MASTER

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LOFT CIS ANALYSIS 2"-LS-118-AB
OUTSIDE CONTAINMENT PENETRATION S5-D

D. K. Morton

EG&G Idaho, Inc.

IDAHO NATIONAL ENGINEERING LABORATORY

DEPARTMENT OF ENERGY

IDAHO OPERATIONS OFFICE UNDER CONTRACT EY-76-C-07-1570

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LOFT CIS ANALYSIS 2"-LS-118-AB

OUTSIDE CONTAINMENT PENETRATION S5-D

D. K. Morton / *D. K. Morton*
AUTHOR

CHECKED BY:

J. W. Muffett / *J. W. Muffett*

APPROVED BY:

C. A. Moore / *C. A. Moore*

cc:

J. G. Arendts
S. M. Gardner (3)
M. M. Laughlin (5)
C. A. Moore
D. K. Morton
J. W. Muffett

JB
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ABSTRACT

A stress analysis was performed on the 2"-LS-118-AB pipe system outside containment penetration S5-D. Deadweight, thermal expansion, and seismic loads were considered. The results indicate that this piping will meet ASME Section III, Class 2 requirements provided a U-bolt (S4) is installed as indicated in this report.

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I. SCOPE

This document constitutes the stress report required by Subarticle NCA-3350 of the ASME Boiler and Pressure Vessel Code, Section III, "Nuclear Power Plant Components", 1977 through Winter 1977 Addenda*. The piping system analyzed, to be installed as part of the "Loss-of-Fluid-Test" (LOFT) Reactor, was the 2"-LS-118-AB outside containment penetration S5-D.

II. INTRODUCTION

The piping system was analyzed according to the procedures specified in Subsection NC-3600 of the Code and found acceptable. The governing conditions, engineering assumptions, and analytical techniques used in completing the analysis are described in the following pages. All loading conditions and design data used in performing the analysis were obtained from the cognizant engineer^[2]. The design specification is to be issued at a later date.

III. PIPING SYSTEM DESCRIPTION

The Low Pressure Steam System (LS) provides the necessary utility steam to the plant operational equipment for the conduct of the LOFT experimental program.

The purposes of this analysis were to (1) determine the loads imposed on the containment penetration and (2) assure containment isolation integrity. As a result, not all of the main pipe system or branch piping may have been analyzed due to its negligible effect on the two primary purposes of this analysis.

1. STRUCTURAL DESCRIPTION

Figure 1 is a computer plot of the Class 2 piping system analyzed in this report. The data points and elements are identified on the plot and a listing of the geometric data used in performing the system's structural analysis appears in Appendix A.

2. MATERIAL AND GEOMETRIC DATA

The piping has the following design parameters:

O.D. (inches)	2.375
Thickness (inches)	0.154
Weight (lbs/inch)	0.458
Material	SA-106 GR. B
E_{cold} (10^6 psi)	27.9
S (365°F) (psi)	15,000
S_y (psi)	35,000
α (10^{-6} in./in.°F)	6.47

LOFT CIS ANALYSIS - 2-LS-118-AB OUTSIDE
NUPIPE MATHEMATICAL MODEL

LEGEND

- / - NODE LOCATION
- o - MASSPOINT LOCATION
- ←--- - SPRING HANGER
- |--- - SLABBER
- ↑ - RIGID SUPPORT
- |--- - ANCHOR
- |--- - ELASTO JOINT
- |--- - FLEXIBLE ANCHOR
- |--- - VALVE

ROTATION ABOUT Y-AXIS = 45-DEG.
X-Z PLANE TILT = 45-DEG.

SEE REFERENCE 4.

Figure 1. Piping System Computer Model Plot

The expansion coefficients and thermal conductivities of SA-106, GR. B steel are defined in Tables I-4.0 and I-5.0 of the Code.

IV. DESIGN AND SERVICE CONDITIONS

Listed in the following sections are the various design and service conditions used in analyzing the piping. This information was obtained from the cognizant engineer.

1. DESIGN CONDITIONS

Class 2 - All Piping

Design Pressure: 150 psi

Design Temperature: 365°F

2. LEVEL A SERVICE CONDITIONS

Level A service conditions, dealing mainly with the stress range due to thermal expansion, are based on the operating temperature(s) given below:

Class 2 - All Piping

Operating Pressure: 25 psi

Operating Temperature: 240°F

3. LEVEL B SERVICE CONDITIONS

The only Level B service condition resulting in significant dynamic loads for the piping system is the Operating Basis Earthquake (OBE).

4. LEVEL C SERVICE CONDITIONS

The only significant Level C service condition which affects the piping system is the Safe Shutdown Earthquake (SSE).

5. LEVEL D SERVICE CONDITIONS

The SSE plus Loss-of-Coolant Accident (LOCA) response envelopes all other Level D service responses for LOFT and will be used as the basis for Level D service conditions analysis.

6. TEST CONDITIONS

Cold Hydrostatic Test - Design Pressure x 1.25

Cold Leakage Test - Design Pressure Only

Hot Leakage Test - Design Pressure and Level A Service Temperature(s).

V. PIPING SYSTEM STRUCTURAL ANALYSIS

The piping system was analyzed for the various structural loads described in Section IV using the computer code NUPIPE-II, developed by Nuclear Services Corporation. This computer program is described in Appendix B. All limiting assumptions made in performing the analysis are listed in the following subsections:

1. WEIGHT ANALYSIS

An analysis for normal weight loading was performed for the system; the piping uniform weights used are listed in Section III.2 of this report. The weights and C.G.'s of the valves and operators are given in Table I. The results of the weight analysis are contained in Appendix C of this report.

2. THERMAL EXPANSION ANALYSIS

The piping system addressed in this report was analyzed for the steady-state temperature conditions as outlined in Section IV.2. The results of this analysis are contained in Appendix D.

3. SEISMIC ANALYSES

The piping system was analyzed for the effects of the Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). For this analysis, OBE is to be considered one-half the magnitude of the SSE. The SSE response spectra is shown in Figure 2. This response spectra, multiplied by conservative directional intensity factors, was applied in all three directions simultaneously. Any seismic differential anchor movement effects present on the piping were taken into account. The results of the seismic analyses are contained in Appendix E.

FIGURE 2.
SSE - SEISMIC RESPONSE SPECTRA ENVELOPE

1% DAMPING

46 1323

TABLE IPIPING SYSTEM VALVE DESIGN WEIGHTS
AND CENTERS OF GRAVITY

<u>Valve</u>	<u>Flooded Weight</u>	<u>(Distance from C.G. axis of Pipe)</u>
V-1379-LS	50 lb _f	10 inches
V-1748-LS	50 lb _f	10 inches

VI. ASME BOILER AND PRESSURE VESSEL CODE, SECTION III, STRESS ANALYSIS

A stress analysis of the Class 2 piping addressed in this report, per rules of Subsection NC-3600 of the Code, was performed using the results obtained from the analyses described in Section V of this report.

1. MINIMUM THICKNESS CHECK

The Code requires verification that the piping minimum wall thickness is satisfactory. The thickness was checked against Equation (1) of NC-3641.1:

$$t_M = \frac{P D_o}{2 (S + P_y)} + A$$

where t_M = Minimum required wall thickness

P = Internal design pressure

D_o = Outside diameter

S = Allowable stress

$y = .4$ or $\frac{d}{d + D_o}$ if $D_o/t_M < 6$ (per Code)

A = Corrosion allowance (.08).

Results of this calculation are contained in Table II.

TABLE II

MINIMUM THICKNESS PARAMETERS

<u>Pressure (psi)</u>	<u>O.D. (inches)</u>	<u>S (psi)</u>	<u>t_M (inches)</u>	<u>t_{actual} (inches)</u>
150	2.375	15000	0.092	0.154

Since the actual thicknesses are all greater than the t_M calculated, the system meets the requirements of NC-3641.1.

2. DESIGN, LEVEL A, AND LEVEL B SERVICE CONDITIONS STRESS ANALYSIS

The loading conditions, defined as Design, Level A, and Level B in Section IV.1, 2, and 3, were used in performing a stress analysis of the piping system per the rules given in Subsection NC-3650 of the Code.

The computer program NUPIPE-II was used for this analysis. The results of Equations (8), (9), (10), and (11) are detailed in Appendix F. Test conditions are encompassed by this stress analysis.

3. LEVEL C SERVICE CONDITIONS STRESS ANALYSIS

The only loading which was postulated as a Level C service condition is the SSE. NC-3611.2 (c) requires that Equation (9) of NC-3652.2 be satisfied with an allowable of $1.8 S_h$. These results, as calculated using NUPIPE-II, are contained in Appendix G.

4. LEVEL D SERVICE CONDITIONS STRESS ANALYSIS

There were no Level D service conditions specified for this piping.

VII. COMPONENT SUPPORT ANALYSIS

Any component supports designed and built by EG&G Idaho, Inc. have been analyzed in accordance with the AISC Manual of Steel Construction^[3]. The analysis of these component supports would be contained in Appendix I. All component supports which have been supplied by a commercial manufacturer carry loads which are less than the manufacturer's stated load capacity. A summary of sustained loads on all piping supports is contained in Table III.

Support S4, a 1/4" U-bolt, should be install approximately 24 inches from the second elbow upstream from valve V-1748-LS (where a bottom support is located). See Figure 1 for further location details.

With regard to the rod hangers already present on the piping system, the cognizant engineer should assure that the pipe experiences an equivalent amount of support in both the upward and downward directions. If this is not the case, an appropriate pipe clamp (or its equivalent) should be installed.

TABLE IIILOADS ON PIPING SUPPORTS

<u>Support Type</u>	<u>Support No.</u>	<u>Deadweight</u>	<u>Thermal</u>	<u>OBE</u>	<u>SSE</u>	<u>Rated Load</u>
Rod ⁺	S1-Y	170	-19	66	132	610
Rod ⁺	S2-Y	109	7	26	52	250
Rod ⁺	S3-Y	5	-24	22	45	250
U-bolt*	S4-Y	90	17	24	47	485
	S4-Z	2	0	36	71	

Loads are in lb_f.

* - Supports to be added.

+ - Assure equivalent support for both upward and downward directions.

VIII. SPECIAL CONSIDERATIONS

The piping system modeled has both "A" and "AB" pipe material specifications. A sufficient amount of piping with the "A" material specification was modeled in only to assure correct loadings on the pipe with the "AB" material specification. A Class 2 analysis was then performed which showed the "AB" piping adequate. Any stress results pertaining to the "A" piping should be disregarded. The "A" piping has screwed fittings which would require additional analysis not required at this time. Supports added to this piping were to reduce large deflections during SSE.

IX. CONCLUSIONS

The piping system addressed in this report was analyzed for the stated loads and operating conditions using the techniques described herein. All stresses have been found to be within limits established by Section III of the ASME Boiler and Pressure Vessel Code.

X. REFERENCES

1. American Society of Mechanical Engineers, ASME Boiler & Pressure Vessel Code, Section III, Division 1, "Nuclear Power Plant Components", Subsection NC, 1977 Edition, Winter 1977 Addenda.
2. Telephone conversation with N. Maringas of LOFT PSB, April 26, 1978.
3. American Institute of Steel Construction, Manual of Steel Construction, Seventh Edition, pp 5-6 to 5-24, 1973.
4. Computer plot based on sketches made at LOFT by Applied Mechanics personnel during March, 1978.

APPENDIX A
BASIC DATA, INPUT PARAMETERS

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 LOFT CIS ANALYSIS - 2nd S-118-A8 OUTSIDE CONTAINMENT PENETRATION S5-D

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PROGRAM CONTROL CARD

CARDTYPE	NCHECK	DAMP	CODE	GLOB	DYN	THEATA	INTOUT	STORE
CONTROL	0	0	2.	0.	0.	0.0000	0.	0.

CARDTYPE	NPR	NPIPS	UNITS	EIGSAV
CONTROL	10	0	ENGLISH	0

FLEXIBILITY ANALYSIS CONTROL CARDS

CARDTYPE	NCASE	MODE	TLOAD	CMODE	CFREQ	SPEC	SAVE	CYCLE	TITLE
FLEXAN	1	1	3.	0.	0.	0.00	1.	0.	DEADWEIGHT
FLEXAN	2	1	2.	0.	0.	0.00	1.	0.	THERMAL EXPANSION PLUS ANCHOR MOVEMENTS
FLEXAN	3	1	11.	40.	50.	1.00	1.	0.	SSE RESPONSE SPECTRUM - 1% DAMPING

CASE COMBINATION CONTROL CARDS

CARDTYPE	NCASE	CASES-COMD	AMULT	BMULT	CCODE	SAVE	CYCLE	TITLE
MODFLEX	4	3 AND 1	.5	0.0	0.0	1.0	0.0	OBE RESPONSE SPECTRUM - ONE-HALF SSE

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SEISMIC RESPONSE SPECTRA - SET 1

X-EARTHQUAKE		Y-EARTHQUAKE		Z-EARTHQUAKE	
PERIOD (SEC)	ACCELERATION (G)	PERIOD (SEC)	ACCELERATION (G)	PERIOD (SEC)	ACCELERATION (G)
0.000	.342	0.000	.228	0.000	.342
.010	.342	.010	.228	.010	.342
.250	1.460	.250	.973	.250	1.460
.800	.637	.800	.425	.800	.637
1.400	.342	1.400	.228	1.400	.342
2.200	.217	2.200	.145	2.200	.217

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*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
XSECTN	0	1	.238E+01	.154E+00	.549E+01	.279E+02	.150E+03	0.
OPVAL	1	1	.276E+02	.132E-01	0.	0.	.250E+02	0.
CHECK MAGNITUDE OF ENTRIES ON ABOVE OPVAL CARD ****								
ANCHOR	0	5	0.	0.	0.	0.	0.	0.
FGRUN	5	10	0.	0.	-.180E+01	.100E+01	.100E+01	0.
MASSPT	0	10	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	10	15	0.	0.	-.180E+01	.100E+01	.100E+01	0.
MASSPT	0	15	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	15	20	0.	0.	-.180E+01	.100E+01	.100E+01	0.
MASSPT	0	20	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	20	25	0.	0.	-.180E+01	.100E+01	.100E+01	0.
MASSPT	0	25	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	25	30	0.	0.	-.180E+01	.100E+01	.100E+01	0.
MASSPT	0	30	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	30	35	.300E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	35	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	35	40	-.158E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	40	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	40	45	-.158E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	45	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	45	50	.300E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	50	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	50	55	0.	-.138E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	55	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	55	60	0.	-.138E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	60	.100E+01	.100E+01	.100E+01	0.	0.	0.

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*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
RUN	60	65	0.	-.138E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	65	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	65	70	0.	-.138E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	70	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	70	.100E+03	0.	.100E+03	0.	0.	0.
RUN	70	75	0.	-.200E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	75	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	75	.100E+03	0.	.100E+03	0.	0.	0.
FGRUN	75	80	0.	-.100E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	80	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	80	85	.300E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	85	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	85	90	-.158E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	90	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	90	95	-.158E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	95	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	95	0.	.200E+05	0.	0.	0.	0.
RUN	95	100	-.833E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	100	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	100	0.	.100E+05	.100E+05	0.	0.	0.
RUN	100	105	-.200E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	105	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	105	0.	.100E+05	.100E+05	0.	0.	0.
FGRUN	105	110	-.167E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	110	.100E+01	.100E+01	.100E+01	0.	0.	0.

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*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
VALVE	110	115	-.438E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	115	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	115	120	0.	0.	.833E+00	.100E+01	.100E+01	0.
MASSPT	0	120	.500E+02	.500E+02	.500E+02	0.	0.	0.
CWEIGHT	0	120	0.	.500E+02	0.	0.	0.	0.
VALVE	115	125	-.438E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	125	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	125	130	-.108E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	130	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	130	0.	.200E+05	0.	0.	0.	0.
FGRUN	130	135	-.500E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	135	.100E+01	.100E+01	.100E+01	0.	0.	0.
VALVE	135	140	-.438E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	140	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	140	145	0.	0.	.833E+00	.100E+01	.100E+01	0.
MASSPT	0	145	.500E+02	.500E+02	.500E+02	0.	0.	0.
CWEIGHT	0	145	0.	.500E+02	0.	0.	0.	0.
VALVE	140	150	-.438E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	150	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	150	155	-.458E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	155	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	155	160	-.833E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	160	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	160	165	-.117E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	165	.100E+01	.100E+01	.100E+01	0.	0.	0.

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2"-LS-118-A8 OUTSIDE CONTAINMENT PENETRATION S5-D

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*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
RESTRAINT	0	165	0.	.200E+05	0.	0.	0.	0.
RUN	165	170	-.183E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	170	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	170	175	-.183E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	175	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	175	180	.300E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	180	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	180	185	0.	-.100E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	185	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	185	190	.300E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	190	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	190	195	-.200E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	195	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	195	0.	.200E+05	.200E+05	0.	0.	0.
RUN	195	200	-.258E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	200	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	200	205	-.258E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	205	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	205	210	-.267E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	210	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	210	215	-.267E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	215	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	215	220	-.217E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	220	.100E+01	.100E+01	.100E+01	0.	0.	0.
RUN	220	225	-.217E+01	0.	0.	.100E+01	.100E+01	0.

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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      *** INPUT DATA ***
CARDTYPE  I1      I2      DELTA(1)  DELTA(2)  DELTA(3)  DELTA(4)  DELTA(5)  DELTA(6)
MASSPT      0      225      .100E+01  .100E+01  .100E+01  0.        0.        0.
FGRUN      225      230      -.217E+01  0.        0.        .100E+01  .100E+01  0.
MASSPT      0      230      .100E+01  .100E+01  .100E+01  0.        0.        0.
ELBOW      230      235      .300E+01  0.        0.        .100E+01  .100E+01  0.
MASSPT      0      235      .100E+01  .100E+01  .100E+01  0.        0.        0.
FGRUN      235      240      0.        -.117E+01  0.        .100E+01  .100E+01  0.
ANCHOR      0      240      0.        0.        0.        0.        0.        0.
STRESS7     0        0      0.        0.        0.        0.        0.        0.
9CASES      1        0      0      0      0      0      0      0      0
10CASES     0        0      0      0      0      0      0      0      0
CKNODES     0        0      0      0      0      0      0      0      0
ALLDONE     0        0      0      0      0      0      0      0      0
  
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APPENDIX B
COMPUTER PROGRAM DESCRIPTION

The NUPIPE-II computer program performs linear elastic analysis of three-dimensional piping systems subject to thermal, deadweight, seismic, and other static and dynamic loads. The NUPIPE-II program is also designed to perform stress and fatigue analyses in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components, 1974 Edition through the Summer 1975 Addenda; and the ANSI B31.1 Code, 1967 and Summer 1973 versions. Piping systems of more than one classification can be analyzed.

NUPIPE-II utilizes the finite element method of analysis with special features incorporated to accommodate specific requirements of piping system analysis. In accordance with the finite element method, the continuous piping is mathematically idealized as an assembly of elastic structural members connecting discrete nodal points. Nodal points are placed in such a manner as to isolate particular types of piping elements, such as straight runs of pipe, elbows, valves, etc., for which force-deformation characteristics can be categorized. Nodal points are also placed at all discontinuities, such as piping supports, concentrated weights, branch lines, and changes in cross-section. System loads such as weights, equivalent thermal forces, and earthquake inertia forces are applied at the nodal points. For the deadweight and dynamic time-history and response spectra analyses, distributed weight properties of the piping as well as concentrated weights, such as valves, pumps, or snubbers, can be considered. A lumped mass model of the piping system is used for all dynamic analyses. Both translational and rotational degrees-of-freedom may be considered.

For further information concerning NUPIPE-II capabilities or analytical procedures, contact Applied Mechanics Branch.

APPENDIX C
WEIGHT ANALYSIS RESULTS

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2W-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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SUPPORT REACTIONS FOR LOAD CASE NO. 1
 DEADWEIGHT

NODE	TYPE	REACTION (LBS OR IN-LBS)	DIRECTION
5	FORCE	-10.	X COORD
5	FORCE	41.	Y COORD
5	FORCE	-5.	Z COORD
5	MOMENT	1576.	X COORD
5	MOMENT	775.	Y COORD
5	MOMENT	214.	Z COORD
70	FORCE	-6.	X COORD
70	FORCE	-1.	Y COORD
70	FORCE	-3.	Z COORD
70	MOMENT	0.	X COORD
70	MOMENT	170.	Y COORD
70	MOMENT	-14.	Z COORD
100	FORCE	19.	X COORD
100	FORCE	-14.	Y COORD
100	FORCE	-14.	Z COORD
100	MOMENT	109.	X COORD
100	MOMENT	5.	Y COORD
100	MOMENT	90.	Z COORD
100	MOMENT	2.	X COORD
100	MOMENT	19.	Y COORD
100	MOMENT	53.	Z COORD
100	MOMENT	-1.	X COORD
100	MOMENT	-291.	Y COORD
100	MOMENT	19.	Z COORD
100	MOMENT	987.	X COORD

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

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LOFT CIS ANALYSIS - 2#-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-0

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 1

DEADWEIGHT

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	5	-10.	-41.	-5.	1576.	-775.	-219.	.000	-.000	.000	-.0000	-.0000	-.0000
	10	-10.	-31.	-5.	-802.	-552.	-219.	.009	-.017	.000	-.0014	-.0008	-.0003
RUN	10	-10.	-31.	-5.	-802.	-552.	-219.	.009	-.017	.000	-.0014	-.0008	-.0003
	15	-10.	-21.	-5.	-242.	-330.	-219.	.032	-.054	.000	-.0020	-.0013	-.0007
RUN	15	-10.	-21.	-5.	-242.	-330.	-219.	.032	-.054	.000	-.0020	-.0013	-.0007
	20	-10.	-11.	-5.	105.	-108.	-219.	.063	-.099	.000	-.0021	-.0015	-.0010
RUN	20	-10.	-11.	-5.	-105.	108.	-219.	.063	-.099	.000	-.0021	-.0015	-.0010
	25	-10.	-1.	-5.	238.	114.	-219.	.096	-.142	.000	-.0019	-.0015	-.0013
FGRUN	25	-10.	1.	-5.	-238.	-114.	-219.	.096	-.142	.000	-.0019	-.0015	-.0013
	30	-10.	7.	-5.	182.	305.	-219.	.123	-.175	.000	-.0017	-.0013	-.0016
ELBOW	30	-10.	-7.	-5.	-182.	-305.	-219.	.123	-.175	.000	-.0017	-.0013	-.0016
	35	-10.	-9.	-5.	157.	319.	-194.	.127	-.174	-.003	-.0015	-.0010	-.0018
FGRUN	35	-10.	-9.	-5.	-157.	-319.	194.	.127	-.174	-.003	-.0015	-.0010	-.0018
	40	-10.	17.	-5.	157.	233.	15.	.127	-.144	-.017	-.0013	-.0007	-.0019
FGRUN	40	-10.	-17.	-5.	-157.	-233.	-15.	.127	-.144	-.017	-.0013	-.0007	-.0019
	45	-10.	-24.	-5.	157.	146.	342.	.127	-.115	-.027	-.0011	-.0006	-.0017
ELBOW	45	-10.	-24.	-5.	-157.	-146.	-342.	.127	-.115	-.027	-.0011	-.0006	-.0017
	50	-10.	-26.	-5.	173.	129.	387.	.123	-.110	-.025	-.0010	-.0005	-.0013
FGRUN	50	-10.	-26.	-5.	-173.	-129.	-387.	.123	-.110	-.025	-.0010	-.0005	-.0013
	55	-10.	-32.	-5.	246.	129.	248.	.107	-.110	-.012	-.0009	-.0004	-.0011
RUN	55	-10.	-32.	-5.	-246.	-129.	-248.	.107	-.110	-.012	-.0009	-.0004	-.0011
	60	-10.	-40.	-5.	336.	129.	79.	.090	-.110	.001	-.0006	-.0002	-.0009
RUN	60	-10.	-40.	-5.	-336.	-129.	-79.	.090	-.110	.001	-.0006	-.0002	-.0009
	65	-10.	-48.	-5.	425.	129.	-91.	.075	-.110	.008	-.0003	-.0001	-.0009
RUN	65	-10.	-48.	-5.	-425.	-129.	91.	.075	-.110	.008	-.0003	-.0001	-.0009
	70	-10.	-55.	-5.	515.	129.	-261.	.059	-.110	.010	.0001	.0001	-.0011
RUN	70	-10.	-55.	-5.	-515.	-129.	261.	.059	-.110	.010	.0001	.0001	-.0011
	75	-16.	-66.	-6.	669.	129.	-648.	.027	-.110	-.002	.0009	.0003	-.0017

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT-CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	75	-19.	-66.	-6.	-669.	-129.	648.	.027	-.110	-.002	.0009	.0003	-.0017
	80	19.	70.	6.	725.	129.	-818.	.010	-.110	-.011	.0012	.0004	-.0020
ELBOW	80	-19.	-70.	-6.	-725.	-129.	818.	.010	-.110	-.011	.0012	.0004	-.0020
	85	19.	72.	6.	744.	111.	-661.	.003	-.102	-.015	.0017	.0003	-.0029
FGRUN	85	-19.	-72.	-6.	-744.	-111.	661.	.003	-.102	-.015	.0017	.0003	-.0029
	90	19.	80.	6.	744.	10.	555.	.003	-.054	-.010	.0026	.0003	-.0029
RUN	90	-19.	-80.	-6.	-744.	-10.	-555.	.003	-.054	-.010	.0026	.0003	-.0029
	95	19.	88.	6.	744.	-109.	2152.	.003	-.009	-.004	.0035	.0003	-.0016
RUN	95	-19.	-82.	-6.	-744.	109.	-2152.	.003	-.009	-.004	.0035	.0003	-.0016
	100	19.	-77.	6.	744.	-171.	1358.	.003	.002	-.002	.0041	.0002	-.0006
RUN	100	-19.	-58.	-13.	-744.	171.	-1358.	.003	.002	-.002	.0041	.0002	-.0006
	105	19.	-47.	13.	744.	135.	86.	.003	.002	.001	.0053	.0002	-.0003
FGRUN	105	-19.	-28.	-1.	-744.	-135.	-86.	.003	-.002	.001	.0053	.0002	-.0003
	110	19.	-19.	1.	744.	106.	-386.	.003	-.004	.006	.0064	.0003	.0002
VALVE	110	-19.	-19.	-1.	-744.	-106.	386.	.003	-.004	.006	.0064	.0003	.0002
	115	19.	-17.	1.	744.	98.	-479.	.003	-.004	.008	.0064	.0003	.0001
RUN	115	-0.	-55.	-0.	-523.	-0.	0.	.003	-.004	.008	.0064	.0003	.0001
	120	0.	-50.	0.	0.	0.	-0.	.006	-.070	.008	.0066	.0003	.0001
VALVE	115	-19.	-38.	-1.	-222.	-98.	479.	.003	-.004	.008	.0064	.0003	.0001
	125	19.	40.	1.	222.	91.	-273.	.003	-.005	.009	.0065	.0003	.0001
FGRUN	125	-19.	-40.	-1.	-222.	-91.	273.	.003	-.005	.009	.0065	.0003	.0001
	130	19.	46.	1.	222.	72.	290.	.003	-.005	.014	.0067	.0004	.0001
FGRUN	130	-19.	-63.	-1.	-222.	-72.	-290.	.003	-.005	.014	.0067	.0004	.0001
	135	19.	-60.	1.	222.	63.	-80.	.003	-.006	.016	.0068	.0004	.0001
VALVE	135	-19.	-60.	-1.	-222.	-63.	80.	.003	-.006	.016	.0068	.0004	.0001
	140	19.	-58.	1.	222.	55.	-390.	.003	-.007	.018	.0068	.0004	.0001
RLN	140	-0.	-55.	-0.	-523.	-0.	0.	.003	-.007	.018	.0068	.0004	.0001
	145	0.	-50.	0.	0.	0.	-0.	.007	-.076	.018	.0069	.0004	.0001
VALVE	140	-19.	-3.	-1.	-301.	-55.	390.	.003	-.007	.018	.0068	.0004	.0001
	150	19.	-1.	1.	301.	47.	-402.	.003	-.007	.020	.0068	.0004	.0001
FGRUN	150	-19.	1.	-1.	-301.	-47.	402.	.003	-.007	.020	.0068	.0004	-.0001
	155	19.	2.	1.	301.	39.	-400.	.003	-.007	.022	.0066	.0004	-.0001

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	155	-19.	-2.	-1.	301.	-39.	400.	.003	-.007	.022	.0066	.0004	-.0001
	160	19.	6.	1.	-301.	24.	-361.	.003	-.006	.027	.0064	.0004	-.0003
FGRUN	160	-19.	-6.	-1.	301.	-24.	361.	.003	-.006	.027	.0064	.0004	-.0003
	165	19.	13.	1.	-301.	4.	-229.	.003	-.000	.033	.0061	.0004	-.0005
RUN	165	-19.	-8.	-1.	301.	-4.	229.	.003	-.012	.042	.0057	.0004	-.0005
	170	19.	18.	1.	-301.	28.	-49.	.003	.012	.042	.0057	.0004	-.0006
FGRUN	170	-19.	-18.	-1.	301.	-28.	49.	.003	-.022	.050	.0053	.0004	-.0006
	175	19.	26.	1.	-301.	56.	-468.	.003	.022	.050	.0053	.0004	-.0006
ELBOW	175	-19.	-26.	-1.	301.	-56.	468.	.003	-.022	.036	.0051	.0004	-.0003
	180	19.	29.	1.	-297.	61.	-494.	.003	.022	.036	.0051	.0004	-.0003
FGRUN	180	-19.	-29.	-1.	297.	-61.	494.	.003	-.022	.005	.0050	.0004	-.0002
	185	19.	31.	1.	-289.	61.	-381.	.003	.022	.005	.0050	.0004	-.0002
ELBOW	185	-19.	-31.	-1.	289.	-61.	381.	.003	-.022	.005	.0050	.0004	-.0002
	190	19.	33.	1.	-284.	65.	-421.	.003	.020	.008	.0048	.0004	-.0003
FGRUN	190	-19.	-33.	-1.	284.	-65.	421.	.003	-.020	.008	.0048	.0004	-.0003
	195	19.	43.	1.	-284.	96.	-1225.	.007	-.004	.000	.0044	.0003	-.0017
RUN	195	-19.	-47.	-1.	284.	-96.	1225.	.007	-.004	.000	.0044	.0003	-.0017
	200	19.	32.	1.	-284.	78.	-1.	.007	-.079	.008	.0038	.0002	-.0027
RUN	200	-19.	-32.	-1.	284.	-78.	1.	.007	-.079	.008	.0038	.0002	-.0027
	205	19.	18.	1.	-284.	61.	-783.	.007	-.158	.011	.0031	.0001	-.0021
RUN	205	-19.	-18.	-1.	284.	-61.	783.	.007	-.158	.011	.0031	.0001	-.0021
	210	19.	4.	1.	-284.	43.	-1131.	.007	-.200	.012	.0025	.0000	-.0004
RUN	210	-19.	-4.	-1.	284.	-43.	1131.	.007	-.200	.012	.0025	.0000	-.0004
	215	19.	11.	1.	-284.	25.	-1010.	.007	-.184	.010	.0019	.0001	-.0014
RUN	215	-19.	-11.	-1.	284.	-25.	1010.	.007	-.184	.010	.0019	.0001	-.0014
	220	19.	23.	1.	-284.	10.	-566.	.007	-.132	.007	.0014	.0001	-.0025
RUN	220	-19.	-23.	-1.	284.	-10.	566.	.007	-.132	.007	.0014	.0001	-.0025
	225	19.	35.	1.	-284.	5.	-187.	.007	-.061	.004	.0008	.0001	-.0028
FGRUN	225	-19.	-35.	-1.	284.	-5.	187.	.007	-.061	.004	.0008	.0001	-.0028
	230	19.	45.	1.	-284.	18.	-1111.	.007	-.005	.002	.0004	.0001	-.0020
ELBOW	230	-19.	-45.	-1.	284.	-18.	1111.	.007	-.005	.002	.0004	.0001	-.0020
	235	19.	48.	1.	-285.	19.	-1194.	.003	-.000	.001	.0002	.0000	-.0006

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 LOFT CIS ANALYSIS - 2W-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	235	-19.	-48.	1.	285.	-19.	-1194.	.003	-.000	.001	.0002	-.0000	-.0006
	240	19.	53.	-1.	-291.	19.	987.	-.000	-.000	.000	.0000	-.0000	-.0000

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APPENDIX D
THERMAL EXPANSION ANALYSIS RESULTS

05/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2#-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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SUPPORT REACTIONS FOR LOAD CASE NO. 2
 THERMAL EXPANSION PLUS ANCHOR MOVEMENTS

NODE	TYPE	REACTION (LBS OR IN-LBS)	DIRECTION
5	FORCE	-8.	X COORD
5	FORCE	-20.	Y COORD
5	FORCE	-10.	Z COORD
5	MOMENT	-1446.	X COORD
5	MOMENT	542.	Y COORD
5	MOMENT	-118.	Z COORD
70	FORCE	-30.	X COORD
70	FORCE	6.	Z COORD
75	FORCE	-42.	X COORD
75	FORCE	2.	Z COORD
95	FORCE	-19.	Y COORD
100	FORCE	20.	Y COORD
100	FORCE	3.	Z COORD
105	FORCE	18.	Y COORD
105	FORCE	-2.	Z COORD
130	FORCE	-7.	Y COORD
165	FORCE	-24.	Y COORD
195	FORCE	17.	Y COORD
195	FORCE	-0.	Z COORD
240	FORCE	80.	X COORD
240	FORCE	1.	Z COORD
240	FORCE	0.	Y COORD
240	MOMENT	44.	X COORD
240	MOMENT	-4.	Y COORD
240	MOMENT	-992.	Z COORD

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2W-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 2

THERMAL EXPANSION PLUS ANCHOR MOVEMENTS

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	5	-8.	-20.	-10.	-1446.	542.	-118.	.000	.000	.000	.0000	-.0000	.0000
	10	8.	20.	10.	1019.	-353.	118.	.006	.016	-.024	.0014	-.0005	.0002
RUN	10	-8.	-20.	-10.	-1019.	353.	-118.	.006	.016	-.024	.0014	-.0005	.0002
	15	8.	20.	10.	593.	-134.	118.	.021	.058	-.048	.0024	-.0008	.0004
RUN	15	-8.	-20.	-10.	-593.	134.	-118.	.021	.058	-.048	.0024	-.0008	.0004
	20	8.	20.	10.	167.	-5.	118.	.041	.115	-.071	.0028	-.0010	.0005
RUN	20	-8.	-20.	-10.	-167.	5.	-118.	.041	.115	-.071	.0028	-.0010	.0005
	25	8.	20.	10.	-259.	174.	118.	.061	.177	-.095	.0028	-.0009	.0007
FGRUN	25	-8.	-20.	-10.	259.	-174.	-118.	.061	.177	-.095	.0028	-.0009	.0007
	30	8.	20.	10.	-626.	328.	118.	.075	.224	-.115	.0023	-.0006	.0009
ELBOW	30	-8.	-20.	-10.	626.	-328.	-118.	.075	.224	-.115	.0023	-.0006	.0009
	35	8.	20.	10.	-686.	324.	177.	.073	.228	-.120	.0018	-.0002	.0011
FGRUN	35	-8.	-20.	-10.	686.	-324.	-177.	.073	.228	-.120	.0018	-.0002	.0011
	40	8.	20.	10.	-686.	172.	492.	.056	.208	-.122	.0010	-.0000	.0014
FGRUN	40	-8.	-20.	-10.	686.	-172.	-492.	.056	.208	-.122	.0010	-.0000	.0014
	45	8.	20.	10.	-686.	20.	808.	.038	.181	-.121	.0003	.0001	.0020
ELBOW	45	-8.	-20.	-10.	686.	-20.	-808.	.038	.181	-.121	.0003	.0001	.0020
	50	8.	20.	10.	-657.	-8.	842.	.042	.170	-.121	-.0002	.0002	.0029
FGRUN	50	-8.	-20.	-10.	657.	8.	-842.	.042	.170	-.121	-.0002	.0002	.0029
	55	8.	20.	10.	-529.	-8.	731.	.086	.156	-.115	-.0006	.0002	.0035
RUN	55	-8.	-20.	-10.	529.	8.	-731.	.086	.156	-.115	-.0006	.0002	.0035
	60	8.	20.	10.	-372.	-8.	594.	.148	.137	-.101	-.0010	.0002	.0041
RUN	60	-8.	-20.	-10.	372.	8.	-594.	.148	.137	-.101	-.0010	.0002	.0041
	65	8.	20.	10.	-215.	-8.	457.	.220	.119	-.081	-.0013	.0002	.0045
RUN	65	-8.	-20.	-10.	215.	8.	-457.	.220	.119	-.081	-.0013	.0002	.0045
	70	8.	20.	10.	-58.	-8.	320.	.298	.101	-.058	-.0014	.0002	.0049
RUN	70	-38.	-20.	-4.	58.	8.	-320.	.298	.101	-.058	-.0014	.0002	.0049
	75	38.	20.	4.	30.	-8.	594.	.416	.075	-.023	-.0014	.0002	.0047

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 LOFT CIS ANALYSIS - 2M-LS-118-A8 OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	75	-80.	-20.	-1.	-30.	8.	594.	.416	.075	-.023	-.0014	.0002	.0047
	80	80.	20.	1.	42.	-8.	-1310.	.456	.065	-.011	-.0014	.0002	.0043
ELBOW	80	-80.	-20.	-1.	-42.	8.	1310.	.456	.065	-.011	-.0014	.0002	.0043
	85	80.	20.	1.	46.	-12.	-1490.	.464	.052	-.006	-.0014	.0002	.0026
FGRUN	85	-80.	-20.	-1.	-46.	12.	1490.	.464	.052	-.006	-.0014	.0002	.0026
	90	80.	20.	1.	46.	-34.	-1174.	.447	.019	-.003	-.0013	.0001	.0015
RUN	90	-80.	-20.	-1.	-46.	34.	1174.	.447	.019	-.003	-.0013	.0001	.0015
	95	80.	20.	1.	46.	-59.	-799.	.426	.001	-.001	-.0013	.0001	.0005
RUN	95	-80.	-39.	-1.	-46.	59.	799.	.426	.001	-.001	-.0013	.0001	.0005
	100	80.	39.	1.	46.	-73.	-409.	.415	-.002	-.000	-.0012	.0001	.0002
RUN	100	-80.	-19.	-2.	-46.	73.	409.	.415	-.002	-.000	-.0012	.0001	.0002
	105	80.	19.	2.	46.	-29.	38.	.389	-.002	-.000	-.0012	-.0000	-.0001
FGRUN	105	-80.	-1.	0.	-46.	29.	38.	.389	-.002	-.000	-.0012	-.0000	-.0001
	110	80.	1.	0.	46.	-23.	48.	.367	-.001	-.000	-.0011	-.0000	-.0000
VALVE	110	-80.	-1.	0.	-46.	23.	48.	.367	-.001	-.000	-.0011	-.0000	-.0000
	115	80.	1.	0.	46.	-22.	51.	.361	-.001	-.001	-.0011	-.0000	-.0000
RUN	115	-0.	-0.	-0.	0.	0.	0.	.361	-.001	-.001	-.0011	-.0000	-.0000
	120	0.	0.	0.	0.	0.	0.	.360	.010	.010	-.0011	-.0000	-.0000
VALVE	115	-80.	-1.	0.	-46.	22.	51.	.361	-.001	-.001	-.0011	-.0000	-.0000
	125	80.	1.	0.	46.	-20.	53.	.355	-.000	-.001	-.0011	-.0000	-.0000
FGRUN	125	-80.	-1.	0.	-46.	20.	53.	.355	-.000	-.001	-.0011	-.0000	-.0000
	130	80.	1.	0.	46.	-17.	60.	.341	-.000	-.001	-.0011	-.0001	.0000
FGRUN	130	-80.	-7.	0.	-46.	17.	60.	.341	-.000	-.001	-.0011	-.0001	.0000
	135	80.	7.	0.	46.	-15.	18.	.334	-.001	-.002	-.0010	-.0001	.0000
VALVE	135	-80.	-7.	0.	-46.	15.	18.	.334	-.001	-.002	-.0010	-.0001	.0000
	140	80.	7.	0.	46.	-13.	18.	.328	-.001	-.002	-.0010	-.0001	.0000
RUN	140	-0.	-0.	-0.	0.	0.	0.	.328	-.001	-.002	-.0010	-.0001	.0000
	145	0.	0.	0.	0.	0.	0.	.328	.010	.009	-.0010	-.0001	.0000
VALVE	140	-80.	-7.	0.	-46.	13.	18.	.328	-.001	-.002	-.0010	-.0001	.0000
	150	80.	7.	0.	46.	-12.	55.	.323	-.001	-.002	-.0010	-.0001	.0000
FGRUN	150	-80.	-7.	0.	-46.	12.	55.	.323	-.001	-.002	-.0010	-.0001	.0000
	155	80.	7.	0.	46.	-10.	93.	.317	-.001	-.003	-.0010	-.0001	.0000

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LOFT CIS ANALYSIS - 2nd-LS-118-A3 OUTSIDE CONTAINMENT PENETRATION S5-D

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	155	-80.	7.	0.	-46.	10.	93.	.317	-.001	-.003	-.0010	-.0001	-.0000
	160	80.	-7.	-0.	46.	-7.	-162.	.306	-.001	-.003	-.0010	-.0001	-.0001
FGRUN	160	-80.	7.	0.	-46.	7.	162.	.306	-.001	-.003	-.0010	-.0001	-.0001
	165	80.	-7.	-0.	46.	-3.	-259.	.290	.001	-.004	-.0009	-.0001	-.0002
RUN	165	-80.	-17.	0.	-46.	3.	259.	.290	.001	-.004	-.0009	-.0001	-.0002
	170	80.	17.	-0.	46.	-3.	123.	.266	.008	-.006	-.0009	-.0001	-.0003
FGRUN	170	-80.	-17.	0.	-46.	-3.	-123.	.266	.008	-.006	-.0009	-.0001	-.0003
	175	80.	17.	-0.	46.	9.	453.	.245	.011	-.007	-.0008	-.0001	-.0000
ELBOW	175	-80.	-17.	0.	-46.	-9.	-453.	.245	.011	-.007	-.0008	-.0001	-.0000
	180	80.	17.	-0.	46.	10.	266.	.243	.008	-.005	-.0008	-.0001	-.0004
FGRUN	180	-80.	-17.	0.	-46.	-10.	-266.	.243	.008	-.005	-.0008	-.0001	-.0004
	185	80.	17.	-0.	44.	10.	-211.	.246	.001	-.001	-.0008	-.0001	.0004
ELBOW	185	-80.	-17.	0.	-44.	-10.	211.	.246	.001	-.001	-.0008	-.0001	.0004
	190	80.	17.	-0.	43.	11.	-398.	.243	-.003	.001	-.0007	-.0001	.0001
FGRUN	190	-80.	-17.	0.	-43.	-11.	398.	.243	-.003	.001	-.0007	-.0001	.0001
	195	80.	17.	-0.	43.	17.	-33.	.220	-.001	.000	-.0007	-.0001	-.0002
RUN	195	-80.	-1.	0.	-43.	-17.	33.	.220	-.001	.000	-.0007	-.0001	-.0002
	200	80.	1.	0.	43.	14.	-9.	.186	.006	-.001	-.0006	-.0000	-.0002
RUN	200	-80.	-1.	0.	-43.	-14.	9.	.186	.006	-.001	-.0006	-.0000	-.0002
	205	80.	1.	0.	43.	11.	14.	.152	.012	-.002	-.0005	-.0000	-.0002
RUN	205	-80.	-1.	0.	-43.	-11.	-14.	.152	.012	-.002	-.0005	-.0000	-.0002
	210	80.	1.	0.	43.	7.	39.	.117	.019	-.002	-.0004	.0000	-.0002
RUN	210	-80.	-1.	0.	-43.	-7.	-39.	.117	.019	-.002	-.0004	.0000	-.0002
	215	80.	1.	0.	43.	4.	63.	.082	.023	-.002	-.0003	.0000	-.0001
RUN	215	-80.	-1.	0.	-43.	-4.	-63.	.082	.023	-.002	-.0003	.0000	-.0001
	220	80.	1.	0.	43.	1.	83.	.054	.024	-.001	-.0002	.0000	-.0000
RUN	220	-80.	-1.	0.	-43.	-1.	-83.	.054	.024	-.001	-.0002	.0000	-.0000
	225	80.	1.	0.	43.	1.	103.	.025	.021	-.001	-.0001	.0000	.0002
FGRUN	225	-80.	-1.	0.	-43.	-1.	-103.	.025	.021	-.001	-.0001	.0000	.0002
	230	80.	1.	0.	43.	-1.	120.	-.000	.016	-.000	-.0001	.0000	.0003
ELBOW	230	-80.	-1.	0.	-43.	-1.	-120.	-.000	.016	-.000	-.0001	.0000	.0003
	235	80.	1.	0.	43.	-1.	116.	-.002	.012	-.000	-.0000	.0000	.0003

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LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

MEMBER	END	FX	FORCES (LBS) FY	FZ	HX	MOMENTS (IN-LBS) MY	MZ	DEFLECTIONS (IN) DX	DY	DZ	ROTATIONS (RAD) RX	RY	RZ
FGRUN	235	-80.	-1.	-0.	-43.	4.	116.	-.002	-.012	-.000	-.0000	.0000	.0003
	240	80.	1.	0.	44.	-4.	-992.	-.000	-.000	-.000	-.0000	.0000	.0000

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APPENDIX E
SEISMIC ANALYSES RESULTS

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LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

SUPPORT REACTIONS FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING
COMBINED RESULT FOR MODE 1 THRU 22 BY RMS SUMMATION SPECTRA SET = 1

MODE	TYPE	REACTIONS (LBS OR IN-LBS)	DIRECTION
5	FORCE	51.	X COORD
5	FORCE	27.	Y COORD
5	FORCE	27.	Z COORD
5	MOMENT	1956.	X COORD
5	MOMENT	4161.	Y COORD
5	MOMENT	666.	Z COORD
70	FORCE	24.	X COORD
70	FORCE	9.	Z COORD
75	FORCE	7.	X COORD
75	FORCE	7.	Z COORD
95	FORCE	132.	Y COORD
100	FORCE	37.	Y COORD
100	FORCE	90.	Z COORD
105	FORCE	56.	Y COORD
105	FORCE	135.	Z COORD
130	FORCE	52.	Y COORD
165	FORCE	45.	Y COORD
195	FORCE	47.	Y COORD
195	FORCE	71.	Z COORD
240	FORCE	115.	X COORD
240	FORCE	24.	Y COORD
240	FORCE	38.	Z COORD
240	MOMENT	830.	X COORD
240	MOMENT	1259.	Y COORD
240	MOMENT	1684.	Z COORD

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LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING

COMBINED RESULT FOR MODE 1 THRU 22 BY RMS SUMMATION

SPECTRA SET = 1

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	5	51.	27.	27.	1956.	4161.	666.	.000	.000	.000	.0000	.0000	.0000
	10	51.	27.	27.	1409.	3075.	666.	.048	.022	.000	.0020	.0042	.0010
RUN	10	49.	25.	27.	1409.	3075.	666.	.048	.022	.000	.0020	.0042	.0010
	15	49.	25.	27.	921.	2036.	666.	.173	.080	.000	.0033	.0072	.0020
RUN	15	46.	22.	27.	921.	2036.	666.	.173	.080	.000	.0033	.0072	.0020
	20	46.	22.	27.	534.	1116.	666.	.350	.161	.000	.0041	.0090	.0030
RUN	20	38.	17.	27.	534.	1116.	666.	.350	.161	.000	.0041	.0090	.0030
	25	38.	17.	27.	283.	535.	666.	.553	.253	.000	.0044	.0097	.0040
FGRUN	25	28.	13.	27.	283.	535.	666.	.553	.253	.000	.0044	.0097	.0040
	30	28.	13.	27.	170.	633.	666.	.735	.335	.000	.0045	.0098	.0049
ELBOW	30	21.	14.	27.	170.	633.	666.	.735	.335	.000	.0045	.0098	.0049
	35	21.	14.	27.	166.	635.	682.	.764	.333	.029	.0042	.0095	.0054
FGRUN	35	14.	16.	27.	166.	635.	682.	.764	.333	.029	.0042	.0095	.0054
	40	14.	16.	27.	166.	590.	759.	.764	.244	.179	.0041	.0092	.0060
FGRUN	40	8.	20.	23.	166.	590.	759.	.764	.244	.179	.0041	.0092	.0060
	45	8.	20.	23.	166.	757.	890.	.764	.149	.322	.0041	.0087	.0066
ELBOW	45	11.	21.	19.	166.	757.	890.	.764	.149	.322	.0041	.0087	.0066
	50	11.	21.	19.	152.	792.	898.	.743	.130	.335	.0042	.0081	.0074
FGRUN	50	16.	23.	15.	152.	792.	898.	.743	.130	.335	.0042	.0081	.0074
	55	16.	23.	15.	280.	792.	713.	.640	.130	.281	.0042	.0074	.0079
RUN	55	24.	25.	9.	280.	792.	713.	.640	.130	.281	.0042	.0074	.0079
	60	24.	25.	9.	412.	792.	406.	.507	.130	.215	.0042	.0065	.0082
RUN	60	32.	29.	6.	412.	792.	406.	.507	.130	.215	.0042	.0065	.0082
	65	32.	29.	6.	463.	792.	416.	.372	.130	.149	.0043	.0057	.0082
RUN	65	38.	34.	9.	463.	792.	416.	.372	.130	.149	.0043	.0057	.0082
	70	38.	34.	9.	464.	792.	929.	.241	.130	.067	.0043	.0048	.0077
RUN	70	21.	40.	10.	464.	792.	929.	.241	.130	.087	.0043	.0048	.0077
	75	21.	40.	10.	520.	792.	1363.	.073	.130	.065	.0044	.0037	.0063
FGRUN	75	17.	45.	10.	520.	792.	1363.	.073	.130	.065	.0044	.0037	.0063
	80	17.	45.	10.	561.	792.	1489.	.023	.130	.094	.0045	.0033	.0058

SPEEDREAD WITH EYE TRACK PATENT PENDING

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 LOFT-CIS ANALYSIS - 2W-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
ELBOW	80	17.	47.	13.	561.	792.	1489.	.023	.130	.094	.0045	.0033	.0058
	85	17.	47.	13.	583.	776.	1501.	.017	.116	.098	.0048	.0028	.0044
FGRUN	85	17.	50.	17.	583.	778.	1501.	.017	.116	.098	.0048	.0028	.0044
	90	17.	50.	17.	583.	751.	1575.	.017	.054	.058	.0051	.0023	.0033
RUN	90	19.	53.	21.	583.	751.	1575.	.017	.054	.058	.0051	.0023	.0033
	95	19.	53.	21.	583.	893.	2137.	.017	.007	.022	.0055	.0015	.0015
RUN	95	20.	90.	23.	583.	893.	2137.	.017	.007	.022	.0055	.0015	.0015
	100	20.	90.	23.	583.	1035.	1240.	.017	.004	.009	.0057	.0011	.0006
RUN	100	22.	54.	77.	583.	1035.	1240.	.017	.004	.009	.0057	.0011	.0006
	105	22.	54.	77.	583.	1378.	78.	.017	.006	.013	.0064	.0014	.0002
FGRUN	105	25.	12.	64.	583.	1378.	78.	.017	.006	.013	.0064	.0014	.0002
	110	25.	12.	64.	583.	271.	194.	.017	.004	.052	.0070	.0022	.0001
VALVE	110	27.	12.	62.	583.	271.	194.	.017	.004	.052	.0070	.0022	.0001
	115	27.	12.	62.	583.	364.	255.	.017	.003	.063	.0070	.0022	.0001
RUN	115	25.	31.	23.	306.	246.	0.	.017	.003	.063	.0070	.0022	.0001
	120	25.	31.	23.	0.	0.	0.	.031	.073	.063	.0071	.0022	.0001
VALVE	115	50.	20.	39.	337.	344.	255.	.017	.003	.063	.0070	.0022	.0001
	125	50.	20.	39.	337.	514.	168.	.017	.003	.075	.0070	.0022	.0001
FGRUN	125	52.	20.	37.	337.	514.	168.	.017	.003	.075	.0070	.0022	.0001
	130	52.	20.	37.	337.	963.	186.	.017	.003	.100	.0072	.0017	.0001
FGRUN	130	54.	32.	34.	337.	963.	186.	.017	.003	.100	.0072	.0017	.0001
	135	54.	32.	34.	337.	1161.	82.	.017	.003	.109	.0073	.0014	.0001
VALVE	135	55.	32.	32.	337.	1161.	82.	.017	.003	.109	.0073	.0014	.0001
	140	55.	32.	32.	337.	1326.	215.	.017	.003	.116	.0073	.0013	.0001
RUN	140	26.	33.	38.	326.	257.	0.	.017	.003	.116	.0073	.0013	.0001
	145	26.	33.	38.	0.	0.	0.	.024	.077	.116	.0074	.0013	.0001
VALVE	140	81.	15.	12.	247.	1368.	215.	.017	.003	.116	.0073	.0013	.0001
	150	81.	15.	12.	247.	1315.	219.	.017	.003	.122	.0073	.0012	.0001
FGRUN	150	82.	15.	13.	247.	1315.	219.	.017	.003	.122	.0073	.0012	.0001
	155	82.	15.	13.	247.	1250.	231.	.016	.003	.127	.0073	.0008	.0001
FGRUN	155	34.	15.	16.	247.	1250.	231.	.016	.003	.127	.0073	.0008	.0001
	160	34.	15.	16.	247.	1105.	299.	.016	.003	.132	.0073	.0005	.0002

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	160	86.	15.	20.	247.	1105.	299.	.016	.003	.132	.0073	.0005	.0002
	165	86.	15.	20.	247.	847.	492.	.016	.002	.129	.0072	.0008	.0004
RUN	165	90.	31.	27.	247.	847.	492.	.016	.002	.129	.0072	.0008	.0004
	170	90.	31.	27.	247.	397.	251.	.016	.014	.109	.0072	.0014	.0006
FGRUN	170	94.	29.	32.	247.	397.	251.	.016	.014	.109	.0072	.0014	.0006
	175	94.	29.	32.	247.	521.	759.	.016	.022	.088	.0071	.0014	.0003
ELBOW	175	96.	27.	35.	247.	521.	759.	.016	.022	.088	.0071	.0014	.0003
	180	96.	27.	35.	215.	603.	596.	.014	.022	.066	.0070	.0013	.0009
FGRUN	180	97.	26.	35.	215.	603.	596.	.014	.022	.066	.0070	.0013	.0009
	185	97.	26.	35.	289.	603.	388.	.009	.022	.036	.0070	.0013	.0009
ELBOW	185	98.	26.	36.	289.	603.	388.	.009	.022	.036	.0070	.0013	.0009
	190	98.	26.	36.	370.	692.	573.	.008	.020	.030	.0066	.0013	.0009
FGRUN	190	99.	25.	36.	370.	692.	573.	.008	.020	.030	.0066	.0013	.0009
	195	99.	25.	36.	370.	1381.	735.	.008	.002	.004	.0061	.0018	.0014
RUN	195	101.	24.	37.	370.	1381.	735.	.008	.002	.004	.0061	.0018	.0014
	200	101.	24.	37.	370.	355.	203.	.008	.056	.079	.0053	.0028	.0019
RUN	200	103.	18.	30.	370.	355.	203.	.007	.111	.162	.0045	.0023	.0015
	205	103.	18.	30.	370.	790.	606.	.007	.111	.162	.0045	.0023	.0015
RUN	205	105.	10.	16.	370.	790.	606.	.007	.111	.162	.0045	.0023	.0015
	210	105.	10.	16.	370.	1258.	833.	.007	.140	.209	.0036	.0006	.0005
RUN	210	107.	9.	6.	370.	1258.	833.	.007	.140	.209	.0036	.0006	.0005
	215	107.	9.	6.	370.	1107.	725.	.007	.128	.193	.0028	.0015	.0011
RUN	215	110.	15.	22.	370.	1107.	725.	.007	.128	.193	.0028	.0015	.0011
	220	110.	15.	22.	370.	555.	429.	.007	.091	.138	.0022	.0026	.0018
RUN	220	111.	21.	32.	370.	555.	429.	.007	.091	.138	.0022	.0026	.0018
	225	111.	21.	32.	370.	303.	297.	.007	.042	.065	.0015	.0028	.0019
FGRUN	225	113.	24.	37.	370.	303.	297.	.007	.042	.065	.0015	.0028	.0019
	230	113.	24.	37.	370.	1146.	748.	.007	.003	.009	.0009	.0019	.0014
ELBOW	230	114.	24.	38.	370.	1146.	748.	.007	.003	.009	.0009	.0019	.0014
	235	114.	24.	38.	456.	1259.	810.	.004	.000	.002	.0004	.0010	.0007
FGRUN	235	115.	24.	38.	456.	1259.	810.	.004	.000	.002	.0004	.0010	.0007
	240	115.	24.	38.	830.	1259.	1684.	.000	.000	.000	.0000	.0000	.0000

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LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

SUPPORT REACTIONS FOR LOAD COMBINATION CASE NO. 4

OBE RESPONSE SPECTRUM - ONE-HALF SSE

NODE	TYPE	REACTIONS (LBS OR IN-LBS)	DIRECTION
5	FORCE	26.	X COORD
5	FORCE	14.	Y COORD
5	FORCE	13.	Z COORD
5	MOMENT	978.	X COORD
5	MOMENT	2080.	Y COORD
5	MOMENT	333.	Z COORD
70	FORCE	12.	X COORD
70	FORCE	4.	Z COORD
75	FORCE	4.	X COORD
75	FORCE	3.	Z COORD
95	FORCE	66.	Y COORD
100	FORCE	19.	Y COORD
100	FORCE	45.	Z COORD
105	FORCE	28.	Y COORD
105	FORCE	67.	Z COORD
130	FORCE	26.	Y COORD
165	FORCE	22.	Y COORD
195	FORCE	34.	Y COORD
195	FORCE	36.	Z COORD
240	FORCE	57.	X COORD
240	FORCE	12.	Y COORD
240	FORCE	19.	Z COORD
240	MOMENT	415.	X COORD
240	MOMENT	629.	Y COORD
240	MOMENT	842.	Z COORD

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LOFT CIS ANALYSIS - 24-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 4

DBE RESPONSE SPECTRUM - ONE-HALF SSE

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	5	26.	14.	13.	978.	2080.	333.	.000	.000	.000	.0000	.0000	.0000
	10	26.	14.	13.	705.	1537.	333.	.024	.011	.000	.0010	.0021	.0005
RUN	10	25.	13.	13.	705.	1537.	333.	.024	.011	.000	.0010	.0021	.0005
	15	25.	13.	13.	461.	1018.	333.	.087	.040	.000	.0016	.0036	.0010
RUN	15	23.	11.	13.	461.	1018.	333.	.087	.040	.000	.0016	.0036	.0010
	20	23.	11.	13.	267.	558.	333.	.175	.080	.000	.0020	.0045	.0015
RUN	20	19.	8.	13.	267.	558.	333.	.175	.080	.000	.0020	.0045	.0015
	25	19.	8.	13.	142.	268.	333.	.277	.126	.000	.0022	.0049	.0020
FGRUN	25	14.	7.	13.	142.	268.	333.	.277	.126	.000	.0022	.0049	.0020
	30	14.	7.	13.	85.	316.	333.	.367	.168	.000	.0022	.0049	.0024
ELBOW	30	10.	7.	13.	85.	316.	333.	.367	.168	.000	.0022	.0049	.0024
	35	10.	7.	13.	83.	318.	341.	.382	.167	.014	.0021	.0048	.0027
FGRUN	35	7.	8.	13.	83.	318.	341.	.382	.167	.014	.0021	.0048	.0027
	40	7.	8.	13.	83.	295.	380.	.382	.122	.090	.0021	.0046	.0030
FGRUN	40	4.	10.	11.	83.	295.	380.	.382	.122	.090	.0021	.0046	.0030
	45	4.	10.	11.	83.	379.	445.	.382	.074	.161	.0020	.0043	.0033
ELBOW	45	5.	11.	9.	83.	379.	445.	.382	.074	.161	.0020	.0043	.0033
	50	5.	11.	9.	76.	396.	449.	.371	.065	.168	.0021	.0041	.0037
FGRUN	50	8.	11.	7.	76.	396.	449.	.371	.065	.168	.0021	.0041	.0037
	55	8.	11.	7.	140.	396.	356.	.320	.065	.140	.0021	.0037	.0039
RUN	55	12.	13.	5.	140.	396.	356.	.320	.065	.140	.0021	.0037	.0039
	60	12.	13.	5.	206.	396.	203.	.254	.065	.107	.0021	.0033	.0041
RUN	60	16.	15.	3.	206.	396.	203.	.254	.065	.107	.0021	.0033	.0041
	65	16.	15.	3.	231.	396.	208.	.186	.065	.074	.0021	.0028	.0041
RUN	65	19.	17.	4.	231.	396.	208.	.186	.065	.074	.0021	.0028	.0041
	70	19.	17.	4.	232.	396.	464.	.120	.065	.043	.0022	.0024	.0038
RUN	70	10.	20.	5.	232.	396.	464.	.120	.065	.043	.0022	.0024	.0038
	75	10.	20.	5.	260.	396.	682.	.036	.065	.033	.0022	.0018	.0032
FGRUN	75	9.	22.	5.	260.	396.	682.	.036	.065	.033	.0022	.0018	.0032
	80	9.	22.	5.	281.	396.	744.	.012	.065	.047	.0023	.0016	.0029

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 LOFT CIS ANALYSIS - 2#-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
ELBOW	80	9.	23.	6.	281.	396.	744.	.012	.065	.047	.0023	.0016	.0029
	85	9.	23.	6.	291.	389.	750.	.008	.058	.049	.0024	.0014	.0022
FGRUN	85	9.	25.	8.	291.	389.	750.	.008	.058	.049	.0024	.0014	.0022
	90	9.	25.	8.	291.	375.	787.	.008	.027	.029	.0025	.0011	.0017
RUN	90	9.	26.	11.	291.	375.	787.	.008	.027	.029	.0025	.0011	.0017
	95	9.	26.	11.	291.	446.	1068.	.008	.003	.011	.0027	.0008	.0008
RUN	95	10.	45.	11.	291.	446.	1068.	.008	.003	.011	.0027	.0008	.0008
	100	10.	45.	11.	291.	517.	620.	.008	.002	.005	.0029	.0009	.0003
RUN	100	11.	27.	39.	291.	517.	620.	.008	.002	.005	.0029	.0009	.0003
	105	11.	27.	39.	291.	689.	39.	.008	.003	.007	.0032	.0007	.0001
FGRUN	105	13.	6.	32.	291.	689.	39.	.008	.003	.007	.0032	.0007	.0001
	110	13.	6.	32.	291.	136.	97.	.008	.002	.026	.0035	.0011	.0001
VALVE	110	14.	6.	31.	291.	136.	97.	.008	.002	.026	.0035	.0011	.0001
	115	14.	6.	31.	291.	182.	128.	.008	.002	.032	.0035	.0011	.0001
RUN	115	12.	15.	11.	153.	123.	0.	.008	.002	.032	.0035	.0011	.0001
	120	12.	15.	11.	0.	0.	0.	.016	.037	.032	.0035	.0011	.0001
VALVE	115	25.	10.	19.	168.	172.	128.	.008	.002	.032	.0035	.0011	.0001
	125	25.	10.	19.	168.	257.	84.	.008	.001	.037	.0035	.0011	.0001
FGRUN	125	26.	10.	18.	168.	257.	84.	.008	.001	.037	.0035	.0011	.0001
	130	26.	10.	18.	168.	482.	93.	.008	.001	.050	.0036	.0008	.0000
FGRUN	130	27.	16.	17.	168.	482.	93.	.008	.001	.050	.0036	.0008	.0000
	135	27.	16.	17.	168.	581.	41.	.008	.001	.055	.0037	.0007	.0000
VALVE	135	27.	16.	16.	168.	581.	41.	.008	.001	.055	.0037	.0007	.0000
	140	27.	16.	16.	168.	663.	108.	.008	.002	.058	.0037	.0006	.0000
RUN	140	13.	16.	19.	163.	128.	0.	.008	.002	.058	.0037	.0006	.0000
	145	13.	16.	19.	0.	0.	0.	.012	.038	.058	.0037	.0006	.0000
VALVE	140	41.	8.	6.	123.	684.	108.	.008	.002	.058	.0037	.0006	.0000
	150	41.	8.	6.	123.	658.	109.	.008	.002	.061	.0037	.0006	.0000
FGRUN	150	41.	8.	7.	123.	658.	109.	.008	.002	.061	.0037	.0006	.0000
	155	41.	8.	7.	123.	625.	116.	.008	.002	.064	.0037	.0004	.0000
FGRUN	155	42.	8.	8.	123.	625.	116.	.008	.002	.064	.0037	.0004	.0000
	160	42.	8.	8.	123.	552.	149.	.008	.001	.066	.0036	.0002	.0001

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2M-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	160	43.	8.	10.	123.	552.	149.	.008	.001	.066	.0036	.0002	.0001
	165	43.	8.	10.	123.	423.	246.	.008	.001	.064	.0036	.0004	.0002
RUN	165	45.	15.	13.	123.	423.	246.	.008	.001	.064	.0036	.0004	.0002
	170	45.	15.	13.	123.	199.	126.	.008	.007	.055	.0036	.0007	.0003
FGRUN	170	47.	14.	16.	123.	199.	126.	.008	.007	.055	.0036	.0007	.0003
	175	47.	14.	16.	123.	261.	379.	.008	.011	.044	.0036	.0007	.0002
ELBOW	175	48.	13.	17.	123.	261.	379.	.008	.011	.044	.0036	.0007	.0002
	180	48.	13.	17.	107.	301.	298.	.007	.011	.033	.0035	.0006	.0004
FGRUN	180	49.	13.	18.	107.	301.	298.	.007	.011	.033	.0035	.0006	.0004
	185	49.	13.	18.	145.	301.	194.	.005	.011	.018	.0035	.0006	.0005
ELBOW	185	49.	13.	18.	145.	346.	286.	.004	.010	.015	.0033	.0007	.0004
	190	49.	12.	18.	185.	346.	286.	.004	.001	.002	.0033	.0009	.0007
RUN	195	49.	12.	18.	185.	691.	368.	.004	.001	.002	.0030	.0009	.0007
	200	50.	12.	19.	185.	691.	368.	.004	.001	.002	.0030	.0009	.0007
RUN	200	51.	9.	15.	185.	178.	102.	.004	.028	.039	.0026	.0014	.0010
	205	51.	9.	15.	185.	395.	303.	.004	.056	.081	.0022	.0012	.0007
RUN	205	53.	5.	8.	185.	629.	416.	.004	.070	.105	.0018	.0003	.0002
	210	53.	5.	8.	185.	629.	416.	.004	.070	.105	.0018	.0003	.0002
RUN	210	54.	4.	3.	185.	629.	416.	.004	.064	.097	.0014	.0007	.0005
	215	54.	4.	3.	185.	553.	363.	.004	.064	.097	.0014	.0007	.0005
RUN	215	55.	7.	11.	185.	553.	363.	.004	.064	.097	.0014	.0007	.0005
	220	55.	7.	11.	185.	278.	214.	.004	.045	.069	.0011	.0013	.0009
RUN	220	56.	10.	16.	185.	278.	214.	.004	.021	.032	.0008	.0014	.0009
	225	56.	10.	16.	185.	151.	148.	.004	.021	.032	.0008	.0014	.0009
FGRUN	225	57.	12.	19.	185.	151.	148.	.004	.021	.032	.0008	.0014	.0009
	230	57.	12.	19.	185.	573.	374.	.004	.002	.004	.0005	.0010	.0007
ELBOW	230	57.	12.	19.	185.	573.	374.	.004	.002	.004	.0005	.0010	.0007
	235	57.	12.	19.	228.	629.	405.	.002	.000	.001	.0002	.0005	.0003
FGRUN	235	57.	12.	19.	228.	629.	405.	.002	.000	.001	.0002	.0005	.0003
	240	57.	12.	19.	415.	629.	842.	.000	.000	.000	.0000	.0000	.0000

SPEEDREAD WITH FIVE TRACK PATENT PENDING

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APPENDIX F
DESIGN, LEVEL A, AND LEVEL B SERVICE
CONDITIONS STRESS ANALYSIS RESULTS

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NOOE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ. 8 (PSI)	OCCASIONAL STRESS EQ. 9 (PSI)	EXPANSION STRESS EQ. 10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ. 11 (PSI)
FGRUN	5	1.000	3545.	7438.	2595.	6141.
	10	1.000	2252.	5141.	1824.	4077.
RUN	10	1.000	2252.	5141.	1824.	4077.
	15	1.000	1357.	3311.	1060.	2417.
RUN	15	1.000	1357.	3311.	1060.	2417.
	20	1.000	1025.	2202.	342.	1367.
RUN	20	1.000	1025.	2202.	342.	1367.
	25	1.000	1154.	1908.	559.	1713.
FGRUN	25	1.000	1154.	1908.	559.	1713.
	30	1.000	1278.	2060.	1201.	2479.
ELBOW	30	1.732	1487.	2504.	2081.	3568.
	35	1.732	1461.	2492.	2261.	3722.
FGRUN	35	1.000	1258.	2051.	1305.	2563.
	40	1.000	1049.	1867.	1444.	2493.
FGRUN	40	1.000	1049.	1867.	1444.	2493.
	45	1.000	1255.	2244.	1777.	3032.
ELBOW	45	1.732	1457.	2743.	3078.	4535.
	50	1.732	1544.	2857.	3102.	4646.
FGRUN	50	1.000	1321.	2332.	1791.	3112.
	55	1.000	1203.	2126.	1512.	2715.
RUN	55	1.000	1203.	2126.	1512.	2715.
	60	1.000	1196.	2017.	1174.	2370.
RUN	60	1.000	1196.	2017.	1174.	2370.
	65	1.000	1339.	2183.	847.	2186.
RUN	65	1.000	1339.	2183.	847.	2186.
	70	1.000	1569.	2663.	546.	2115.
RUN	70	1.000	1569.	2663.	546.	2115.
	75	1.000	2155.	3546.	996.	3151.

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NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 2"-LS-118-AB OUTSIDE CONTAINMENT PENETRATION S5-D

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ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ. 8 (PSI)	OCCASIONAL STRESS EQ. 9 (PSI)	EXPANSION STRESS EQ. 10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ. 11 (PSI)
FGRUN	75	1.000	2155.	3546.	996.	3151.
	80	1.000	2424.	3913.	2197.	4621.
ELBOW	80	1.732	2976.	4911.	3807.	6782.
	85	1.732	2759.	4706.	4329.	7087.
FGRUN	85	1.000	2257.	3755.	2499.	4755.
	90	1.000	2135.	3676.	1971.	4106.
RUN	90	1.000	2135.	3676.	1971.	4106.
	95	1.000	4399.	6400.	1346.	5745.
RUN	95	1.000	4399.	6400.	1346.	5745.
	100	1.000	3189.	4628.	701.	3890.
RUN	100	1.000	3189.	4628.	701.	3890.
	105	1.000	1854.	3110.	112.	1966.
FGRUN	105	1.000	1854.	3110.	112.	1966.
	110	1.000	1994.	2557.	118.	2113.
RUN	115	1.000	1454.	1784.	0.	1454.
	120	1.000	578.	578.	0.	578.
FGRUN	125	1.000	1187.	1721.	123.	1310.
	130	1.000	1202.	2071.	130.	1332.
FGRUN	130	1.000	1202.	2071.	130.	1332.
	135	1.000	987.	2002.	87.	1074.
RUN	140	1.000	1454.	1802.	0.	1454.
	145	1.000	578.	578.	0.	578.
FGRUN	150	1.000	1423.	2559.	122.	1545.
	155	1.000	1420.	2505.	175.	1594.
FGRUN	155	1.000	1420.	2505.	175.	1594.
	160	1.000	1367.	2348.	283.	1650.
FGRUN	160	1.000	1367.	2348.	283.	1650.
	165	1.000	1213.	2059.	442.	1655.

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ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NGDE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ. 8 (PSI)	OCCASIONAL STRESS EQ. 9 (PSI)	EXPANSION STRESS EQ. 10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ. 11 (PSI)
RUN	165	1.000	1213.	2059.	442.	1655.
	170	1.000	1092.	1537.	220.	1312.
FGRUN	170	1.000	1092.	1537.	220.	1312.
	175	1.000	1515.	2314.	764.	2279.
ELBOW	175	1.732	1796.	2834.	1323.	3119.
	180	1.732	1839.	2791.	785.	2624.
FGRUN	180	1.000	1549.	2281.	453.	2002.
	185	1.000	1385.	2032.	362.	1747.
ELBOW	185	1.732	1626.	2467.	628.	2254.
	190	1.732	1693.	2750.	1163.	2856.
FGRUN	190	1.000	1436.	2250.	672.	2108.
	195	1.000	2691.	4039.	95.	2786.
RUN	195	1.000	2691.	4039.	95.	2786.
	200	1.000	1071.	1534.	77.	1148.
RUN	200	1.000	1071.	1534.	77.	1148.
	205	1.000	1978.	2868.	77.	2056.
RUN	205	1.000	1978.	2868.	77.	2056.
	210	1.000	2534.	3836.	97.	2632.
RUN	210	1.000	2534.	3836.	97.	2632.
	215	1.000	2337.	3489.	128.	2465.
RUN	215	1.000	2337.	3489.	128.	2465.
	220	1.000	1640.	2305.	157.	1797.
RUN	220	1.000	1640.	2305.	157.	1797.
	225	1.000	1147.	1619.	187.	1334.
FGRUN	225	1.000	1147.	1619.	187.	1334.
	230	1.000	2501.	3689.	214.	2715.
ELBOW	230	1.732	3076.	4620.	371.	3447.
	235	1.732	3253.	4956.	360.	3612.

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ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
FGRUN	235 240	1.000 1.000	2637. 2304.	3948. 4198.	208. 1665.	2844. 3969.

APPENDIX G
LEVEL C SERVICE CONDITIONS
STRESS ANALYSIS RESULTS

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ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ. 8 (PSI)	OCCASIONAL STRESS EQ. 9 (PSI)	EXPANSION STRESS EQ. 10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ. 11 (PSI)
FGRUN	5	1.000	3545.	11331.	0.	3545.
	10	1.000	2252.	8030.	0.	2252.
RUN	10	1.000	2252.	8030.	0.	2252.
	15	1.000	1357.	5266.	0.	1357.
RUN	15	1.000	1357.	5266.	0.	1357.
	20	1.000	1025.	3380.	0.	1025.
RUN	20	1.000	1025.	3380.	0.	1025.
	25	1.000	1154.	2662.	0.	1154.
FGRUN	25	1.000	1154.	2662.	0.	1154.
	30	1.000	1278.	2843.	0.	1278.
ELBOW	30	1.732	1487.	3521.	0.	1487.
	35	1.732	1461.	3523.	0.	1461.
FGRUN	35	1.000	1258.	2845.	0.	1258.
	40	1.000	1049.	2685.	0.	1049.
FGRUN	40	1.000	1049.	2685.	0.	1049.
	45	1.000	1255.	3233.	0.	1255.
ELBOW	45	1.732	1457.	4028.	0.	1457.
	50	1.732	1544.	4171.	0.	1544.
FGRUN	50	1.000	1321.	3344.	0.	1321.
	55	1.000	1203.	3050.	0.	1203.
RUN	55	1.000	1203.	3050.	0.	1203.
	60	1.000	1196.	2839.	0.	1196.
RUN	60	1.000	1196.	2839.	0.	1196.
	65	1.000	1339.	3026.	0.	1339.
RUN	65	1.000	1339.	3026.	0.	1339.
	70	1.000	1569.	3757.	0.	1569.
RUN	70	1.000	1569.	3757.	0.	1569.
	75	1.000	2155.	4937.	0.	2155.

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ASME SECTION III CLASS 2 OR ANSI 831.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ. 8 (PSI)	OCCASIONAL STRESS EQ. 9 (PSI)	EXPANSION STRESS EQ. 10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ. 11 (PSI)
FGRUN	75	1.000	2155.	4937.	0.	2155.
	80	1.000	2424.	5402.	0.	2424.
ELBOW	80	1.732	2976.	6846.	0.	2976.
	85	1.732	2759.	6653.	0.	2759.
FGRUN	85	1.000	2257.	5253.	0.	2257.
	90	1.000	2135.	5218.	0.	2135.
RUN	90	1.000	2135.	5218.	0.	2135.
	95	1.000	4399.	8401.	0.	4399.
RUN	95	1.000	4399.	8401.	0.	4399.
	100	1.000	3189.	6067.	0.	3189.
RUN	100	1.000	3189.	6067.	0.	3189.
	105	1.000	1854.	4365.	0.	1854.
FGRUN	105	1.000	1854.	4365.	0.	1854.
	110	1.000	1994.	3120.	0.	1994.
RUN	115	1.000	1454.	2113.	0.	1454.
	120	1.000	578.	578.	0.	578.
FGRUN	125	1.000	1187.	2255.	0.	1187.
	130	1.000	1202.	2940.	0.	1202.
FGRUN	130	1.000	1202.	2940.	0.	1202.
	135	1.000	987.	3018.	0.	987.
RUN	140	1.000	1454.	2150.	0.	1454.
	145	1.000	578.	578.	0.	578.
FGRUN	150	1.000	1423.	3696.	0.	1423.
	155	1.000	1420.	3590.	0.	1420.
FGRUN	155	1.000	1420.	3590.	0.	1420.
	160	1.000	1367.	3329.	0.	1367.
FGRUN	160	1.000	1367.	3329.	0.	1367.
	165	1.000	1213.	2905.	0.	1213.

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ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
RUN	165	1.000	1213.	2905.	0.	1213.
	170	1.000	1092.	1981.	0.	1092.
FGRUN	170	1.000	1092.	1981.	0.	1092.
	175	1.000	1515.	3113.	0.	1515.
ELBOW	175	1.732	1796.	3871.	0.	1796.
	180	1.732	1839.	3743.	0.	1839.
FGRUN	180	1.000	1549.	3014.	0.	1549.
	185	1.000	1385.	2680.	0.	1385.
ELBOW	185	1.732	1626.	3309.	0.	1626.
	190	1.732	1693.	3807.	0.	1693.
FGRUN	190	1.000	1436.	3063.	0.	1436.
	195	1.000	2691.	5386.	0.	2691.
RUN	195	1.000	2691.	5386.	0.	2691.
	200	1.000	1071.	1996.	0.	1071.
RUN	200	1.000	1071.	1996.	0.	1071.
	205	1.000	1978.	3759.	0.	1978.
RUN	205	1.000	1978.	3759.	0.	1978.
	210	1.000	2534.	5137.	0.	2534.
RUN	210	1.000	2534.	5137.	0.	2534.
	215	1.000	2337.	4640.	0.	2337.
RUN	215	1.000	2337.	4640.	0.	2337.
	220	1.000	1640.	2970.	0.	1640.
RUN	220	1.000	1640.	2970.	0.	1640.
	225	1.000	1147.	2090.	0.	1147.
FGRUN	225	1.000	1147.	2090.	0.	1147.
	230	1.000	2501.	4877.	0.	2501.
ELBOW	230	1.732	3076.	6164.	0.	3076.
	235	1.732	3253.	6660.	0.	3253.

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ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
FGRUN	235 240	1.000 1.000	2637. 2304.	5259. 6092.	0. 0.	2637. 2304.

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APPENDIX H
LEVEL D SERVICE CONDITIONS
STRESS ANALYSIS RESULTS

THERE ARE NO LEVEL D SERVICE CONDITIONS
APPLICABLE TO THIS SYSTEM

APPENDIX I
COMPONENT SUPPORT ANALYSIS RESULTS

THIS SYSTEM CONTAINS NO SUPPORTS
WHICH REQUIRE ANALYSIS