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Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
ASME Section XI, IWB-3600 Evaluation

Gentlemen:

During the Arkansas Nuclear One, Unit 2 mid-cycle outage in 2000, evidence of reactor coolant system (RCS) leakage was observed while the unit was shut down. Further evaluation revealed that a number of pressurizer heater nozzles, as well as instrumentation nozzles on the RCS hot leg had developed leaks. Repairs were made to these penetrations and an evaluation in accordance with the American Society of Mechanical Engineers (ASME) Section XI, IWB-3600 was performed. The IWB-3600 evaluation was performed because the repair method did not remove the flaws that exceeded the allowable flaws defined in IWB-3500, but the weld repair met the ASME Code. Pursuant to ASME Section XI, IWB-3610(e), Entergy Operations is providing this evaluation to the NRC. NRC review of this evaluation is not being requested. This submittal contains no commitments. Should you have any questions, please contact me.

Very truly yours,

Jimmy D. Vandergrift
Director, Nuclear Safety Assurance

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Attachment

A047

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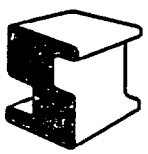
Evaluation of Potential
Crack Growth in Pressurizer Heater and
RCS Hot Leg Penetrations Welds



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Revision No.: 0
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November 2000

Evaluation of Potential Crack Growth in Pressurizer Heater and RCS Hot Leg Penetrations Welds

Prepared for:

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Arkansas Nuclear One, Unit 2
Contract NHS 00384

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Section	Pages	Revision	Date	Comments
1.0	1-1 – 1-3	0	11/15/00	Initial Issue
2.0	2-1 – 2-2			
3.0	3-1 – 3-9			
4.0	4-1 – 4-24			
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1.0 INTRODUCTION

During a recent examination of the pressurizer vessel and reactor coolant system (RCS) hot leg piping at Arkansas Nuclear One (ANO) Unit 2, evidence of leaking penetrations was observed. Additional NDE evaluation revealed that a number of pressurizer heater penetrations, as well as RTD and pressure measurement nozzle penetrations on the RCS hot leg, had developed leaks. Repairs were designed and implemented which moved the pressure boundary from the inside surface to the outside surface for both the pressurizer vessel and hot leg piping penetrations.

In the existing design at ANO-2 for both the pressurizer and RCS hot leg pipe penetrations, the instrument nozzle passes through the vessel or pipe wall, and is welded on the inside surface of the main component with a J-groove weld, as shown in Figures 1-1 and 1-2.

The repair that was designed and implemented for the pressurizer vessel replaced the pressure boundary weld on the inside surface of the pressurizer nozzle with an Alloy 690 OD weld attached to a temperbead weld pad on the pressurizer OD. The modification of the hot leg piping penetration consisted of removing a portion of the old RTD or pressure tap nozzle by cutting it near the outer wall of the RCS piping and replacing it with a new nozzle welded on the outside surface of the RCS piping with a J-groove weld plus a cover fillet. The new RTD or pressure measurement nozzle will be fabricated with Alloy 690 material which is more resistant to stress corrosion cracking than the Alloy 600 material of the old nozzle.

The objective of this report is to document the analyses performed to demonstrate that any cracking in the Alloy 600 welds at the inboard end of the pressurizer heater penetrations and hot leg RTD/pressure taps will not grow to a size greater than allowed by Section XI of the ASME Code [1].

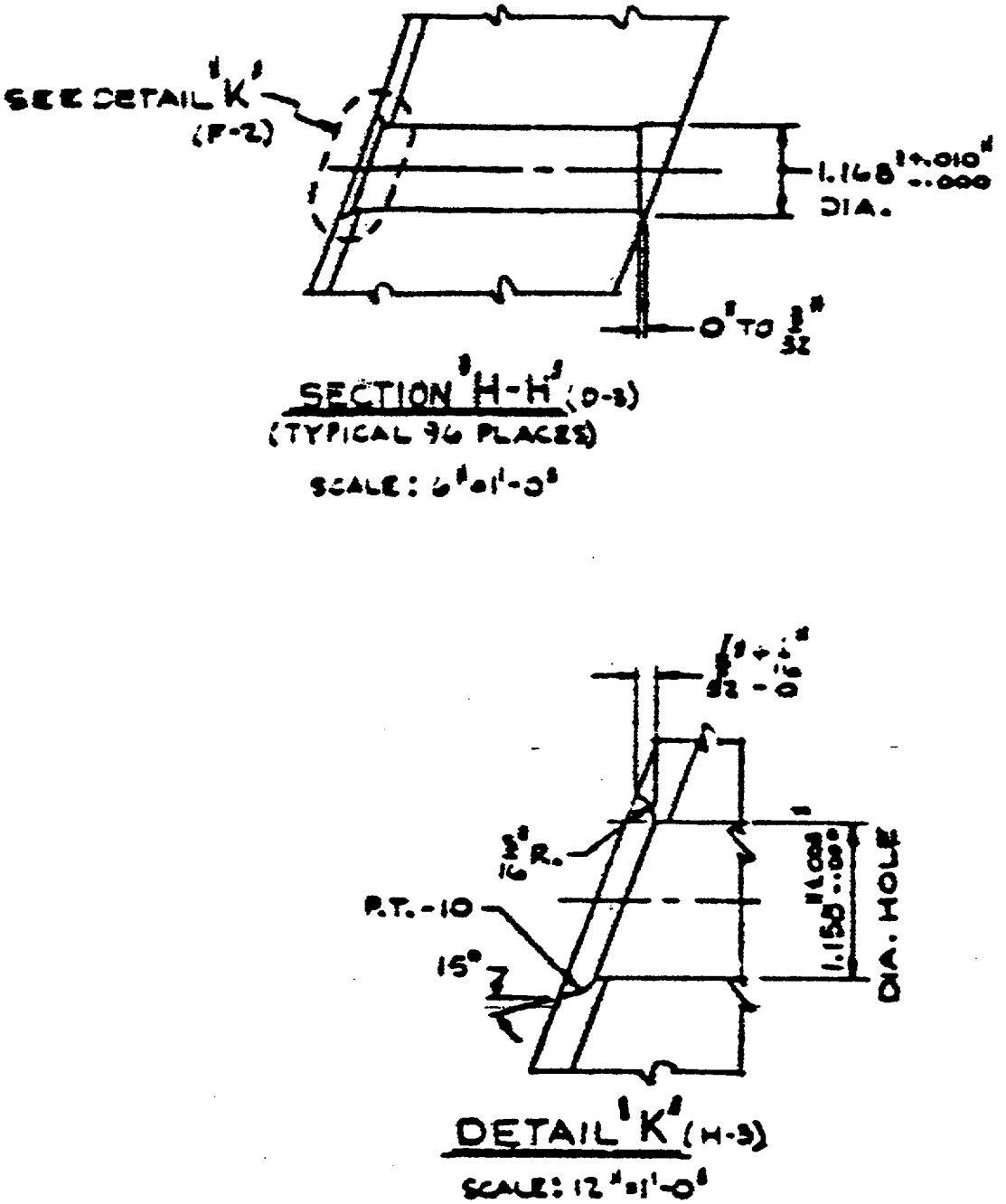

Figure 1-1. ANO-2 Pressurizer Heater Penetration Inboard Weld Groove

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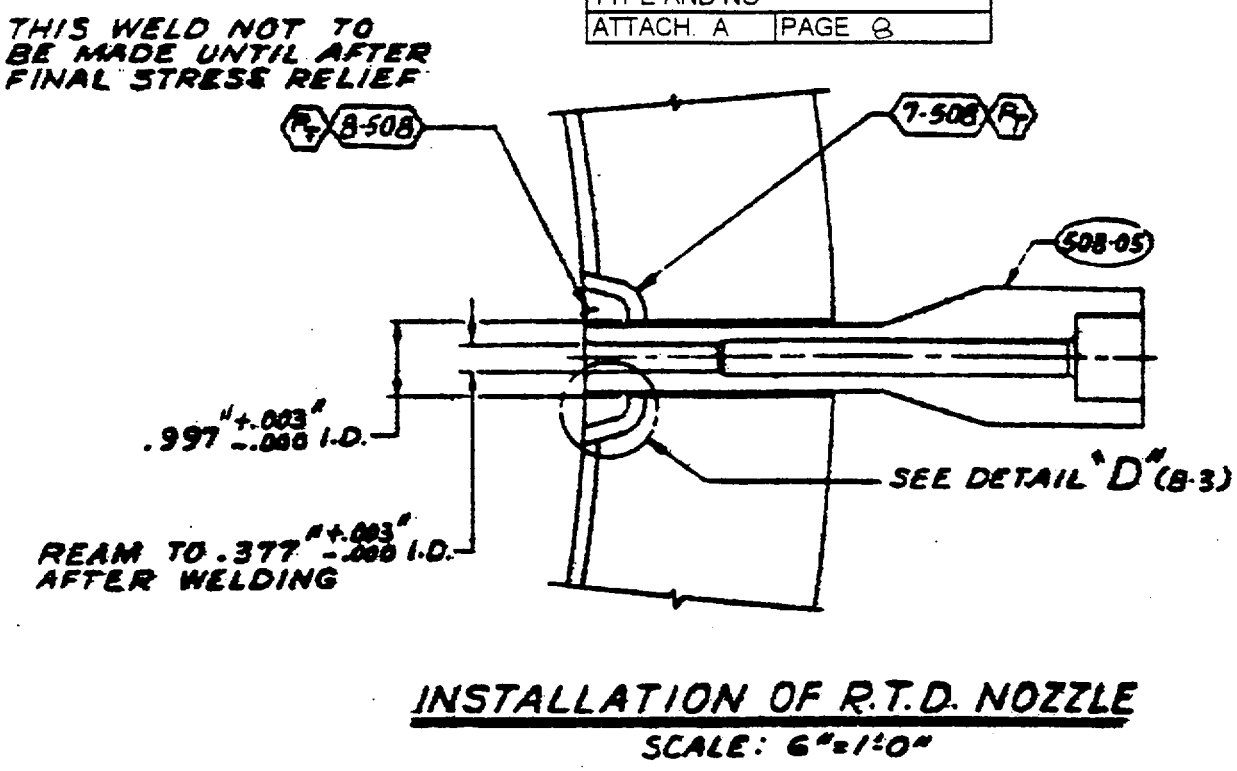

Figure 1-2a. ANO-2 RCS Hot Leg RTD Nozzle Assemblies

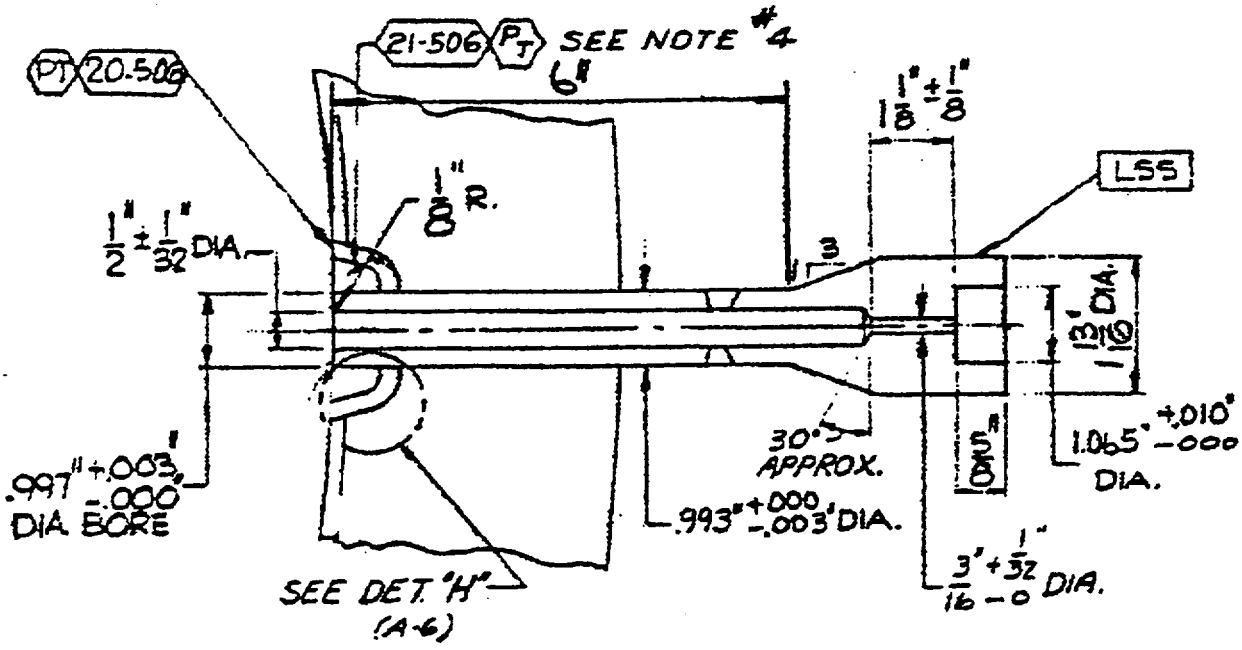

Figure 1-2b. ANO-2 RCS Hot Leg Pressure Tap Nozzle Assemblies

2.0 METHODOLOGY

ASME Code Section XI [1] provides guidance for performing crack growth analyses and for determining allowable flaw sizes in structural components. The evaluation of the potential crack growth into the pressurizer vessel and RCS hot leg piping base material is based on the guidelines of the Code and includes the following tasks:

1. Develop local finite element models of the pressurizer and hot leg penetrations to determine local stress distributions in the weld and base metal near the penetrations. For the pressurizer, the analysis is based on an enlarged hole in the pressurizer shell to account for outermost heater locations with the largest side-hill angle. Thus, the analysis is applicable for a repair at any of the pressurizer heater locations. Similarly, bounding dimensions are used for the hot leg penetration model in order to make the analyses applicable to all hot leg RTD and pressure measurement/sample locations.

2. Quantify the cyclic operating conditions expected for each location. The cyclic operating conditions are combined such that maximum cyclic stress ranges at the penetrations are determined.

3. Perform stress analyses for the internal pressure and the transient thermal conditions to compute the stress distributions for the most severe loading conditions.

4. Perform a crack growth analysis for assumed cracking of the existing Alloy 600 weld. Since the pressurizer cladding is Alloy 600, perform evaluations for both a corner crack and a crack that extends further into the adjacent cladding. For the RCS hot leg, only a corner crack in the Alloy 600 weld needs to be evaluated since the cladding is austenitic stainless steel.

5. Determine the ASME Section XI allowable stress intensity factor for each crack.

6. Determine the number of cycles to reach the allowable stress intensity factor if this is less than the allowable for the plant life and determine the end-of-evaluation period flaw size.

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3.0 DESIGN INPUT

3.1 Component Description

The pressurizer heater penetrations that have exhibited leakage are located in the spherical bottom head of the pressurizer vessel. The penetrations are longitudinal with respect to the axis of the pressurizer and symmetrically spread around the centerline of the spherical bottom head. The basic dimensions of the pressurizer and its penetration nozzle used in this evaluation are obtained from the drawings of References 2 and 3. These dimensions are summarized in Table 3-1 and illustrated in Figure 3-1. The outermost heater penetration with the largest side-hill angle is located at 38.82 inches from the centerline of the bottom head [3].

The RCS hot leg piping is a 50 inches OD, 3-3/4 inches thick cylinder with a 1/4 inch thick stainless steel cladding on its inside surface. The 1-inch inconel RTD and pressure measurement nozzles penetrate the hot leg pipe radially and are welded to the inner surface of the RCS hot leg pipe with a J-groove weld as shown in Figure 1-2. The basic dimensions of the RCS hot leg piping RTD and pressure measurement penetrations are provided by References 4 and 5. The repair designs are documented in Reference 6. The dimensions used in this evaluation are presented in Table 3-1 and illustrated in Figures 3-2 and 3-3.

3.2 Material Properties

The pressurizer vessel shell is made of SA-533, Grade B, Class 1 material and the cladding on its inside surface is made of Alloy 600 material. The pressurizer heater nozzle sleeve is fabricated from SB-166 (Alloy 600) material. The existing penetration weld is assumed to be made of Alloy 600 material. The hot leg piping material is SA-516, Grade 70 with a stainless steel clad (Type 304L assumed). The existing RTD or pressure tap nozzle is made of Inconel SB-166 (Alloy 600), whereas the replacement nozzle is made of Alloy 690. The weld material for the repair weld is Alloy 690 and the original weld is assumed to be made of Alloy 600. The properties for the following material properties were used in the analyses:

Component	Pressurizer Heater Penetrations	RCS Hot Leg Penetrations
Vessel or Pipe	SA-533 Grade B Class 1	SA-516 Grade 70
Cladding	Alloy 600	Stainless Steel (304L assumed)
Old Nozzle	Alloy 600	Alloy 600
New Nozzle	Alloy 690	Alloy 690
Penetration Weld	Alloy 600	Alloy 600

Temperature dependent material properties are used for all materials. The properties are taken from the 1992 edition of the ASME Code [7] and are shown in the following Table 3-2. Material properties in the construction codes were grouped into a very small number of generic material types (e.g., no difference between Alloy 600 and Alloy 690). In addition, the thermal conductivity of the low alloy base materials is much lower in the more recent code, such that higher thermal stresses will be predicted as compared to those based on the construction codes. Thus, the 1992 ASME Code, which provides more specific material properties, is used in the stress analyses.

A constant Poisson ratio of 0.3 is used for all materials at all temperatures. Similarly, constant density values of 0.283 lb/in^3 for the low alloy and stainless steels, and 0.301 lb/in^3 for the Inconel alloys are used in all the analyses.

3.3 Design and Operating Conditions

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The following design data is obtained from References 8 and 9:

Design Pressure	=	2485 psig
Design Temperature	=	700°F (Pressurizer), 650°F (Hot Leg)
Operating pressure	=	2235 psig
Operating temperature	=	653°F (Pressurizer), 611°F (Hot Leg)

Cyclic conditions have been taken from the updated design specifications [8, 9] and include the following significant events;

1. Heatup/Cooldown – 500 lifetime cycles. For the pressurizer, the rate is 200°F/hr; for the hot leg the rate is 100°F/hr. For conservatism, we have added the 100 psig associated with normal variations to the 2235 psig condition. The thermal stresses are small and are of opposite sign from pressure stresses in the area of the assumed cracking. For the period of heatup prior to pressurization, this can result in compressive stresses that will increase the stress intensity factor range.

2. Plant Loading/Unloading – 15,000 cycles. This transient exists only for the hot leg and not for the pressurizer. For the hot leg, this results in a 222°F/hr transient for 17 minutes in going between 548°F and 611°F. The pressure is 2175 psig for unloading and 2275 psig for loading. The thermal stresses are small and will be of opposite sign to the pressure stresses in the region of the cracking and will be conservatively neglected.

3. Normal variations – 10^6 cycles. These are +/- 100 psig and +/- 10°F for the hot leg and +/-20°F for the pressurizer. It is assumed that the temperature and pressure variations are relatively slow since rapid changes do not normally occur with this high frequency. Since the thermal stress sign is opposite to the pressure sign, the thermal stresses are conservatively neglected.

4. Reactor Trip, etc. – 480 cycles. This transient is a 2535 psig overpressure, followed by a reduction in pressure to 1635 psig, and then a slow repressurization. There is also a significant thermal transient with a rapid temperature reduction from normal operating temperature to zero power conditions. (For ease of calculation, it is assumed that there are 500 cycles.)

5. Leak Test – 200 cycles. This is assumed to be a separate cycle from zero pressure to normal pressure of 2235 psig. The heatup rate for both the pressurizer and hot leg is given as 100°F/hour. (It is conservatively assumed that there are 500 of these cycles.)

The five Emergency Condition Secondary Depressurization transients are not included since they are not normal expected events. ASME Code Section XI [1] provides lower safety factors for these transients and the resulting stresses are not expected to be significantly different than those already evaluated. The 10 ASME Hydrotests to 3125 psig are also not considered. ASME Code Section XI no longer requires elevated pressure testing of vessels in service.

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Table 3-1 Basic Pressurizer and RCS Hot Leg Penetration Dimensions

Parameter	Pressurizer Lower Head	Heater Sleeve	RCS Hot Leg Pipe	RTD Nozzle	Pressure Meas. Nozzle
Inside Radius (Base Metal)	48.4375	0.4525	21.0	0.1885	0.266
Base Metal Thickness	3.875	0.1255	3.75	0.3725	0.293
Clad Thickness)	3/8	----	1/4	----	----
Bore Diameter	1.158		1.122		
Existing Weld at ID					
J-Groove Weld Depth	5/32		15/16		
J-Groove Weld Radius	3/16		½		
Fillet Weld Leg	3/32		----		
Repair Weld at OD					
J-Groove Weld Depth	----		¼		
J-Groove Weld Radius	----		¼		
Fillet Weld Leg	----		¼		

Table 3-2 Material Properties

Material	Mechanical Properties	Temperature							
		70	100	200	300	400	500	600	650
SA-516 Grade 70	E (10^6 psi)	29.5	29.34	28.8	28.3	27.7	27.3	26.7	26.1
	α (in/in/0Fx 10^{-6})	5.42	5.53	5.89	6.26	6.61	6.91	7.17	7.3
	K (Btu/sec-in-°F)	5.46E-04	5.53E-04	5.65E-04	5.65E-04	5.60E-04	5.49E-04	5.35E-04	5.26E-04
	c (Btu/lb-°F)	0.106	0.11	0.118	0.123	0.128	0.133	0.137	0.139
SA-533 Grade B Class 1	E (10^6 psi)	29.2	29	28.5	28	27.4	27	26.4	26.1
	α (in/in/0Fx 10^{-6})	7.02	7.06	7.25	7.43	7.55	7.70	7.83	7.90
	K (Btu/sec-in-°F)	5.16E-04	5.23E-04	5.42E-04	5.51E-04	5.51E-04	5.44E-04	5.32E-04	5.26E-04
	c (Btu/lb-°F)	0.106	0.108	0.114	0.119	0.125	0.131	0.138	0.141
Stainless Steel (304L)	E (10^6 psi)	28.3	28.14	27.6	27	26.5	25.8	25.3	25.05
	α (in/in/0Fx 10^{-6})	8.46	8.55	8.79	9	9.19	9.37	9.53	9.61
	K (Btu/sec-in-°F)	1.99E-04	2.01E-04	2.15E-04	2.27E-04	2.41E-04	2.52E-04	2.62E-04	2.69E-04
	c (Btu/lb-°F)	0.116	0.117	0.122	0.125	0.129	0.131	0.133	0.134
SB 166 Alloy 600	E (10^6 psi)	31	30.82	30.2	29.9	29.5	29	28.7	28.45
	α (in/in/0Fx 10^{-6})	6.76	6.9	7.2	7.4	7.57	7.7	7.82	7.88
	K (Btu/sec-in-°F)	1.99E-04	2.01E-04	2.11E-04	2.22E-04	2.34E-04	2.45E-04	2.57E-04	2.62E-04
	c (Btu/lb-°F)	0.107	0.109	0.112	0.115	0.118	0.119	0.123	0.123
SB-166 Alloy 690	E (10^6 psi)	30.3	30.12	29.5	29.1	28.8	28.3	28.1	27.85
	α (in/in/0Fx 10^{-6})	7.73	7.76	7.85	7.93	8.02	8.09	8.16	8.2
	K (Btu/sec-in-°F)	1.57E-04	1.62E-04	1.76E-04	1.90E-04	2.04E-04	2.18E-04	2.32E-04	2.38E-04
	c (Btu/lb-°F)	0.105	0.105	0.109	0.113	0.115	0.118	0.119	0.120

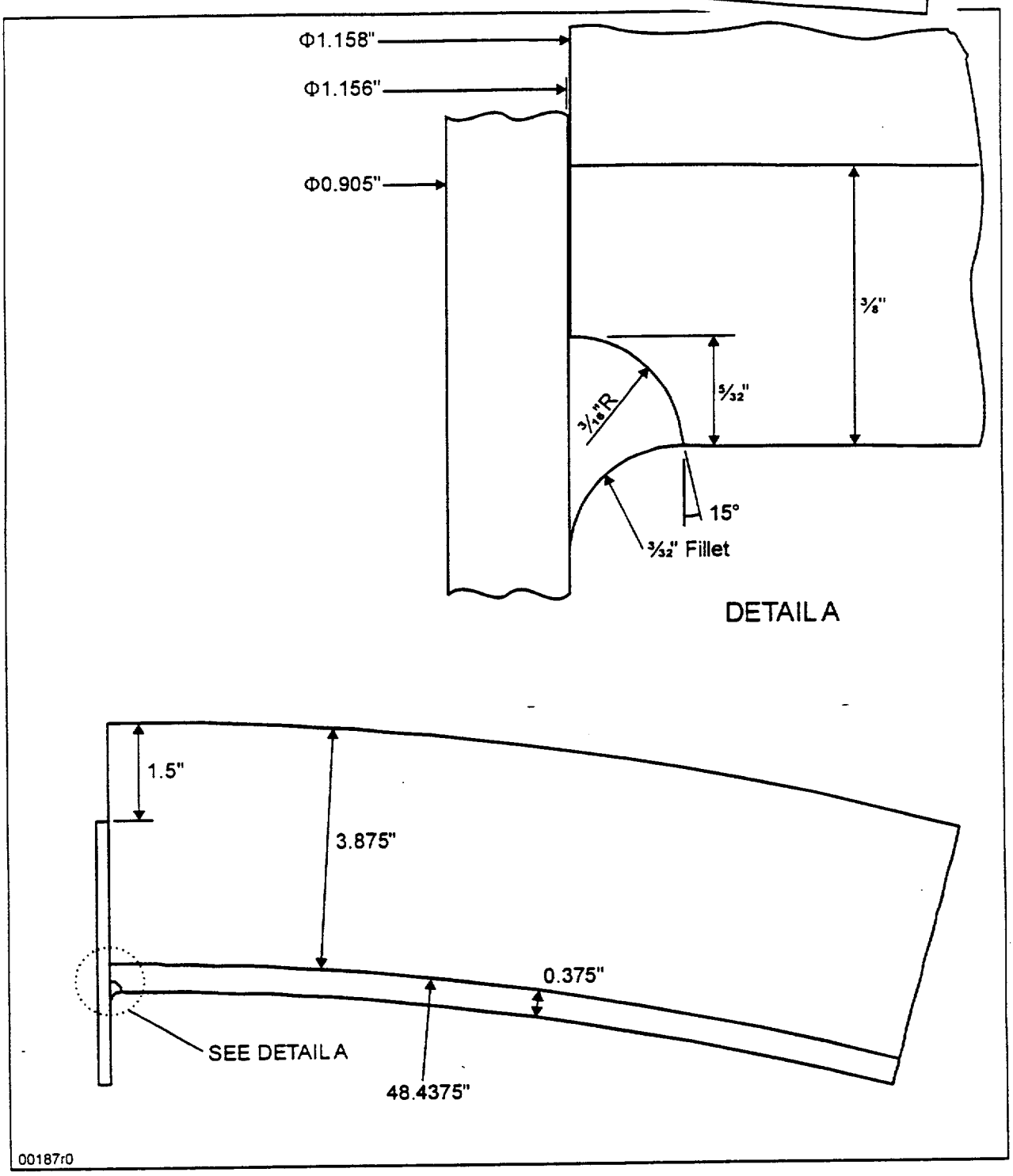

Figure 3-1. Geometry and Dimensions of Pressurizer Vessel Heater Penetration

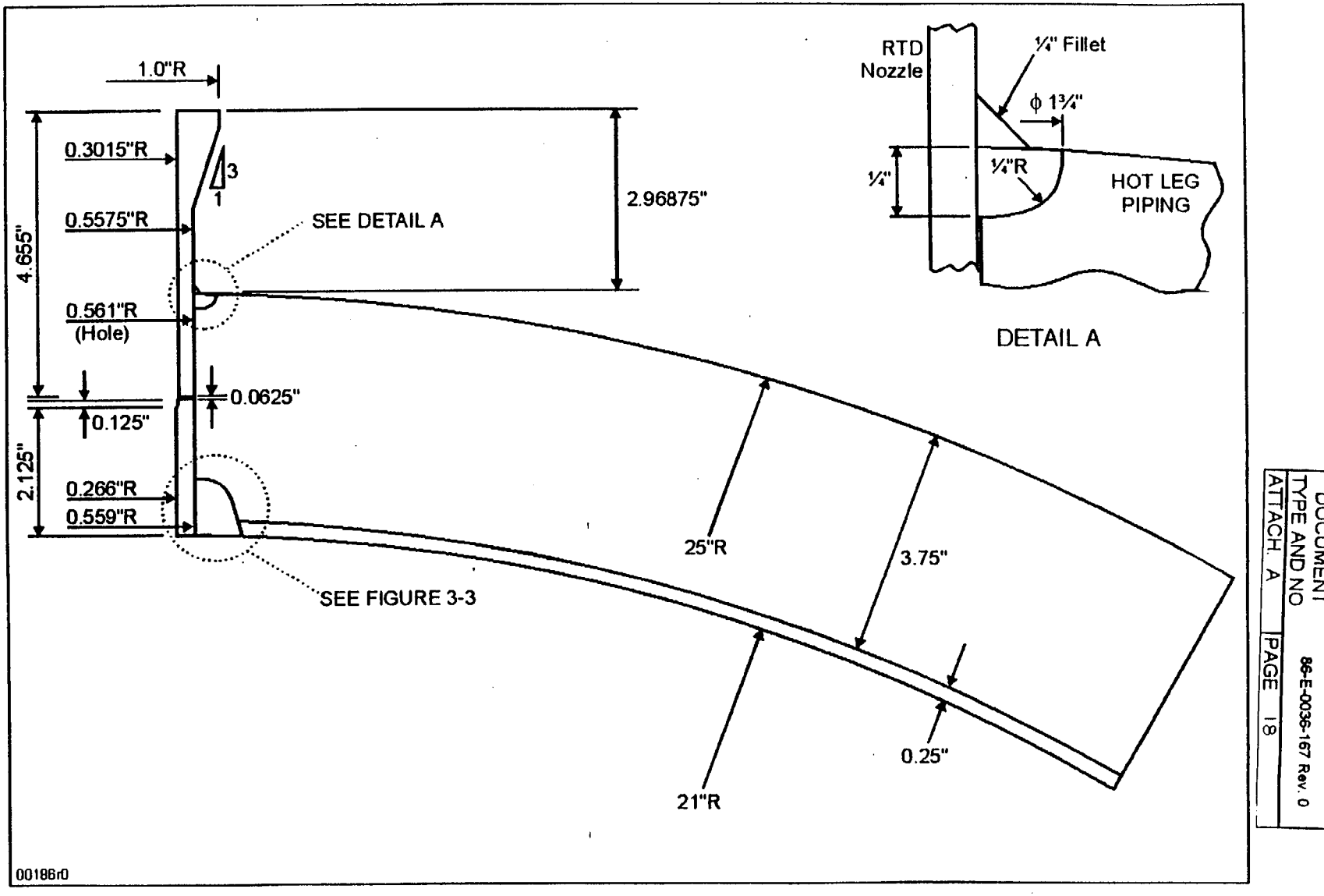

Figure 3-2. Geometry and Dimensions of Hot Leg Pipe RTD Nozzle Penetration, General View

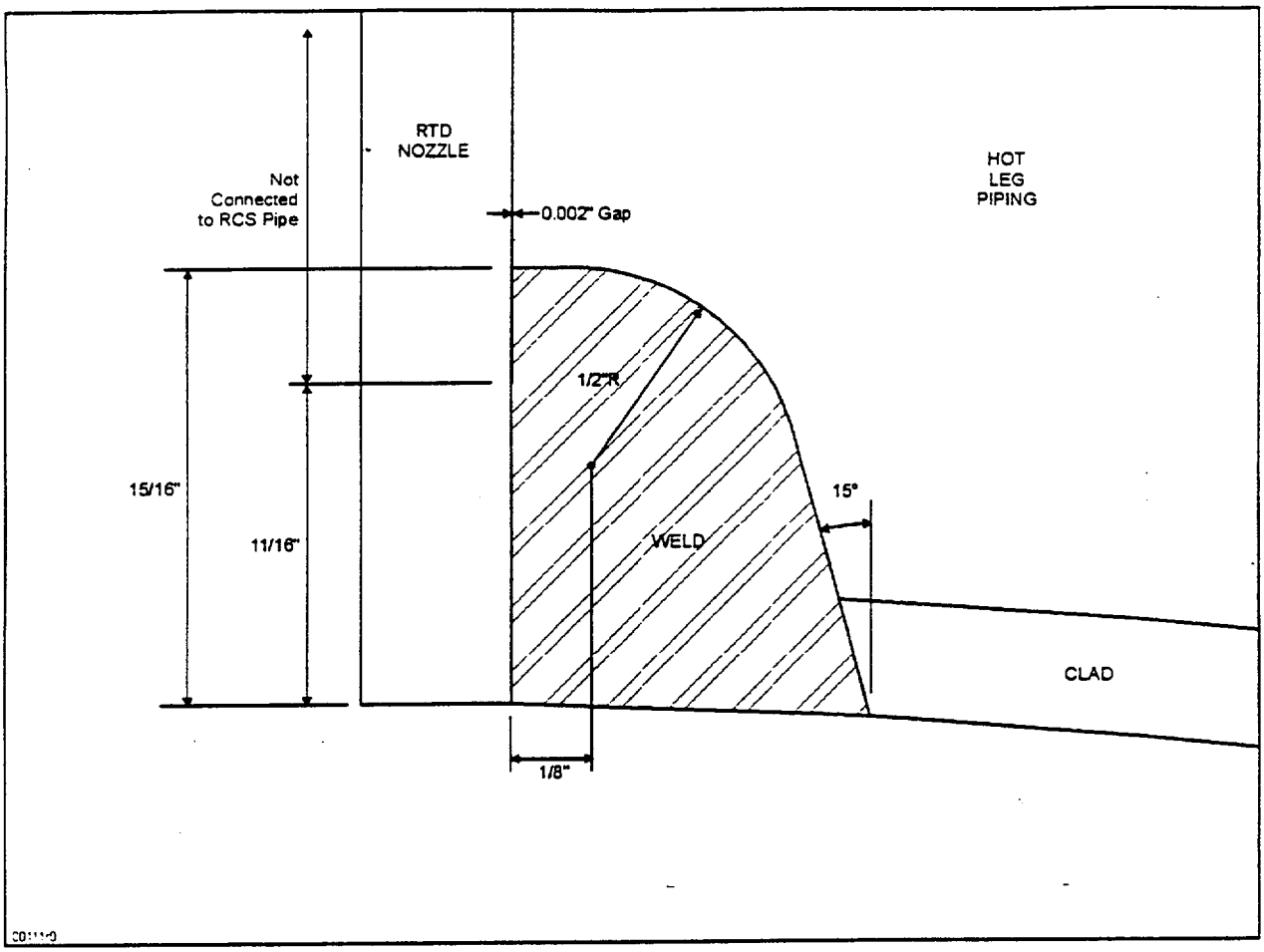

Figure 3-3. Geometry and Dimensions of Hot Leg Pipe RTD Nozzle Penetration, Existing Alloy 600 ID Weld

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4.0 STRESS EVALUATIONS

4.1 Finite Element Analysis

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4.1.1 Analytical Models

Axisymmetric finite element models of the pressurizer and hot leg penetrations were developed using the ANSYS software package [10]. Although the actual penetrations are located on the side-hill of the spherical pressurizer lower head and in the RCS cylindrical pipe, the resulting axisymmetric model will be that of a penetration at the center of a spherical shell. To more closely approximate the real configuration and the actual state of stresses, the finite element models are conservatively modified as follows:

- For the pressurizer vessel model, the analysis is based on an enlarged hole in the pressurizer shell equal to the maximum side-hill dimensions to account for outermost heater locations with the largest side-hill angle. The increased hole diameter results in higher local stresses around the penetration. Thus, the analysis will be applicable for a repair at any of the pressurizer heater locations.

- For the RCS hot leg penetration, the radius of the hot leg pipe model is increased to 1.5 times the original radius and the internal pressure load in the pipe is increased by 4/3 to obtain the expected cylinder hoop stress remote from the penetration. Bounding dimensions are used in order to make the analysis applicable to all hot leg RTD and pressure measurement nozzle penetrations.

The resulting finite element models of the pressurizer and hot leg penetrations are shown in Figure 4-1 and Figure 4-2, respectively. The boundaries of the finite element model are set far enough from the nozzle weld region to avoid end effects as shown in Figure 4-3 for the pressurizer penetration and Figure 4-6 for the hot leg penetration. The thermal analyses are performed with the two-dimensional thermal solid elements (PLANE55), and the stress analyses are performed with the two-dimensional structural solid elements (PLANE42).

4.1.2 Bounding Dimensions for RCS Hot Leg Penetrations

In order for the RCS hot leg penetration evaluation performed herein to be conservatively applicable to all the RTD and pressure measurement nozzles at ANO-2, bounding dimensions needed to be used in the finite element models. The nominal dimensions obtained from the construction drawings [4, 5] and analytical stress report [11] are such that the RTD and pressure measurement/sampling nozzle have the same bore diameter of 0.997 inch but, the RTD nozzle is the thicker of the two nozzles.

To determine the bounding penetration dimensions, two axisymmetric finite element models representing the two hot leg nozzles were built and analyzed under both fast and slow thermal transient loads identical to the thermal loads considered in this evaluation. A sample of the resulting stress distributions in the vicinity of the penetration weld is shown in Figures 4-9 through 4-12. Based on a comparison of the results from the finite element analyses, the penetration with the thinner nozzle sleeve (i.e., pressure measurement) experienced the largest stresses. Therefore, the pressure measurement/sampling nozzle dimensions for the existing nozzle were used for all the remaining analyses for this evaluation.

The repair drawings [6] indicate that the modified RTD nozzle is thinner than the pressure measurement nozzle. Also, the repair drawings show that at least one RTD location has a bore diameter of 1.122 inches, which is larger than the nominal bore diameter. Hence, that location was used to represent all the hot leg penetrations considered in this evaluation but, the thickness of the existing nozzle remained that of the pressure measurement nozzle.

4.2 Applied Loads

4.2.1 Internal pressure

Internal pressure (P) was applied to all the inside surfaces of the pressurizer and hot leg penetration nozzle assemblies. In addition, end cap loads are applied at the pressurizer penetration bore and at the top of the hot leg nozzle. In the case of the pressurizer, since the

penetration plug is not explicitly modeled, the end cap load is applied as an equivalent force, F, calculated as

$$F = PA$$

where,

A is the pressurizer penetration bore opening area.

For the hot leg, the end cap load (P_{cap}) due to internal pressure is calculated as follows:

$$P_{cap} = \frac{P\, A_{opening}}{A_{wall}}$$

where,

A_{wall} is the hot leg nozzle wall cross-sectional area, and

$A_{opening}$ is the hot leg nozzle opening area.

The applied internal pressure loading is illustrated in Figure 4-4 for the pressurizer penetration and Figure 4-7 for the hot leg penetration.

4.2.2 Thermal Transient Analyses

The thermal transient conditions specified for the pressurizer and RCS hot leg penetration nozzles are discussed in Section 3. Two thermal transients are used as bounding cases for all the prescribed conditions: the heat up/cool down ramp transient, and the reactor trip transient.

In all thermal transient analyses, a very large conservative film coefficient of 25,000 BTU/hr-ft^2-°F is used on the inside surface of the pressurizer vessel or hot leg pipe. The inside surface of the penetration nozzle is conservatively assumed perfectly insulated in all the analyses. The surfaces in the gap between the pressurizer vessel shell and the nozzle sleeve are also conservatively assumed to be perfectly insulated. For the hot leg penetration, thermal couples are used between the nozzle sleeve and the hot leg pipe wall. The thermal boundary conditions for the analyses of the pressurizer and hot leg penetrations are illustrated in Figures 4-5 and 4-8, respectively.

4.2.3 Residual Stress Considerations

It is expected that the Alloy 600 welds would have a high degree of residual tensile stresses at the time of initial construction. However, in initial vessel hydrotest and the first heatup to operating conditions, there will be additional tensile yielding of the material due to the applied thermal and pressure stress loadings. Pressurized transients such as the rapid temperature reduction for a reactor trip transient would further yield the material at the surface. Thus, at maximum pressure conditions, the state of stress in the weld is expected to be at the tensile yield stress level (with a small amount of hardening). Upon depressurization, the stress will elastically reduce such that residual stresses will be significantly reduced. At the locations considered in the analysis, the combination of pressure plus thermal stresses for the weld region exceed 35 ksi for the reactor trip transient. Therefore, residual stresses can be neglected. The 35 ksi value is conservatively taken as equal to the room temperature minimum yield strength of Alloy 600 materials from the ASME Code [7], and accounts for some additional tensile stress above the Code value of 27.4 ksi at 650°F.

4.2.4 Axial Stress Considerations

The reactor coolant piping stress analysis [11] was reviewed to determine whether the combination of bending in the pipe and axial stress due to pressure is comparable to the hoop stress due to pressure in the piping. There are nozzles at points DP 2450 through DP 2650, from page A-30 of Reference 11. The thermal expansion loads on the hot leg piping at these locations are as follows:

DP	S_e, psi
2450*	4,830
2500	2,149
2600	2,677
2650	5,895

*The location without the "R" on p. A-33 [11] is chosen since it matches the dimension on p. A-30 [11].

It can be seen that DP 2650 has bounding stress.

From page A-53 [11], the controlling thermal expansion moment on the hot leg is at the reactor vessel outlet, and equals 5,796 ft-kips. However, ANO Document No. 86-E-0036-130 [9] shows a maximum thermal expansion moment of 6,695 ft-kips at assembly P-10, end A. Therefore, the revised stress at the bounding nozzle is:

$$5.895(6{,}695)/(5{,}796) = 6.81 \text{ ksi.}$$

The pressure stress in the axial direction is

$$P/[(R_o/R_i)^2 - 1] = 2.235/[(25/21.25)^2 - 1] = 5.82 \text{ ksi,}$$

where: P = pressure, ksi

R_i, R_o = inner and outer radii, inches [11], Page A-52.

The total axial stress is therefore 6.81 + 5.82 = 12.63 ksi. For comparison, the hoop pressure stress is

$$PR_i/t = 2.235(25 - 3.75)/3.75 = 12.66 \text{ ksi,}$$

where, t = thickness, inches

Thus, the use of the stresses from an axisymmetric model of the hot leg penetration that correctly predicts the hoop stress remote from the penetration is conservative.

4.3 Analysis Results

For each of the penetration configurations, the results of the two limiting thermal transient cases are processed to determine the time at which the nozzle weld region experiences the maximum

compressive or tensile hoop stresses, which will combined with the pressure induced hoop stresses to determine the maximum stress ranges.

The hoop stress at the pressurizer heater penetration due to internal pressure is shown in Figure 4-13. Figures 4-14 and 4-15 show the temperature distribution and the corresponding hoop stresses at the pressurizer penetration during the reactor trip transient. Similarly, the hoop stress at the hot leg RTD penetration due to internal pressure is shown in Figure 4-16 while Figures 4-17 and 4-18 show the temperature distribution and the corresponding hoop stresses during the plant heatup transient.

The stress distributions along a through-wall path from the Alloy 600 weld to the OD of the pressurizer or hot leg pipe are extracted for use in the crack growth evaluations.

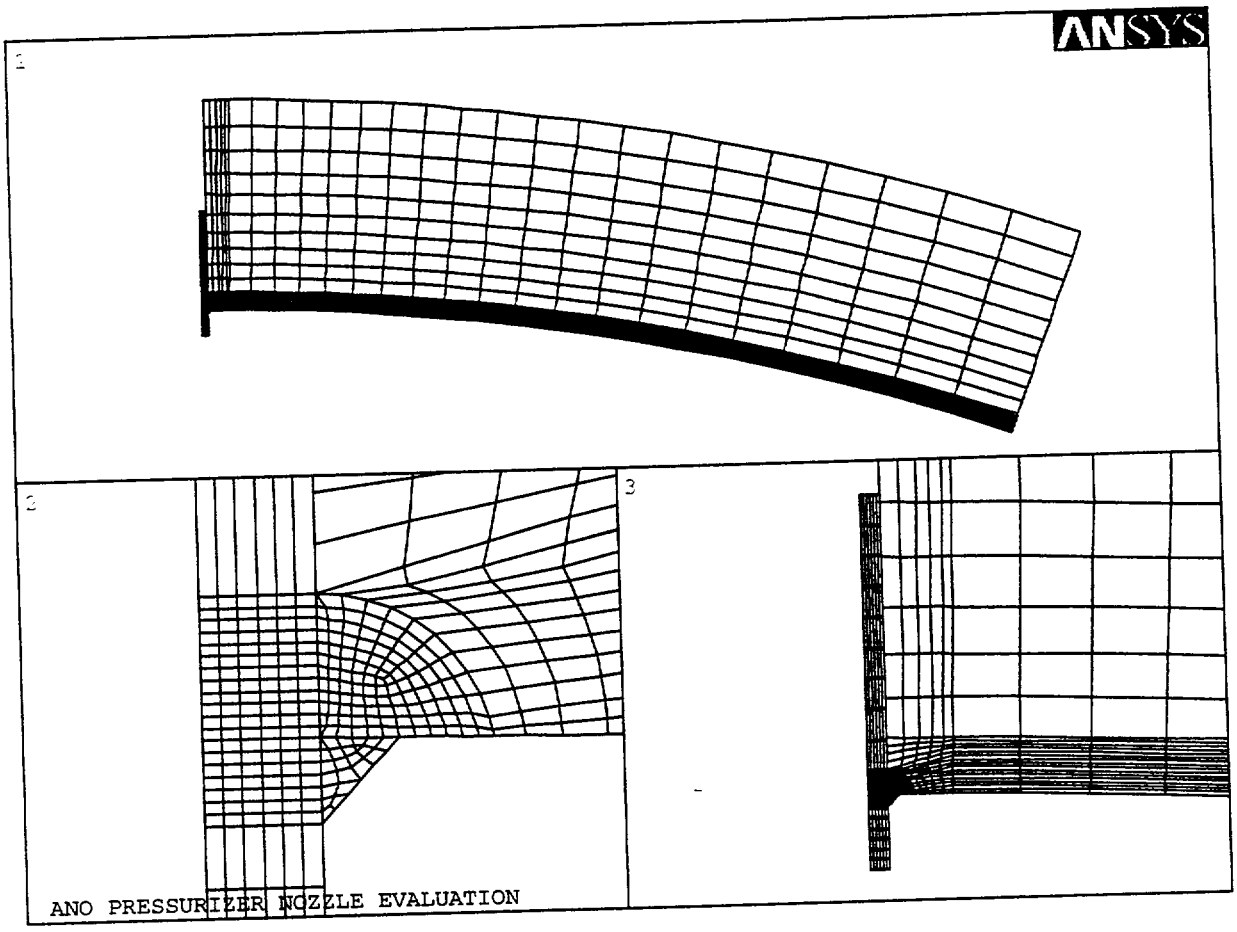

Figure 4-1. Pressurizer Heater Penetration Finite Element Model

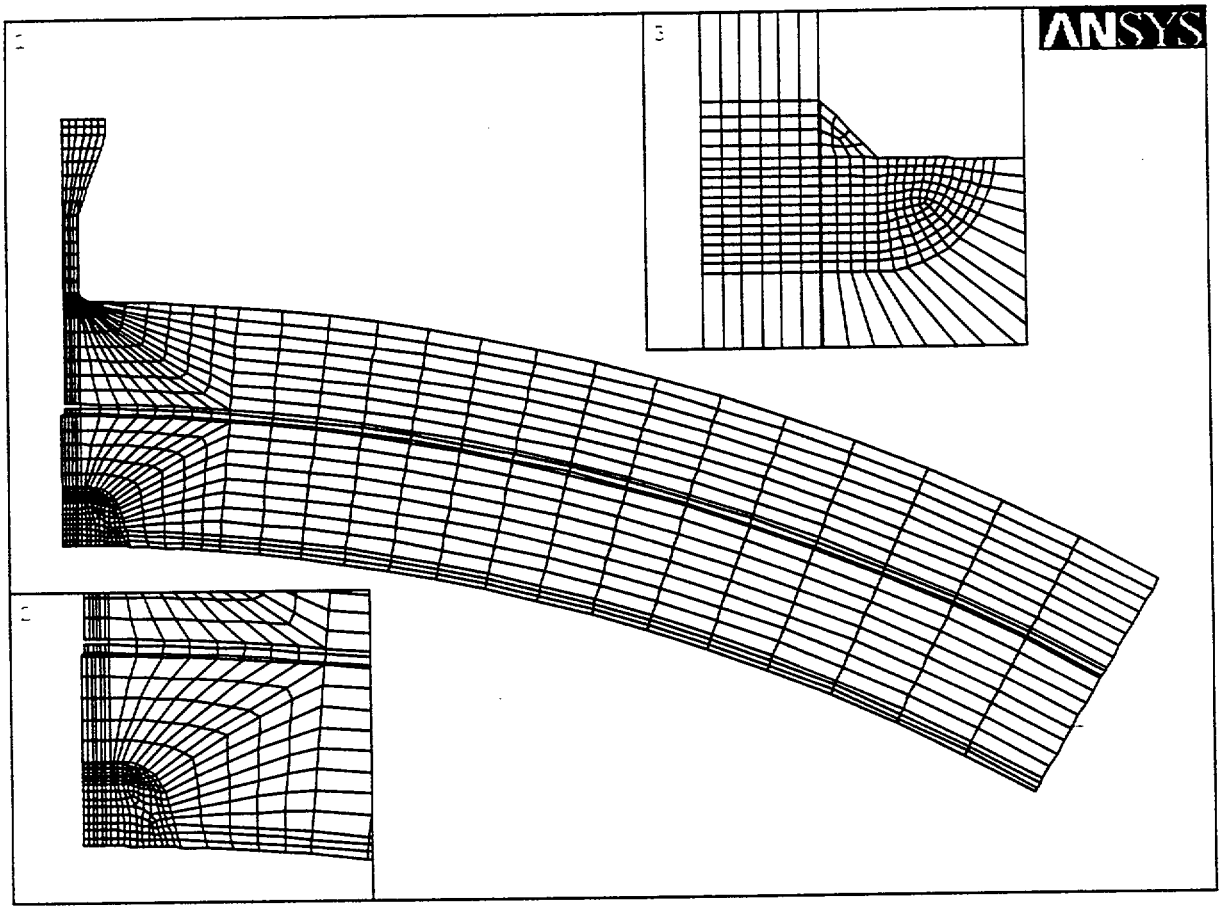

Figure 4-2. RCS Hot Leg RTD Penetration Finite Element Model

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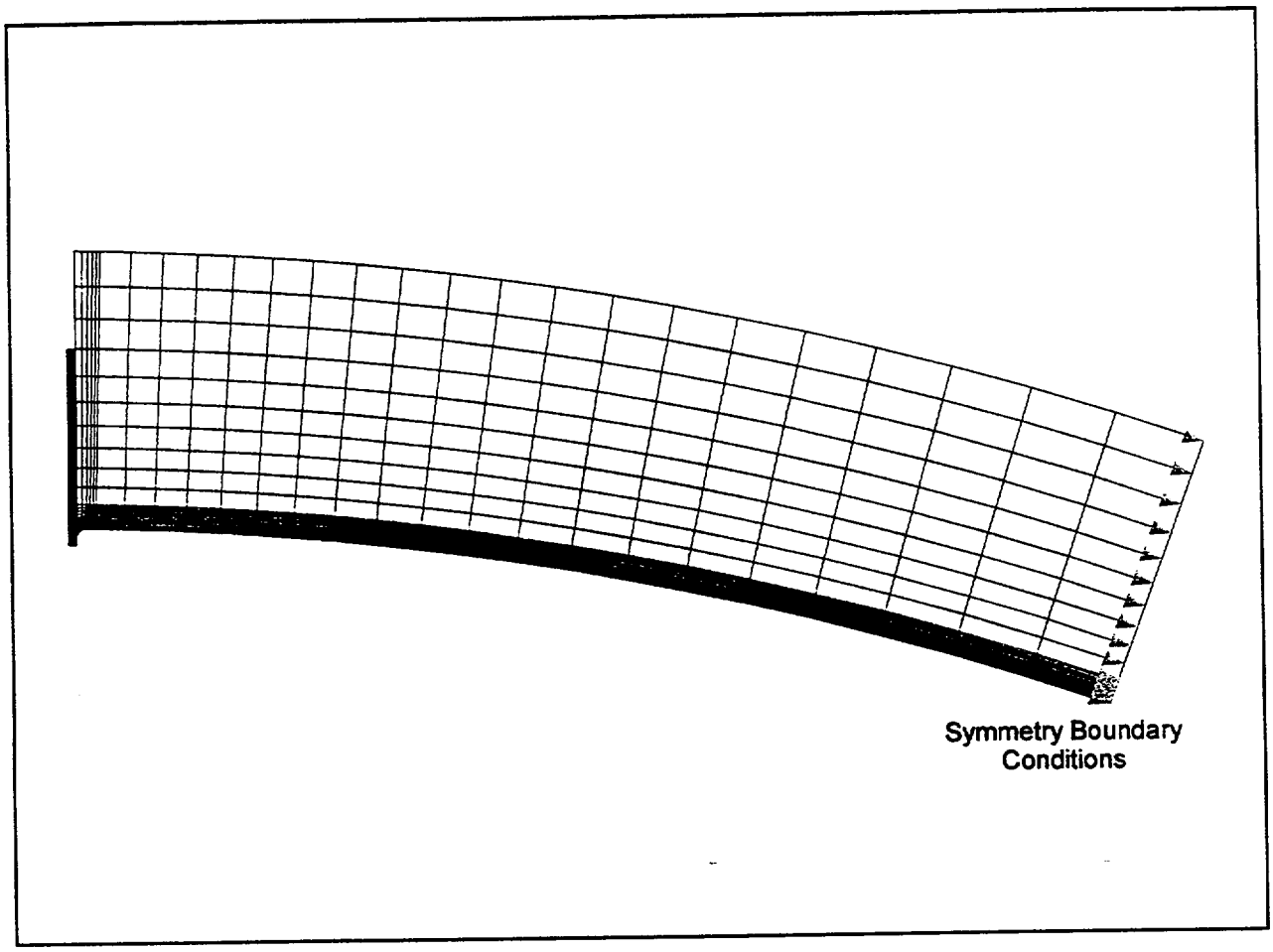

Figure 4-3. Pressurizer Heater Penetration, Applied Mechanical Boundary Conditions

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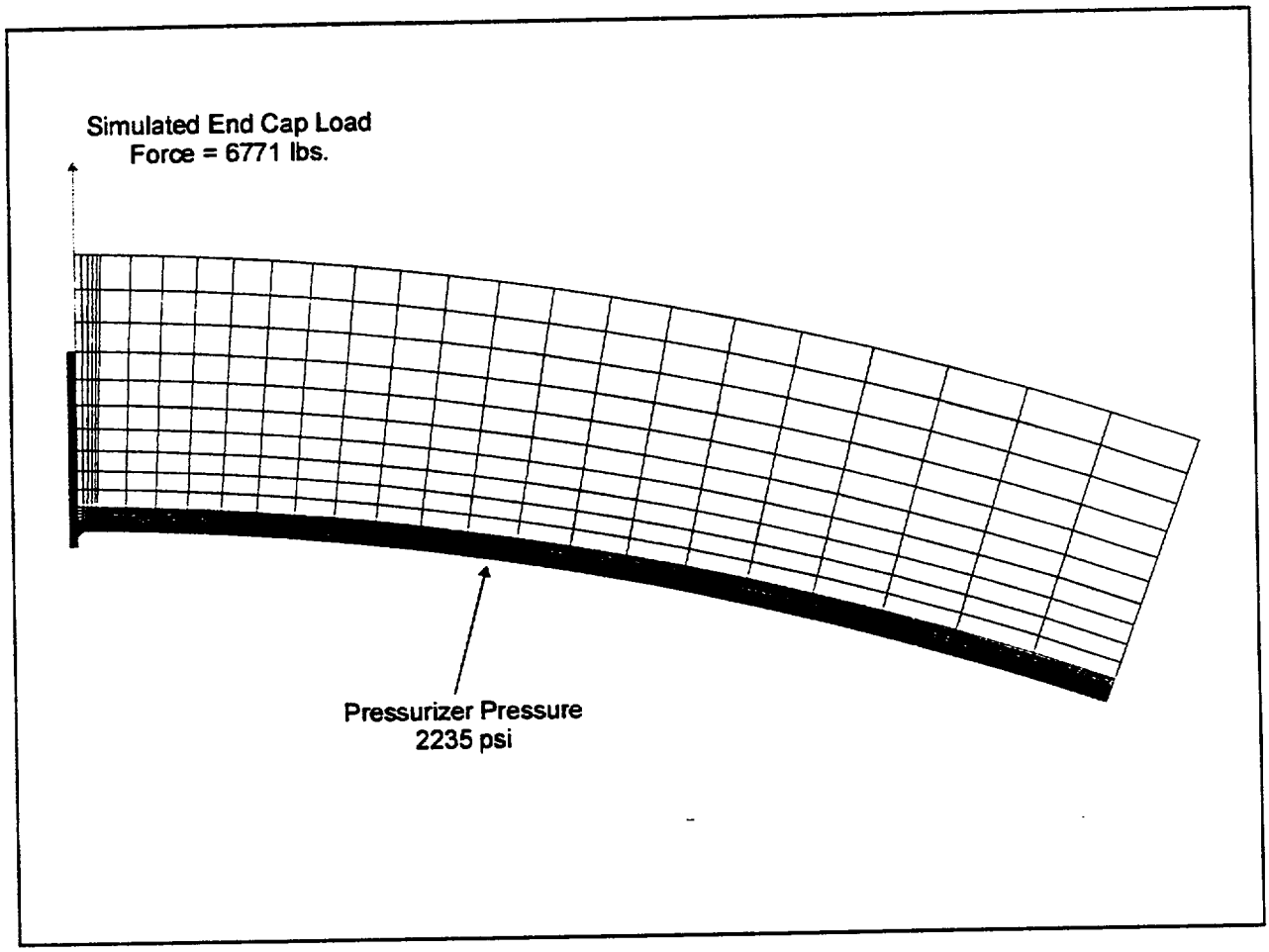

Figure 4-4. Pressurizer Heater Penetration, Applied Pressure Loads

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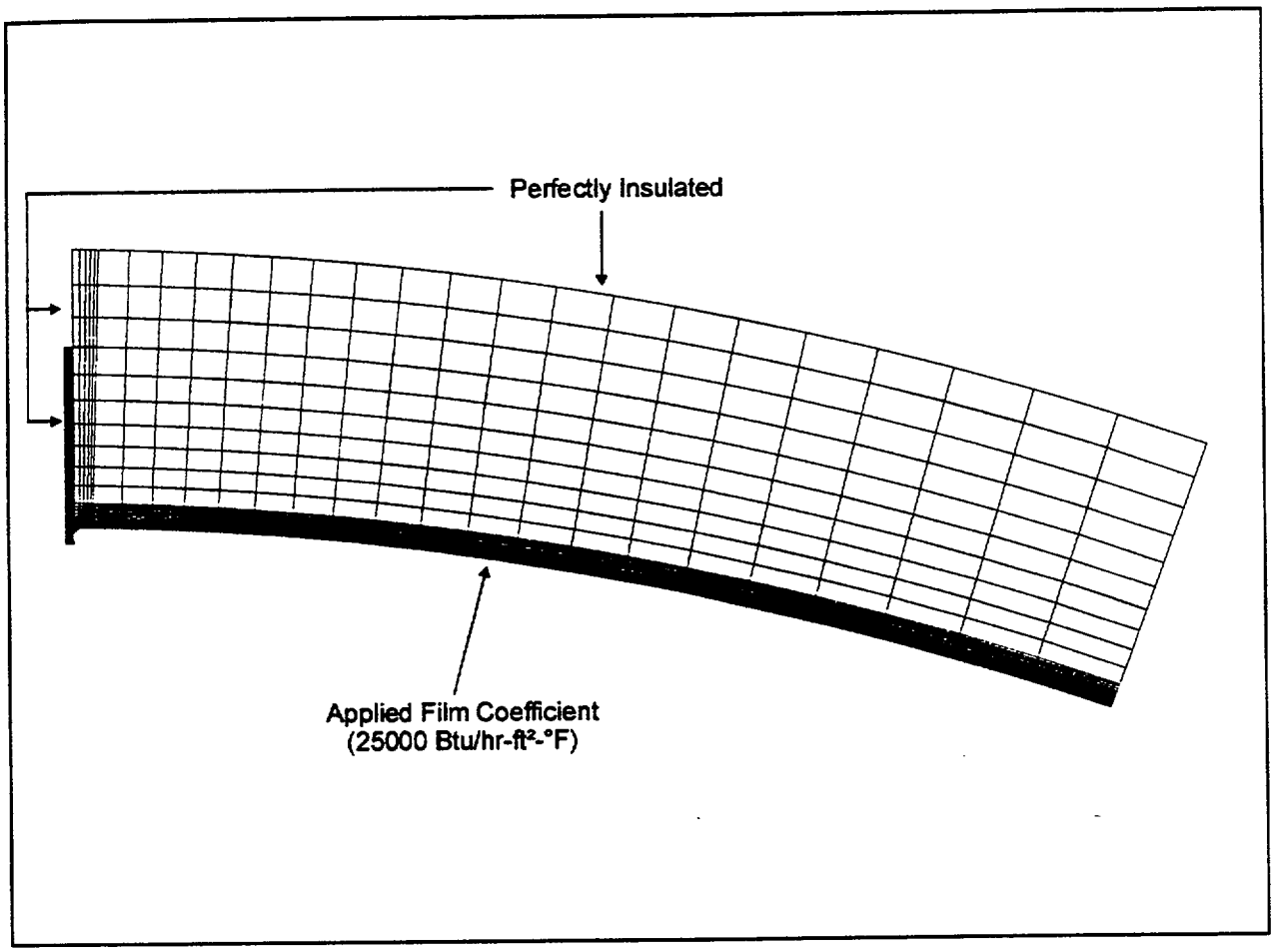

Figure 4-5. Pressurizer Heater Penetration, Applied Film Coefficients

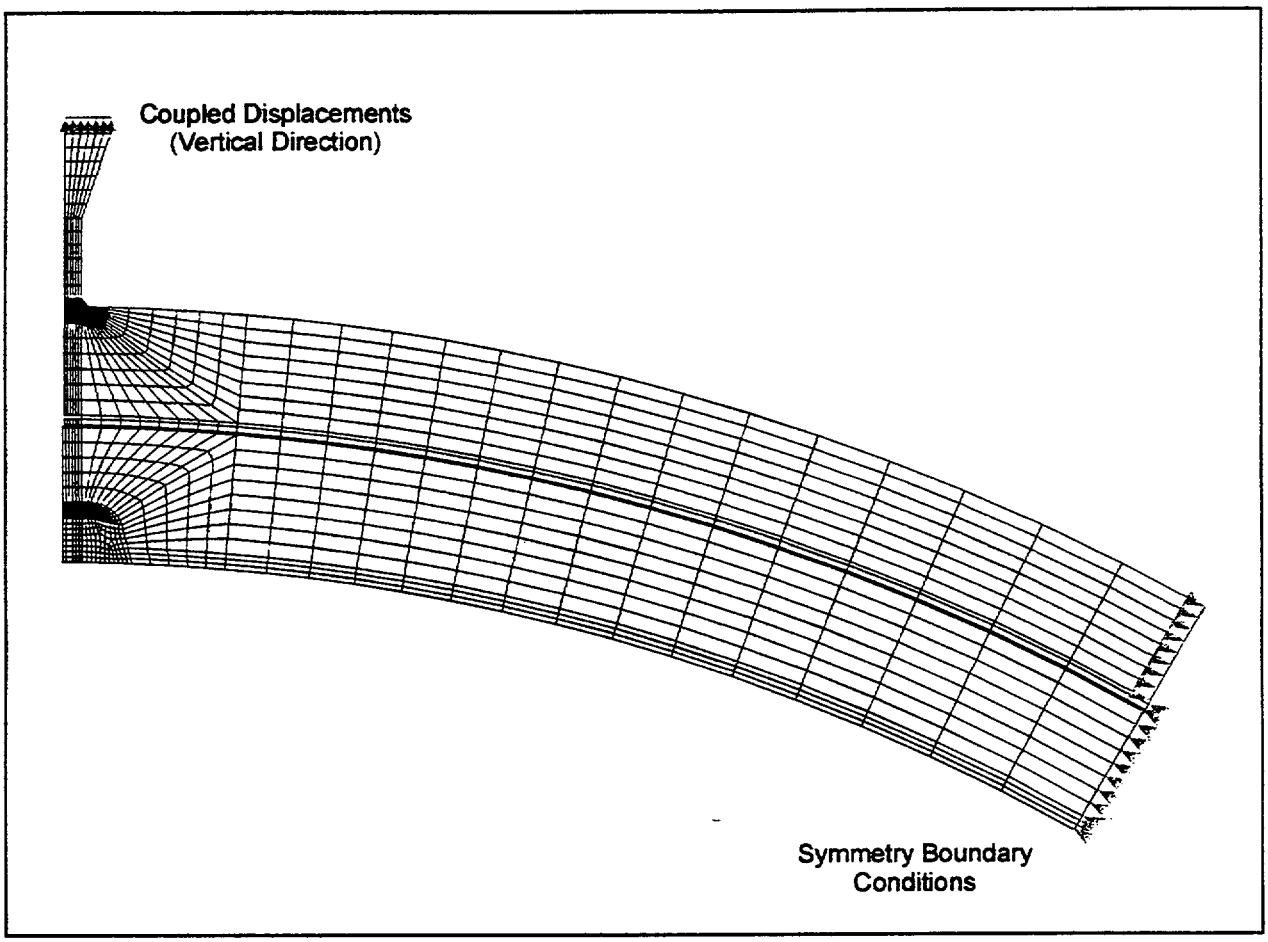

Figure 4-6. RCS Hot Leg Penetration, Applied Mechanical Boundary Conditions

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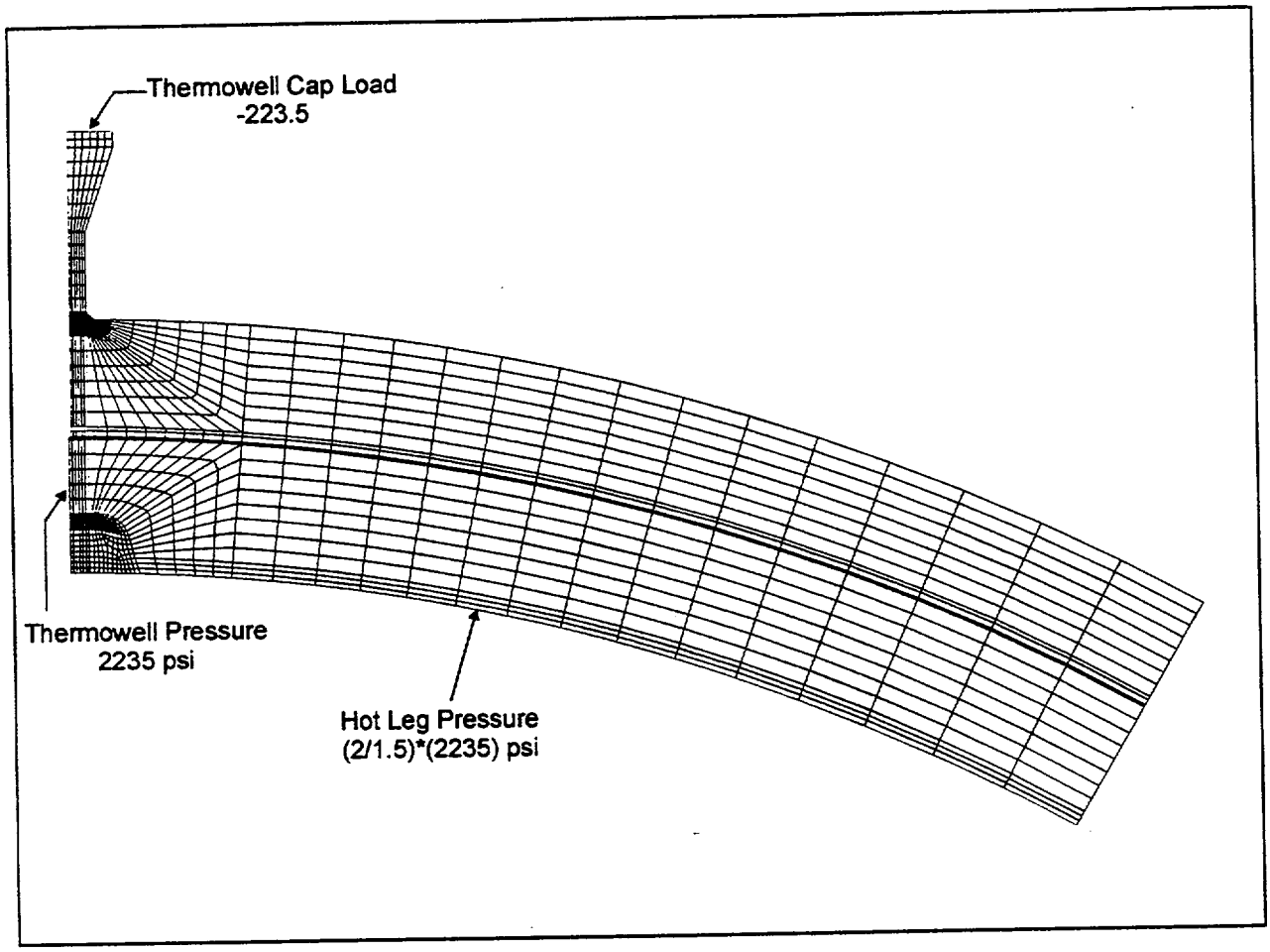

Figure 4-7. RCS Hot Leg Penetration, Applied Pressure Loads

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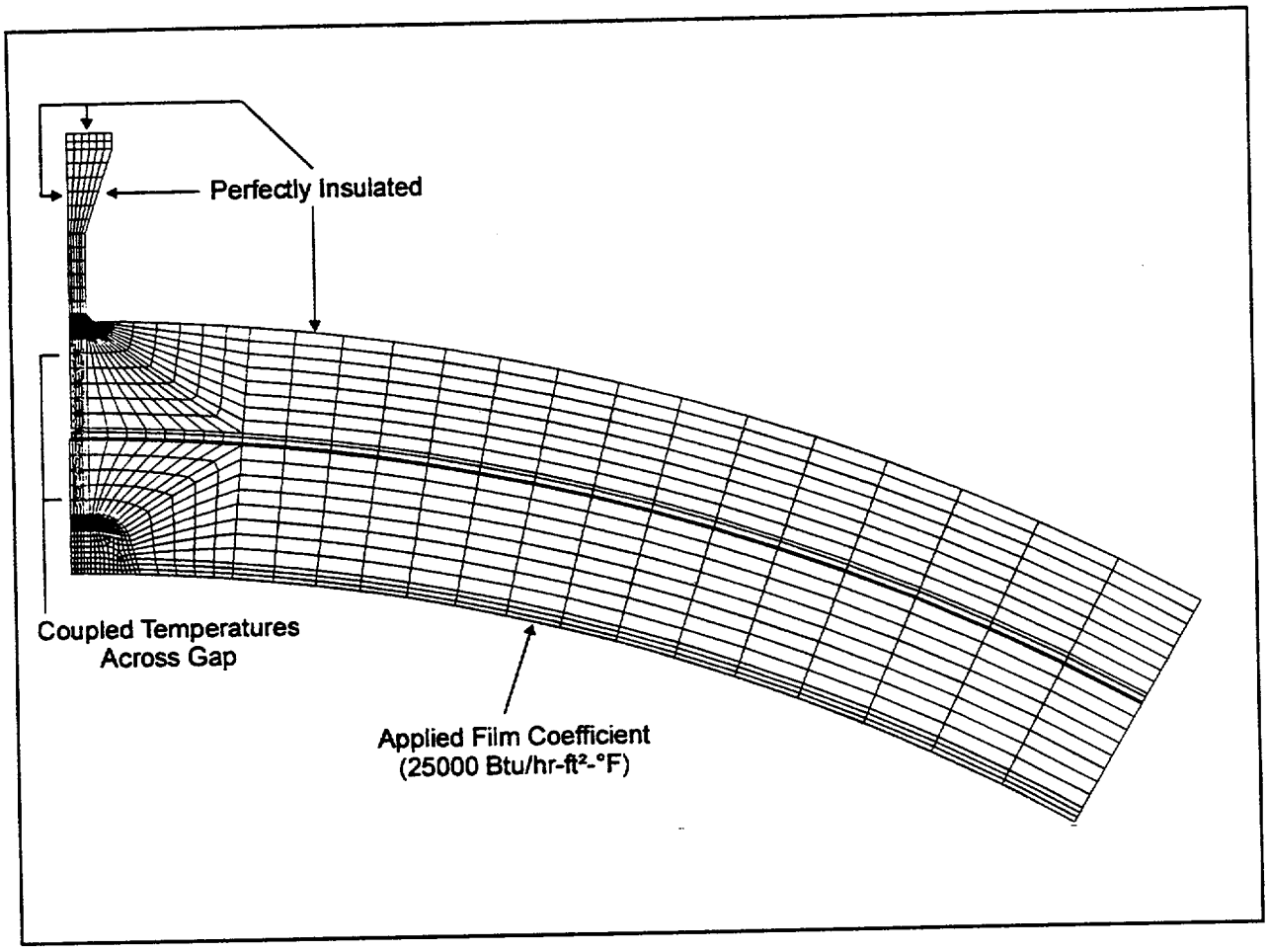

Figure 4-8. RCS Hot Leg Penetration, Applied Film Coefficients

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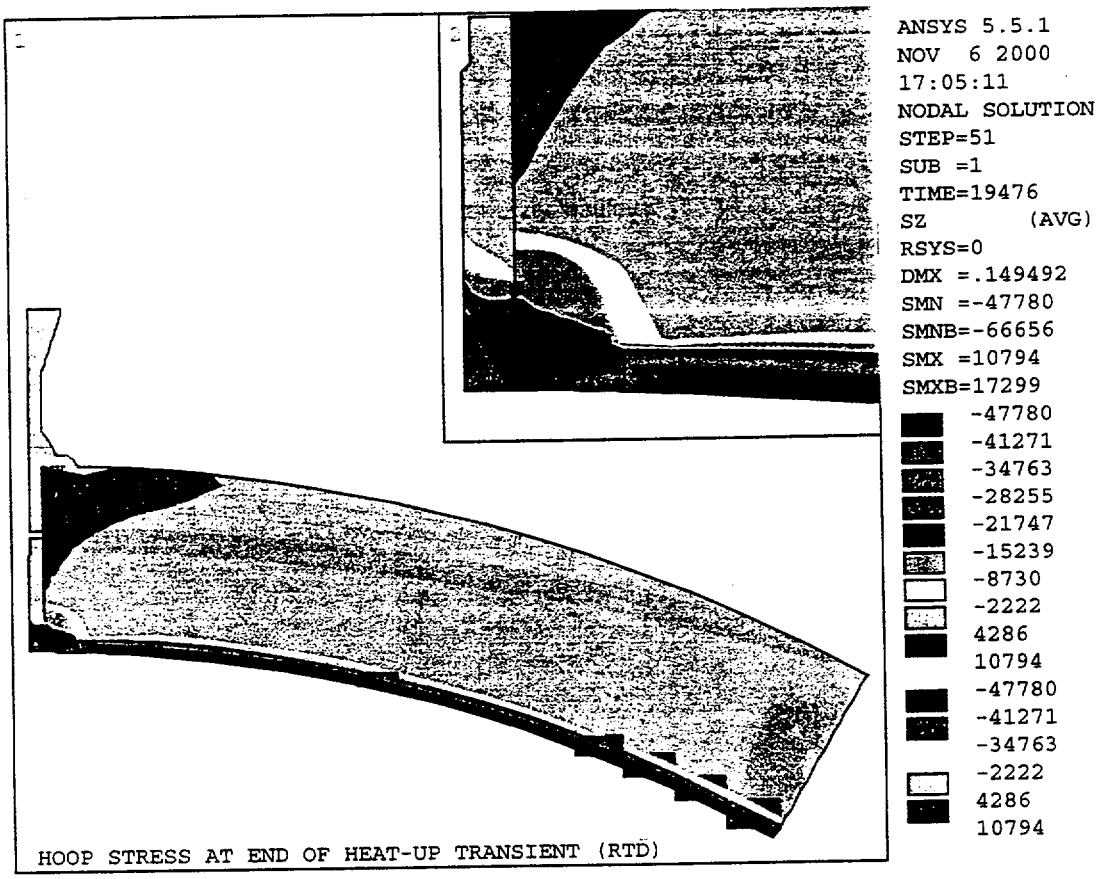

Figure 4-9. RTD Nozzle Hoop Stress Due to Heatup Transient

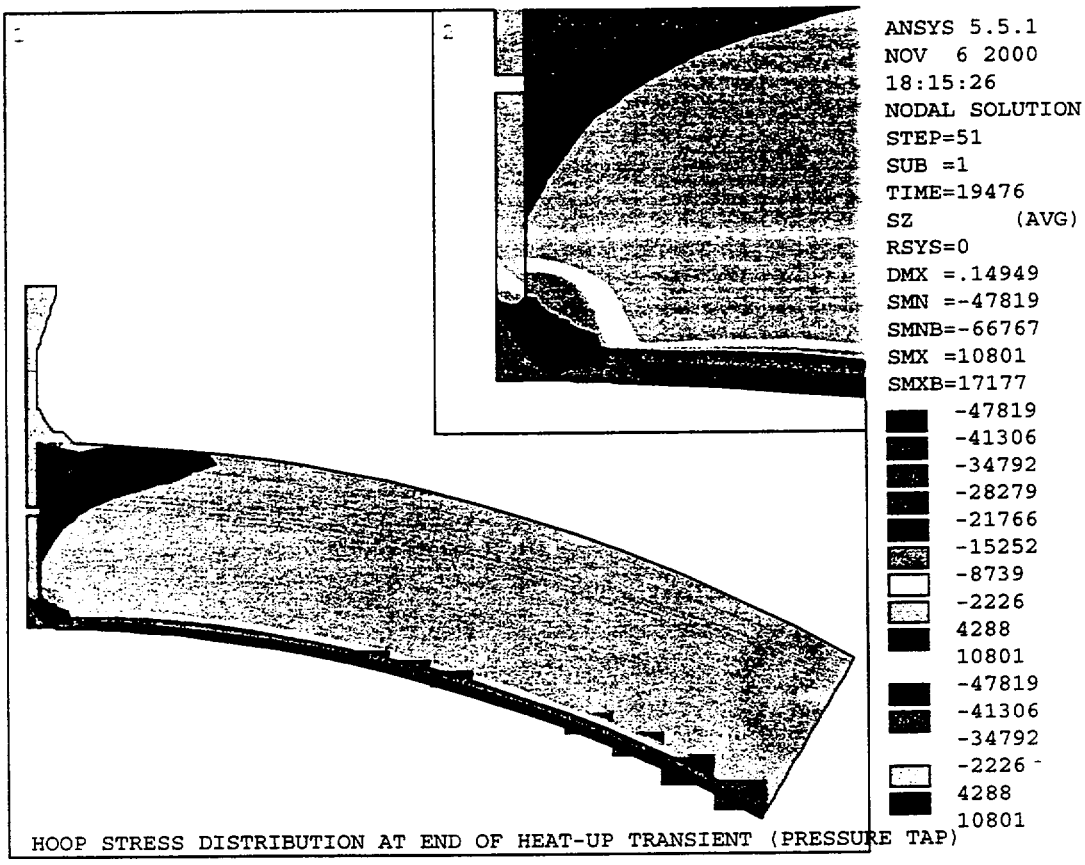

Figure 4-10. Pressure Measurement Nozzle Hoop Stress Due to Heatup Transient

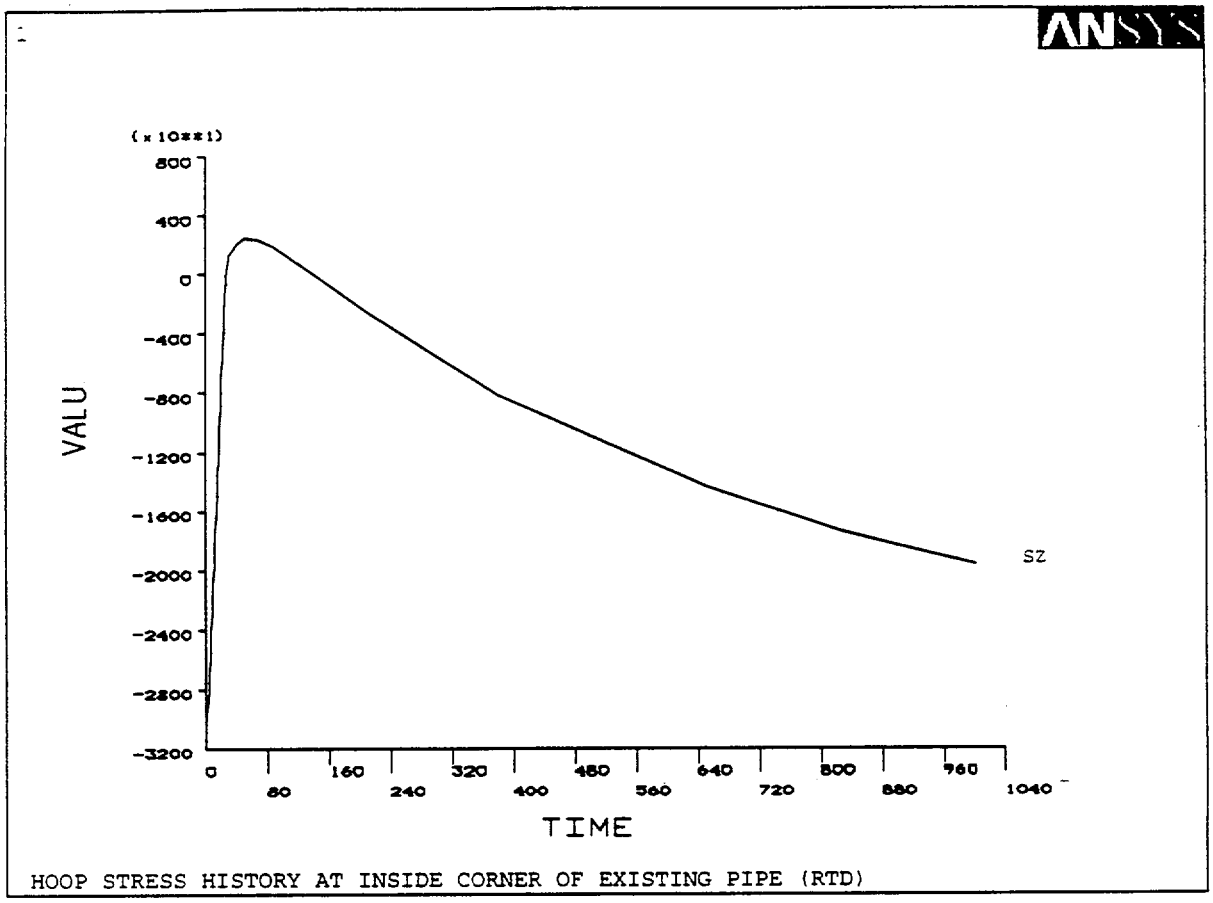

Figure 4-11. RTD Nozzle Hoop Stress Time-History Due to Reactor Trip Transient

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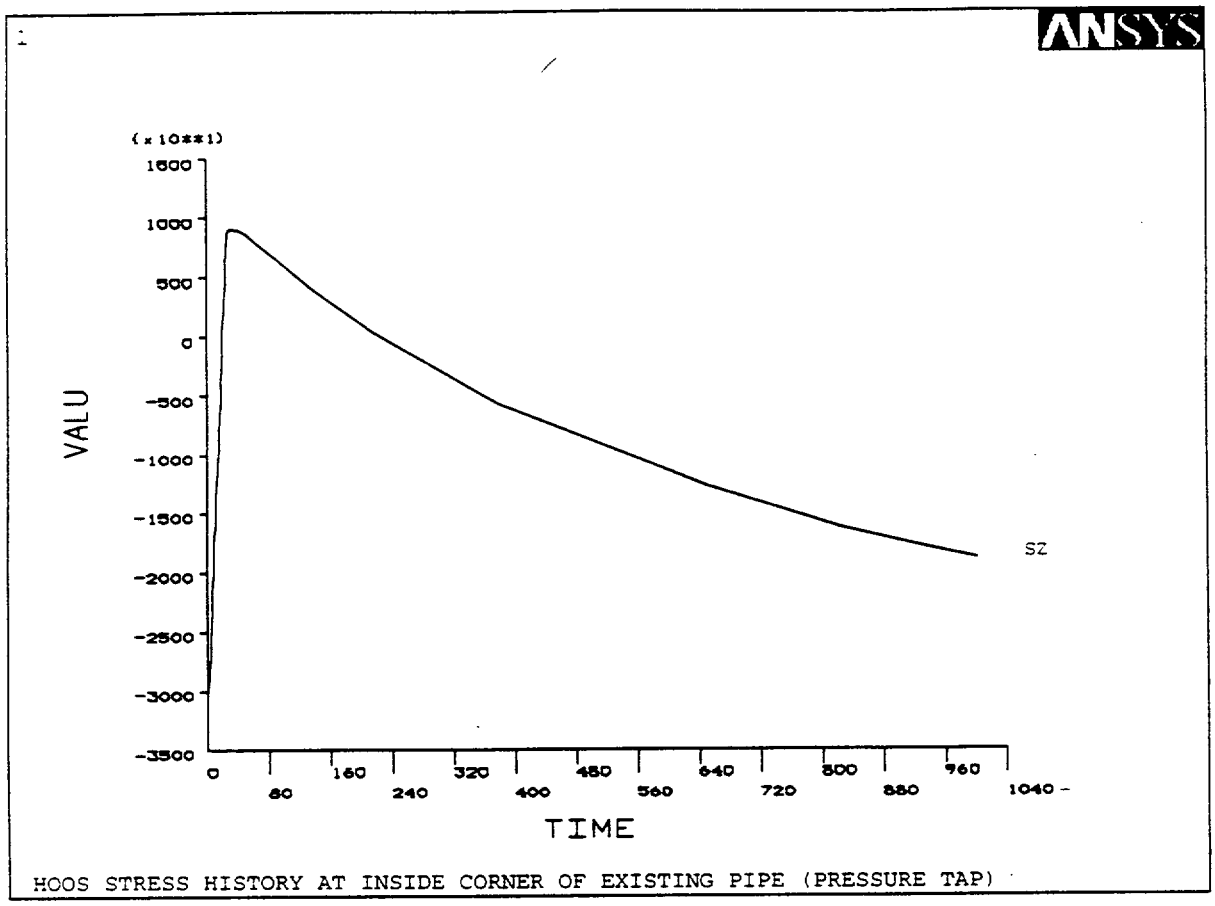

Figure 4-12. Pressure Measurement Nozzle Hoop Stress Time-History Due to Reactor Trip Transient

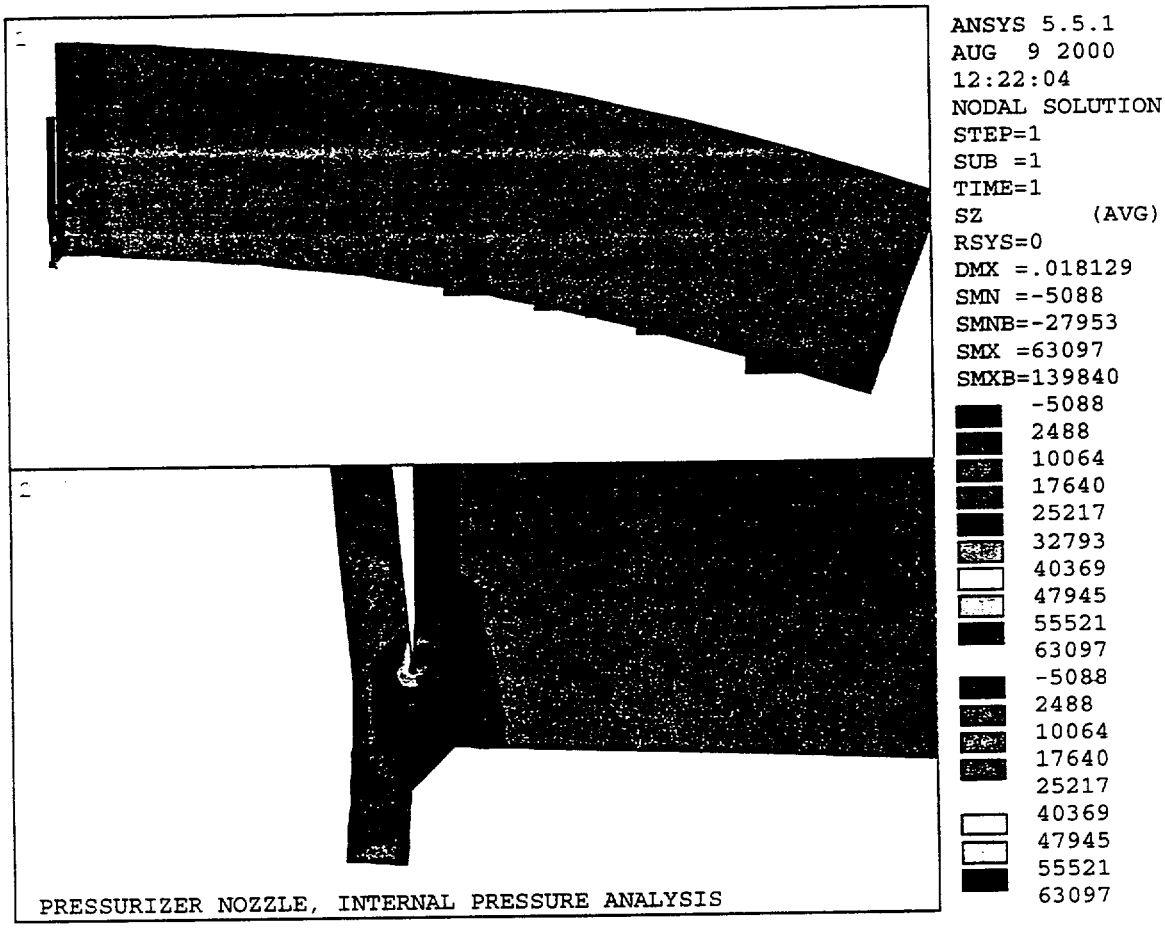

Figure 4-13. Pressurizer Heater Penetration Hoop Stresses Due to Internal Pressure

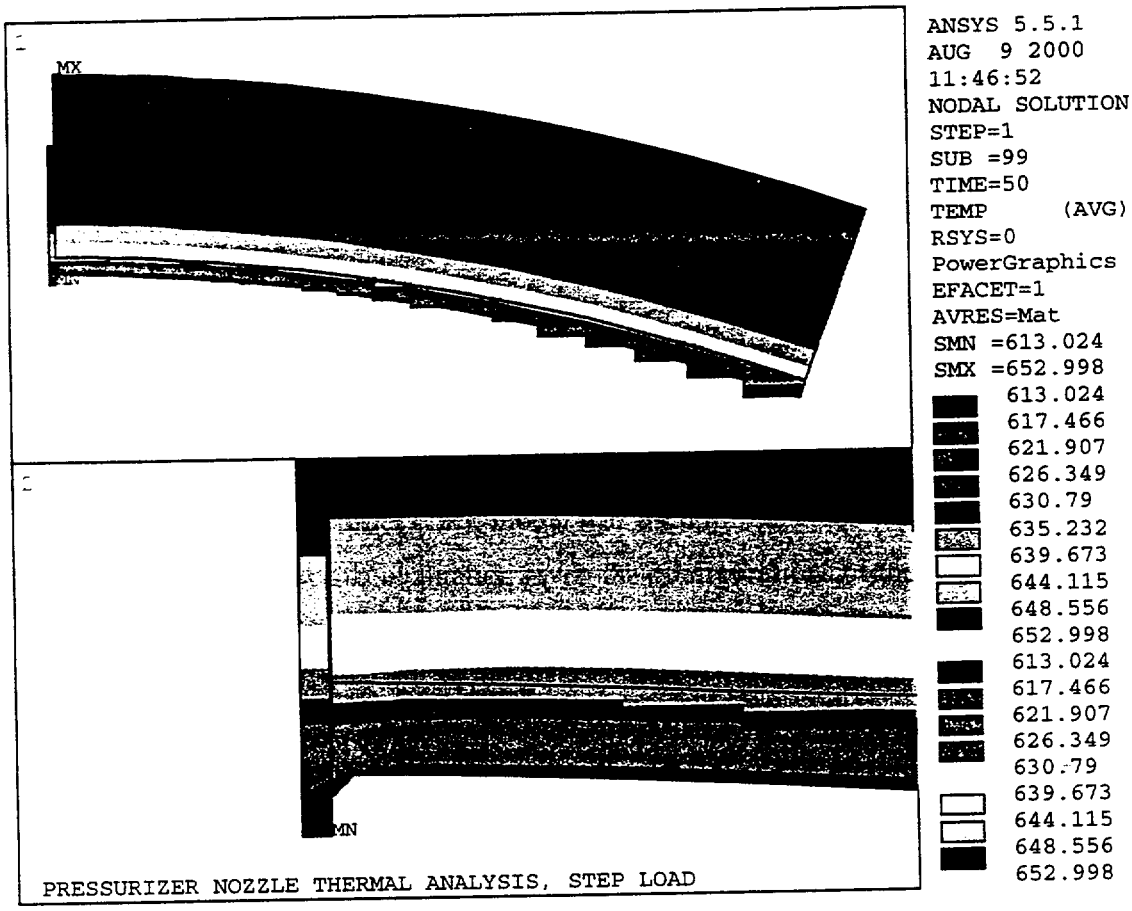

Figure 4-14. Pressurizer Heater Penetration Temperature Distribution Due to Reactor Trip

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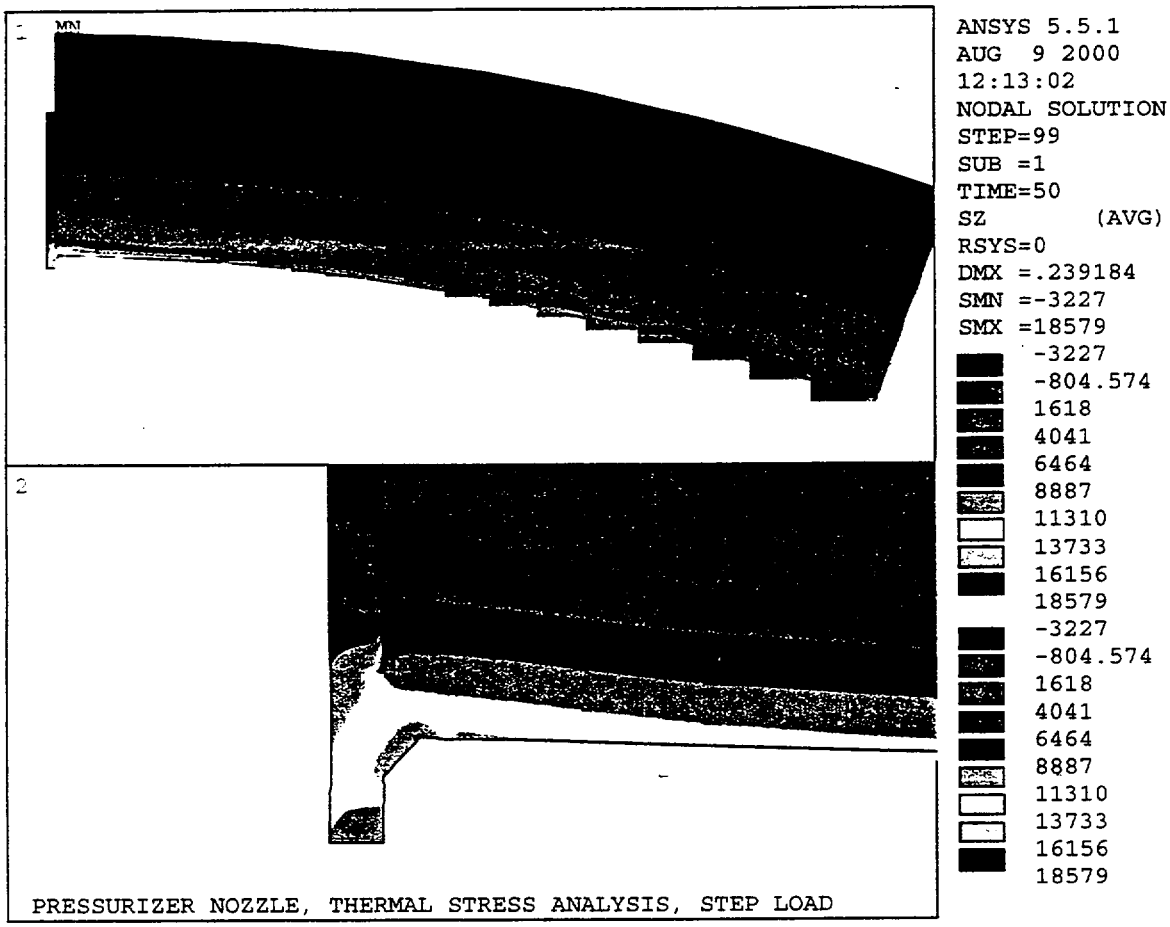

Figure 4-15. Pressurizer Heater Penetration Hoop Stresses Due to Reactor Trip

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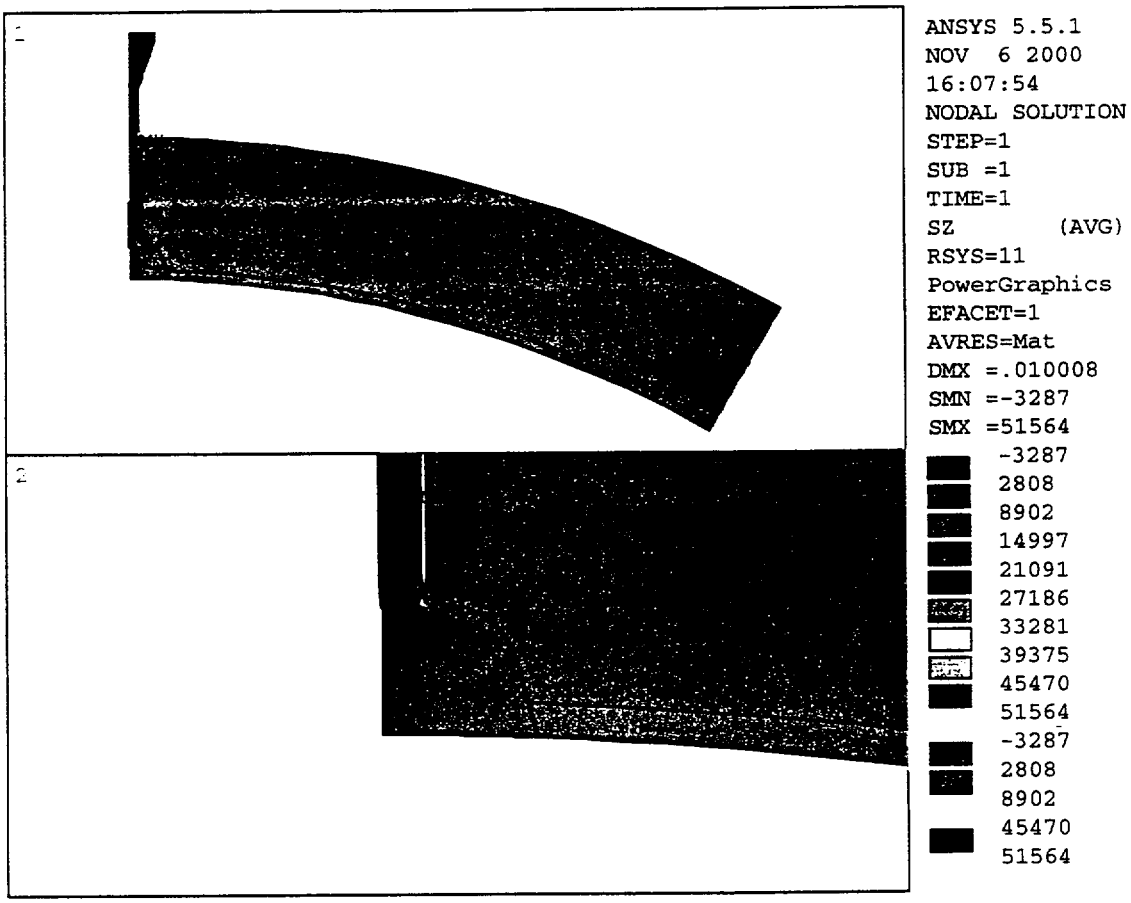

Figure 4-16. RCS Hot Leg RTD Penetration Hoop Stresses Due to Internal Pressure

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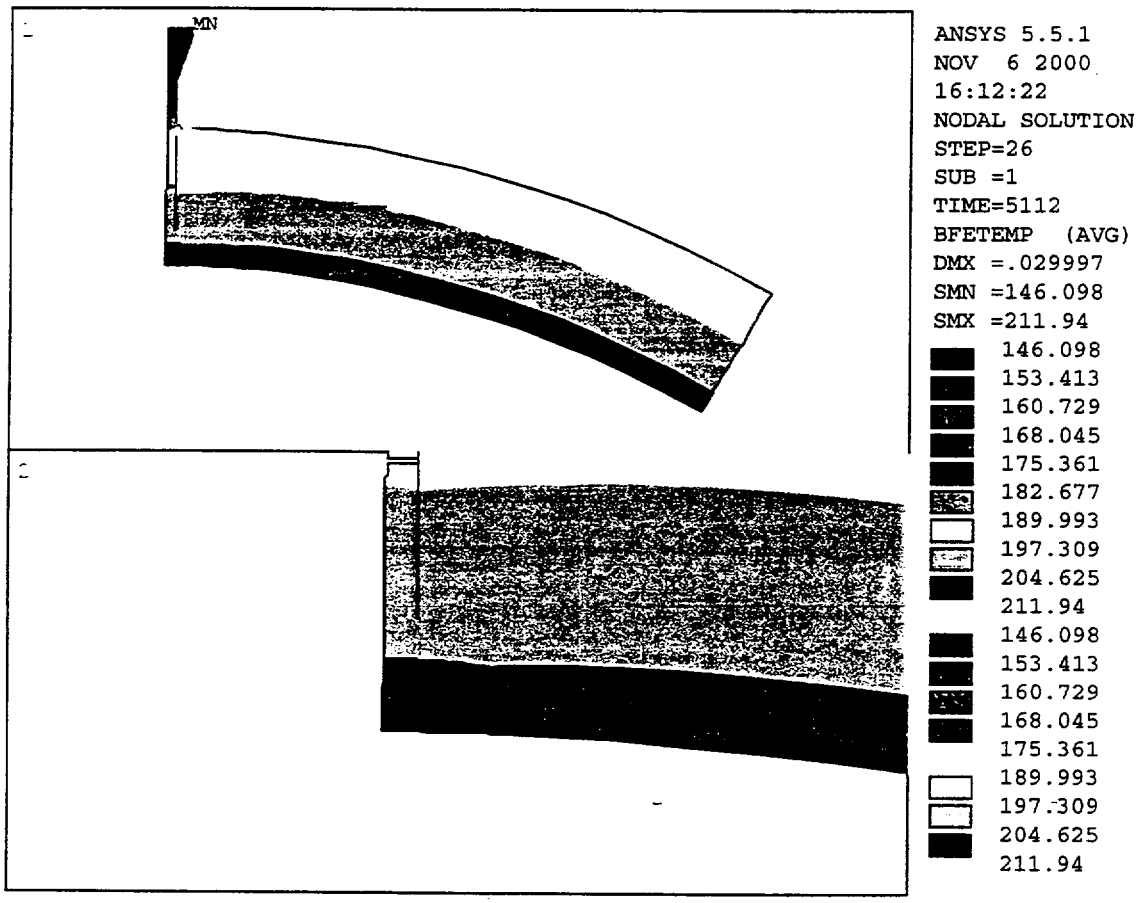

Figure 4-17. RCS Hot Leg RTD Penetration Temperature Distribution at Intermediate Heatup Point (212°F)

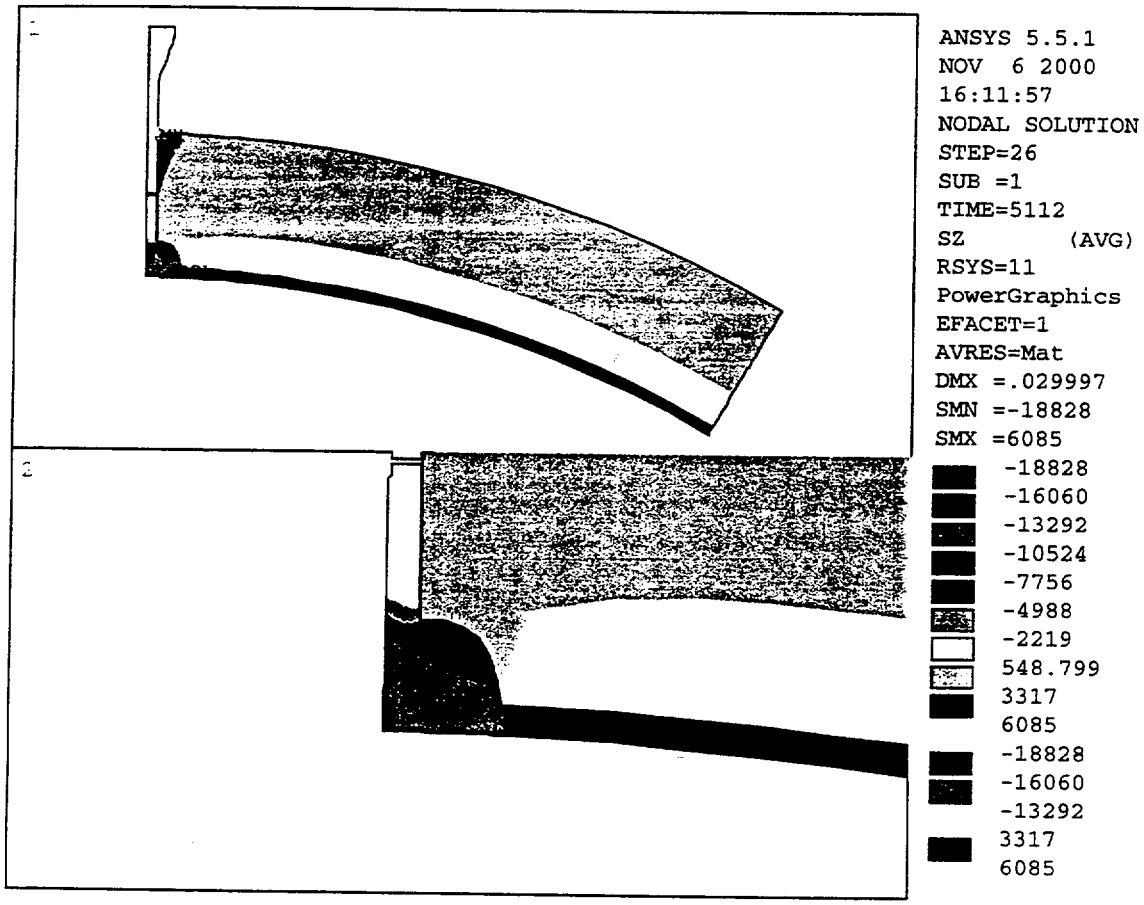

Figure 4-18. RCS Hot Leg RTD Penetration Hoop Stresses Due to Heatup Transient

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5.0 CRACK GROWTH EVALUATIONS

The evaluation of the potential for a crack in the existing pressurizer and RCS hot leg penetration welds to propagate in the pressurizer vessel and hot leg pipe wall is summarized in the following paragraphs.

5.1 Applied Stresses

The loadings in the pressurizer and RCS hot leg systems include internal pressure and bounding thermal transients. The stress distributions at the pressurizer and hot leg pipe penetrations due to these loading conditions were obtained by finite element analyses discussed in Section 4. The relevant stress distributions due to pressure and thermal transients are extracted from the stress analyses along a through-wall path for input in the crack growth evaluations. The through-wall path used for the hot leg penetration is inclined at approximately 45° from the nozzle bore axis, which is appropriate for the corner crack model. The through-wall path used for the pressurizer penetration is conservatively inclined at approximately 23° from the nozzle bore axis. This path is also conservative for use with the 360° circumferential crack model. The through-wall stress distributions are presented in Figures 5-1 and 5-2.

The pressure loading on the crack faces is also taken into consideration. This is done by determining polynomial distribution that approximates the pressure up to the region of the crack tip. For this analysis, the crack face loading is taken as a series of data points with a pressure equal to the operating internal pressure up to the approximate final depth of the crack, and then zero beyond that depth.

5.2 Fatigue Cycle Definition

The ANO-2 plant operation design transients are described in Section 3 and listed in Table 3-1. The significant operating condition transients for both the pressurizer and RCS hot leg are the heatup/cooldown, reactor trip, leak test and normal plant variations transients. In addition, the RCS hot leg experiences significant loads during the plant loading/unloading transients.

For the purpose of the crack growth evaluation, the heatup + reactor trip and coodown transients were combined to form a complete maximum stress range cycle. Similarly, the loading and unloading transients were combined for the RCS hot leg. In the crack growth analyses, the 500 heatup/cooldown cycles and the other operating transient cycles are assumed to be evenly distributed over the plant lifetime of 40 years. Coincident internal pressure levels described in Section 3 are combined appropriately with the thermal transient loads. The defined cyclic load ranges and corresponding number of cycles are presented in Table 5-1.

5.3 Fracture Mechanics Evaluation

5.3.1 Fracture Mechanics Models

A simulated 3-D nozzle corner crack model was used for the crack growth analysis. This crack model is appropriate for this evaluation given the configurations of the pressurizer and RCS hot leg pressure tap nozzle assembly. From Reference 14, the stress intensity factor for this crack model is expressed as

$$K_I = \sqrt{\pi a}\left(0.706C_o + 0.537(2a/\pi)C_1 + 0.448\left(a^2/2\right)C_2 + 0.393\left(4a^3/3\pi\right)C_3\right)$$

where,

a	=	crack depth
C_0, C_1, C_2 and C_3	=	polynomial coefficients defining the stress distribution at the critical through-wall section of the hot leg pipe

For the pressurizer, a model for a 360° circumferential crack in a cylinder (t/R = 0.1) is also evaluated since the cracking could extend along the shell in the Alloy 600 cladding. This model conservatively represents a very long flaw through the Alloy 600 cladding on both sides of the penetration.

All the crack growth analyses are performed with the **pc-CRACK for Windows** [12] fracture mechanics analysis program, which includes both the simulated corner crack and circumferential crack models.

5.3.2 *Initial Flaw Size*

The initial flaw size is taken as the maximum depth of the Alloy 600 material at each location. For the pressurizer penetration, it is assumed that the weld and underlying clad material contains a flaw to a depth of 0.375 in. [13]. For the hot leg RTD nozzle, the crack depth includes the initial weld size and butter dimension of 15/16 in. plus tolerance of 1/8 in. [4]. In both cases, this conservatively assumes that the cracking extends to the Alloy 600/ferritic interface.

Since hoop stresses are the governing stresses at the penetrations, the crack is assumed to be axially oriented with respect to the hot leg piping.

5.3.3 *Crack Growth Law*

For the flaw growth through the pressurizer and RCS hot leg pipe, it was assumed that base metal fatigue is the primary propagation mechanism. The methodology of Section XI of the ASME Code [1] was used to perform the fatigue crack growth. The ASME fatigue crack growth law for carbon and low alloy steels in water environment was used. This crack growth law has the form of a Paris law expressed as:

$$\frac{da}{dN} = C(\Delta K)^n$$

where,	a	=	flaw depth
	N	=	number of stress cycles
	C and n	=	experimentally determined parameters related to the material and operating environment
	ΔK	=	stress intensity factor range ($K_{max} - K_{min}$)

5.3.4 *Fracture Toughness*

The major stress in the vicinity of the cracking is due to applied pressure. At conditions of high pressure, the temperature is also high. Thus, it is assumed that the material is on the upper shelf and the fracture toughness curve from Section XI, Appendix A is used, assuming 200 ksi-in$^{1/2}$. A factor of $\sqrt{10}$ (3.1622) is used resulting in an allowable fracture toughness is 63.24 ksi-in$^{1/2}$.

5.3.5 *Multiple Flaw Considerations*

The effect of cracking on both sides of the nozzle is accounted for by multiplying the stress intensity factors by a scale factor. This factor is derived using the single crack-to-two crack multiplier for an assumed corner crack flaw size of 1.5 inches, the bore diameter of the actual heater penetration or hot leg penetration, and the model from Reference 16:

$$\frac{K_{2\,Flaws}}{K_{1\,Flaw}} = \sqrt{\frac{\frac{4}{\pi}+\frac{ac}{tr}}{\frac{4}{\pi}+\frac{ac}{2tr}}}$$

where: a = flaw depth into nozzle bore
c = flaw length along shell
t = shell thickness
r = nozzle bore radius

The multiplication factor calculations are summarized as follows:

Parameter	Pressurizer	RCS Hot Leg
a	1.5	1.5
c	1.5	1.5
t	3.875	3.75
r	0.579	0.4985
Multiplication Factor	1.1325	1.1493

Thus, the multiplication factors used in the analyses are 1.1325 and 1.1493 for the pressurizer and hot leg penetrations, respectively. These factors could be reduced by using the actual smaller flaw sizes computed in the analysis.

A model for a 360° circumferential surface crack in a cylinder (t/R = 0.1) [15] was also evaluated for the pressurizer penetration since the cracking could extend along the shell in the Alloy 600 cladding. For the large aspect ratio, relatively higher stress intensity factors are calculated. Since this assumes a crack on either side of the penetration, no multiplier needs to be applied to account for multiple flaws near the repaired heater tube.

5.4 Crack Growth Results

The applied stresses described in Section 5.1 were input to **pc-CRACK**. These stresses were represented as third order polynomial functions of distance from the inside surface of the pressurizer or RCS hot leg pipe. The calculated stress intensity factors corresponding to the applied stresses are shown in Figure 5-3 and Figure 5-4 for the pressurizer penetration corner crack and circumferential crack models, respectively. The stress intensity factors computed for the hot leg penetration are shown in Figure 5-5. The **pc-CRACK** analyses are documented in detail in Reference 17, and are shown in Appendix A.

For the pressurizer penetration, the postulated corner crack is predicted to grow 0.104 inches to a depth of 0.479 inches after 500 heatup/cooldown cycles (including all other transients described above). The end-of-period maximum stress intensity factor is 32.0 ksi-in$^{1/2}$, is controlled by the reactor trip cycle and significantly less than the allowable. The stress intensity factor for the initial flaw size is 29.5 ksi-in$^{1/2}$. For the circumferential crack, the crack grows 0.225 inches, reaching 0.60 inches at 500 heatup/cooldown cycles (plus other associated cycles). The controlling stress intensity factor starts at 40.6 ksi-in$^{1/2}$ and increases to only 48.4 ksi-in$^{1/2}$ at the end of the evaluation period.

For the hot leg RTD penetration, the crack grows 0.213 inches to 1.275 inches after 500 heatup/cooldown cycles (including all other associated transients). The stress intensity factor is 32.3 ksi-in$^{1/2}$. The stress intensity factor at the initial crack size is 30.6 ksi-in$^{1/2}$.

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Table 5-1. Crack Growth Evaluation Cyclic Loads

Load Cycle I.D.	Maximum		Minimum		Number of Cycles
	Pressure (psi)	Thermal	Pressure (psi)	Thermal	
Heatup/Cooldown + Reactor Trip	2535	Reactor Trip	0	Heatup @ 212 °F	500
Pressure Leak Test	2235	0	0	Heatup @ 212 °F	500
Normal Variations	2335	0	2135	0	10^6
Normal Operation + Reactor Trip	2335	0	1635	Hot Steady-State	500
Plant Loading/Unloading [1]	2275	0	2175	0	15,000

Note 1: This condition applies to the RCS hot leg only.

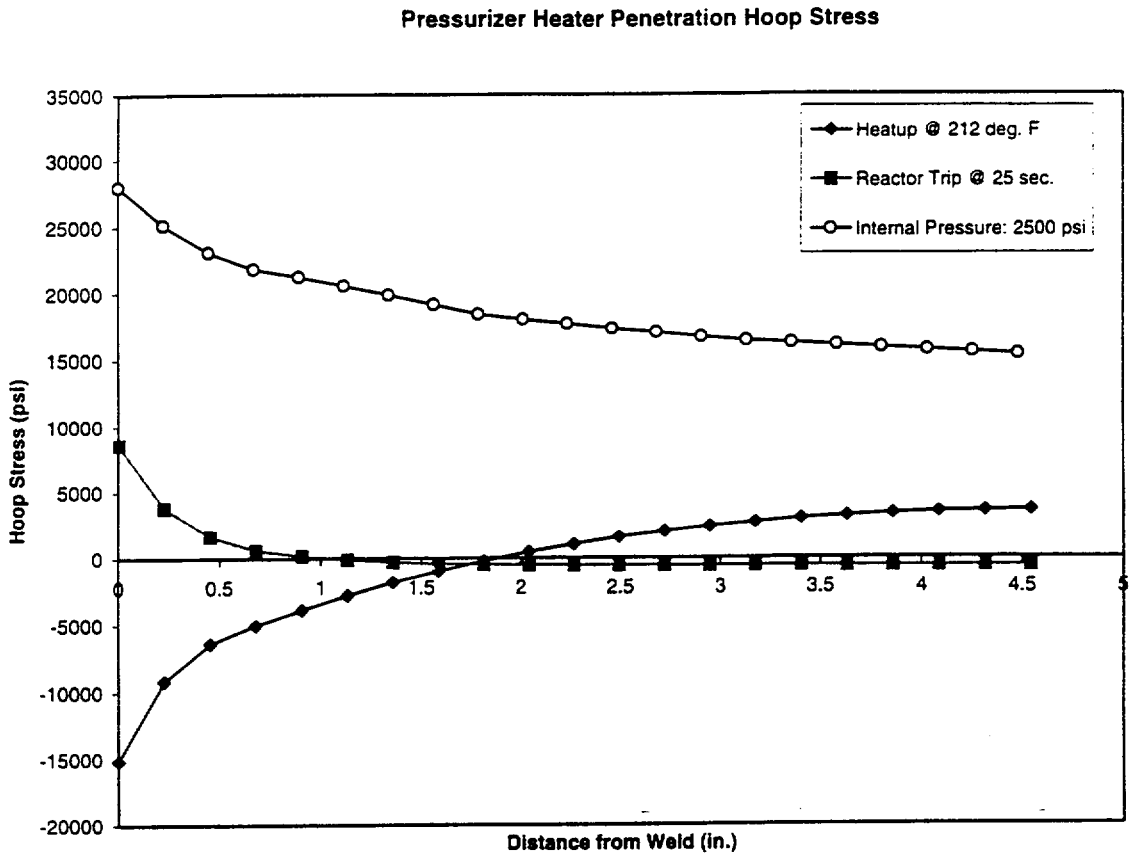

Figure 5-1. Pressurizer Penetration Hoop Stress Distributions

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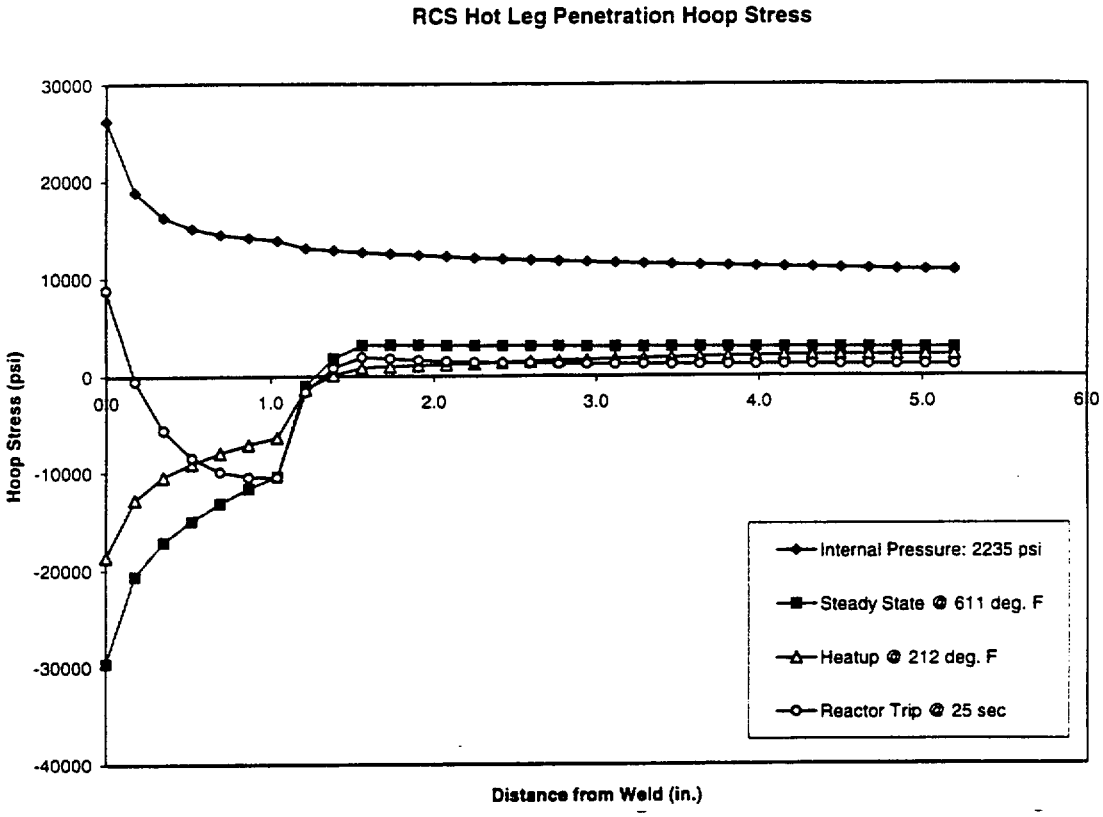

Figure 5-2. RCS Hot Leg Penetration Hoop Stress Distributions

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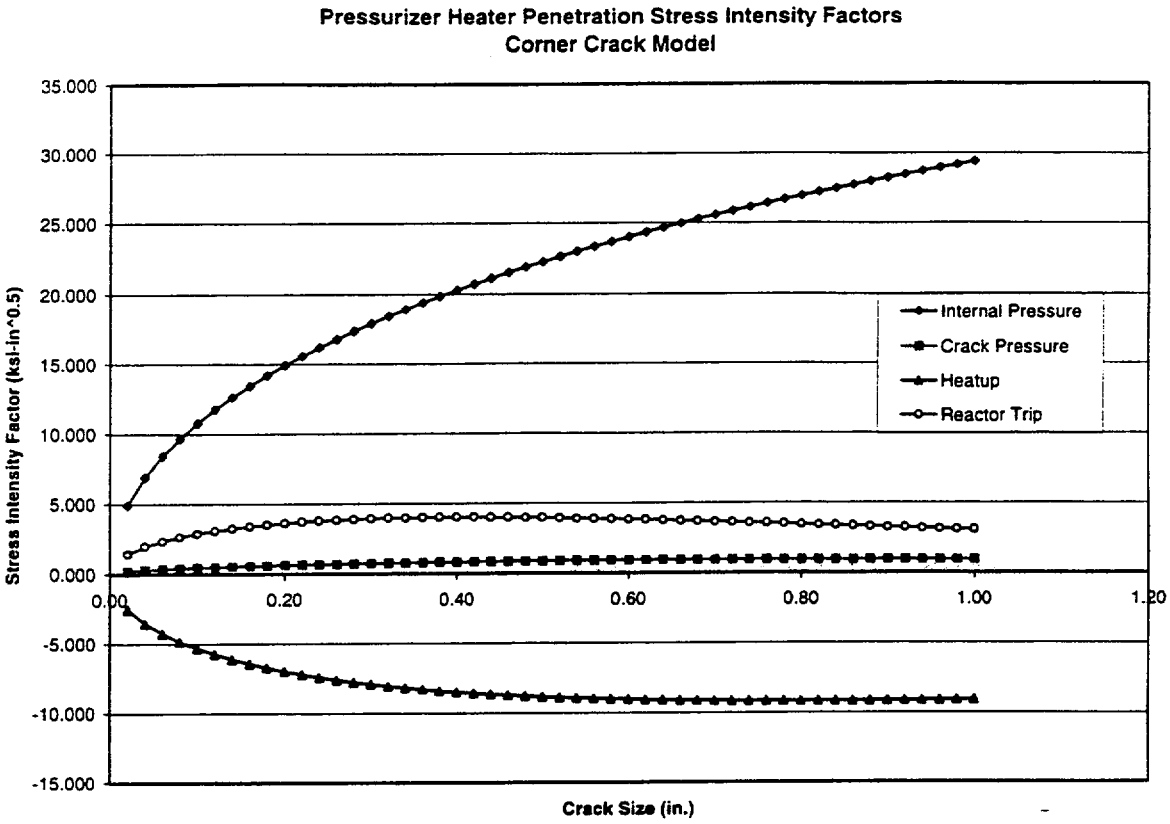

Figure 5-3. Pressurizer Heater Penetration Stress Intensity Factors
Corner Crack Model

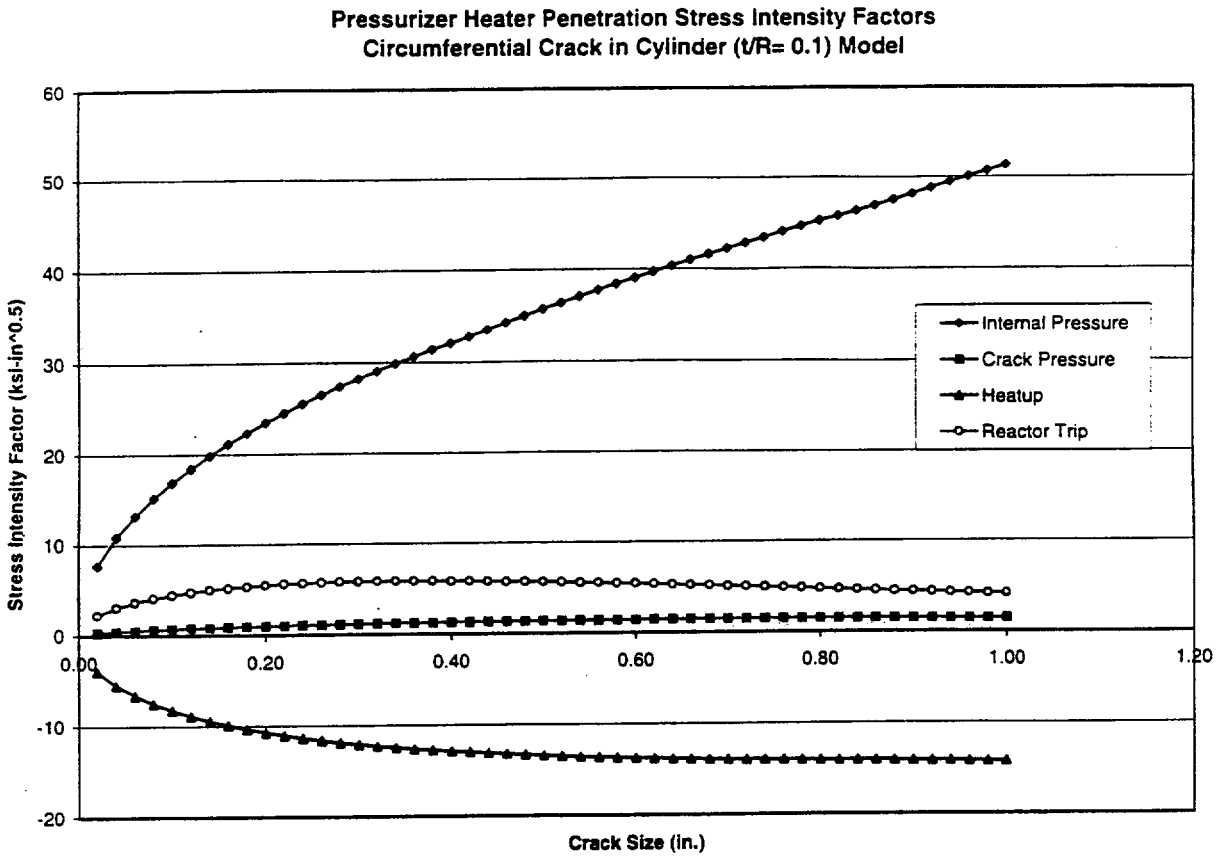

Figure 5-4. Pressurizer Heater Penetration Stress Intensity Factors
Circumferential Crack in Cylinder (t/R= 0.1) Model

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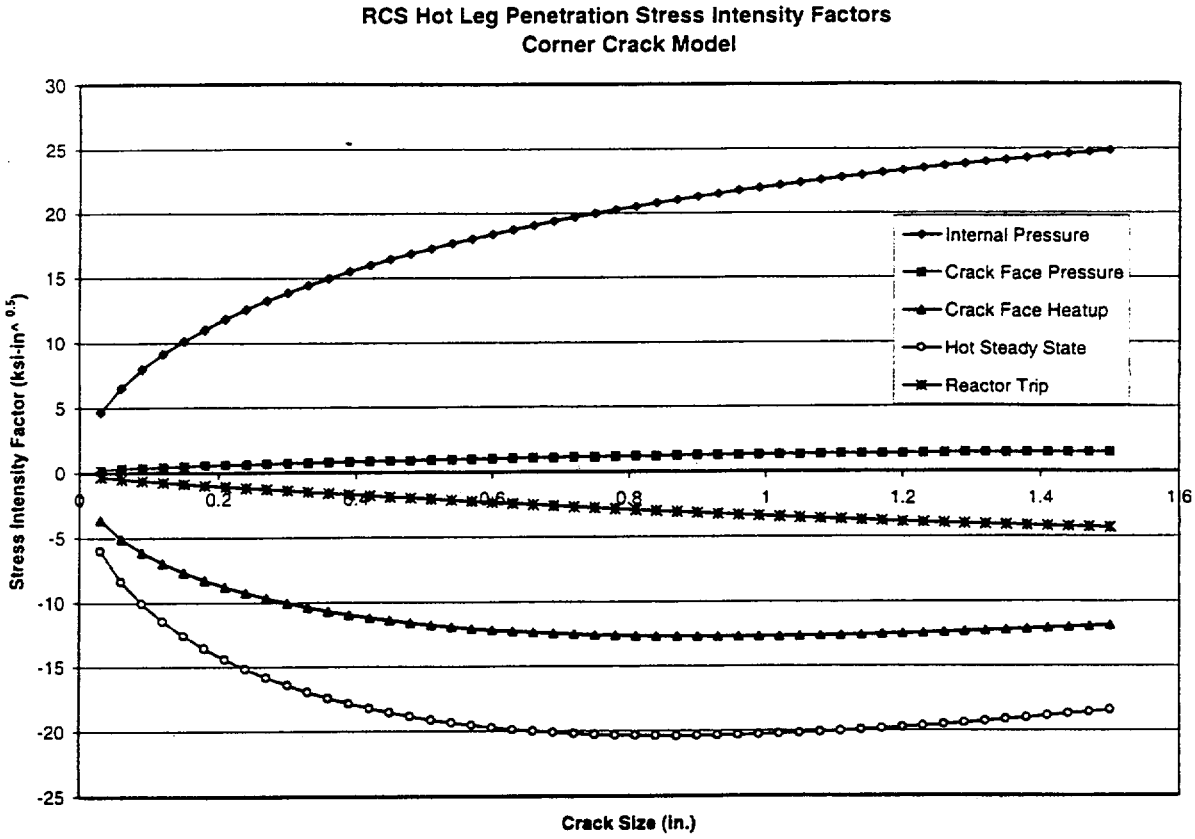

Figure 5-5. RCS Hot Leg Penetration Stress Intensity Factors

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6.0 CONCLUSIONS

Fracture mechanics analyses have been performed to evaluate the potential for a crack in the pressurizer heater and RCS hot leg RTD and pressure measurement penetration welds to grow to a depth greater than the ASME Code Section XI allowable flaw size. The fracture mechanics evaluations used stress input from detailed finite element stress analyses of the nozzle penetrations, which are bounding for all the pressurizer heater locations as well as all the hot leg RTD and pressure measurement/sample locations at ANO-2.

The analyses performed in this evaluation include some conservative assumptions. There is significant margin between the computed stress intensity factors and the allowable fracture toughness. The crack growth rate has been demonstrated to be small, even for the total expected number of transients for the plant design life.

In the uncracked configuration, there is a pressure loading on the inner sleeve that produces tensile stresses in the hoop direction. This can cause through-wall cracking of the sleeve that results in leakage. In the repaired condition, the pressure load is taken at the outside diameter of the piping. In the case of a leaking inner sleeve, there will no longer be an applied pressure load causing tensile stresses in the hoop direction, except locally near each end of the piping where the tube is welded. In the absence of the applied pressure loading, there will be no driving force to continue to grow a crack in the sleeve axial direction.

7.0 REFERENCES

1. ASME Boiler and Pressure Vessel Code, Section XI, 1989 Edition.

2. Combustion Engineering Drawing No. E73370-671-002, Revision 3, "General Arrangement, Arkansas Nuclear 96" I.D. Pressurizer Equipment No. 2T1", SI File No. ANO-21Q-207.

3. Combustion Engineering Drawing No. E73370-671-003, Revision 4, "Vessel Assembly and Heater Penetrations, Arkansas Nuclear 96" I.D. Pressurizer Equipment No. 2T1", SI File No. ANO-21Q-205.

4. Combustion Engineering Drawing E235-222, "Nozzle Details – Arkansas Nuclear Piping," Rev. 7, SI File No. ANO-21Q-217P.

5. Combustion Engineering Drawing E235-224,"Nozzle Details – Arkansas Nuclear Piping," Rev. 8, SI File No. ANO-21Q-217P.

6. Framatome Technologies, Inc., ANO-2 Hot Leg Replacement Design Drawings, SI File No. ANO-21Q-226
   a. Drawing No. 5009755, Revision 1, "Alloy 690 Pressure Sample Nozzle"
   b. Drawing No. 5009756, Revision 1, "Alloy 690 Modified RTD Nozzle"
   c. Drawing No. 5009757 D, Revision 1, "ANO-2 Alloy 690 Hot Leg Pressure/Sample Nozzle Replacement"
   d. Drawing No. 5009758 D, Revision 2, "ANO-2 Alloy 690 hot Leg RTD Nozzle Replacement"

7. ASME Boiler and Pressure Vessel Code, Section II, Part D, 1992 Edition.

8. ANO Document No. 86-E-0036-148, Rev. 0, "Project Specification for a Pressurizer Assembly for Arkansas Nuclear One – Unit 2"; ABB/CE Spec. No. 06370-PE-130, Rev. 11, SI File No. ANO-21Q-220.

9. ANO Document No. 86-E-0036-130, Rev. 0, "Project Specification for Reactor Coolant Pipe and Fittings for Arkansas Nuclear One – Unit 2"; ABB/CE Spec. No. 06370-PE-140, Rev. 9, SI File No. ANO-21Q-221.

10. ANSYS/Mechanical, Revision 5.5.1, ANSYS, Inc., October 1998.

11. Combustion Engineering Report CENC-1289, "Analytical Report for Arkansas Nuclear One-Unit 2 Piping", July 1977, SI File No. ANO-21Q-217P.

12. **pc-CRACK for Windows**, Version 3.1-98348, Structural Integrity Associates, 1998.

13. Telecon from Steve Lewis at Entergy 8/8/2000, SI File No. File ANO-21Q-103.

14. Riccardella, P. C., and Delvin, S. A., "Fracture Mechanics Analysis of JAERI Model Pressure Vessel Test", ASME Publication 78-PVP-91.

15. Buchalet, C. B., and Bamford, W. H., "Stress Intensity Factor Solutions for Continuous Surface Flaws in Reactor Pressure Vessels", ASTM STP-590, 1975.

16. Newman, J. C. and Raju, I. S., "Stress-Intensity Factor Equations for Cracks in Three Dimensional Bodies Subjected to Tension and Bending Loads", NASA Tech. Memorandum 85793, April 1984.

17. SI Calculation Package ANO-21Q-306, Rev. 0, "Crack Growth and Critical Flaw Size Evaluation for Pressurizer Heater and Hot Leg Instrument Penetrations".

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APPENDIX A

CRACK GROWTH ANALYSIS FILES

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tm
pc-CRACK for Windows
Version 3.1-98348
(C) Copyright '84 - '98
Structural Integrity Associates, Inc.
3315 Almaden Expressway, Suite 24
San Jose, CA 95118-1557
Voice: 408-978-8200
Fax: 408-978-8964
E-mail: pccrack@structint.com

Linear Elastic Fracture Mechanics

Date: Thu Nov 09 11:47:48 2000
Input Data and Results File: ANO_CNEW.LFM

Title: ANO-2 Pressurizer Heater Penetration - Corner Crack, With Multi-Flaw Factor

Load Cases:

Case ID: Pressure Dist - 2500 psig --- Stress Distribution

Depth	Stress
0.0000	27.9790
0.2230	25.1440
0.4461	23.0870
0.6693	21.8670
0.8927	21.2600
1.1161	20.5820
1.3397	19.8760
1.5634	19.1460
1.7873	18.4030
2.0112	18.0030

Case ID: Crack Pressue 1000 psi --- Stress Distribution

Depth	Stress
0.0000	1.0000
0.1000	1.0000
0.2000	1.0000
0.3000	1.0000
0.4000	1.0000
0.5000	1.0000
0.6000	1.0000
0.7000	1.0000
0.7100	0.0000
0.8000	0.0000
0.9000	0.0000
1.0000	0.0000
1.2500	0.0000
1.5000	0.0000
1.7500	0.0000
2.0000	0.0000

Case ID: Heatup 212 --- Stress Distribution

Depth	Stress
0.0000	-15.1280

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0.2261	-9.1585
0.4523	-6.3704
0.6786	-5.0184
0.9050	-3.8490
1.1316	-2.7846
1.3583	-1.8146
1.5851	-0.9689
1.8120	-0.2237
2.0390	0.4438

Case ID: RTrip 25 --- Stress Distribution

Depth	Stress
0.0000	8.6304
0.2261	3.8245
0.4523	1.6330
0.6786	0.6301
0.9050	0.1831
1.1316	-0.1150
1.3583	-0.3113
1.5851	-0.4104
1.8120	-0.4728
2.0390	-0.5136

Case ID	Stress Coefficients C0	C1	C2	C3	Type
Pressure 1000 p	15.65	0	0	0	Coeff
Pressure Dist -	27.8397	-13.4214	8.28596	-2.03742	StressDist
Crack Pressue 1	1.09032	-0.0572721	-1.53487	0.664123	StressDist
Heatup 212	-14.5416	23.352	-15.5326	3.8104	StressDist
RTrip 25	8.21622	-20.0256	15.148	-3.67478	StressDist

------Through Wall Stresses for Load Cases With Stress Coeff-------

Wall Depth	Case Pressure 1
0.0000	15.65
0.1000	15.65
0.2000	15.65
0.3000	15.65
0.4000	15.65
0.5000	15.65
0.6000	15.65
0.7000	15.65
0.8000	15.65
0.9000	15.65
1.0000	15.65

Crack Model: Simulated 3-D Nozzle Corner Crack

WARNING: The stress intensity factor (K) is calculated at the deepest point only.
May be non-conservative in some cases.

Crack Parameters:
Max. crack size: 1.0000

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Crack Size	Case Pressure 1	Case Pressure D	Case Crack Pres	Case Heatup 212	Case RTrip 25
			Stress Intensity Factor		
0.0200	2.76955	4.90392	0.192819	-2.53373	1.42003
0.0400	3.91673	6.90344	0.272405	-3.5281	1.96111
0.0600	4.797	8.4167	0.333165	-4.25469	2.34533
0.0800	5.5391	9.67532	0.384044	-4.83763	2.64418
0.1000	6.1929	10.7696	0.428491	-5.32599	2.88622
0.1200	6.78398	11.746	0.468269	-5.74542	3.08652
0.1400	7.32754	12.6324	0.504417	-6.11144	3.2543
0.1600	7.83347	13.4471	0.537611	-6.4344	3.39577
0.1800	8.30865	14.2029	0.568315	-6.7216	3.51534
0.2000	8.75808	14.909	0.596865	-6.9785	3.61635
0.2200	9.18555	15.5726	0.623515	-7.20927	3.70138
0.2400	9.594	16.1993	0.648459	-7.41724	3.77249
0.2600	9.98575	16.7934	0.671852	-7.6051	3.83137
0.2800	10.3627	17.3587	0.693818	-7.77507	3.87944
0.3000	10.7264	17.8981	0.714461	-7.92902	3.91788
0.3200	11.0782	18.4142	0.733865	-8.06855	3.94773
0.3400	11.4191	18.9091	0.752104	-8.19503	3.96987
0.3600	11.7502	19.3847	0.76924	-8.30965	3.98508
0.3800	12.0722	19.8426	0.785326	-8.41346	3.99404
0.4000	12.3858	20.2842	0.800409	-8.50739	3.99738
0.4200	12.6917	20.7107	0.814532	-8.59225	3.99564
0.4400	12.9903	21.1233	0.827733	-8.6688	3.98931
0.4600	13.2823	21.5229	0.840044	-8.73769	3.97883
0.4800	13.568	21.9104	0.851496	-8.79953	3.96463
0.5000	13.8477	22.2867	0.862118	-8.85487	3.94706
0.5200	14.122	22.6524	0.871936	-8.90419	3.92647
0.5400	14.391	23.0082	0.880975	-8.94797	3.90317
0.5600	14.6551	23.3546	0.889256	-8.98662	3.87744
0.5800	14.9145	23.6923	0.896801	-9.02051	3.84955
0.6000	15.1694	24.0217	0.903631	-9.05002	3.81974
0.6200	15.4202	24.3434	0.909766	-9.07546	3.78824
0.6400	15.6669	24.6576	0.915223	-9.09714	3.75525
0.6600	15.9098	24.9649	0.920022	-9.11534	3.72098
0.6800	16.1491	25.2655	0.924179	-9.13032	3.68559
0.7000	16.3849	25.5598	0.927711	-9.14232	3.64927
0.7200	16.6173	25.8482	0.930636	-9.15157	3.61215
0.7400	16.8465	26.1309	0.93297	-9.15828	3.5744
0.7600	17.0726	26.4082	0.934728	-9.16265	3.53614
0.7800	17.2958	26.6803	0.935926	-9.16484	3.49749
0.8000	17.5162	26.9476	0.936581	-9.16504	3.45858
0.8200	17.7338	27.2101	0.936708	-9.16341	3.41951
0.8400	17.9487	27.4681	0.936322	-9.16008	3.38038
0.8600	18.1611	27.7219	0.935439	-9.1552	3.34128
0.8800	18.3711	27.9715	0.934073	-9.1489	3.3023
0.9000	18.5787	28.2172	0.932241	-9.14129	3.26352
0.9200	18.784	28.4592	0.929958	-9.13248	3.225
0.9400	18.9871	28.6975	0.927239	-9.12257	3.18683
0.9600	19.188	28.9324	0.9241	-9.11167	3.14905
0.9800	19.3868	29.1639	0.920556	-9.09985	3.11172
1.0000	19.5837	29.3921	0.916622	-9.0872	3.0749

Crack Growth Laws:

Law ID: Crack Growth
Model: ASME Section XI - ferritic steel in water environment

da/dN = CL * SL * dK^5.95 for dK < dKtran

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```
  da/dN = CU * SU * dK^1.95  for dK >= dKtran
where
      dK = Kmax - Kmin
       R = Kmin / Kmax
for R <= 0.25:
  SL = 1.0                  SU = 1.0    dKtran = 17.74
for 0.25 < R <= 0.65:
  SL = 26.9 * R - 5.725     SU = 3.75 * R + 0.06
  dKtran = 17.74*{(3.75 * R + 0.06)/(26.9 * R - 5.725)}^0.25
 for 0.65 < R:
  SL = 11.76                SU = 2.5    dKtran = 12.04

where:
  CL =  1.0200e-012
  CU =  1.0100e-007
 are for the selected units of:
   force: kip
  length: inch
```

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Material Fracture Toughness KIc:

Material ID: C-Steel

Depth	KIc
0.0000	63.2400
4.0000	63.2400

Initial crack size= 0.3750
Max. crack size= 1.0000

Number of blocks= 50
Print increment of block= 1

Subblock	Cycles /Time	Calc. incre.	Print incre.	Crk. Grw. Law	Mat. Klc
Heatup/Cooldown	10	1	10	Crack Growth	C-Steel
Pressure Leak T	10	1	10	Crack Growth	C-Steel
Variations	20000	2000	20000	Crack Growth	C-Steel
Reactor Trip	10	1	10	Crack Growth	C-Steel

Subblock	Kmax Case ID	Kmax Scale Factor	Kmin Case ID	Kmin Scale Factor
Heatup/Cooldown	Crack Pressue 1000 psi	2.8709	Heatup 212	1.1325
	RTrip 25 1.1325			
	Pressure Dist - 2500 psig	1.1483		
Pressure Leak T	Crack Pressue 1000 psi	2.5311	Heatup 212	0.5662
	Pressure Dist - 2500 psig	1.0125		
Variations	Crack Pressue 1000 psi	2.6444	Crack Pressue 1000 psi	2.4179
	Pressure Dist - 2500 psig	1.0578	Pressure Dist - 2500 psig	0.9672
Reactor Trip	Crack Pressue 1000 psi	2.6444	Crack Pressue 1000 psi	1.8516
	Pressure Dist - 2500 psig	1.0578	Pressure Dist - 2500 psig	0.7407

Crack growth results:

Total Cycles	Subblock Cycles	DaDn

/Time	/Time	Kmax	Kmin	DeltaK	R	/DaDt	Da	a	a/thk
Block:	1								
10	10	2.95e+001	-9.51e+000	3.90e+001	-0.32	1.27e-004	1.27e-004	0.3763	0.00
20	10	2.20e+001	-4.75e+000	2.68e+001	-0.22	6.12e-005	6.12e-005	0.3769	0.00
20020	20000	2.30e+001	2.10e+001	1.97e+000	0.91	6.75e-010	1.35e-006	0.3769	0.00
20030	10	2.30e+001	1.61e+001	6.89e+000	0.70	1.17e-006	1.17e-006	0.3769	0.00
Block:	2								
20040	10	2.95e+001	-9.52e+000	3.90e+001	-0.32	1.28e-004	1.28e-004	0.3782	0.00
20050	10	2.20e+001	-4.76e+000	2.68e+001	-0.22	6.14e-005	6.14e-005	0.3788	0.00
40050	20000	2.30e+001	2.11e+001	1.97e+000	0.91	6.84e-010	1.37e-006	0.3788	0.00
40060	10	2.30e+001	1.61e+001	6.91e+000	0.70	1.18e-006	1.18e-006	0.3788	0.00
Block:	3								
40070	10	2.96e+001	-9.53e+000	3.91e+001	-0.32	1.28e-004	1.28e-004	0.3801	0.00
40080	10	2.21e+001	-4.77e+000	2.69e+001	-0.22	6.17e-005	6.17e-005	0.3807	0.00
60080	20000	2.31e+001	2.11e+001	1.98e+000	0.91	6.93e-010	1.39e-006	0.3807	0.00
60090	10	2.31e+001	1.62e+001	6.92e+000	0.70	1.20e-006	1.20e-006	0.3807	0.00
Block:	4								
60100	10	2.96e+001	-9.54e+000	3.92e+001	-0.32	1.29e-004	1.29e-004	0.382	0.00
60110	10	2.21e+001	-4.77e+000	2.69e+001	-0.22	6.19e-005	6.19e-005	0.3826	0.00
80110	20000	2.31e+001	2.12e+001	1.98e+000	0.91	7.01e-010	1.40e-006	0.3827	0.00
80120	10	2.31e+001	1.62e+001	6.94e+000	0.70	1.21e-006	1.21e-006	0.3827	0.00
Block:	5								
80130	10	2.97e+001	-9.55e+000	3.92e+001	-0.32	1.29e-004	1.29e-004	0.384	0.00
80140	10	2.22e+001	-4.78e+000	2.70e+001	-0.22	6.21e-005	6.21e-005	0.3846	0.00
100140	20000	2.32e+001	2.12e+001	1.99e+000	0.91	7.10e-010	1.42e-006	0.3846	0.00
100150	10	2.32e+001	1.62e+001	6.95e+000	0.70	1.23e-006	1.23e-006	0.3846	0.00
Block:	6								
100160	10	2.97e+001	-9.56e+000	3.93e+001	-0.32	1.29e-004	1.29e-004	0.3859	0.00
100170	10	2.22e+001	-4.78e+000	2.70e+001	-0.22	6.24e-005	6.24e-005	0.3865	0.00
120170	20000	2.32e+001	2.12e+001	1.99e+000	0.91	7.19e-010	1.44e-006	0.3865	0.00
120180	10	2.32e+001	1.63e+001	6.96e+000	0.70	1.24e-006	1.24e-006	0.3866	0.00
Block:	7								
120190	10	2.98e+001	-9.57e+000	3.93e+001	-0.32	1.30e-004	1.30e-004	0.3879	0.00
120200	10	2.23e+001	-4.79e+000	2.71e+001	-0.21	6.26e-005	6.26e-005	0.3885	0.00
140200	20000	2.33e+001	2.13e+001	1.99e+000	0.91	7.29e-010	1.46e-006	0.3885	0.00
140210	10	2.33e+001	1.63e+001	6.98e+000	0.70	1.26e-006	1.26e-006	0.3885	0.00
Block:	8								
140220	10	2.98e+001	-9.58e+000	3.94e+001	-0.32	1.30e-004	1.30e-004	0.3898	0.00
140230	10	2.23e+001	-4.79e+000	2.71e+001	-0.21	6.28e-005	6.28e-005	0.3904	0.00
160230	20000	2.33e+001	2.13e+001	2.00e+000	0.91	7.38e-010	1.48e-006	0.3904	0.00
160240	10	2.33e+001	1.63e+001	6.99e+000	0.70	1.27e-006	1.27e-006	0.3905	0.00
Block:	9								
160250	10	2.99e+001	-9.59e+000	3.95e+001	-0.32	1.31e-004	1.31e-004	0.3918	0.00
160260	10	2.24e+001	-4.80e+000	2.72e+001	-0.21	6.31e-005	6.31e-005	0.3924	0.00
180260	20000	2.34e+001	2.14e+001	2.00e+000	0.91	7.47e-010	1.49e-006	0.3924	0.00
180270	10	2.34e+001	1.64e+001	7.01e+000	0.70	1.29e-006	1.29e-006	0.3924	0.00
Block:	10								
180280	10	2.99e+001	-9.60e+000	3.95e+001	-0.32	1.31e-004	1.31e-004	0.3937	0.00
180290	10	2.24e+001	-4.80e+000	2.72e+001	-0.21	6.33e-005	6.33e-005	0.3944	0.00
200290	20000	2.34e+001	2.14e+001	2.01e+000	0.91	7.57e-010	1.51e-006	0.3944	0.00
200300	10	2.34e+001	1.64e+001	7.02e+000	0.70	1.31e-006	1.31e-006	0.3944	0.00

```
Block:    11
  200310       10 3.00e+001 -9.61e+000 3.96e+001 -0.32 1.31e-004 1.31e-004 0.3957 0.00
  200320       10 2.25e+001 -4.81e+000 2.73e+001 -0.21 6.36e-005 6.36e-005 0.3963 0.00
  220320    20000 2.35e+001 2.15e+001 2.01e+000 0.91 7.66e-010 1.53e-006 0.3964 0.00
  220330       10 2.35e+001 1.64e+001 7.04e+000 0.70 1.32e-006 1.32e-006 0.3964 0.00

Block:    12
  220340       10 3.00e+001 -9.62e+000 3.97e+001 -0.32 1.32e-004 1.32e-004 0.3977 0.00
  220350       10 2.25e+001 -4.81e+000 2.73e+001 -0.21 6.38e-005 6.38e-005 0.3983 0.00
  240350    20000 2.35e+001 2.15e+001 2.02e+000 0.91 7.76e-010 1.55e-006 0.3983 0.00
  240360       10 2.35e+001 1.65e+001 7.05e+000 0.70 1.34e-006 1.34e-006 0.3984 0.00

Block:    13
  240370       10 3.01e+001 -9.63e+000 3.97e+001 -0.32 1.32e-004 1.32e-004 0.3997 0.00
  240380       10 2.26e+001 -4.82e+000 2.74e+001 -0.21 6.40e-005 6.40e-005 0.4003 0.00
  260380    20000 2.36e+001 2.16e+001 2.02e+000 0.91 7.86e-010 1.57e-006 0.4003 0.00
  260390       10 2.36e+001 1.65e+001 7.07e+000 0.70 1.36e-006 1.36e-006 0.4003 0.00

Block:    14
  260400       10 3.02e+001 -9.64e+000 3.98e+001 -0.32 1.33e-004 1.33e-004 0.4017 0.00
  260410       10 2.26e+001 -4.82e+000 2.74e+001 -0.21 6.43e-005 6.43e-005 0.4023 0.00
  280410    20000 2.36e+001 2.16e+001 2.02e+000 0.91 7.96e-010 1.59e-006 0.4023 0.00
  280420       10 2.36e+001 1.65e+001 7.08e+000 0.70 1.37e-006 1.37e-006 0.4023 0.00

Block:    15
  280430       10 3.02e+001 -9.65e+000 3.99e+001 -0.32 1.33e-004 1.33e-004 0.4037 0.00
  280440       10 2.27e+001 -4.83e+000 2.75e+001 -0.21 6.45e-005 6.45e-005 0.4043 0.00
  300440    20000 2.37e+001 2.17e+001 2.03e+000 0.91 8.06e-010 1.61e-006 0.4043 0.00
  300450       10 2.37e+001 1.66e+001 7.10e+000 0.70 1.39e-006 1.39e-006 0.4044 0.00

Block:    16
  300460       10 3.03e+001 -9.66e+000 3.99e+001 -0.32 1.34e-004 1.34e-004 0.4057 0.00
  300470       10 2.27e+001 -4.83e+000 2.75e+001 -0.21 6.47e-005 6.47e-005 0.4063 0.00
  320470    20000 2.37e+001 2.17e+001 2.03e+000 0.91 8.16e-010 1.63e-006 0.4063 0.00
  320480       10 2.37e+001 1.66e+001 7.11e+000 0.70 1.41e-006 1.41e-006 0.4064 0.00

Block:    17
  320490       10 3.03e+001 -9.67e+000 4.00e+001 -0.32 1.34e-004 1.34e-004 0.4077 0.00
  320500       10 2.28e+001 -4.84e+000 2.76e+001 -0.21 6.50e-005 6.50e-005 0.4084 0.00
  340500    20000 2.38e+001 2.17e+001 2.04e+000 0.91 8.26e-010 1.65e-006 0.4084 0.00
  340510       10 2.38e+001 1.66e+001 7.13e+000 0.70 1.43e-006 1.43e-006 0.4084 0.00

Block:    18
  340520       10 3.04e+001 -9.68e+000 4.01e+001 -0.32 1.34e-004 1.34e-004 0.4097 0.00
  340530       10 2.28e+001 -4.84e+000 2.76e+001 -0.21 6.52e-005 6.52e-005 0.4104 0.00
  360530    20000 2.38e+001 2.18e+001 2.04e+000 0.91 8.36e-010 1.67e-006 0.4104 0.00
  360540       10 2.38e+001 1.67e+001 7.14e+000 0.70 1.44e-006 1.44e-006 0.4104 0.00

Block:    19
  360550       10 3.04e+001 -9.69e+000 4.01e+001 -0.32 1.35e-004 1.35e-004 0.4118 0.00
  360560       10 2.29e+001 -4.85e+000 2.77e+001 -0.21 6.55e-005 6.55e-005 0.4124 0.00
  380560    20000 2.39e+001 2.18e+001 2.05e+000 0.91 8.47e-010 1.69e-006 0.4124 0.00
  380570       10 2.39e+001 1.67e+001 7.16e+000 0.70 1.46e-006 1.46e-006 0.4124 0.00

Block:    20
  380580       10 3.05e+001 -9.70e+000 4.02e+001 -0.32 1.35e-004 1.35e-004 0.4138 0.00
  380590       10 2.29e+001 -4.85e+000 2.78e+001 -0.21 6.57e-005 6.57e-005 0.4144 0.00
  400590    20000 2.39e+001 2.19e+001 2.05e+000 0.91 8.57e-010 1.71e-006 0.4145 0.00
  400600       10 2.39e+001 1.68e+001 7.17e+000 0.70 1.48e-006 1.48e-006 0.4145 0.00

Block:    21
  400610       10 3.05e+001 -9.71e+000 4.02e+001 -0.32 1.36e-004 1.36e-004 0.4158 0.00
  400620       10 2.29e+001 -4.86e+000 2.78e+001 -0.21 6.60e-005 6.60e-005 0.4165 0.00
```

420620	20000	2.40e+001	2.19e+001	2.05e+000	0.91	8.68e-010	1.74e-006	0.4165	0.00
420630	10	2.40e+001	1.68e+001	7.19e+000	0.70	1.50e-006	1.50e-006	0.4165	0.00
Block:	22								
420640	10	3.06e+001	-9.72e+000	4.03e+001	-0.32	1.36e-004	1.36e-004	0.4179	0.00
420650	10	2.30e+001	-4.86e+000	2.79e+001	-0.21	6.62e-005	6.62e-005	0.4185	0.00
440650	20000	2.40e+001	2.20e+001	2.06e+000	0.91	8.79e-010	1.76e-006	0.4186	0.00
440660	10	2.40e+001	1.68e+001	7.20e+000	0.70	1.52e-006	1.52e-006	0.4186	0.00
Block:	23								
440670	10	3.06e+001	-9.73e+000	4.04e+001	-0.32	1.36e-004	1.36e-004	0.4199	0.00
440680	10	2.30e+001	-4.87e+000	2.79e+001	-0.21	6.64e-005	6.64e-005	0.4206	0.00
460680	20000	2.41e+001	2.20e+001	2.06e+000	0.91	8.90e-010	1.78e-006	0.4206	0.00
460690	10	2.41e+001	1.69e+001	7.22e+000	0.70	1.54e-006	1.54e-006	0.4206	0.00
Block:	24								
460700	10	3.07e+001	-9.74e+000	4.04e+001	-0.32	1.37e-004	1.37e-004	0.422	0.00
460710	10	2.31e+001	-4.87e+000	2.80e+001	-0.21	6.67e-005	6.67e-005	0.4227	0.00
480710	20000	2.41e+001	2.21e+001	2.07e+000	0.91	9.00e-010	1.80e-006	0.4227	0.00
480720	10	2.41e+001	1.69e+001	7.23e+000	0.70	1.55e-006	1.55e-006	0.4227	0.00
Block:	25								
480730	10	3.07e+001	-9.75e+000	4.05e+001	-0.32	1.37e-004	1.37e-004	0.4241	0.00
480740	10	2.31e+001	-4.88e+000	2.80e+001	-0.21	6.69e-005	6.69e-005	0.4247	0.00
500740	20000	2.42e+001	2.21e+001	2.07e+000	0.91	9.11e-010	1.82e-006	0.4248	0.00
500750	10	2.42e+001	1.69e+001	7.25e+000	0.70	1.57e-006	1.57e-006	0.4248	0.00
Block:	26								
500760	10	3.08e+001	-9.76e+000	4.06e+001	-0.32	1.38e-004	1.38e-004	0.4262	0.00
500770	10	2.32e+001	-4.88e+000	2.81e+001	-0.21	6.72e-005	6.72e-005	0.4268	0.00
520770	20000	2.42e+001	2.21e+001	2.07e+000	0.91	9.22e-010	1.84e-006	0.4268	0.00
520780	10	2.42e+001	1.70e+001	7.26e+000	0.70	1.59e-006	1.59e-006	0.4269	0.00
Block:	27								
520790	10	3.09e+001	-9.77e+000	4.06e+001	-0.32	1.38e-004	1.38e-004	0.4282	0.00
520800	10	2.32e+001	-4.88e+000	2.81e+001	-0.21	6.74e-005	6.74e-005	0.4289	0.00
540800	20000	2.43e+001	2.22e+001	2.08e+000	0.91	9.34e-010	1.87e-006	0.4289	0.00
540810	10	2.43e+001	1.70e+001	7.28e+000	0.70	1.61e-006	1.61e-006	0.429	0.00
Block:	28								
540820	10	3.09e+001	-9.77e+000	4.07e+001	-0.32	1.39e-004	1.39e-004	0.4303	0.00
540830	10	2.33e+001	-4.89e+000	2.82e+001	-0.21	6.76e-005	6.76e-005	0.431	0.00
560830	20000	2.43e+001	2.22e+001	2.08e+000	0.91	9.45e-010	1.89e-006	0.431	0.00
560840	10	2.43e+001	1.70e+001	7.29e+000	0.70	1.63e-006	1.63e-006	0.431	0.00
Block:	29								
560850	10	3.10e+001	-9.78e+000	4.07e+001	-0.32	1.39e-004	1.39e-004	0.4324	0.00
560860	10	2.33e+001	-4.89e+000	2.82e+001	-0.21	6.79e-005	6.79e-005	0.4331	0.00
580860	20000	2.44e+001	2.23e+001	2.09e+000	0.91	9.56e-010	1.91e-006	0.4331	0.00
580870	10	2.44e+001	1.71e+001	7.31e+000	0.70	1.65e-006	1.65e-006	0.4331	0.00
Block:	30								
580880	10	3.10e+001	-9.79e+000	4.08e+001	-0.32	1.39e-004	1.39e-004	0.4345	0.00
580890	10	2.34e+001	-4.90e+000	2.83e+001	-0.21	6.81e-005	6.81e-005	0.4352	0.00
600890	20000	2.44e+001	2.23e+001	2.09e+000	0.91	9.68e-010	1.94e-006	0.4352	0.00
600900	10	2.44e+001	1.71e+001	7.32e+000	0.70	1.67e-006	1.67e-006	0.4353	0.00
Block:	31								
600910	10	3.11e+001	-9.80e+000	4.09e+001	-0.32	1.40e-004	1.40e-004	0.4367	0.00
600920	10	2.34e+001	-4.90e+000	2.83e+001	-0.21	6.84e-005	6.84e-005	0.4373	0.00
620920	20000	2.45e+001	2.24e+001	2.10e+000	0.91	9.80e-010	1.96e-006	0.4374	0.00
620930	10	2.45e+001	1.71e+001	7.34e+000	0.70	1.69e-006	1.69e-006	0.4374	0.00

```
Block:    32
  620940       10 3.11e+001 -9.81e+000 4.09e+001 -0.32 1.40e-004 1.40e-004 0.4388 0.00
  620950       10 2.35e+001 -4.91e+000 2.84e+001 -0.21 6.86e-005 6.86e-005 0.4395 0.00
  640950    20000 2.45e+001 2.24e+001 2.10e+000 0.91 9.92e-010 1.98e-006 0.4395 0.00
  640960       10 2.45e+001 1.72e+001 7.35e+000 0.70 1.71e-006 1.71e-006 0.4395 0.00

Block:    33
  640970       10 3.12e+001 -9.82e+000 4.10e+001 -0.32 1.41e-004 1.41e-004 0.4409 0.00
  640980       10 2.35e+001 -4.91e+000 2.84e+001 -0.21 6.89e-005 6.89e-005 0.4416 0.00
  660980    20000 2.46e+001 2.25e+001 2.10e+000 0.91 1.00e-009 2.01e-006 0.4416 0.00
  660990       10 2.46e+001 1.72e+001 7.37e+000 0.70 1.73e-006 1.73e-006 0.4416 0.00

Block:    34
  661000       10 3.12e+001 -9.83e+000 4.10e+001 -0.31 1.41e-004 1.41e-004  0.443 0.00
  661010       10 2.36e+001 -4.92e+000 2.85e+001 -0.21 6.91e-005 6.91e-005 0.4437 0.00
  681010    20000 2.46e+001 2.25e+001 2.11e+000 0.91 1.02e-009 2.03e-006 0.4437 0.00
  681020       10 2.46e+001 1.72e+001 7.38e+000 0.70 1.75e-006 1.75e-006 0.4438 0.00

Block:    35
  681030       10 3.13e+001 -9.84e+000 4.11e+001 -0.31 1.41e-004 1.41e-004 0.4452 0.00
  681040       10 2.36e+001 -4.92e+000 2.85e+001 -0.21 6.93e-005 6.93e-005 0.4459 0.00
  701040    20000 2.47e+001 2.26e+001 2.11e+000 0.91 1.03e-009 2.06e-006 0.4459 0.00
  701050       10 2.47e+001 1.73e+001 7.39e+000 0.70 1.77e-006 1.77e-006 0.4459 0.00

Block:    36
  701060       10 3.13e+001 -9.85e+000 4.12e+001 -0.31 1.42e-004 1.42e-004 0.4473 0.00
  701070       10 2.37e+001 -4.92e+000 2.86e+001 -0.21 6.96e-005 6.96e-005  0.448 0.00
  721070    20000 2.47e+001 2.26e+001 2.12e+000 0.91 1.04e-009 2.08e-006  0.448 0.00
  721080       10 2.47e+001 1.73e+001 7.41e+000 0.70 1.80e-006 1.80e-006 0.4481 0.00

Block:    37
  721090       10 3.14e+001 -9.85e+000 4.12e+001 -0.31 1.42e-004 1.42e-004 0.4495 0.00
  721100       10 2.37e+001 -4.93e+000 2.86e+001 -0.21 6.98e-005 6.98e-005 0.4502 0.00
  741100    20000 2.48e+001 2.26e+001 2.12e+000 0.91 1.05e-009 2.10e-006 0.4502 0.00
  741110       10 2.48e+001 1.73e+001 7.42e+000 0.70 1.82e-006 1.82e-006 0.4502 0.00

Block:    38
  741120       10 3.14e+001 -9.86e+000 4.13e+001 -0.31 1.43e-004 1.43e-004 0.4516 0.00
  741130       10 2.37e+001 -4.93e+000 2.87e+001 -0.21 7.01e-005 7.01e-005 0.4523 0.00
  761130    20000 2.48e+001 2.27e+001 2.13e+000 0.91 1.06e-009 2.13e-006 0.4524 0.00
  761140       10 2.48e+001 1.74e+001 7.44e+000 0.70 1.84e-006 1.84e-006 0.4524 0.00

Block:    39
  761150       10 3.15e+001 -9.87e+000 4.14e+001 -0.31 1.43e-004 1.43e-004 0.4538 0.00
  761160       10 2.38e+001 -4.94e+000 2.87e+001 -0.21 7.03e-005 7.03e-005 0.4545 0.00
  781160    20000 2.49e+001 2.27e+001 2.13e+000 0.91 1.08e-009 2.15e-006 0.4545 0.00
  781170       10 2.49e+001 1.74e+001 7.45e+000 0.70 1.86e-006 1.86e-006 0.4546 0.00

Block:    40
  781180       10 3.15e+001 -9.88e+000 4.14e+001 -0.31 1.43e-004 1.43e-004  0.456 0.00
  781190       10 2.38e+001 -4.94e+000 2.88e+001 -0.21 7.06e-005 7.06e-005 0.4567 0.00
  801190    20000 2.49e+001 2.28e+001 2.13e+000 0.91 1.09e-009 2.18e-006 0.4567 0.00
  801200       10 2.49e+001 1.74e+001 7.47e+000 0.70 1.88e-006 1.88e-006 0.4567 0.00

Block:    41
  801210       10 3.16e+001 -9.89e+000 4.15e+001 -0.31 1.44e-004 1.44e-004 0.4582 0.00
  801220       10 2.39e+001 -4.94e+000 2.88e+001 -0.21 7.08e-005 7.08e-005 0.4589 0.00
  821220    20000 2.50e+001 2.28e+001 2.14e+000 0.91 1.10e-009 2.21e-006 0.4589 0.00
  821230       10 2.50e+001 1.75e+001 7.48e+000 0.70 1.91e-006 1.91e-006 0.4589 0.00

Block:    42
  821240       10 3.16e+001 -9.90e+000 4.15e+001 -0.31 1.44e-004 1.44e-004 0.4604 0.00
  821250       10 2.39e+001 -4.95e+000 2.89e+001 -0.21 7.11e-005 7.11e-005 0.4611 0.00
```

```
  841250    20000 2.50e+001 2.29e+001 2.14e+000 0.91 1.12e-009 2.23e-006 0.4611 0.00
  841260       10 2.50e+001 1.75e+001 7.50e+000 0.70 1.93e-006 1.93e-006 0.4611 0.00

Block:     43
  841270       10 3.17e+001 -9.90e+000 4.16e+001 -0.31 1.45e-004 1.45e-004 0.4626 0.00
  841280       10 2.40e+001 -4.95e+000 2.89e+001 -0.21 7.13e-005 7.13e-005 0.4633 0.00
  861280    20000 2.51e+001 2.29e+001 2.15e+000 0.91 1.13e-009 2.26e-006 0.4633 0.00
  861290       10 2.51e+001 1.75e+001 7.51e+000 0.70 1.95e-006 1.95e-006 0.4633 0.00

Block:     44
  861300       10 3.17e+001 -9.91e+000 4.17e+001 -0.31 1.45e-004 1.45e-004 0.4648 0.00
  861310       10 2.40e+001 -4.96e+000 2.90e+001 -0.21 7.15e-005 7.15e-005 0.4655 0.00
  881310    20000 2.51e+001 2.30e+001 2.15e+000 0.91 1.14e-009 2.28e-006 0.4655 0.00
  881320       10 2.51e+001 1.76e+001 7.53e+000 0.70 1.97e-006 1.97e-006 0.4655 0.00

Block:     45
  881330       10 3.18e+001 -9.92e+000 4.17e+001 -0.31 1.45e-004 1.45e-004  0.467 0.00
  881340       10 2.41e+001 -4.96e+000 2.90e+001 -0.21 7.18e-005 7.18e-005 0.4677 0.00
  901340    20000 2.52e+001 2.30e+001 2.15e+000 0.91 1.16e-009 2.31e-006 0.4677 0.00
  901350       10 2.52e+001 1.76e+001 7.54e+000 0.70 2.00e-006 2.00e-006 0.4677 0.00

Block:     46
  901360       10 3.18e+001 -9.93e+000 4.18e+001 -0.31 1.46e-004 1.46e-004 0.4692 0.00
  901370       10 2.41e+001 -4.96e+000 2.91e+001 -0.21 7.20e-005 7.20e-005 0.4699 0.00
  921370    20000 2.52e+001 2.30e+001 2.16e+000 0.91 1.17e-009 2.34e-006 0.4699 0.00
  921380       10 2.52e+001 1.77e+001 7.56e+000 0.70 2.02e-006 2.02e-006   0.47 0.00

Block:     47
  921390       10 3.19e+001 -9.93e+000 4.18e+001 -0.31 1.46e-004 1.46e-004 0.4714 0.00
  921400       10 2.42e+001 -4.97e+000 2.91e+001 -0.21 7.23e-005 7.23e-005 0.4721 0.00
  941400    20000 2.53e+001 2.31e+001 2.16e+000 0.91 1.18e-009 2.36e-006 0.4722 0.00
  941410       10 2.53e+001 1.77e+001 7.57e+000 0.70 2.04e-006 2.04e-006 0.4722 0.00

Block:     48
  941420       10 3.19e+001 -9.94e+000 4.19e+001 -0.31 1.47e-004 1.47e-004 0.4736 0.00
  941430       10 2.42e+001 -4.97e+000 2.92e+001 -0.21 7.25e-005 7.25e-005 0.4744 0.00
  961430    20000 2.53e+001 2.31e+001 2.17e+000 0.91 1.20e-009 2.39e-006 0.4744 0.00
  961440       10 2.53e+001 1.77e+001 7.59e+000 0.70 2.07e-006 2.07e-006 0.4744 0.00

Block:     49
  961450       10 3.20e+001 -9.95e+000 4.19e+001 -0.31 1.47e-004 1.47e-004 0.4759 0.00
  961460       10 2.43e+001 -4.98e+000 2.92e+001 -0.21 7.28e-005 7.28e-005 0.4766 0.00
  981460    20000 2.54e+001 2.32e+001 2.17e+000 0.91 1.21e-009 2.42e-006 0.4766 0.00
  981470       10 2.54e+001 1.78e+001 7.60e+000 0.70 2.09e-006 2.09e-006 0.4767 0.00

Block:     50
  981480       10 3.20e+001 -9.96e+000 4.20e+001 -0.31 1.47e-004 1.47e-004 0.4781 0.00
  981490       10 2.43e+001 -4.98e+000 2.93e+001 -0.20 7.30e-005 7.30e-005 0.4789 0.00
 1001490    20000 2.54e+001 2.32e+001 2.18e+000 0.91 1.22e-009 2.45e-006 0.4789 0.00
 1001500       10 2.54e+001 1.78e+001 7.62e+000 0.70 2.11e-006 2.11e-006 0.4789 0.00

                    End of pc-CRACK Output
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tm
pc-CRACK for Windows
Version 3.1-98348
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Linear Elastic Fracture Mechanics

Date: Thu Nov 09 15:57:56 2000
Input Data and Results File: ANO_CIRC.LFM

Title: ANO-2 Pressurizer Heater Penetration - Circ. Flaw Model

Load Cases:

Case ID: Pressure Dist - 2500 psig --- Stress Distribution

Depth	Stress
0.0000	27.9790
0.2230	25.1440
0.4461	23.0870
0.6693	21.8670
0.8927	21.2600
1.1161	20.5820
1.3397	19.8760
1.5634	19.1460
1.7873	18.4030
2.0112	18.0030

Case ID: Crack Pressue 1000 psi --- Stress Distribution

Depth	Stress
0.0000	1.0000
0.1000	1.0000
0.2000	1.0000
0.3000	1.0000
0.4000	1.0000
0.5000	1.0000
0.6000	1.0000
0.7000	1.0000
0.7100	0.0000
0.8000	0.0000
0.9000	0.0000
1.0000	0.0000
1.2500	0.0000
1.5000	0.0000
1.7500	0.0000
2.0000	0.0000

Case ID: Heatup 212 --- Stress Distribution

Depth	Stress
0.0000	-15.1280

0.2261	-9.1585
0.4523	-6.3704
0.6786	-5.0184
0.9050	-3.8490
1.1316	-2.7846
1.3583	-1.8146
1.5851	-0.9689
1.8120	-0.2237
2.0390	0.4438

Case ID: RTrip 25 --- Stress Distribution

Depth	Stress
0.0000	8.6304
0.2261	3.8245
0.4523	1.6330
0.6786	0.6301
0.9050	0.1831
1.1316	-0.1150
1.3583	-0.3113
1.5851	-0.4104
1.8120	-0.4728
2.0390	-0.5136

	Stress Coefficients				
Case ID	C0	C1	C2	C3	Type
Pressure 1000 p	15.65	0	0	0	Coeff
Pressure Dist -	27.8397	-13.4214	8.28596	-2.03742	StressDist
Crack Pressue 1	1.09032	-0.0572721	-1.53487	0.664123	StressDist
Heatup 212	-14.5416	23.352	-15.5326	3.8104	StressDist
RTrip 25	8.21622	-20.0256	15.148	-3.67478	StressDist

------Through Wall Stresses for Load Cases With Stress Coeff-------

Wall Depth	Case Pressure 1
0.0000	15.65
0.1000	15.65
0.2000	15.65
0.3000	15.65
0.4000	15.65
0.5000	15.65
0.6000	15.65
0.7000	15.65
0.8000	15.65
0.9000	15.65
1.0000	15.65

Crack Model: Circumferential Crack in Cylinder (t/R=0.1)

Crack Parameters:
Wall thickness: 4.2500
Max. crack size: 1.0000

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----------Stress Intensity Factor----------

Crack Size	Case Pressure 1	Case Pressure D	Case Crack Pres	Case Heatup 212	Case RTrip 25

0.0200	4.3374	7.67263	0.301919	-3.95522	2.21291
0.0400	6.14215	10.8053	0.426956	-5.49699	3.04491
0.0600	7.53254	13.1792	0.522625	-6.61653	3.62795
0.0800	8.70935	15.1566	0.602851	-7.50899	4.0749
0.1000	9.75023	16.8784	0.672988	-8.25167	4.43103
0.1200	10.695	18.4175	0.735762	-8.88511	4.72037
0.1400	11.5671	19.8173	0.792775	-9.43392	4.95767
0.1600	12.382	21.1064	0.845063	-9.91452	5.15289
0.1800	13.1504	22.3047	0.893336	-10.3386	5.31319
0.2000	13.88	23.4268	0.938107	-10.7147	5.44396
0.2200	14.5765	24.4839	0.979761	-11.0497	5.54939
0.2400	15.2447	25.4845	1.01859	-11.3488	5.63285
0.2600	15.8879	26.4357	1.05484	-11.6164	5.69711
0.2800	16.5092	27.3431	1.08868	-11.856	5.74448
0.3000	17.111	28.2114	1.12028	-12.0707	5.77692
0.3200	17.6952	29.0446	1.14977	-12.2629	5.79611
0.3400	18.2635	29.846	1.17725	-12.435	5.80352
0.3600	18.8174	30.6185	1.20282	-12.5889	5.80042
0.3800	19.3582	31.3647	1.22657	-12.7261	5.78795
0.4000	19.8868	32.0867	1.24856	-12.8483	5.76712
0.4200	20.4043	32.7865	1.26887	-12.9567	5.73882
0.4400	20.9453	33.5203	1.28972	-13.0743	5.71351
0.4600	21.4898	34.2556	1.30979	-13.1879	5.68528
0.4800	22.0274	34.9758	1.32843	-13.2911	5.65151
0.5000	22.5585	35.6821	1.34565	-13.3849	5.61277
0.5200	23.0836	36.3754	1.36151	-13.4698	5.56956
0.5400	23.6033	37.0567	1.37602	-13.5467	5.52236
0.5600	24.1178	37.7267	1.38923	-13.616	5.4716
0.5800	24.6275	38.3862	1.40115	-13.6783	5.41768
0.6000	25.1327	39.0359	1.41183	-13.7341	5.36096
0.6200	25.6338	39.6765	1.42129	-13.784	5.30178
0.6400	26.1309	40.3084	1.42955	-13.8283	5.24045
0.6600	26.6244	40.9323	1.43664	-13.8674	5.17726
0.6800	27.1145	41.5486	1.44259	-13.9018	5.11248
0.7000	27.6013	42.1578	1.44742	-13.9316	5.04635
0.7200	28.0851	42.7602	1.45116	-13.9574	4.9791
0.7400	28.566	43.3564	1.45384	-13.9792	4.91095
0.7600	29.0443	43.9465	1.45547	-13.9975	4.84208
0.7800	29.52	44.5311	1.4561	-14.0125	4.77268
0.8000	29.9933	45.1103	1.45573	-14.0243	4.70292
0.8200	30.4644	45.6844	1.4544	-14.0332	4.63293
0.8400	30.9333	46.2538	1.45214	-14.0394	4.56287
0.8600	31.4255	46.8579	1.45018	-14.057	4.49864
0.8800	31.9419	47.4979	1.44854	-14.0863	4.44038
0.9000	32.4576	48.1354	1.44601	-14.1137	4.38243
0.9200	32.9728	48.7705	1.44261	-14.1391	4.32488
0.9400	33.4874	49.4033	1.43838	-14.1628	4.26785
0.9600	34.0017	50.034	1.43333	-14.1848	4.21143
0.9800	34.5156	50.6628	1.42749	-14.2054	4.15569
1.0000	35.0292	51.2897	1.42088	-14.2245	4.10072

Crack Growth Laws:

Law ID: Crack Growth
Model: ASME Section XI - ferritic steel in water environment

da/dN = CL * SL * dK^5.95 for dK < dKtran
da/dN = CU * SU * dK^1.95 for dK >= dKtran

where

dK = Kmax - Kmin

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      R = Kmin / Kmax
for R <= 0.25:
  SL = 1.0                  SU = 1.0     dKtran = 17.74
for 0.25 < R <= 0.65:
  SL = 26.9 * R - 5.725     SU = 3.75 * R + 0.06
  dKtran = 17.74*{(3.75 * R + 0.06)/(26.9 * R - 5.725)}^0.25
 for 0.65 < R:
  SL = 11.76                SU = 2.5     dKtran = 12.04

where:
  CL =  1.0200e-012
  CU =  1.0100e-007
 are for the selected units of:
   force: kip
  length: inch
```

Material Fracture Toughness KIc:

Material ID: C-Steel

Depth	KIc
0.0000	63.2400
4.0000	63.2400

Initial crack size= 0.3750
Max. crack size= 1.0000

Number of blocks= 50
Print increment of block= 1

Subblock	Cycles /Time	Calc. incre.	Print incre.	Crk. Grw. Law	Mat. Klc
Heatup/Cooldown	10	1	10	Crack Growth	C-Steel
Pressure Leak T	10	1	10	Crack Growth	C-Steel
Variations	20000	2000	20000	Crack Growth	C-Steel
Reactor Trip	10	1	10	Crack Growth	C-Steel

Subblock	Kmax Case ID	Kmax Scale Factor	Kmin Case ID	Kmin Scale Factor
Heatup/Cooldown	Pressure Dist - 2500 psig	1.0140	Heatup 212	1.0000
	Crack Pressue 1000 psi	2.5350		
	RTrip 25	1.0000		
Pressure Leak T	Pressure Dist - 2500 psig	0.8940	Heatup 212	0.5000
	Crack Pressue 1000 psi	2.2350		
Variations	Pressure Dist - 2500 psig	0.9340	Pressure Dist - 2500 psig	0.8540
	Crack Pressue 1000 psi	2.3350	Crack Pressue 1000 psi	2.1350
Reactor Trip	Pressure Dist - 2500 psig	0.9340	Pressure Dist - 2500 psig	0.6540
	Crack Pressue 1000 psi	2.3350	Crack Pressue 1000 psi	1.6350

Crack growth results:

Total Cycles /Time	Subblock Cycles /Time	Kmax	Kmin	DeltaK	R	DaDn /DaDt	Da	a	a/thk

Block:	1								
10	10	4.06e+001	-1.27e+001	5.33e+001	-0.31	2.35e-004	2.35e-004	0.3773	0.09
20	10	3.07e+001	-6.36e+000	3.71e+001	-0.21	1.16e-004	1.16e-004	0.3785	0.09
20020	20000	3.21e+001	2.94e+001	2.75e+000	0.91	4.93e-009	9.86e-006	0.3786	0.09
20030	10	3.21e+001	2.25e+001	9.63e+000	0.70	8.52e-006	8.52e-006	0.3787	0.09
Block:	2								
20040	10	4.07e+001	-1.27e+001	5.35e+001	-0.31	2.36e-004	2.36e-004	0.381	0.09
20050	10	3.09e+001	-6.37e+000	3.72e+001	-0.21	1.16e-004	1.16e-004	0.3822	0.09
40050	20000	3.22e+001	2.95e+001	2.76e+000	0.91	5.06e-009	1.01e-005	0.3823	0.09
40060	10	3.22e+001	2.26e+001	9.67e+000	0.70	8.74e-006	8.74e-006	0.3824	0.09
Block:	3								
40070	10	4.09e+001	-1.28e+001	5.36e+001	-0.31	2.37e-004	2.37e-004	0.3848	0.09
40080	10	3.10e+001	-6.38e+000	3.74e+001	-0.21	1.17e-004	1.17e-004	0.3859	0.09
60080	20000	3.24e+001	2.96e+001	2.77e+000	0.91	5.19e-009	1.04e-005	0.386	0.09
60090	10	3.24e+001	2.27e+001	9.71e+000	0.70	8.96e-006	8.96e-006	0.3861	0.09
Block:	4								
60100	10	4.10e+001	-1.28e+001	5.38e+001	-0.31	2.39e-004	2.39e-004	0.3885	0.09
60110	10	3.11e+001	-6.39e+000	3.75e+001	-0.21	1.18e-004	1.18e-004	0.3897	0.09
80110	20000	3.25e+001	2.97e+001	2.78e+000	0.91	5.32e-009	1.06e-005	0.3898	0.09
80120	10	3.25e+001	2.28e+001	9.75e+000	0.70	9.19e-006	9.19e-006	0.3899	0.09
Block:	5								
80130	10	4.12e+001	-1.28e+001	5.40e+001	-0.31	2.40e-004	2.40e-004	0.3923	0.09
80140	10	3.12e+001	-6.40e+000	3.76e+001	-0.20	1.19e-004	1.19e-004	0.3935	0.09
100140	20000	3.27e+001	2.99e+001	2.80e+000	0.91	5.45e-009	1.09e-005	0.3936	0.09
100150	10	3.27e+001	2.29e+001	9.79e+000	0.70	9.42e-006	9.42e-006	0.3937	0.09
Block:	6								
100160	10	4.13e+001	-1.28e+001	5.41e+001	-0.31	2.42e-004	2.42e-004	0.3961	0.09
100170	10	3.14e+001	-6.42e+000	3.78e+001	-0.20	1.20e-004	1.20e-004	0.3973	0.09
120170	20000	3.28e+001	3.00e+001	2.81e+000	0.91	5.59e-009	1.12e-005	0.3974	0.09
120180	10	3.28e+001	2.30e+001	9.83e+000	0.70	9.66e-006	9.66e-006	0.3975	0.09
Block:	7								
120190	10	4.15e+001	-1.28e+001	5.43e+001	-0.31	2.43e-004	2.43e-004	0.3999	0.09
120200	10	3.15e+001	-6.43e+000	3.79e+001	-0.20	1.21e-004	1.21e-004	0.4011	0.09
140200	20000	3.29e+001	3.01e+001	2.82e+000	0.91	5.73e-009	1.15e-005	0.4013	0.09
140210	10	3.29e+001	2.31e+001	9.87e+000	0.70	9.90e-006	9.90e-006	0.4014	0.09
Block:	8								
140220	10	4.16e+001	-1.29e+001	5.45e+001	-0.31	2.45e-004	2.45e-004	0.4038	0.10
140230	10	3.16e+001	-6.44e+000	3.81e+001	-0.20	1.22e-004	1.22e-004	0.405	0.10
160230	20000	3.31e+001	3.02e+001	2.83e+000	0.91	5.87e-009	1.17e-005	0.4051	0.10
160240	10	3.31e+001	2.32e+001	9.91e+000	0.70	1.01e-005	1.01e-005	0.4052	0.10
Block:	9								
160250	10	4.17e+001	-1.29e+001	5.46e+001	-0.31	2.46e-004	2.46e-004	0.4077	0.10
160260	10	3.18e+001	-6.45e+000	3.82e+001	-0.20	1.23e-004	1.23e-004	0.4089	0.10
180260	20000	3.32e+001	3.04e+001	2.84e+000	0.91	6.02e-009	1.20e-005	0.409	0.10
180270	10	3.32e+001	2.33e+001	9.95e+000	0.70	1.04e-005	1.04e-005	0.4091	0.10
Block:	10								
180280	10	4.19e+001	-1.29e+001	5.48e+001	-0.31	2.48e-004	2.48e-004	0.4116	0.10
180290	10	3.19e+001	-6.46e+000	3.84e+001	-0.20	1.24e-004	1.24e-004	0.4128	0.10
200290	20000	3.33e+001	3.05e+001	2.86e+000	0.91	6.17e-009	1.23e-005	0.413	0.10
200300	10	3.33e+001	2.33e+001	1.00e+001	0.70	1.07e-005	1.07e-005	0.4131	0.10
Block:	11								
200310	10	4.20e+001	-1.29e+001	5.50e+001	-0.31	2.49e-004	2.49e-004	0.4156	0.10
200320	10	3.20e+001	-6.47e+000	3.85e+001	-0.20	1.24e-004	1.24e-004	0.4168	0.10

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  220320    20000 3.35e+001 3.06e+001 2.87e+000 0.91 6.33e-009 1.27e-005 0.4169 0.10
  220330       10 3.35e+001 2.34e+001 1.00e+001 0.70 1.09e-005 1.09e-005  0.417 0.10

Block:     12
  220340       10 4.22e+001 -1.30e+001 5.51e+001 -0.31 2.51e-004 2.51e-004 0.4195 0.10
  220350       10 3.22e+001 -6.48e+000 3.87e+001 -0.20 1.25e-004 1.25e-004 0.4208 0.10
  240350    20000 3.36e+001 3.07e+001 2.88e+000 0.91 6.49e-009 1.30e-005 0.4209 0.10
  240360       10 3.36e+001 2.35e+001 1.01e+001 0.70 1.12e-005 1.12e-005  0.421 0.10

Block:     13
  240370       10 4.23e+001 -1.30e+001 5.53e+001 -0.31 2.52e-004 2.52e-004 0.4236 0.10
  240380       10 3.23e+001 -6.49e+000 3.88e+001 -0.20 1.26e-004 1.26e-004 0.4248 0.10
  260380    20000 3.38e+001 3.09e+001 2.89e+000 0.91 6.66e-009 1.33e-005 0.4249 0.10
  260390       10 3.38e+001 2.36e+001 1.01e+001 0.70 1.15e-005 1.15e-005 0.4251 0.10

Block:     14
  260400       10 4.25e+001 -1.30e+001 5.55e+001 -0.31 2.54e-004 2.54e-004 0.4276 0.10
  260410       10 3.25e+001 -6.50e+000 3.90e+001 -0.20 1.27e-004 1.27e-004 0.4289 0.10
  280410    20000 3.39e+001 3.10e+001 2.90e+000 0.91 6.83e-009 1.37e-005  0.429 0.10
  280420       10 3.39e+001 2.38e+001 1.02e+001 0.70 1.18e-005 1.18e-005 0.4291 0.10

Block:     15
  280430       10 4.26e+001 -1.30e+001 5.57e+001 -0.31 2.55e-004 2.55e-004 0.4317 0.10
  280440       10 3.26e+001 -6.52e+000 3.91e+001 -0.20 1.28e-004 1.28e-004  0.433 0.10
  300440    20000 3.41e+001 3.11e+001 2.92e+000 0.91 7.02e-009 1.40e-005 0.4331 0.10
  300450       10 3.41e+001 2.39e+001 1.02e+001 0.70 1.21e-005 1.21e-005 0.4332 0.10

Block:     16
  300460       10 4.28e+001 -1.30e+001 5.58e+001 -0.30 2.57e-004 2.57e-004 0.4358 0.10
  300470       10 3.27e+001 -6.53e+000 3.93e+001 -0.20 1.29e-004 1.29e-004 0.4371 0.10
  320470    20000 3.42e+001 3.13e+001 2.93e+000 0.91 7.20e-009 1.44e-005 0.4372 0.10
  320480       10 3.42e+001 2.40e+001 1.03e+001 0.70 1.24e-005 1.24e-005 0.4373 0.10

Block:     17
  320490       10 4.30e+001 -1.31e+001 5.60e+001 -0.30 2.59e-004 2.59e-004 0.4399 0.10
  320500       10 3.29e+001 -6.54e+000 3.94e+001 -0.20 1.30e-004 1.30e-004 0.4412 0.10
  340500    20000 3.44e+001 3.14e+001 2.94e+000 0.91 7.40e-009 1.48e-005 0.4414 0.10
  340510       10 3.44e+001 2.41e+001 1.03e+001 0.70 1.28e-005 1.28e-005 0.4415 0.10

Block:     18
  340520       10 4.31e+001 -1.31e+001 5.62e+001 -0.30 2.60e-004 2.60e-004 0.4441 0.10
  340530       10 3.30e+001 -6.55e+000 3.96e+001 -0.20 1.31e-004 1.31e-004 0.4454 0.10
  360530    20000 3.45e+001 3.16e+001 2.96e+000 0.91 7.60e-009 1.52e-005 0.4456 0.10
  360540       10 3.45e+001 2.42e+001 1.04e+001 0.70 1.31e-005 1.31e-005 0.4457 0.10

Block:     19
  360550       10 4.33e+001 -1.31e+001 5.64e+001 -0.30 2.62e-004 2.62e-004 0.4483 0.11
  360560       10 3.32e+001 -6.56e+000 3.97e+001 -0.20 1.32e-004 1.32e-004 0.4496 0.11
  380560    20000 3.47e+001 3.17e+001 2.97e+000 0.91 7.80e-009 1.56e-005 0.4498 0.11
  380570       10 3.47e+001 2.43e+001 1.04e+001 0.70 1.35e-005 1.35e-005 0.4499 0.11

Block:     20
  380580       10 4.34e+001 -1.31e+001 5.66e+001 -0.30 2.64e-004 2.64e-004 0.4526 0.11
  380590       10 3.33e+001 -6.58e+000 3.99e+001 -0.20 1.33e-004 1.33e-004 0.4539 0.11
  400590    20000 3.48e+001 3.19e+001 2.98e+000 0.91 8.01e-009 1.60e-005  0.454 0.11
  400600       10 3.48e+001 2.44e+001 1.04e+001 0.70 1.38e-005 1.38e-005 0.4542 0.11

Block:     21
  400610       10 4.36e+001 -1.32e+001 5.68e+001 -0.30 2.65e-004 2.65e-004 0.4568 0.11
  400620       10 3.35e+001 -6.59e+000 4.01e+001 -0.20 1.35e-004 1.35e-004 0.4582 0.11
  420620    20000 3.50e+001 3.20e+001 3.00e+000 0.91 8.23e-009 1.65e-005 0.4583 0.11
  420630       10 3.50e+001 2.45e+001 1.05e+001 0.70 1.42e-005 1.42e-005 0.4585 0.11
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Block:    22
  420640       10 4.38e+001 -1.32e+001 5.70e+001 -0.30 2.67e-004 2.67e-004 0.4611 0.11
  420650       10 3.36e+001 -6.60e+000 4.02e+001 -0.20 1.36e-004 1.36e-004 0.4625 0.11
  440650    20000 3.51e+001 3.21e+001 3.01e+000 0.91 8.45e-009 1.69e-005 0.4627 0.11
  440660       10 3.52e+001 2.46e+001 1.05e+001 0.70 1.46e-005 1.46e-005 0.4628 0.11

Block:    23
  440670       10 4.39e+001 -1.32e+001 5.72e+001 -0.30 2.69e-004 2.69e-004 0.4655 0.11
  440680       10 3.38e+001 -6.61e+000 4.04e+001 -0.20 1.37e-004 1.37e-004 0.4669 0.11
  460680    20000 3.53e+001 3.23e+001 3.02e+000 0.91 8.68e-009 1.74e-005  0.467 0.11
  460690       10 3.53e+001 2.47e+001 1.06e+001 0.70 1.50e-005 1.50e-005 0.4672 0.11

Block:    24
  460700       10 4.41e+001 -1.32e+001 5.73e+001 -0.30 2.71e-004 2.71e-004 0.4699 0.11
  460710       10 3.39e+001 -6.62e+000 4.06e+001 -0.20 1.38e-004 1.38e-004 0.4713 0.11
  480710    20000 3.55e+001 3.24e+001 3.04e+000 0.91 8.91e-009 1.78e-005 0.4714 0.11
  480720       10 3.55e+001 2.48e+001 1.06e+001 0.70 1.54e-005 1.54e-005 0.4716 0.11

Block:    25
  480730       10 4.43e+001 -1.33e+001 5.75e+001 -0.30 2.72e-004 2.72e-004 0.4743 0.11
  480740       10 3.41e+001 -6.63e+000 4.07e+001 -0.19 1.39e-004 1.39e-004 0.4757 0.11
  500740    20000 3.56e+001 3.26e+001 3.05e+000 0.91 9.15e-009 1.83e-005 0.4759 0.11
  500750       10 3.56e+001 2.49e+001 1.07e+001 0.70 1.58e-005 1.58e-005  0.476 0.11

Block:    26
  500760       10 4.44e+001 -1.33e+001 5.77e+001 -0.30 2.74e-004 2.74e-004 0.4788 0.11
  500770       10 3.42e+001 -6.65e+000 4.09e+001 -0.19 1.40e-004 1.40e-004 0.4802 0.11
  520770    20000 3.58e+001 3.27e+001 3.06e+000 0.91 9.40e-009 1.88e-005 0.4804 0.11
  520780       10 3.58e+001 2.51e+001 1.07e+001 0.70 1.62e-005 1.62e-005 0.4805 0.11

Block:    27
  520790       10 4.46e+001 -1.33e+001 5.79e+001 -0.30 2.76e-004 2.76e-004 0.4833 0.11
  520800       10 3.44e+001 -6.66e+000 4.10e+001 -0.19 1.41e-004 1.41e-004 0.4847 0.11
  540800    20000 3.59e+001 3.29e+001 3.08e+000 0.91 9.65e-009 1.93e-005 0.4849 0.11
  540810       10 3.59e+001 2.52e+001 1.08e+001 0.70 1.67e-005 1.67e-005  0.485 0.11

Block:    28
  540820       10 4.48e+001 -1.33e+001 5.81e+001 -0.30 2.77e-004 2.77e-004 0.4878 0.11
  540830       10 3.45e+001 -6.67e+000 4.12e+001 -0.19 1.42e-004 1.42e-004 0.4892 0.12
  560830    20000 3.61e+001 3.30e+001 3.09e+000 0.91 9.91e-009 1.98e-005 0.4894 0.12
  560840       10 3.61e+001 2.53e+001 1.08e+001 0.70 1.71e-005 1.71e-005 0.4896 0.12

Block:    29
  560850       10 4.49e+001 -1.33e+001 5.83e+001 -0.30 2.79e-004 2.79e-004 0.4924 0.12
  560860       10 3.47e+001 -6.68e+000 4.14e+001 -0.19 1.43e-004 1.43e-004 0.4938 0.12
  580860    20000 3.63e+001 3.32e+001 3.11e+000 0.91 1.02e-008 2.03e-005  0.494 0.12
  580870       10 3.63e+001 2.54e+001 1.09e+001 0.70 1.76e-005 1.76e-005 0.4942 0.12

Block:    30
  580880       10 4.51e+001 -1.34e+001 5.85e+001 -0.30 2.81e-004 2.81e-004  0.497 0.12
  580890       10 3.49e+001 -6.69e+000 4.15e+001 -0.19 1.44e-004 1.44e-004 0.4984 0.12
  600890    20000 3.64e+001 3.33e+001 3.12e+000 0.91 1.04e-008 2.09e-005 0.4987 0.12
  600900       10 3.64e+001 2.55e+001 1.09e+001 0.70 1.81e-005 1.81e-005 0.4988 0.12

Block:    31
  600910       10 4.53e+001 -1.34e+001 5.86e+001 -0.30 2.83e-004 2.83e-004 0.5017 0.12
  600920       10 3.50e+001 -6.70e+000 4.17e+001 -0.19 1.45e-004 1.45e-004 0.5031 0.12
  620920    20000 3.66e+001 3.34e+001 3.13e+000 0.91 1.07e-008 2.14e-005 0.5033 0.12
  620930       10 3.66e+001 2.56e+001 1.10e+001 0.70 1.85e-005 1.85e-005 0.5035 0.12

Block:    32
  620940       10 4.54e+001 -1.34e+001 5.88e+001 -0.30 2.84e-004 2.84e-004 0.5063 0.12
  620950       10 3.52e+001 -6.71e+000 4.19e+001 -0.19 1.47e-004 1.47e-004 0.5078 0.12
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  640950    20000 3.67e+001 3.36e+001 3.15e+000 0.91 1.10e-008 2.20e-005  0.508 0.12
  640960       10 3.67e+001 2.57e+001 1.10e+001 0.70 1.90e-005 1.90e-005 0.5082 0.12

Block:     33
  640970       10 4.56e+001 -1.34e+001 5.90e+001 -0.29 2.86e-004 2.86e-004 0.5111 0.12
  640980       10 3.53e+001 -6.72e+000 4.20e+001 -0.19 1.48e-004 1.48e-004 0.5126 0.12
  660980    20000 3.69e+001 3.37e+001 3.16e+000 0.91 1.13e-008 2.26e-005 0.5128 0.12
  660990       10 3.69e+001 2.58e+001 1.11e+001 0.70 1.95e-005 1.95e-005  0.513 0.12

Block:     34
  661000       10 4.58e+001 -1.35e+001 5.92e+001 -0.29 2.88e-004 2.88e-004 0.5158 0.12
  661010       10 3.55e+001 -6.73e+000 4.22e+001 -0.19 1.49e-004 1.49e-004 0.5173 0.12
  681010    20000 3.71e+001 3.39e+001 3.18e+000 0.91 1.16e-008 2.32e-005 0.5176 0.12
  681020       10 3.71e+001 2.60e+001 1.11e+001 0.70 2.01e-005 2.01e-005 0.5178 0.12

Block:     35
  681030       10 4.59e+001 -1.35e+001 5.94e+001 -0.29 2.90e-004 2.90e-004 0.5207 0.12
  681040       10 3.56e+001 -6.74e+000 4.24e+001 -0.19 1.50e-004 1.50e-004 0.5222 0.12
  701040    20000 3.72e+001 3.40e+001 3.19e+000 0.91 1.19e-008 2.38e-005 0.5224 0.12
  701050       10 3.72e+001 2.61e+001 1.12e+001 0.70 2.06e-005 2.06e-005 0.5226 0.12

Block:     36
  701060       10 4.61e+001 -1.35e+001 5.96e+001 -0.29 2.91e-004 2.91e-004 0.5255 0.12
  701070       10 3.58e+001 -6.75e+000 4.25e+001 -0.19 1.51e-004 1.51e-004  0.527 0.12
  721070    20000 3.74e+001 3.42e+001 3.20e+000 0.91 1.22e-008 2.44e-005 0.5273 0.12
  721080       10 3.74e+001 2.62e+001 1.12e+001 0.70 2.11e-005 2.11e-005 0.5275 0.12

Block:     37
  721090       10 4.62e+001 -1.35e+001 5.98e+001 -0.29 2.93e-004 2.93e-004 0.5304 0.12
  721100       10 3.59e+001 -6.76e+000 4.27e+001 -0.19 1.52e-004 1.52e-004 0.5319 0.13
  741100    20000 3.76e+001 3.43e+001 3.22e+000 0.91 1.25e-008 2.51e-005 0.5322 0.13
  741110       10 3.76e+001 2.63e+001 1.13e+001 0.70 2.17e-005 2.17e-005 0.5324 0.13

Block:     38
  741120       10 4.64e+001 -1.35e+001 5.99e+001 -0.29 2.95e-004 2.95e-004 0.5353 0.13
  741130       10 3.61e+001 -6.77e+000 4.29e+001 -0.19 1.53e-004 1.53e-004 0.5369 0.13
  761130    20000 3.77e+001 3.45e+001 3.23e+000 0.91 1.29e-008 2.58e-005 0.5371 0.13
  761140       10 3.77e+001 2.64e+001 1.13e+001 0.70 2.23e-005 2.23e-005 0.5373 0.13

Block:     39
  761150       10 4.66e+001 -1.35e+001 6.01e+001 -0.29 2.97e-004 2.97e-004 0.5403 0.13
  761160       10 3.63e+001 -6.78e+000 4.30e+001 -0.19 1.55e-004 1.55e-004 0.5419 0.13
  781160    20000 3.79e+001 3.46e+001 3.25e+000 0.91 1.32e-008 2.64e-005 0.5421 0.13
  781170       10 3.79e+001 2.65e+001 1.14e+001 0.70 2.29e-005 2.29e-005 0.5423 0.13

Block:     40
  781180       10 4.68e+001 -1.36e+001 6.03e+001 -0.29 2.99e-004 2.99e-004 0.5453 0.13
  781190       10 3.64e+001 -6.78e+000 4.32e+001 -0.19 1.56e-004 1.56e-004 0.5469 0.13
  801190    20000 3.81e+001 3.48e+001 3.26e+000 0.91 1.36e-008 2.71e-005 0.5472 0.13
  801200       10 3.81e+001 2.67e+001 1.14e+001 0.70 2.35e-005 2.35e-005 0.5474 0.13

Block:     41
  801210       10 4.69e+001 -1.36e+001 6.05e+001 -0.29 3.00e-004 3.00e-004 0.5504 0.13
  801220       10 3.66e+001 -6.79e+000 4.34e+001 -0.19 1.57e-004 1.57e-004  0.552 0.13
  821220    20000 3.82e+001 3.50e+001 3.27e+000 0.91 1.39e-008 2.78e-005 0.5522 0.13
  821230       10 3.82e+001 2.68e+001 1.15e+001 0.70 2.41e-005 2.41e-005 0.5525 0.13

Block:     42
  821240       10 4.71e+001 -1.36e+001 6.07e+001 -0.29 3.02e-004 3.02e-004 0.5555 0.13
  821250       10 3.67e+001 -6.80e+000 4.35e+001 -0.19 1.58e-004 1.58e-004 0.5571 0.13
  841250    20000 3.84e+001 3.51e+001 3.29e+000 0.91 1.43e-008 2.86e-005 0.5574 0.13
  841260       10 3.84e+001 2.69e+001 1.15e+001 0.70 2.47e-005 2.47e-005 0.5576 0.13
```

```
Block:    43
  841270       10 4.73e+001 -1.36e+001 6.09e+001 -0.29 3.04e-004 3.04e-004 0.5606 0.13
  841280       10 3.69e+001 -6.81e+000 4.37e+001 -0.18 1.59e-004 1.59e-004 0.5622 0.13
  861280    20000 3.86e+001 3.53e+001 3.30e+000 0.91 1.47e-008 2.93e-005 0.5625 0.13
  861290       10 3.86e+001 2.70e+001 1.16e+001 0.70 2.54e-005 2.54e-005 0.5628 0.13

Block:    44
  861300       10 4.74e+001 -1.36e+001 6.11e+001 -0.29 3.06e-004 3.06e-004 0.5658 0.13
  861310       10 3.71e+001 -6.82e+000 4.39e+001 -0.18 1.61e-004 1.61e-004 0.5674 0.13
  881310    20000 3.87e+001 3.54e+001 3.32e+000 0.91 1.51e-008 3.01e-005 0.5677 0.13
  881320       10 3.87e+001 2.71e+001 1.16e+001 0.70 2.60e-005 2.60e-005  0.568 0.13

Block:    45
  881330       10 4.76e+001 -1.36e+001 6.12e+001 -0.29 3.08e-004 3.08e-004 0.5711 0.13
  881340       10 3.72e+001 -6.83e+000 4.40e+001 -0.18 1.62e-004 1.62e-004 0.5727 0.13
  901340    20000 3.89e+001 3.56e+001 3.33e+000 0.91 1.54e-008 3.09e-005  0.573 0.13
  901350       10 3.89e+001 2.72e+001 1.17e+001 0.70 2.67e-005 2.67e-005 0.5733 0.13

Block:    46
  901360       10 4.78e+001 -1.37e+001 6.14e+001 -0.29 3.09e-004 3.09e-004 0.5763 0.14
  901370       10 3.74e+001 -6.84e+000 4.42e+001 -0.18 1.63e-004 1.63e-004  0.578 0.14
  921370    20000 3.91e+001 3.57e+001 3.35e+000 0.91 1.59e-008 3.17e-005 0.5783 0.14
  921380       10 3.91e+001 2.74e+001 1.17e+001 0.70 2.74e-005 2.74e-005 0.5786 0.14

Block:    47
  921390       10 4.79e+001 -1.37e+001 6.16e+001 -0.29 3.11e-004 3.11e-004 0.5817 0.14
  921400       10 3.75e+001 -6.84e+000 4.44e+001 -0.18 1.64e-004 1.64e-004 0.5833 0.14
  941400    20000 3.92e+001 3.59e+001 3.36e+000 0.91 1.63e-008 3.25e-005 0.5836 0.14
  941410       10 3.92e+001 2.75e+001 1.18e+001 0.70 2.81e-005 2.81e-005 0.5839 0.14

Block:    48
  941420       10 4.81e+001 -1.37e+001 6.18e+001 -0.28 3.13e-004 3.13e-004  0.587 0.14
  941430       10 3.77e+001 -6.85e+000 4.46e+001 -0.18 1.65e-004 1.65e-004 0.5887 0.14
  961430    20000 3.94e+001 3.60e+001 3.38e+000 0.91 1.67e-008 3.34e-005  0.589 0.14
  961440       10 3.94e+001 2.76e+001 1.18e+001 0.70 2.89e-005 2.89e-005 0.5893 0.14

Block:    49
  961450       10 4.83e+001 -1.37e+001 6.20e+001 -0.28 3.15e-004 3.15e-004 0.5925 0.14
  961460       10 3.79e+001 -6.86e+000 4.47e+001 -0.18 1.67e-004 1.67e-004 0.5941 0.14
  981460    20000 3.96e+001 3.62e+001 3.39e+000 0.91 1.71e-008 3.43e-005 0.5945 0.14
  981470       10 3.96e+001 2.77e+001 1.19e+001 0.70 2.96e-005 2.96e-005 0.5948 0.14

Block:    50
  981480       10 4.84e+001 -1.37e+001 6.22e+001 -0.28 3.17e-004 3.17e-004 0.5979 0.14
  981490       10 3.80e+001 -6.87e+000 4.49e+001 -0.18 1.68e-004 1.68e-004 0.5996 0.14
 1001490    20000 3.98e+001 3.63e+001 3.41e+000 0.91 1.76e-008 3.52e-005    0.6 0.14
 1001500       10 3.98e+001 2.78e+001 1.19e+001 0.70 3.04e-005 3.04e-005 0.6003 0.14

                          End of pc-CRACK Output
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tm
pc-CRACK for Windows
Version 3.1-98348
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Linear Elastic Fracture Mechanics

Date: Tue Nov 07 16:52:41 2000
Input Data and Results File: HL_NEW.LFM

Title: ANO-2 Hot Leg RTD/Pressure Measurement Penetration

Load Cases:

Case ID: CrackFace 1000 --- Stress Distribution

Depth	Stress
0.0000	1.0000
0.2000	1.0000
0.4000	1.0000
0.6000	1.0000
0.8000	1.0000
1.0000	1.0000
1.1000	1.0000
1.2000	1.0000
1.3000	1.0000
1.4000	1.0000
1.4990	1.0000
1.5000	0.0000
1.7500	0.0000
2.0000	0.0000
3.0000	0.0000
4.0000	0.0000

Case ID: Thermal at 212 --- Stress Distribution

Depth	Stress
0.0000	-18.6400
0.1731	-12.7530
0.3462	-10.4320
0.5193	-9.0370
0.6924	-7.9680
0.8655	-7.1130
1.0385	-6.4070
1.2116	-1.3790
1.3847	0.0614
1.5578	0.8376
1.7309	0.9469
1.9040	1.0483
2.0771	1.1466
2.2502	1.2455
2.4233	1.3461
2.5964	1.4454

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2.7695	1.5419
2.9425	1.6305
3.1156	1.7161
3.2887	1.7898
3.4618	1.8555
3.6349	1.9196
3.8080	1.9744
3.9811	2.0193
4.1542	2.0586
4.3273	2.0871
4.5004	2.1081
4.6735	2.1231
4.8466	2.1261
5.0196	2.1214
5.1927	2.1095

Case ID: Trip SS --- Stress Distribution

Depth	Stress
0.0000	-29.6160
0.1731	-20.6040
0.3462	-17.1370
0.5193	-14.9330
0.6924	-13.1120
0.8655	-11.6070
1.0385	-10.4160
1.2116	-0.9771
1.3847	1.7838
1.5578	3.1682
1.7309	3.1818
1.9040	3.1661
2.0771	3.1305
2.2502	3.0985
2.4233	3.0714
2.5964	3.0537
2.7695	3.0386
2.9425	3.0209
3.1156	3.0025
3.2887	2.9874
3.4618	2.9750
3.6349	2.9680
3.8080	2.9540
3.9811	2.9372
4.1542	2.9260
4.3273	2.9162
4.5004	2.9054
4.6735	2.8929
4.8466	2.8789
5.0196	2.8618
5.1927	2.8406

Case ID: trip25 --- Stress Distribution

Depth	Stress
0.0000	8.8280
0.1731	-0.4870
0.3462	-5.6036
0.5193	-8.4481
0.6924	-9.8924
0.8655	-10.4340
1.0385	-10.4840

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1.2116	-1.6494
1.3847	0.8116
1.5578	1.9502
1.7309	1.7621
1.9040	1.6025
2.0771	1.4698
2.2502	1.3732
2.4233	1.3034
2.5964	1.2595
2.7695	1.2284
2.9425	1.2002
3.1156	1.1812
3.2887	1.1709
3.4618	1.1606
3.6349	1.1596
3.8080	1.1533
3.9811	1.1446
4.1542	1.1406
4.3273	1.1376
4.5004	1.1337
4.6735	1.1284
4.8466	1.1216
5.0196	1.1128
5.1927	1.1014

Stress Coefficients

Case ID	C0	C1	C2	C3	Type
Pressure 2235	21.669	-10.49	3.4258	-0.35513	Coeff
CrackFace 1000	0.97192	0.538295	-0.707082	0.129052	StressDist
Thermal at 212	-17.0225	17.2101	-5.01016	0.468462	StressDist
Trip SS	-28.1051	30.0658	-8.99728	0.846695	StressDist
trip25	-1.47656	-4.39833	3.04695	-0.421565	StressDist

------Through Wall Stresses for Load Cases With Stress Coeff-------

Wall Depth	Case Pressure 2
0.0000	21.669
0.1500	20.1714
0.3000	18.8207
0.4500	17.6099
0.6000	16.5316
0.7500	15.5787
0.9000	14.744
1.0500	14.0203
1.2000	13.4005
1.3500	12.8773
1.5000	12.4435

Crack Model: Simulated 3-D Nozzle Corner Crack

WARNING: The stress intensity factor (K) is calculated at the deepest point only.
May be non-conservative in some cases.

Crack Parameters:
Max. crack size: 1.5000

----------Stress Intensity Factor----------

Crack Size	Case Pressure 2	Case CrackFace	Case Thermal at	Case Trip SS	Case trip25
0.0300	4.66373	0.212306	-3.6356	-5.99741	-0.33369
0.0600	6.5497	0.302459	-5.06619	-8.3501	-0.490699
0.0900	7.96633	0.372997	-6.1136	-10.0676	-0.623354
0.1200	9.1356	0.43349	-6.9553	-11.4434	-0.744886
0.1500	10.1443	0.48759	-7.66124	-12.5935	-0.860059
0.1800	11.0372	0.537141	-8.26795	-13.5783	-0.971117
0.2100	11.8413	0.583217	-8.79749	-14.4346	-1.07928
0.2400	12.5742	0.626508	-9.26449	-15.1865	-1.18524
0.2700	13.2483	0.667481	-9.67931	-15.8514	-1.28945
0.3000	13.8728	0.70647	-10.0496	-16.4419	-1.39216
0.3300	14.4547	0.743721	-10.3813	-16.968	-1.49354
0.3600	14.9992	0.779421	-10.679	-17.4373	-1.5937
0.3900	15.5109	0.813715	-10.9465	-17.8562	-1.6927
0.4200	15.9932	0.846717	-11.187	-18.2299	-1.79055
0.4500	16.4492	0.878521	-11.403	-18.5628	-1.88727
0.4800	16.8815	0.9092	-11.5969	-18.8586	-1.98286
0.5100	17.292	0.938816	-11.7704	-19.1205	-2.07729
0.5400	17.6828	0.967422	-11.9252	-19.3514	-2.17054
0.5700	18.0554	0.99506	-12.0629	-19.5536	-2.26257
0.6000	18.4112	1.02177	-12.1847	-19.7293	-2.35337
0.6300	18.7515	1.04758	-12.2918	-19.8806	-2.44288
0.6600	19.0774	1.07251	-12.3853	-20.0091	-2.53108
0.6900	19.39	1.0966	-12.4659	-20.1165	-2.61793
0.7200	19.69	1.11986	-12.5347	-20.2041	-2.70339
0.7500	19.9784	1.14231	-12.5924	-20.2733	-2.78742
0.7800	20.2559	1.16397	-12.6397	-20.3253	-2.87
0.8100	20.5232	1.18485	-12.6772	-20.3611	-2.95107
0.8400	20.7808	1.20497	-12.7056	-20.3818	-3.03062
0.8700	21.0294	1.22433	-12.7253	-20.3884	-3.1086
0.9000	21.2695	1.24296	-12.737	-20.3816	-3.18499
0.9300	21.5016	1.26085	-12.7411	-20.3624	-3.25975
0.9600	21.7261	1.27802	-12.7381	-20.3315	-3.33286
0.9900	21.9435	1.29448	-12.7283	-20.2895	-3.40428
1.0200	22.1541	1.31023	-12.7122	-20.2372	-3.474
1.0500	22.3583	1.3253	-12.6901	-20.1752	-3.54198
1.0800	22.5565	1.33967	-12.6624	-20.1041	-3.6082
1.1100	22.7489	1.35336	-12.6294	-20.0244	-3.67264
1.1400	22.9359	1.36639	-12.5914	-19.9366	-3.73528
1.1700	23.1178	1.37874	-12.5487	-19.8413	-3.7961
1.2000	23.2948	1.39044	-12.5016	-19.7389	-3.85508
1.2300	23.4672	1.40149	-12.4504	-19.6299	-3.9122
1.2600	23.6353	1.4119	-12.3952	-19.5147	-3.96745
1.2900	23.7991	1.42167	-12.3364	-19.3937	-4.02081
1.3200	23.959	1.43082	-12.2742	-19.2673	-4.07228
1.3500	24.1152	1.43934	-12.2087	-19.1358	-4.12183
1.3800	24.2679	1.44724	-12.1402	-18.9995	-4.16947
1.4100	24.4172	1.45454	-12.0688	-18.8589	-4.21517
1.4400	24.5632	1.46124	-11.9948	-18.7143	-4.25894
1.4700	24.7063	1.46735	-11.9184	-18.5658	-4.30076
1.5000	24.8465	1.47287	-11.8396	-18.4139	-4.34063

Crack Growth Laws:

Law ID: ASME Water
Model: ASME Section XI - ferritic steel in water environment

da/dN = CL * SL * dK^5.95 for dK < dKtran
da/dN = CU * SU * dK^1.95 for dK >= dKtran

where
dK = Kmax - Kmin
R = Kmin / Kmax
for R <= 0.25:
SL = 1.0 SU = 1.0 dKtran = 17.74
for 0.25 < R <= 0.65:
SL = 26.9 * R - 5.725 SU = 3.75 * R + 0.06
dKtran = 17.74*{(3.75 * R + 0.06)/(26.9 * R - 5.725)}^0.25
for 0.65 < R:
SL = 11.76 SU = 2.5 dKtran = 12.04

where:
CL = 1.0200e-012
CU = 1.0100e-007
are for the selected units of:
force: kip
length: inch

Material Fracture Toughness KIc:

Material ID: 51670

Depth	KIc
0.0000	63.2400
2.0000	63.2400

Initial crack size= 1.0625
Max. crack size= 1.5000

Number of blocks= 50
Print increment of block= 1

Subblock	Cycles /Time	Calc. incre.	Print incre.	Crk. Grw. Law	Mat. K1c
Heatup/Cooldown	10	1	10	ASME Water	51670
Pressure Test	10	1	10	ASME Water	51670
Variations	20000	1000	20000	ASME Water	51670
Reactor Trip	10	1	10	ASME Water	51670
Loading/Unloadi	300	50	300	ASME Water	51670

Subblock	Kmax Case ID	Kmax Scale Factor	Kmin Case ID	Kmin Scale Factor
Heatup/Cooldown	Pressure 2235	1.3036	Thermal at 212	1.1493
	CrackFace 1000	2.9135		
	trip25	1.1493		
Pressure Test	Pressure 2235	1.1493	Pressure 2235	0.0000
	CrackFace 1000	2.5687	Thermal at 212	1.1493
Variations	Pressure 2235	1.2008	Pressure 2235	1.0979
	CrackFace 1000	2.6837	CrackFace 1000	2.4538
Reactor Trip	Pressure 2235	1.2008	Pressure 2235	0.8408
	CrackFace 1000	2.6837	CrackFace 1000	1.8792
			Trip SS	1.1493
Loading/Unloadi	Pressure 2235	1.1699	Pressure 2235	1.1185
	CrackFace 1000	2.6147	CrackFace 1000	2.4998

Crack growth results:

Total Cycles /Time	Subblock Cycles /Time	Kmax	Kmin	DeltaK	R	DaDn /DaDt	Da	a	a/thk
Block:	1								
10	10	2.90e+001	-1.46e+001	4.36e+001	-0.50	1.59e-004	1.59e-004	1.064	0.00
20	10	2.92e+001	-1.46e+001	4.38e+001	-0.50	1.60e-004	1.60e-004	1.066	0.00
20020	20000	3.05e+001	2.79e+001	2.62e+000	0.91	3.68e-009	3.68e-006	1.066	0.00
20030	10	3.06e+001	-1.75e+000	3.23e+001	-0.06	8.84e-005	8.84e-005	1.067	0.00
20330	300	2.98e+001	2.85e+001	1.31e+000	0.96	5.93e-011	2.96e-009	1.067	0.00
Block:	2								
20340	10	2.91e+001	-1.46e+001	4.36e+001	-0.50	1.59e-004	1.59e-004	1.068	0.00
20350	10	2.93e+001	-1.46e+001	4.38e+001	-0.50	1.60e-004	1.60e-004	1.07	0.00
40350	20000	3.06e+001	2.80e+001	2.62e+000	0.91	3.71e-009	3.71e-006	1.07	0.00
40360	10	3.06e+001	-1.71e+000	3.23e+001	-0.06	8.84e-005	8.84e-005	1.071	0.00
40660	300	2.98e+001	2.85e+001	1.31e+000	0.96	5.97e-011	2.99e-009	1.071	0.00
Block:	3								
40670	10	2.91e+001	-1.46e+001	4.37e+001	-0.50	1.59e-004	1.59e-004	1.072	0.00
40680	10	2.93e+001	-1.46e+001	4.39e+001	-0.50	1.60e-004	1.60e-004	1.074	0.00
60680	20000	3.06e+001	2.80e+001	2.62e+000	0.91	3.73e-009	3.73e-006	1.074	0.00
60690	10	3.06e+001	-1.67e+000	3.23e+001	-0.05	8.84e-005	8.84e-005	1.075	0.00
60990	300	2.98e+001	2.85e+001	1.31e+000	0.96	6.02e-011	3.01e-009	1.075	0.00
Block:	4								
61000	10	2.91e+001	-1.46e+001	4.37e+001	-0.50	1.59e-004	1.59e-004	1.077	0.00
61010	10	2.93e+001	-1.46e+001	4.39e+001	-0.50	1.61e-004	1.61e-004	1.078	0.00
81010	20000	3.07e+001	2.80e+001	2.63e+000	0.91	3.76e-009	3.76e-006	1.078	0.00
81020	10	3.07e+001	-1.63e+000	3.23e+001	-0.05	8.84e-005	8.84e-005	1.079	0.00
81320	300	2.99e+001	2.86e+001	1.31e+000	0.96	6.06e-011	3.03e-009	1.079	0.00
Block:	5								
81330	10	2.92e+001	-1.46e+001	4.37e+001	-0.50	1.59e-004	1.59e-004	1.081	0.00
81340	10	2.94e+001	-1.46e+001	4.39e+001	-0.50	1.61e-004	1.61e-004	1.082	0.00
101340	20000	3.07e+001	2.81e+001	2.63e+000	0.91	3.79e-009	3.79e-006	1.082	0.00
101350	10	3.07e+001	-1.59e+000	3.23e+001	-0.05	8.84e-005	8.84e-005	1.083	0.00
101650	300	2.99e+001	2.86e+001	1.31e+000	0.96	6.11e-011	3.05e-009	1.083	0.00
Block:	6								
101660	10	2.92e+001	-1.45e+001	4.37e+001	-0.50	1.60e-004	1.60e-004	1.085	0.00
101670	10	2.94e+001	-1.45e+001	4.40e+001	-0.49	1.61e-004	1.61e-004	1.086	0.00
121670	20000	3.07e+001	2.81e+001	2.63e+000	0.91	3.82e-009	3.82e-006	1.087	0.00
121680	10	3.07e+001	-1.55e+000	3.23e+001	-0.05	8.83e-005	8.83e-005	1.087	0.00
121980	300	3.00e+001	2.86e+001	1.32e+000	0.96	6.15e-011	3.08e-009	1.087	0.00
Block:	7								
121990	10	2.92e+001	-1.45e+001	4.38e+001	-0.50	1.60e-004	1.60e-004	1.089	0.00
122000	10	2.95e+001	-1.45e+001	4.40e+001	-0.49	1.61e-004	1.61e-004	1.091	0.00
142000	20000	3.08e+001	2.81e+001	2.64e+000	0.91	3.84e-009	3.84e-006	1.091	0.00
142010	10	3.08e+001	-1.52e+000	3.23e+001	-0.05	8.83e-005	8.83e-005	1.092	0.00
142310	300	3.00e+001	2.87e+001	1.32e+000	0.96	6.19e-011	3.10e-009	1.092	0.00
Block:	8								
142320	10	2.93e+001	-1.45e+001	4.38e+001	-0.50	1.60e-004	1.60e-004	1.093	0.00
142330	10	2.95e+001	-1.45e+001	4.40e+001	-0.49	1.62e-004	1.62e-004	1.095	0.00
162330	20000	3.08e+001	2.82e+001	2.64e+000	0.91	3.87e-009	3.87e-006	1.095	0.00
162340	10	3.08e+001	-1.48e+000	3.23e+001	-0.05	8.83e-005	8.83e-005	1.096	0.00
162640	300	3.00e+001	2.87e+001	1.32e+000	0.96	6.24e-011	3.12e-009	1.096	0.00

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Block:     9
  162650       10 2.93e+001 -1.45e+001 4.38e+001 -0.50 1.60e-004 1.60e-004  1.097 0.00
  162650       10 2.95e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.099 0.00
  182660    20000 3.09e+001 2.82e+001 2.64e+000 0.91 3.90e-009 3.90e-006  1.099 0.00
  182670       10 3.09e+001 -1.44e+000 3.23e+001 -0.05 8.83e-005 8.83e-005    1.1 0.00
  182970      300 3.01e+001 2.87e+001 1.32e+000 0.96 6.28e-011 3.14e-009    1.1 0.00

Block:    10
  182980       10 2.93e+001 -1.45e+001 4.38e+001 -0.50 1.60e-004 1.60e-004  1.102 0.00
  182990       10 2.96e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.103 0.00
  202990    20000 3.09e+001 2.82e+001 2.65e+000 0.91 3.93e-009 3.93e-006  1.103 0.00
  203000       10 3.09e+001 -1.40e+000 3.23e+001 -0.05 8.83e-005 8.83e-005  1.104 0.00
  203300      300 3.01e+001 2.88e+001 1.32e+000 0.96 6.33e-011 3.17e-009  1.104 0.00

Block:    11
  203310       10 2.93e+001 -1.45e+001 4.39e+001 -0.49 1.60e-004 1.60e-004  1.106 0.00
  203320       10 2.96e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.107 0.00
  223320    20000 3.09e+001 2.83e+001 2.65e+000 0.91 3.96e-009 3.96e-006  1.107 0.00
  223330       10 3.09e+001 -1.36e+000 3.23e+001 -0.04 8.83e-005 8.83e-005  1.108 0.00
  223630      300 3.01e+001 2.88e+001 1.32e+000 0.96 6.38e-011 3.19e-009  1.108 0.00

Block:    12
  223640       10 2.94e+001 -1.45e+001 4.39e+001 -0.49 1.61e-004 1.61e-004   1.11 0.00
  223650       10 2.96e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.112 0.00
  243650    20000 3.10e+001 2.83e+001 2.65e+000 0.91 3.99e-009 3.99e-006  1.112 0.00
  243660       10 3.10e+001 -1.32e+000 3.23e+001 -0.04 8.83e-005 8.83e-005  1.113 0.00
  243960      300 3.02e+001 2.88e+001 1.33e+000 0.96 6.42e-011 3.21e-009  1.113 0.00

Block:    13
  243970       10 2.94e+001 -1.45e+001 4.39e+001 -0.49 1.61e-004 1.61e-004  1.114 0.00
  243980       10 2.97e+001 -1.45e+001 4.42e+001 -0.49 1.63e-004 1.63e-004  1.116 0.00
  263980    20000 3.10e+001 2.83e+001 2.66e+000 0.91 4.01e-009 4.01e-006  1.116 0.00
  263990       10 3.10e+001 -1.28e+000 3.23e+001 -0.04 8.83e-005 8.83e-005  1.117 0.00
  264290      300 3.02e+001 2.89e+001 1.33e+000 0.96 6.47e-011 3.23e-009  1.117 0.00

Block:    14
  264300       10 2.94e+001 -1.45e+001 4.39e+001 -0.49 1.61e-004 1.61e-004  1.118 0.00
  264310       10 2.97e+001 -1.45e+001 4.42e+001 -0.49 1.63e-004 1.63e-004   1.12 0.00
  284310    20000 3.10e+001 2.84e+001 2.66e+000 0.91 4.04e-009 4.04e-006   1.12 0.00
  284320       10 3.10e+001 -1.24e+000 3.23e+001 -0.04 8.83e-005 8.83e-005  1.121 0.00
  284620      300 3.02e+001 2.89e+001 1.33e+000 0.96 6.51e-011 3.26e-009  1.121 0.00

Block:    15
  284630       10 2.95e+001 -1.45e+001 4.40e+001 -0.49 1.61e-004 1.61e-004  1.123 0.00
  284640       10 2.97e+001 -1.45e+001 4.42e+001 -0.49 1.63e-004 1.63e-004  1.124 0.00
  304640    20000 3.11e+001 2.84e+001 2.66e+000 0.91 4.07e-009 4.07e-006  1.124 0.00
  304650       10 3.11e+001 -1.20e+000 3.23e+001 -0.04 8.82e-005 8.82e-005  1.125 0.00
  304950      300 3.03e+001 2.89e+001 1.33e+000 0.96 6.56e-011 3.28e-009  1.125 0.00

Block:    16
  304960       10 2.95e+001 -1.45e+001 4.40e+001 -0.49 1.61e-004 1.61e-004  1.127 0.00
  304970       10 2.98e+001 -1.45e+001 4.43e+001 -0.49 1.63e-004 1.63e-004  1.128 0.00
  324970    20000 3.11e+001 2.84e+001 2.67e+000 0.91 4.10e-009 4.10e-006  1.128 0.00
  324980       10 3.11e+001 -1.16e+000 3.23e+001 -0.04 8.82e-005 8.82e-005  1.129 0.00
  325280      300 3.03e+001 2.90e+001 1.33e+000 0.96 6.60e-011 3.30e-009  1.129 0.00

Block:    17
  325290       10 2.95e+001 -1.45e+001 4.40e+001 -0.49 1.61e-004 1.61e-004  1.131 0.00
  325300       10 2.98e+001 -1.45e+001 4.43e+001 -0.49 1.64e-004 1.64e-004  1.133 0.00
  345300    20000 3.11e+001 2.85e+001 2.67e+000 0.91 4.13e-009 4.13e-006  1.133 0.00
  345310       10 3.12e+001 -1.12e+000 3.23e+001 -0.04 8.82e-005 8.82e-005  1.134 0.00
  345610      300 3.04e+001 2.90e+001 1.33e+000 0.96 6.65e-011 3.32e-009  1.134 0.00
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Block:    18
  345620       10 2.96e+001 -1.45e+001 4.40e+001 -0.49 1.62e-004 1.62e-004  1.135 0.00
  345630       10 2.98e+001 -1.45e+001 4.43e+001 -0.49 1.64e-004 1.64e-004  1.137 0.00
  365630    20000 3.12e+001 2.85e+001 2.67e+000 0.91 4.16e-009 4.16e-006  1.137 0.00
  365640       10 3.12e+001 -1.08e+000 3.23e+001 -0.03 8.82e-005 8.82e-005  1.138 0.00
  365940      300 3.04e+001 2.91e+001 1.34e+000 0.96 6.70e-011 3.35e-009  1.138 0.00

Block:    19
  365950       10 2.96e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.139 0.00
  365960       10 2.99e+001 -1.45e+001 4.43e+001 -0.48 1.64e-004 1.64e-004  1.141 0.00
  385960    20000 3.12e+001 2.85e+001 2.68e+000 0.91 4.18e-009 4.18e-006  1.141 0.00
  385970       10 3.12e+001 -1.04e+000 3.23e+001 -0.03 8.82e-005 8.82e-005  1.142 0.00
  386270      300 3.04e+001 2.91e+001 1.34e+000 0.96 6.74e-011 3.37e-009  1.142 0.00

Block:    20
  386280       10 2.96e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.144 0.00
  386290       10 2.99e+001 -1.45e+001 4.44e+001 -0.48 1.64e-004 1.64e-004  1.145 0.00
  406290    20000 3.13e+001 2.86e+001 2.68e+000 0.91 4.21e-009 4.21e-006  1.145 0.00
  406300       10 3.13e+001 -1.00e+000 3.23e+001 -0.03 8.81e-005 8.81e-005  1.146 0.00
  406600      300 3.05e+001 2.91e+001 1.34e+000 0.96 6.79e-011 3.39e-009  1.146 0.00

Block:    21
  406610       10 2.96e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.148 0.00
  406620       10 2.99e+001 -1.45e+001 4.44e+001 -0.48 1.64e-004 1.64e-004  1.149 0.00
  426620    20000 3.13e+001 2.86e+001 2.68e+000 0.91 4.24e-009 4.24e-006   1.15 0.00
  426630       10 3.13e+001 -9.62e-001 3.23e+001 -0.03 8.81e-005 8.81e-005   1.15 0.00
  426930      300 3.05e+001 2.92e+001 1.34e+000 0.96 6.83e-011 3.42e-009   1.15 0.00

Block:    22
  426940       10 2.97e+001 -1.45e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.152 0.00
  426950       10 3.00e+001 -1.44e+001 4.44e+001 -0.48 1.64e-004 1.64e-004  1.154 0.00
  446950    20000 3.13e+001 2.86e+001 2.68e+000 0.91 4.27e-009 4.27e-006  1.154 0.00
  446960       10 3.13e+001 -9.22e-001 3.23e+001 -0.03 8.81e-005 8.81e-005  1.155 0.00
  447260      300 3.05e+001 2.92e+001 1.34e+000 0.96 6.88e-011 3.44e-009  1.155 0.00

Block:    23
  447270       10 2.97e+001 -1.44e+001 4.41e+001 -0.49 1.62e-004 1.62e-004  1.156 0.00
  447280       10 3.00e+001 -1.44e+001 4.45e+001 -0.48 1.65e-004 1.65e-004  1.158 0.00
  467280    20000 3.14e+001 2.87e+001 2.69e+000 0.91 4.30e-009 4.30e-006  1.158 0.00
  467290       10 3.14e+001 -8.82e-001 3.22e+001 -0.03 8.81e-005 8.81e-005  1.159 0.00
  467590      300 3.06e+001 2.92e+001 1.34e+000 0.96 6.93e-011 3.46e-009  1.159 0.00

Block:    24
  467600       10 2.97e+001 -1.44e+001 4.42e+001 -0.49 1.63e-004 1.63e-004  1.161 0.00
  467610       10 3.00e+001 -1.44e+001 4.45e+001 -0.48 1.65e-004 1.65e-004  1.162 0.00
  487610    20000 3.14e+001 2.87e+001 2.69e+000 0.91 4.33e-009 4.33e-006  1.162 0.00
  487620       10 3.14e+001 -8.41e-001 3.22e+001 -0.03 8.80e-005 8.80e-005  1.163 0.00
  487920      300 3.06e+001 2.93e+001 1.34e+000 0.96 6.97e-011 3.49e-009  1.163 0.00

Block:    25
  487930       10 2.98e+001 -1.44e+001 4.42e+001 -0.49 1.63e-004 1.63e-004  1.165 0.00
  487940       10 3.01e+001 -1.44e+001 4.45e+001 -0.48 1.65e-004 1.65e-004  1.166 0.00
  507940    20000 3.14e+001 2.87e+001 2.69e+000 0.91 4.36e-009 4.36e-006  1.167 0.00
  507950       10 3.14e+001 -8.01e-001 3.22e+001 -0.03 8.80e-005 8.80e-005  1.167 0.00
  508250      300 3.06e+001 2.93e+001 1.35e+000 0.96 7.02e-011 3.51e-009  1.167 0.00

Block:    26
  508260       10 2.98e+001 -1.44e+001 4.42e+001 -0.48 1.63e-004 1.63e-004  1.169 0.00
  508270       10 3.01e+001 -1.44e+001 4.45e+001 -0.48 1.65e-004 1.65e-004  1.171 0.00
  528270    20000 3.15e+001 2.88e+001 2.70e+000 0.91 4.39e-009 4.39e-006  1.171 0.00
  528280       10 3.15e+001 -7.60e-001 3.22e+001 -0.02 8.80e-005 8.80e-005  1.172 0.00
  528580      300 3.07e+001 2.93e+001 1.35e+000 0.96 7.07e-011 3.53e-009  1.172 0.00
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Block:	27								
528590	10	2.98e+001	-1.44e+001	4.42e+001	-0.48	1.63e-004	1.63e-004	1.173	0.00
528600	10	3.01e+001	-1.44e+001	4.46e+001	-0.48	1.65e-004	1.65e-004	1.175	0.00
548600	20000	3.15e+001	2.88e+001	2.70e+000	0.91	4.42e-009	4.42e-006	1.175	0.00
548610	10	3.15e+001	-7.19e-001	3.22e+001	-0.02	8.80e-005	8.80e-005	1.176	0.00
548910	300	3.07e+001	2.93e+001	1.35e+000	0.96	7.11e-011	3.56e-009	1.176	0.00
Block:	28								
548920	10	2.98e+001	-1.44e+001	4.42e+001	-0.48	1.63e-004	1.63e-004	1.178	0.00
548930	10	3.02e+001	-1.44e+001	4.46e+001	-0.48	1.66e-004	1.66e-004	1.179	0.00
568930	20000	3.15e+001	2.88e+001	2.70e+000	0.91	4.44e-009	4.44e-006	1.179	0.00
568940	10	3.15e+001	-6.78e-001	3.22e+001	-0.02	8.79e-005	8.79e-005	1.18	0.00
569240	300	3.07e+001	2.94e+001	1.35e+000	0.96	7.16e-011	3.58e-009	1.18	0.00
Block:	29								
569250	10	2.99e+001	-1.44e+001	4.43e+001	-0.48	1.63e-004	1.63e-004	1.182	0.00
569260	10	3.02e+001	-1.44e+001	4.46e+001	-0.48	1.66e-004	1.66e-004	1.183	0.00
589260	20000	3.16e+001	2.89e+001	2.71e+000	0.91	4.47e-009	4.47e-006	1.184	0.00
589270	10	3.16e+001	-6.37e-001	3.22e+001	-0.02	8.79e-005	8.79e-005	1.184	0.00
589570	300	3.08e+001	2.94e+001	1.35e+000	0.96	7.21e-011	3.60e-009	1.184	0.00
Block:	30								
589580	10	2.99e+001	-1.44e+001	4.43e+001	-0.48	1.63e-004	1.63e-004	1.186	0.00
589590	10	3.02e+001	-1.44e+001	4.46e+001	-0.48	1.66e-004	1.66e-004	1.188	0.00
609590	20000	3.16e+001	2.89e+001	2.71e+000	0.91	4.50e-009	4.50e-006	1.188	0.00
609600	10	3.16e+001	-5.96e-001	3.22e+001	-0.02	8.79e-005	8.79e-005	1.189	0.00
609900	300	3.08e+001	2.94e+001	1.35e+000	0.96	7.25e-011	3.63e-009	1.189	0.00
Block:	31								
609910	10	2.99e+001	-1.44e+001	4.43e+001	-0.48	1.64e-004	1.64e-004	1.19	0.00
609920	10	3.03e+001	-1.44e+001	4.47e+001	-0.47	1.66e-004	1.66e-004	1.192	0.00
629920	20000	3.16e+001	2.89e+001	2.71e+000	0.91	4.53e-009	4.53e-006	1.192	0.00
629930	10	3.16e+001	-5.55e-001	3.22e+001	-0.02	8.78e-005	8.78e-005	1.193	0.00
630230	300	3.08e+001	2.95e+001	1.35e+000	0.96	7.30e-011	3.65e-009	1.193	0.00
Block:	32								
630240	10	3.00e+001	-1.44e+001	4.43e+001	-0.48	1.64e-004	1.64e-004	1.195	0.00
630250	10	3.03e+001	-1.44e+001	4.47e+001	-0.47	1.66e-004	1.66e-004	1.196	0.00
650250	20000	3.17e+001	2.90e+001	2.71e+000	0.91	4.56e-009	4.56e-006	1.196	0.00
650260	10	3.17e+001	-5.14e-001	3.22e+001	-0.02	8.78e-005	8.78e-005	1.197	0.00
650560	300	3.09e+001	2.95e+001	1.36e+000	0.96	7.35e-011	3.67e-009	1.197	0.00
Block:	33								
650570	10	3.00e+001	-1.44e+001	4.43e+001	-0.48	1.64e-004	1.64e-004	1.199	0.00
650580	10	3.03e+001	-1.44e+001	4.47e+001	-0.47	1.67e-004	1.67e-004	1.201	0.00
670580	20000	3.17e+001	2.90e+001	2.72e+000	0.91	4.59e-009	4.59e-006	1.201	0.00
670590	10	3.17e+001	-4.73e-001	3.22e+001	-0.01	8.77e-005	8.77e-005	1.201	0.00
670890	300	3.09e+001	2.95e+001	1.36e+000	0.96	7.40e-011	3.70e-009	1.201	0.00
Block:	34								
670900	10	3.00e+001	-1.44e+001	4.44e+001	-0.48	1.64e-004	1.64e-004	1.203	0.00
670910	10	3.04e+001	-1.44e+001	4.47e+001	-0.47	1.67e-004	1.67e-004	1.205	0.00
690910	20000	3.17e+001	2.90e+001	2.72e+000	0.91	4.62e-009	4.62e-006	1.205	0.00
690920	10	3.17e+001	-4.32e-001	3.22e+001	-0.01	8.77e-005	8.77e-005	1.206	0.00
691220	300	3.09e+001	2.96e+001	1.36e+000	0.96	7.44e-011	3.72e-009	1.206	0.00
Block:	35								
691230	10	3.00e+001	-1.44e+001	4.44e+001	-0.48	1.64e-004	1.64e-004	1.207	0.00
691240	10	3.04e+001	-1.44e+001	4.48e+001	-0.47	1.67e-004	1.67e-004	1.209	0.00
711240	20000	3.18e+001	2.91e+001	2.72e+000	0.91	4.65e-009	4.65e-006	1.209	0.00
711250	10	3.18e+001	-3.90e-001	3.22e+001	-0.01	8.77e-005	8.77e-005	1.21	0.00
711550	300	3.10e+001	2.96e+001	1.36e+000	0.96	7.49e-011	3.75e-009	1.21	0.00

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Block:    36
  711560       10 3.01e+001 -1.43e+001 4.44e+001 -0.48 1.64e-004 1.64e-004  1.212 0.00
  711570       10 3.04e+001 -1.43e+001 4.48e+001 -0.47 1.67e-004 1.67e-004  1.213 0.00
  731570    20000 3.18e+001 2.91e+001 2.73e+000 0.91 4.68e-009 4.68e-006  1.213 0.00
  731580       10 3.18e+001 -3.49e-001 3.22e+001 -0.01 8.76e-005 8.76e-005  1.214 0.00
  731880      300 3.10e+001 2.96e+001 1.36e+000 0.96 7.54e-011 3.77e-009  1.214 0.00

Block:    37
  731890       10 3.01e+001 -1.43e+001 4.44e+001 -0.48 1.64e-004 1.64e-004  1.216 0.00
  731900       10 3.05e+001 -1.43e+001 4.48e+001 -0.47 1.67e-004 1.67e-004  1.218 0.00
  751900    20000 3.18e+001 2.91e+001 2.73e+000 0.91 4.71e-009 4.71e-006  1.218 0.00
  751910       10 3.19e+001 -3.07e-001 3.22e+001 -0.01 8.76e-005 8.76e-005  1.219 0.00
  752210      300 3.10e+001 2.97e+001 1.36e+000 0.96 7.59e-011 3.79e-009  1.219 0.00

Block:    38
  752220       10 3.01e+001 -1.43e+001 4.44e+001 -0.48 1.65e-004 1.65e-004   1.22 0.00
  752230       10 3.05e+001 -1.43e+001 4.48e+001 -0.47 1.67e-004 1.67e-004  1.222 0.00
  772230    20000 3.19e+001 2.91e+001 2.73e+000 0.91 4.74e-009 4.74e-006  1.222 0.00
  772240       10 3.19e+001 -2.65e-001 3.21e+001 -0.01 8.75e-005 8.75e-005  1.223 0.00
  772540      300 3.11e+001 2.97e+001 1.36e+000 0.96 7.63e-011 3.82e-009  1.223 0.00

Block:    39
  772550       10 3.01e+001 -1.43e+001 4.45e+001 -0.48 1.65e-004 1.65e-004  1.225 0.00
  772560       10 3.05e+001 -1.43e+001 4.49e+001 -0.47 1.68e-004 1.68e-004  1.226 0.00
  792560    20000 3.19e+001 2.92e+001 2.73e+000 0.91 4.77e-009 4.77e-006  1.226 0.00
  792570       10 3.19e+001 -2.24e-001 3.21e+001 -0.01 8.75e-005 8.75e-005  1.227 0.00
  792870      300 3.11e+001 2.97e+001 1.37e+000 0.96 7.68e-011 3.84e-009  1.227 0.00

Block:    40
  792880       10 3.02e+001 -1.43e+001 4.45e+001 -0.47 1.65e-004 1.65e-004  1.229 0.00
  792890       10 3.06e+001 -1.43e+001 4.49e+001 -0.47 1.68e-004 1.68e-004  1.231 0.00
  812890    20000 3.19e+001 2.92e+001 2.74e+000 0.91 4.80e-009 4.80e-006  1.231 0.00
  812900       10 3.20e+001 -1.82e-001 3.21e+001 -0.01 8.75e-005 8.75e-005  1.232 0.00
  813200      300 3.11e+001 2.98e+001 1.37e+000 0.96 7.73e-011 3.87e-009  1.232 0.00

Block:    41
  813210       10 3.02e+001 -1.43e+001 4.45e+001 -0.47 1.65e-004 1.65e-004  1.233 0.00
  813220       10 3.06e+001 -1.43e+001 4.49e+001 -0.47 1.68e-004 1.68e-004  1.235 0.00
  833220    20000 3.20e+001 2.92e+001 2.74e+000 0.91 4.83e-009 4.83e-006  1.235 0.00
  833230       10 3.20e+001 -1.40e-001 3.21e+001 -0.00 8.74e-005 8.74e-005  1.236 0.00
  833530      300 3.12e+001 2.98e+001 1.37e+000 0.96 7.78e-011 3.89e-009  1.236 0.00

Block:    42
  833540       10 3.02e+001 -1.43e+001 4.45e+001 -0.47 1.65e-004 1.65e-004  1.237 0.00
  833550       10 3.06e+001 -1.43e+001 4.49e+001 -0.47 1.68e-004 1.68e-004  1.239 0.00
  853550    20000 3.20e+001 2.93e+001 2.74e+000 0.91 4.86e-009 4.86e-006  1.239 0.00
  853560       10 3.20e+001 -9.78e-002 3.21e+001 -0.00 8.74e-005 8.74e-005   1.24 0.00
  853860      300 3.12e+001 2.98e+001 1.37e+000 0.96 7.83e-011 3.91e-009   1.24 0.00

Block:    43
  853870       10 3.03e+001 -1.43e+001 4.45e+001 -0.47 1.65e-004 1.65e-004  1.242 0.00
  853880       10 3.07e+001 -1.43e+001 4.49e+001 -0.47 1.68e-004 1.68e-004  1.243 0.00
  873880    20000 3.20e+001 2.93e+001 2.75e+000 0.91 4.89e-009 4.89e-006  1.244 0.00
  873890       10 3.21e+001 -5.57e-002 3.21e+001 -0.00 8.73e-005 8.73e-005  1.244 0.00
  874190      300 3.12e+001 2.99e+001 1.37e+000 0.96 7.87e-011 3.94e-009  1.244 0.00

Block:    44
  874200       10 3.03e+001 -1.43e+001 4.46e+001 -0.47 1.65e-004 1.65e-004  1.246 0.00
  874210       10 3.07e+001 -1.43e+001 4.50e+001 -0.46 1.68e-004 1.68e-004  1.248 0.00
  894210    20000 3.21e+001 2.93e+001 2.75e+000 0.91 4.92e-009 4.92e-006  1.248 0.00
  894220       10 3.21e+001 -1.36e-002 3.21e+001 -0.00 8.73e-005 8.73e-005  1.249 0.00
  894520      300 3.13e+001 2.99e+001 1.37e+000 0.96 7.92e-011 3.96e-009  1.249 0.00
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Block:     45
  894530       10 3.03e+001 -1.43e+001 4.46e+001 -0.47 1.66e-004 1.66e-004   1.25 0.00
  894540       10 3.07e+001 -1.43e+001 4.50e+001 -0.46 1.69e-004 1.69e-004  1.252 0.00
  914540    20000 3.21e+001 2.94e+001 2.75e+000 0.91 4.95e-009 4.95e-006  1.252 0.00
  914550       10 3.21e+001 2.86e-002 3.21e+001 0.00 8.72e-005 8.72e-005  1.253 0.00
  914850      300 3.13e+001 2.99e+001 1.37e+000 0.96 7.97e-011 3.99e-009  1.253 0.00

Block:     46
  914860       10 3.03e+001 -1.43e+001 4.46e+001 -0.47 1.66e-004 1.66e-004  1.255 0.00
  914870       10 3.08e+001 -1.43e+001 4.50e+001 -0.46 1.69e-004 1.69e-004  1.256 0.00
  934870    20000 3.21e+001 2.94e+001 2.75e+000 0.91 4.98e-009 4.98e-006  1.256 0.00
  934880       10 3.21e+001 7.08e-002 3.21e+001 0.00 8.72e-005 8.72e-005  1.257 0.00
  935180      300 3.13e+001 2.99e+001 1.38e+000 0.96 8.02e-011 4.01e-009  1.257 0.00

Block:     47
  935190       10 3.04e+001 -1.42e+001 4.46e+001 -0.47 1.66e-004 1.66e-004  1.259 0.00
  935200       10 3.08e+001 -1.42e+001 4.50e+001 -0.46 1.69e-004 1.69e-004  1.261 0.00
  955200    20000 3.22e+001 2.94e+001 2.76e+000 0.91 5.01e-009 5.01e-006  1.261 0.00
  955210       10 3.22e+001 1.13e-001 3.21e+001 0.00 8.71e-005 8.71e-005  1.262 0.00
  955510      300 3.14e+001 3.00e+001 1.38e+000 0.96 8.07e-011 4.03e-009  1.262 0.00

Block:     48
  955520       10 3.04e+001 -1.42e+001 4.46e+001 -0.47 1.66e-004 1.66e-004  1.263 0.00
  955530       10 3.08e+001 -1.42e+001 4.51e+001 -0.46 1.69e-004 1.69e-004  1.265 0.00
  975530    20000 3.22e+001 2.94e+001 2.76e+000 0.91 5.04e-009 5.04e-006  1.265 0.00
  975540       10 3.22e+001 1.56e-001 3.21e+001 0.00 8.71e-005 8.71e-005  1.266 0.00
  975840      300 3.14e+001 3.00e+001 1.38e+000 0.96 8.12e-011 4.06e-009  1.266 0.00

Block:     49
  975850       10 3.04e+001 -1.42e+001 4.46e+001 -0.47 1.66e-004 1.66e-004  1.268 0.00
  975860       10 3.09e+001 -1.42e+001 4.51e+001 -0.46 1.69e-004 1.69e-004  1.269 0.00
  995860    20000 3.22e+001 2.95e+001 2.76e+000 0.91 5.07e-009 5.07e-006  1.269 0.00
  995870       10 3.22e+001 1.98e-001 3.20e+001 0.01 8.70e-005 8.70e-005   1.27 0.00
  996170      300 3.14e+001 3.00e+001 1.38e+000 0.96 8.17e-011 4.08e-009   1.27 0.00

Block:     50
  996180       10 3.04e+001 -1.42e+001 4.47e+001 -0.47 1.66e-004 1.66e-004  1.272 0.00
  996190       10 3.09e+001 -1.42e+001 4.51e+001 -0.46 1.69e-004 1.69e-004  1.274 0.00
 1016190    20000 3.23e+001 2.95e+001 2.77e+000 0.91 5.10e-009 5.10e-006  1.274 0.00
 1016200       10 3.23e+001 2.41e-001 3.20e+001 0.01 8.70e-005 8.70e-005  1.275 0.00
 1016500      300 3.14e+001 3.01e+001 1.38e+000 0.96 8.21e-011 4.11e-009  1.275 0.00
```

End of pc-CRACK Output