.3300-02	3.2790-03	-2.5100-02	7.8500-02	-4.6870-03
0.35800	1.2930-02	5.3600-04	-5.6550-03	-2.9120-02	9.9990-03	-3.4180-02	7.5580-02	-7.5360-03
0.35900	1.5060-02	6.7210-04	-7.6790-03	-3.4220-02	1.6290-02	-4.2160-02	7.1440-02	-9.9040-03
0.36000	1.7550-02	7.5070-04	-8.6770-03	-3.8450-02	2.2130-02	-4.3940-02	6.6050-02	-1.1440-02
0.36100	1.8590-02	7.6950-04	-9.2430-03	-4.1690-02	2.7550-02	-5.4450-02	5.9500-02	-1.1970-02
0.36200	1.8760-02	7.3420-04	-8.8920-03	-4.3840-02	3.2530-02	-5.8600-02	5.1950-02	-1.1490-02
0.36300	1.8140-02	6.5660-04	-8.0500-03	-4.4930-02	3.7020-02	-6.1350-02	4.3650-02	-1.0190-02
0.36400	1.6830-02	5.5270-04	-7.0010-03	-4.4640-02	4.0880-02	-6.2610-02	3.4860-02	-8.3590-03
0.36500	1.4940-02	4.3910-04	-6.0310-03	-4.3300-02	4.3920-02	-6.2350-02	2.5870-02	-6.3970-03
0.36600	1.2620-02	3.3100-04	-5.3710-03	-4.0870-02	4.5970-02	-6.0560-02	1.6980-02	-4.7340-03
0.36700	9.9960-03	2.4040-04	-5.1560-03	-3.7470-02	4.6930-02	-5.7240-02	8.4230-03	-3.7580-03
0.36800	7.2610-03	1.7540-04	-5.4210-03	-3.3240-02	4.6760-02	-5.2620-02	3.8590-04	-3.7[illegible]
0.36900	4.5870-03	1.3940-04	-6.0980-03	-2.8330-02	4.5480-02	-4.6760-02	-7.0210-03	-4.745[illegible]
0.37000	2.1480-03	1.3160-04	-7.0530-03	-2.2910-02	4.3170-02	-3.9960-02	-1.3770-02	-6.6280-03
0.37100	7.6480-05	1.4620-04	-8.1070-03	-1.7120-02	3.9890-02	-3.2430-02	-1.9930-02	-9.0490-03
0.37200	-1.5560-03	1.7370-04	-9.0490-03	-1.1150-02	3.5700-02	-2.4430-02	-2.5610-02	-1.1560-02
0.37300	-2.7470-03	2.0170-04	-9.6520-03	-5.1970-03	3.0650-02	-1.6210-02	-3.0950-02	-1.3710-02
0.37400	-3.5540-03	2.1720-04	-9.6960-03	5.4580-04	2.4790-02	-8.0020-03	-3.6070-02	-1.5160-02
0.37500	-4.0730-03	2.0900-04	-8.9910-03	5.3930-03	1.8180-02	-4.4880-05	-4.1050-02	-1.5700-02
0.37600	-4.4060-03	1.6960-04	-7.4270-03	1.0700-02	1.0960-02	7.4560-03	-4.5860-02	-1.5330-02
0.37700	-4.6440-03	9.7680-05	-5.0100-03	1.4590-02	3.2800-03	1.4320-02	-5.0410-02	-1.4190-02
0.37800	-4.8500-03	-2.1050-06	-1.8880-03	1.8430-02	-4.6400-03	2.0360-02	-5.4520-02	-1.2540-02
0.37900	-5.0600-03	-1.1930-04	1.6570-03	2.1350-02	-1.2560-02	2.5550-02	-5.8020-02	-1.0720-02
0.38000	-5.2950-03	-2.4020-04	5.2450-03	2.3680-02	-2.0210-02	2.9770-02	-6.0730-02	-9.0810-03
0.38100	-5.5690-03	-3.5010-04	8.4740-03	2.5450-02	-2.7330-02	3.3030-02	-6.2540-02	-7.9390-03
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0.38300	-6.3070-03	-4.9230-04	1.2550-02	2.7390-02	-3.8920-02	3.6810-02	-6.3430-02	-7.7650-03
0.38400	-6.7810-03	-5.1330-04	1.3080-02	2.7610-02	-4.2900-02	3.7470-02	-6.2680-02	-8.5800-03
0.38500	-7.2760-03	-5.0080-04	1.2630-02	2.7410-02	-4.5410-02	3.7440-02	-6.1330-02	-9.5760-03
0.38600	-7.7070-03	-4.5900-04	1.1400-02	2.6580-02	-4.6340-02	3.6800-02	-5.9590-02	-1.0280-02
0.38700	-7.9580-03	-3.9460-04	9.6180-03	2.6110-02	-4.5650-02	3.5650-02	-5.7660-02	-1.0240-02
0.38800	-7.9310-03	-3.1560-04	7.5720-03	2.5180-02	-4.3360-02	3.4040-02	-5.5750-02	-9.1130-03
0.38900	-7.5770-03	-2.3130-04	5.5080-03	2.4130-02	-3.9590-02	3.2020-02	-5.4030-02	-6.7910-03
0.39000	-6.9210-03	-1.5150-04	3.6250-03	2.2900-02	-3.4460-02	2.9590-02	-5.2640-02	-3.3990-03
0.39100	-6.0540-03	-8.5160-05	2.0490-03	2.1400-02	-2.8170-02	2.6740-02	-5.1650-02	7.3410-04
0.39200	-5.1010-03	-3.8480-05	8.3290-04	1.9510-02	-2.0900-02	2.3430-02	-5.1060-02	5.1750-03
0.39300	-4.1720-03	-1.3520-05	-4.7390-05	1.7160-02	-1.2910-02	1.9620-02	-5.0780-02	9.4970-03
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0.39800	-3.2380-04	-6.8120-06	-3.1130-03	-7.2230-04	2.8150-02	-7.1300-03	-4.6540-02	2.4360-02
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0.40300	4.1880-03	3.2260-04	-1.0330-02	-2.2410-02	4.9450-02	-4.0970-02	-2.1760-02	4.1320-02
0.40400	5.1500-03	4.0860-04	-1.1820-02	-2.6770-02	5.0030-02	-4.7200-02	-1.4470-02	4.4760-02
0.40500	6.1920-03	4.8460-04	-1.2950-02	-3.0930-02	4.9350-02	-5.2820-02	-6.7910-03	4.7250-02
0.40600	7.3400-03	5.4310-04	-1.3520-02	-3.4720-02	4.7450-02	-5.7620-02	1.1230-03	4.8310-02
0.40700	8.5890-03	5.7760-04	-1.3350-02	-3.8010-02	4.4390-02	-6.1360-02	9.1150-03	4.7650-02
0.40800	9.8970-03	5.8390-04	-1.2340-02	-4.0640-02	4.0290-02	-6.3840-02	1.7060-02	4.5180-02
0.40900	1.1190-02	5.6120-04	-1.0500-02	-4.2470-02	3.5300-02	-6.4870-02	2.4880-02	4.1060-02
0.41000	1.2370-02	5.1270-04	-7.9950-03	-4.3390-02	2.9580-02	-6.4280-02	3.2520-02	3.5630-02
0.41100	1.3360-02	4.4540-04	-5.0700-03	-4.3270-02	2.3350-02	-6.1990-02	3.9990-02	2.9360-02
0.41200	1.4070-02	3.6380-04	-2.0550-03	-4.2020-02	1.6860-02	-5.7920-02	4.7310-02	2.2700-02
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