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LOFT TECHNICAL REPORT LTR 125-8

RE & C INTERNAL REPORT RE-A-78-164

NOVEMBER 13, 1978

LOFT CIS ANALYSIS

PENETRATION S-7A 8" WW - 172-AB

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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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INTERNAL TECHNICAL REPORT

Title: LOFT CIS Analysis
Penetration S-7A 8" WW - 172-AB

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LOFT TECHNICAL REPORT
LOFT PROGRAM

FORM EG&G-229
(Rev. 12-76)

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ABSTRACT

The 8" WW - 172 - AB line from the containment penetration S-7A was analyzed to ASME Code, Subsection NC (Class 2) criteria. This section of piping is part of the LOFT Containment Isolation System. The model considered the line from the penetration S-7A outward through two horizontal-plane elbows and then through three valves to a wall penetration. Results of the analysis show that the system will meet Class 2 requirements if additional support/restraint is installed at three locations besides the existing restraints. The locations and loads for these supports/restraints are included in the body of the 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 8" WW-172-AB line from the S-7A penetration of the LOFT containment.

*Hereafter referred to as the Code^[1].

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 design specification^[2].

III. PIPING SYSTEM DESCRIPTION

The 8" WW-172-AB line being analyzed runs directly east from LØFT containment penetration S-7A through two horizontal bends and then east again through three valves and into the wall facing the containment. Original supports included one at each valve operator and four vertical supports in the region of the valves.

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)	8.625
Thickness (inches)	.322
Weight (lbs/inch)	50.3
Material	A 106 GR. B
E_{cold} (10^6 psi)	27.9
S (200°F) (psi)	15000
S_y (psi)	32000
α (10^{-6} in./in.°F)	6.67

LOFT DIS ANALYSIS - S-7A PENETRATION DUC
NUPIPE MATHEMATICAL MODEL

==LEGEND==

- / - NODE LOCATION
- - MASSPOINT LOCATION
- ←- - SPRING HANGER
- - SNUBBER
- ↑ - RIGID SUPPORT
- ≡ - ANCHOR
- * - ELASTO JOINT
- ≡ - FLEXIBLE ANCHOR
- ⊞ - VALVE

ROTATION ABOUT Y-AXIS = -44.8EC.
X-Z PLANE TILT = 45.40EC.

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 design specification.

1. DESIGN CONDITIONS

An internal pressure of 150 psi and a design temperature of 200°F was used in this model.⁽⁴⁾

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:

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

K&E
10 X 10 TO 1/4 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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>
CV-P-11-7	1000 lb.	2.67 ft
CV-P-11-61	1000 lb.	2.67 ft
Gate Valve (assumed)	700 lb.	0

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	8.625	15000	.123	.322

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

Level D service conditions do not apply to this system.

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.

TABLE III

LOADS 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>
Rigid Horizontal	1	0	219	2584	5707	N.A. (New)
Rigid Vertical	2	610	0	71	142	N.A. (New)
Rigid Vertical	3	389	0	60	119	N.A. (New)
Rigid Horizontal	4	0	16046	1803	3606	N.A. (New)
Rigid Vertical	5	182	0	12	23	N.A.
Rigid Vertical	6	146	0	13	25	N.A. (New)
Rigid Horizontal	7	0	1052	1257	2513	N.A. (New)
Rigid Vertical	8	893	0	132	263	N.A.
Rigid Vertical	9	338	0	15	29	N.A.
Rigid Vertical	10	1056	0	175	349	N.A.
Rigid Vertical	11	695	0	58	116	N.A.
Rigid Vertical	12	542	0	51	102	N.A.

VIII. SPECIAL CONSIDERATIONS

Three additional locations require support for this system to pass Class 2 requirements. They are at nodes 15, 25, and 35 as shown on Figure 1.

IX. CONCLUSIONS

The piping system addressed in this report was analyzed for the loads and operating conditions given in the design specification 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. SDD 1.2.5, Radioactive and Chemical Liquid Waste System.
3. American Institute of Steel Construction, Manual of Steel Construction, Seventh Edition, pp 5-6 to 5-24, 1973.
4. Telecon w/N. B. Smith, 10:45 am 03-02-78.

APPENDIX A
BASIC DATA, INPUT PARAMETERS

03/07/78

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

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WXB-05

*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
XSECT	0	1	.863E+01	.322E+00	.503E+02	.279E+02	.150E+03	0.
OPVAL	1	1	.277E+02	.990E-02	0.	0.	.150E+03	0.
CHECK MAGNITUDE OF ENTRIES ON ABOVE OPVAL CARD ****								
ANCHOR	0	1	0.	0.	0.	0.	0.	0.
FGRUN	1	5	0.	0.	.550E+01	.100E+01	.100E+01	0.
MASSPT	0	5	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	5	10	0.	0.	.550E+01	.100E+01	.100E+01	0.
MASSPT	0	10	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	10	15	0.	0.	.550E+01	.100E+01	.100E+01	0.
MASSPT	0	15	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	15	.100E+06	.100E+06	0.	0.	0.	0.
FGRUN	15	20	0.	0.	.800E+01	.100E+01	.100E+01	0.
MASSPT	0	20	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	20	25	0.	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	25	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	25	0.	.100E+06	.100E+06	0.	0.	0.
FGRUN	25	30	.650E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	30	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	30	0.	.100E+06	0.	0.	0.	0.
FGRUN	30	35	.150E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	35	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	35	0.	.100E+06	.100E+06	0.	0.	0.
ELBOW	35	40	0.	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	40	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	40	45	0.	0.	.125E+01	.100E+01	.100E+01	0.
MASSPT	0	45	.100E+01	.100E+01	.100E+01	0.	0.	0.

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NUPIPE-11M - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
LOFT CTS ANALYSIS - 8-7A PENETRATION DUCT (8 MM-172-26) MKB-05

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CARDTYPE	11	12	*** INPUT DATA ***					
			DELTA:11	DELTA:12	DELTA:13	DELTA:14	DELTA:15	DELTA:16
VALVE	45	50	0	0.	.100E+01	.100E+01	.100E+01	0.
MASSPT	5	50	.100E+01	.100E+01	.100E+01	0.	0	0.
CHEIGHT	0	50	0	.100E+01	0.	0.	0.	0.
RUN	55	55	-267E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	5	55	.100E+04	.100E+04	.100E+04	0.	0.	0.
CHEIGHT	5	55	0.	.100E+04	0.	0.	0.	0.
RESTRAINT	0	55	0	.701E+05	0.	0.	0.	0.
VALVE	55	55	0	0.	.100E+01	.100E+01	.100E+01	0.
MASSPT	0	55	.100E+01	.100E+01	.100E+01	0.	0.	0.
FORUM	60	65	0.	0	.700E+00	.100E+01	.100E+01	0.
MASSPT	0	65	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	65	0.	.100E+05	0.	0.	0.	0.
FORUM	65	70	0	0.	.700E+00	.100E+01	.100E+01	0.
MASSPT	5	70	.100E+01	.100E+01	.100E+01	0.	0.	0.
VALVE	70	75	0.	0.	.100E+01	.100E+01	.100E+01	0.
MASSPT	0	75	.100E+01	.100E+01	.100E+01	0.	0.	0.
CHEIGHT	0	75	0.	.100E+01	0.	0.	0.	0.
RUN	75	80	-267E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	80	.100E+04	.100E+04	.100E+04	0.	0.	0.
CHEIGHT	0	80	0.	.100E+04	0.	0.	0.	0.
RESTRAINT	0	80	0	.701E+05	0.	0.	0.	0.
VALVE	75	85	0.	0.	.100E+01	.100E+01	.100E+01	0.
MASSPT	0	85	.100E+01	.100E+01	.100E+01	0.	0.	0.
FORUM	85	90	0	0.	.100E+01	.100E+01	.100E+01	0.
MASSPT	0	90	.100E+01	.100E+01	.100E+01	0.	0.	0.

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WX3-05

*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
RESTRAINT	0	90	0.	.100E+06	0.	0.	0.	0.
FGRUN	90	95	0.	0.	.350E+01	.100E+01	.100E+01	0.
MASSPT	0	95	.100E+01	.100E+01	.100E+01	0.	0.	0.
VALVE	95	100	0.	0.	.100E+01	.100E+01	.100E+01	0.
MASSPT	0	100	.700E+03	.700E+03	.700E+03	0.	0.	0.
CWEIGHT	0	100	0.	.700E+03	0.	0.	0.	0.
VALVE	100	105	0.	0.	.100E+01	.100E+01	.100E+01	0.
MASSPT	0	105	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	105	110	0.	0.	.200E+01	.100E+01	.100E+01	0.
MASSPT	0	110	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	110	0.	.100E+06	0.	0.	0.	0.
FGRUN	110	115	0.	0.	.200E+01	.100E+01	.100E+01	0.
MASSPT	0	115	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	115	.100E+06	.100E+06	0.	0.	0.	0.
STRESS7	0	0	0.	0.	0.	0.	0.	0.
9CASES		0	1	0	3	0	0	0
10CASES		0	0	0	0	0	0	0
CKNODES		0	0	0	0	0	0	0
ALLDONE		0	0	0	0	0	0	0

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WX8-05

STRAIGHT ELEMENTS

MEMBER	END NI	END NJ	SECTION NUMBER	LENGTH FT	OUTSIDE DIAMETER IN	WALL THICKNESS IN	WEIGHT LB/FT	MODULUS COLD * 1.0E-6 PSI	OPERATING VALUE
FGRUN	1	5	1	5.50	8.625	.3220	50.25	27.90000	1
FGRUN	5	10	1	5.50	8.625	.3220	50.25	27.90000	1
FGRUN	10	15	1	5.50	8.625	.3220	50.25	27.90000	1
FGRUN	15	20	1	7.00	8.625	.3220	50.25	27.90000	1
FGRUN	25	30	1	5.50	8.625	.3220	50.25	27.90000	1
FGRUN	30	35	1	.50	8.625	.3220	50.25	27.90000	1
FGRUN	40	45	1	.25	8.625	.3220	50.25	27.90000	1
VALVE	45	50	1	1.00	8.625	.3220	50.25	27.90000	1
RUN	50	55	1	2.67	8.625	.3220	50.25	27.90000	1
VALVE	50	60	1	1.00	8.625	.3220	50.25	27.90000	1
FGRUN	60	65	1	.75	8.625	.3220	50.25	27.90000	1
FGRUN	65	70	1	.75	8.625	.3220	50.25	27.90000	1
VALVE	70	75	1	1.00	8.625	.3220	50.25	27.90000	1
RUN	75	80	1	2.67	8.625	.3220	50.25	27.90000	1
VALVE	75	85	1	1.00	8.625	.3220	50.25	27.90000	1
FGRUN	85	90	1	1.00	8.625	.3220	50.25	27.90000	1
FGRUN	90	95	1	3.50	8.625	.3220	50.25	27.90000	1
VALVE	95	100	1	1.00	8.625	.3220	50.25	27.90000	1
VALVE	100	105	1	1.00	8.625	.3220	50.25	27.90000	1
FGRUN	105	110	1	2.00	8.625	.3220	50.25	27.90000	1
FGRUN	110	115	1	2.00	8.625	.3220	50.25	27.90000	1

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WX6-05

ELBOW ELEMENTS

MEMBER	END NI	END NJ	SECTION NUMBER	RADIUS IN	OUTSIDE DIAMETER IN	WALL THICKNESS IN	WEIGHT LB/FT	MODULUS COLD * 1.0E+6 PSI	OPERATING VALUE
ELBOW	20	25	1	12.00	8.625	.3220	50.25	27.90000	1
ELBOW	35	40	1	12.00	8.625	.3220	50.25	27.90000	1

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WXB-05

OPERATING CONDITIONS

OPERATING VALUE	MODE	MODULUS HOT * 1.0E-6	ALPHA T-BAR	ALPHA DT-1	ALPHA DT-2	OPERATING PRESSURE	ALLOWABLE STRESS
		PSI	IN/FT	IN/FT	IN/FT	PSI	PSI

1	1	27.70000	.9900000E-02	0.	0.	150.0000	0.00
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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (6 WK-172-AB) WX3-05

STATIC RESTRAINT TABLE

NODE	TYPE	STIFFNESS TRANS LF/IN ROT FT-LF/RAD	DIRECTION	DIRECTION COSINES FOR SKEW RESTRAINTS		
				X	Y	Z
1	TRANS	.1449785E+13	X			
1	TRANS	.1449785E+13	Y			
1	TRANS	.1449785E+13	Z			
1	ROT	.1449785E+13	X			
1	ROT	.1449785E+13	Y			
1	ROT	.1449785E+13	Z			
15	TRANS	.1000000E+06	X			
15	TRANS	.1000000E+06	Y			
25	TRANS	.1000000E+06	Y			
25	TRANS	.1000000E+06	Z			
30	TRANS	.1000000E+06	Y			
35	TRANS	.1000000E+06	Y			
35	TRANS	.1000000E+06	Z			
55	TRANS	.7608500E+05	Y			
65	TRANS	.1000000E+06	Y			
80	TRANS	.7608500E+05	Y			
90	TRANS	.1000000E+06	Y			
110	TRANS	.1000000E+06	Y			
115	TRANS	.1000000E+06	X			
115	TRANS	.1000000E+06	Y			

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WX8-05

SECTION PROPERTIES

NSECT	OUTSIDE DIAMETER	WALL THICKNESS	WEIGHT	MODULUS COLD * 1.0E-6	DESIGN PRESSURE	WELD REF.NO.
	IN	IN	LB/FT	PSI	PSI	

1	8.625	.3220	50.25	27.90000	150.00	0
---	-------	-------	-------	----------	--------	---

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WX8-05

*** NODE GLOBAL COORDINATES ***

POINT NO.	X-COORDINATE (FT)	Y-COORDINATE (FT)	Z-COORDINATE (FT)
1	0.000	0.000	0.000
5	0.000	0.000	5.500
10	0.000	0.000	11.000
15	0.000	0.000	16.500
20	0.000	0.000	23.500
25	1.000	0.000	24.500
30	6.500	0.000	24.500
35	7.000	0.000	24.500
40	8.000	0.000	25.500
45	8.000	0.000	25.750
50	8.000	0.000	26.750
55	5.330	0.000	26.750
60	8.000	0.000	27.750
65	8.000	0.000	28.500
70	8.000	0.000	29.250
75	8.000	0.000	30.250
80	5.330	0.000	30.250
85	8.000	0.000	31.250
90	8.000	0.000	32.250
95	8.000	0.000	33.750
100	8.000	0.000	36.750
105	8.000	0.000	37.750
110	8.000	0.000	39.750
115	8.000	0.000	41.750

TOTAL STATIC DEGREES OF FREEDOM = 144

 

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (S WW-172-AB) WX8-05

*** LUMPED MASS TABLE ***

POINT NO.	X-COORDINATE LBS	Y-COORDINATE LBS	Z-COORDINATE LBS
5	414.563	414.563	414.563
10	276.375	276.375	276.375
15	314.063	314.063	314.063
20	215.341	215.341	215.341
25	177.654	177.654	177.654
30	150.750	150.750	150.750
35	52.029	52.029	52.029
40	45.748	45.748	45.748
45	31.406	31.406	31.406
50	118.334	118.334	118.334
55	1000.000	1000.000	1000.000
60	43.969	43.969	43.969
65	37.688	37.688	37.688
70	43.969	43.969	43.969
75	118.334	118.334	118.334
80	1000.000	1000.000	1000.000
85	50.250	50.250	50.250
90	113.063	113.063	113.063
95	113.063	113.063	113.063
100	700.000	700.000	700.000
105	75.375	75.375	75.375
110	100.500	100.500	100.500
115	50.250	50.250	50.250
TOTAL SYSTEM	5242.720	5242.720	5242.720

TOTAL DYNAMIC DEGREES OF FREEDOM = 69

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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.

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APPENDIX C
WEIGHT ANALYSIS RESULTS

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WXS-05

SUPPORT REACTIONS FOR LOAD CASE NO. 1

DEADWEIGHT

NODE	TYPE	REACTION (LBS OR IN-LBS)	DIRECTION
------	------	-----------------------------	-----------

1	FORCE	0.	X COORD
1	FORCE	456.	Y COORD
1	FORCE	0.	Z COORD
1	MOMENT	-16158.	X COORD
1	MOMENT	0.	Y COORD
1	MOMENT	-399.	Z COORD
15	FORCE	0.	X COORD
15	FORCE	610.	Y COORD
25	FORCE	389.	Y COORD
25	FORCE	0.	Z COORD
30	FORCE	182.	Y COORD
35	FORCE	146.	Y COORD
35	FORCE	0.	Z COORD
55	FORCE	893.	Y COORD
65	FORCE	338.	Y COORD
80	FORCE	1056.	Y COORD
90	FORCE	695.	Y COORD
110	FORCE	542.	Y COORD
115	FORCE	0.	X COORD
115	FORCE	111.	Y COORD

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LOFT CIS ANALYSIS - S-7A PENETRATION DOCT (8 WW-172-A3) WXB-05

EXTERNAL FORCES FOR LOAD CASE NO. 1

DEADWEIGHT

NODE	TYPE	FORCES(LBS OR IN-LBS)	AXIS
------	------	-----------------------	------

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-46) WXB-05

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	1	0.	466.	0.	-16158.	0.	-399.	0.000	-0.000	0.000	.0000	0.0000	.0000
	5	0.	-190.	0.	-5475.	0.	399.	0.000	-0.010	0.000	.0002	0.0000	.0000
FGRUN	5	0.	190.	0.	5475.	0.	-399.	0.000	-0.010	0.000	.0002	0.0000	.0000
	10	0.	87.	0.	-8866.	0.	399.	0.000	-0.015	0.000	-.0001	0.0000	.0000
FGRUN	10	0.	-87.	0.	8866.	0.	-399.	0.000	-0.015	0.000	-.0001	0.0000	.0000
	15	0.	363.	0.	5983.	0.	399.	0.000	-0.006	0.000	-.0001	0.0000	.0001
FGRUN	15	0.	246.	0.	-5983.	0.	-399.	0.000	-0.006	0.000	-.0001	0.0000	.0001
	20	0.	105.	0.	55.	0.	399.	0.000	-0.004	0.000	.0000	0.0000	.0001
ELBOW	20	0.	-105.	0.	-55.	0.	-399.	0.000	-0.004	0.000	.0000	0.0000	.0001
	25	0.	184.	0.	1793.	0.	-1338.	0.000	-0.004	0.000	.0001	0.0000	.0000
FGRUN	25	0.	205.	0.	-1793.	0.	1338.	0.000	-0.004	0.000	.0001	0.0000	.0000
	30	0.	72.	0.	1793.	0.	3049.	0.000	-0.002	0.000	.0001	0.0000	.0001
FGRUN	30	0.	111.	0.	-1793.	0.	-3049.	0.000	-0.002	0.000	.0001	0.0000	.0001
	35	0.	-85.	0.	1793.	0.	3637.	0.000	-0.001	0.000	.0001	0.0000	.0001
ELBOW	35	0.	231.	0.	-1793.	0.	-3637.	0.000	-0.001	0.000	.0001	0.0000	.0001
	40	0.	-152.	0.	-506.	0.	5935.	0.000	-0.001	0.000	.0001	0.0000	.0002
FGRUN	40	0.	152.	0.	506.	0.	-5935.	0.000	-0.001	0.000	.0001	0.0000	.0002
	45	0.	-139.	0.	-943.	0.	5935.	0.000	-0.001	0.000	.0001	0.0000	.0003
VALVE	45	0.	139.	0.	943.	0.	-5935.	0.000	-0.001	0.000	.0001	0.0000	.0003
	50	0.	-89.	0.	-2315.	0.	5935.	0.000	-0.002	0.000	.0001	0.0000	.0003
RUN	50	0.	241.	0.	0.	0.	-5574.	0.000	-0.002	0.000	.0001	0.0000	.0003
	55	0.	-107.	0.	0.	0.	0.	0.000	-0.012	0.000	.0001	0.0000	.0003
VALVE	50	0.	-153.	0.	2315.	0.	-361.	0.000	-0.002	0.000	.0001	0.0000	.0003
	60	0.	203.	0.	-180.	0.	361.	0.000	-0.003	0.000	.0001	0.0000	.0003
FGRUN	60	0.	-203.	0.	180.	0.	-361.	0.000	-0.003	0.000	.0001	0.0000	.0003
	65	0.	241.	0.	1817.	0.	361.	0.000	-0.003	0.000	.0001	0.0000	.0003
FGRUN	65	0.	-97.	0.	-1817.	0.	-361.	0.000	-0.003	0.000	.0001	0.0000	.0003
	70	0.	-60.	0.	1110.	0.	361.	0.000	-0.004	0.000	.0001	0.0000	.0003

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (B WW-172-AB) WX8-05

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
VALVE	70	0.	60.	0.	-1110.	0.	-361.	0.000	-.004	0.000	.0001	0.0000	.0003
	75	0.	-9.	0.	695.	0.	361.	0.000	-.005	0.000	.0001	0.0000	.0003
RUN	75	0.	78.	0.	0.	0.	-361.	0.000	-.005	0.000	.0001	0.0000	.0003
	80	0.	56.	0.	-0.	0.	0.	0.000	-.014	0.000	.0001	0.0000	.0003
VALVE	75	0.	-70.	0.	-695.	0.	-0.	0.000	-.005	0.000	.0001	0.0000	.0003
	85	0.	120.	0.	1835.	0.	0.	0.000	-.006	0.000	.0001	0.0000	.0003
FGRUN	85	0.	-120.	0.	-1835.	0.	0.	0.000	-.006	0.000	.0001	0.0000	.0003
	90	0.	170.	0.	3579.	0.	-0.	0.000	-.007	0.000	.0001	0.0000	.0003
FGRUN	90	0.	524.	0.	-3579.	0.	0.	0.000	-.007	0.000	.0001	0.0000	.0003
	95	0.	-348.	0.	-14751.	0.	-0.	0.000	-.010	0.000	-.0000	0.0000	.0003
VALVE	95	0.	348.	0.	14751.	0.	0.	0.000	-.010	0.000	-.0000	0.0000	.0003
	100	0.	-298.	0.	-18632.	0.	0.	0.000	-.010	0.000	-.0001	0.0000	.0003
VALVE	100	0.	-402.	0.	18632.	0.	0.	0.000	-.010	0.000	-.0001	0.0000	.0003
	105	0.	452.	0.	-13509.	0.	0.	0.000	-.009	0.000	-.0001	0.0000	.0003
FGRUN	105	0.	-452.	0.	13509.	0.	0.	0.000	-.009	0.000	-.0001	0.0000	.0003
	110	0.	553.	0.	-1455.	0.	0.	0.000	-.005	0.000	-.0002	0.0000	.0003
FGRUN	110	0.	-10.	0.	1455.	0.	0.	0.000	-.005	0.000	-.0002	0.0000	.0003
	115	0.	111.	0.	-0.	0.	0.	0.000	-.001	0.000	-.0002	0.0000	.0003

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APPENDIX D
THERMAL EXPANSION ANALYSIS RESULTS

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WXB-05

SUPPORT REACTIONS FOR LOAD CASE NO. 2

THERMAL EXPANSION PLUS ANCHOR MOVEMENTS

NODE	TYPE	REACTION (LBS OR IN-LBS)	DIRECTION
1	FORCE	391.	X COORD
1	FORCE	0.	Y COORD
1	FORCE	14994.	Z COORD
1	MOMENT	0.	X COORD
1	MOMENT	25416.	Y COORD
1	MOMENT	0.	Z COORD
15	FORCE	-219.	X COORD
15	FORCE	0.	Y COORD
25	FORCE	0.	Y COORD
25	FORCE	-16046.	Z COORD
30	FORCE	0.	Y COORD
35	FORCE	0.	Y COORD
35	FORCE	1052.	Z COORD
55	FORCE	0.	Y COORD
65	FORCE	0.	Y COORD
80	FORCE	0.	Y COORD
90	FORCE	0.	Y COORD
110	FORCE	0.	Y COORD
115	FORCE	-172.	X COORD
115	FORCE	0.	Y COORD

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (B WW-172-AB) WXB-05

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	1	391.	0.	-14994.	0.	25418.	0.	-.000	0.000	-.000	0.0000	-.0000	0.0000
	5	-391.	0.	-14994.	0.	404.	0.	-.019	0.000	.050	0.0000	-.0004	0.0000
FGRUN	5	391.	0.	-14994.	0.	-404.	0.	-.019	0.000	.050	0.0000	-.0004	0.0000
	10	-391.	0.	-14994.	0.	26223.	0.	-.036	0.000	.100	0.0000	.0000	0.0000
FGRUN	10	391.	0.	-14994.	0.	-26223.	0.	-.036	0.000	.100	0.0000	.0000	0.0000
	15	-391.	0.	-14994.	0.	52043.	0.	.002	0.000	.151	0.0000	.0013	0.0000
FGRUN	15	391.	0.	-14994.	0.	-52043.	0.	.002	0.000	.151	0.0000	.0013	0.0000
	20	-172.	0.	-14994.	0.	66487.	0.	.211	0.000	.215	0.0000	.0038	0.0000
ELBOW	20	172.	0.	-14994.	0.	-66487.	0.	.211	0.000	.215	0.0000	.0038	0.0000
	25	-172.	0.	-14994.	0.	-111372.	0.	.281	0.000	.160	0.0000	.0039	0.0000
FGRUN	25	172.	0.	-1052.	0.	111372.	0.	.281	0.000	.160	0.0000	.0039	0.0000
	30	-172.	0.	1052.	0.	-41910.	0.	.335	0.000	-.002	0.0000	.0014	0.0000
FGRUN	30	172.	0.	-1052.	0.	41910.	0.	.335	0.000	-.002	0.0000	.0014	0.0000
	35	-172.	0.	1052.	0.	-35595.	0.	.340	0.000	-.011	0.0000	.0013	0.0000
ELBOW	35	172.	0.	-0.	0.	35595.	0.	.340	0.000	-.011	0.0000	.0013	0.0000
	40	-172.	0.	0.	0.	-33531.	0.	.347	0.000	-.006	0.0000	-.0011	0.0000
FGRUN	40	172.	0.	-0.	0.	33531.	0.	.347	0.000	-.006	0.0000	-.0011	0.0000
	45	-172.	0.	0.	0.	-33016.	0.	.344	0.000	-.003	0.0000	-.0011	0.0000
VALVE	45	172.	0.	-0.	0.	33016.	0.	.344	0.000	-.003	0.0000	-.0011	0.0000
	50	-172.	0.	0.	0.	-30952.	0.	.330	0.000	.007	0.0000	-.0012	0.0000
RUN	50	0.	0.	0.	0.	0.	0.	.330	0.000	.007	0.0000	-.0012	0.0000
	55	-0.	0.	-0.	0.	0.	0.	.304	0.000	-.031	0.0000	-.0012	0.0000
VALVE	50	172.	0.	-0.	0.	30952.	0.	.330	0.000	.007	0.0000	-.0012	0.0000
	60	-172.	0.	0.	0.	-28389.	0.	.315	0.000	.016	0.0000	-.0012	0.0000
FGRUN	60	172.	0.	-0.	0.	28389.	0.	.315	0.000	.016	0.0000	-.0012	0.0000
	65	-172.	0.	0.	0.	-27341.	0.	.303	0.000	.024	0.0000	-.0014	0.0000
FGRUN	65	172.	0.	-0.	0.	27341.	0.	.303	0.000	.024	0.0000	-.0014	0.0000
	70	-172.	0.	0.	0.	-25793.	0.	.291	0.000	.031	0.0000	-.0015	0.0000

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WX8-05

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
VALVE	70	172.	0.	-0.	0.	25793.	0.	.291	0.000	.031	0.0000	-.0015	0.0000
	75	-172.	0.	0.	0.	-23730.	0.	.272	0.000	.041	0.0000	-.0015	0.0000
RUN	75	-0.	0.	0.	0.	0.	0.	.272	0.000	.041	0.0000	-.0015	0.0000
	80	0.	0.	-0.	0.	0.	0.	.246	0.000	-.008	0.0000	-.0015	0.0000
VALVE	75	172.	0.	-0.	0.	23730.	0.	.272	0.000	.041	0.0000	-.0015	0.0000
	85	-172.	0.	0.	0.	-21656.	0.	.254	0.000	.051	0.0000	-.0016	0.0000
FGRUN	85	172.	0.	-0.	0.	21666.	0.	.254	0.000	.051	0.0000	-.0016	0.0000
	90	-172.	0.	0.	0.	-19603.	0.	.234	0.000	.061	0.0000	-.0017	0.0000
FGRUN	90	172.	0.	-0.	0.	19603.	0.	.234	0.000	.061	0.0000	-.0017	0.0000
	95	-172.	0.	0.	0.	-12381.	0.	.154	0.000	.096	0.0000	-.0020	0.0000
VALVE	95	172.	0.	-0.	0.	12381.	0.	.154	0.000	.096	0.0000	-.0020	0.0000
	100	-172.	0.	0.	0.	-10317.	0.	.130	0.000	.106	0.0000	-.0021	0.0000
VALVE	100	172.	0.	0.	0.	10317.	0.	.130	0.000	.106	0.0000	-.0021	0.0000
	105	-172.	0.	-0.	0.	-8254.	0.	.105	0.000	.115	0.0000	-.0021	0.0000
FGRUN	105	172.	0.	-0.	0.	8254.	0.	.105	0.000	.115	0.0000	-.0021	0.0000
	110	-172.	0.	0.	0.	-4127.	0.	.054	0.000	.135	0.0000	-.0022	0.0000
FGRUN	110	172.	0.	-0.	0.	4127.	0.	.054	0.000	.135	0.0000	-.0022	0.0000
	115	-172.	0.	0.	0.	-0.	0.	.002	0.000	.155	0.0000	-.0022	0.0000

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APPENDIX E
SEISMIC ANALYSES RESULTS

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WK-172-AB) WX8-05

SUPPORT REACTIONS FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING

COMBINED RESULT FOR MODE 1 THRU 12 BY RMS SUMMATION

SPECTRA SET = 1

MODE	TYPE	REACTIONS (LBS OR IN-LBS)	DIRECTION
1	FORCE	1791.	X COORD
1	FORCE	135.	Y COORD
1	FORCE	4989.	Z COORD
1	MOMENT	6470.	X COORD
1	MOMENT	109771.	Y COORD
1	MOMENT	165.	Z COORD
15	FORCE	5707.	X COORD
15	FORCE	142.	Y COORD
25	FORCE	119.	Y COORD
25	FORCE	3604.	Z COORD
30	FORCE	21.	Y COORD
35	FORCE	25.	Y COORD
35	FORCE	2513.	Z COORD
55	FORCE	263.	Y COORD
65	FORCE	29.	Y COORD
80	FORCE	349.	Y COORD
90	FORCE	116.	Y COORD
110	FORCE	102.	Y COORD
115	FORCE	1419.	X COORD
115	FORCE	15.	Y COORD

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WF-172-AB) WX8-05

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING

COMBINED RESULT FOR MODE 1 THRU 12 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	1	1791.	135.	4989.	6476.	109771.	165.	.000	.000	.000	.0000	.0000	.0000
	5	1791.	135.	4989.	2413.	9009.	165.	.078	.004	.001	.0001	.0017	.0000
FGRUN	5	1716.	18.	4988.	2413.	9009.	165.	.078	.004	.001	.0001	.0017	.0000
	10	1716.	18.	4988.	3537.	121427.	165.	.141	.005	.003	.0000	.0005	.0000
FGRUN	10	1651.	87.	4986.	3537.	121427.	165.	.141	.005	.003	.0000	.0005	.0000
	15	1651.	87.	4986.	2173.	229836.	165.	.057	.001	.004	.0001	.0062	.0000
FGRUN	15	4024.	26.	4984.	2173.	229836.	165.	.057	.001	.004	.0001	.0062	.0000
	20	4024.	26.	4984.	878.	108234.	165.	.789	.002	.006	.0000	.0087	.0000
ELBOW	20	3712.	63.	4981.	878.	108234.	165.	.789	.002	.006	.0000	.0087	.0000
	25	3712.	63.	4981.	437.	93052.	591.	.858	.001	.036	.0000	.0009	.0000
FGRUN	25	3434.	28.	1393.	437.	93052.	591.	.858	.001	.036	.0000	.0009	.0000
	30	3434.	28.	1393.	437.	10072.	1551.	.859	.000	.027	.0000	.0008	.0000
FGRUN	30	3200.	39.	1402.	437.	10072.	1551.	.859	.000	.027	.0000	.0008	.0000
	35	3200.	39.	1402.	437.	12902.	1722.	.859	.000	.025	.0000	.0005	.0000
ELBOW	35	3120.	48.	1772.	437.	12902.	1722.	.859	.000	.025	.0000	.0008	.0000
	40	3120.	48.	1772.	404.	38422.	2126.	.850	.001	.024	.0000	.0015	.0001
FGRUN	40	3050.	48.	1754.	404.	38422.	2126.	.850	.001	.024	.0000	.0015	.0001
	45	3050.	48.	1754.	507.	46615.	2126.	.846	.001	.024	.0000	.0016	.0001
VALVE	45	3003.	49.	1742.	507.	46615.	2126.	.846	.001	.024	.0000	.0016	.0001
	50	3003.	49.	1742.	1021.	80872.	2126.	.830	.000	.024	.0000	.0017	.0001
RUN	50	1535.	71.	657.	0.	21062.	2262.	.830	.000	.024	.0000	.0017	.0001
	55	1535.	71.	657.	0.	0.	0.	.830	.003	.071	.0000	.0018	.0001
VALVE	50	1374.	40.	1206.	1021.	76412.	1949.	.830	.000	.024	.0000	.0017	.0001
	60	1374.	40.	1206.	901.	92220.	1949.	.811	.000	.024	.0000	.0019	.0001
FGRUN	60	1314.	41.	1188.	901.	92220.	1949.	.811	.000	.024	.0000	.0019	.0001
	65	1314.	41.	1188.	975.	103533.	1949.	.795	.000	.024	.0000	.0022	.0001
FGRUN	65	1262.	36.	1172.	975.	103533.	1949.	.795	.000	.024	.0000	.0022	.0001
	70	1262.	36.	1172.	1024.	114537.	1949.	.774	.000	.024	.0000	.0027	.0001
VALVE	70	1201.	36.	1154.	1024.	114537.	1949.	.774	.000	.024	.0000	.0027	.0001
	75	1201.	36.	1154.	1231.	128548.	1949.	.743	.001	.025	.0000	.0029	.0001

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (3 WW-172-AB) WX5-05

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	UX	UY	UZ	RX	RY	RZ
RUN	75	1398.	61.	646.	0.	20754.	1949.	.743	.001	.025	.0000	.0029	.0001
	80	1398.	61.	648.	0.	0.	0.	.743	.005	.107	.0000	.0030	.0001
VALVE	75	437.	31.	557.	1231.	124675.	0.	.743	.001	.025	.0000	.0029	.0001
	85	437.	31.	557.	926.	120105.	0.	.708	.001	.025	.0000	.0031	.0001
FGRUN	85	495.	33.	534.	928.	120105.	0.	.708	.001	.025	.0000	.0031	.0001
	90	495.	33.	534.	747.	114771.	0.	.663	.001	.025	.0000	.0037	.0001
FGRUN	90	625.	90.	462.	747.	114771.	0.	.663	.001	.025	.0000	.0037	.0001
	95	625.	90.	462.	3132.	90339.	0.	.469	.002	.025	.0000	.0057	.0001
VALVE	95	720.	65.	429.	3132.	90339.	0.	.469	.002	.025	.0000	.0057	.0001
	100	720.	65.	429.	3903.	82157.	0.	.399	.002	.025	.0000	.0059	.0001
VALVE	100	1307.	89.	105.	3903.	82157.	0.	.399	.002	.025	.0000	.0059	.0001
	105	1307.	89.	105.	2836.	66479.	0.	.327	.002	.025	.0000	.0060	.0001
FGRUN	105	1363.	104.	70.	2836.	66479.	0.	.327	.002	.025	.0000	.0060	.0001
	110	1363.	104.	70.	345.	33757.	0.	.175	.001	.025	.0000	.0066	.0001
FGRUN	110	1407.	14.	23.	345.	33757.	0.	.175	.001	.025	.0000	.0066	.0001
	115	1407.	14.	23.	0.	0.	0.	.014	.000	.025	.0000	.0068	.0001

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WX3-05

SYSTEM ACCELERATION FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING

COMBINED RESULT FOR MODE 1 THRU 12 BY RMS SUMMATION

SPECTRA SET = 1

POINT NO.	X-DIRECTION (G)	Y-DIRECTION (G)	Z-DIRECTION (G)
1	.000	.000	.000
5	.506	.282	.003
10	.701	.379	.005
15	.227	.139	.008
20	1.532	.299	.011
25	1.667	.217	.073
30	1.668	.029	.302
35	1.669	.034	.342
40	1.612	.067	.454
45	1.595	.063	.454
50	1.534	.049	.456
55	1.535	.313	.657
60	1.489	.039	.457
65	1.462	.040	.458
70	1.433	.052	.459
75	1.398	.075	.460
80	1.398	.395	.648
85	1.369	.100	.461
90	1.337	.130	.461
95	1.072	.224	.463
100	.949	.219	.464
105	.815	.200	.464
110	.493	.116	.464
115	.129	.019	.464

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (S WW-172-AB) WXS-05

SUPPORT REACTIONS FOR LOAD COMBINATION CASE NO. 4

OSE RESPONSE SPECTRUM - ONE-HALF SSE

NODE	TYPE	REACTIONS (LBS OR IN-LBS)	DIRECTION
------	------	------------------------------	-----------

1	FORCE	895.	X COORD
1	FORCE	67.	Y COORD
1	FORCE	2494.	Z COORD
1	MOMENT	3235.	X COORD
1	MOMENT	54885.	Y COORD
1	MOMENT	83.	Z COORD
15	FORCE	2854.	X COORD
15	FORCE	71.	Y COORD
25	FORCE	60.	Y COORD
25	FORCE	1803.	Z COORD
30	FORCE	12.	Y COORD
35	FORCE	13.	Y COORD
35	FORCE	1257.	Z COORD
55	FORCE	132.	Y COORD
65	FORCE	15.	Y COORD
80	FORCE	175.	Y COORD
90	FORCE	58.	Y COORD
110	FORCE	51.	Y COORD
115	FORCE	705.	X COORD
115	FORCE	8.	Y COORD

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WXB-05

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 4

OBE 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	1	895.	67.	2494.	3235.	59885.	83.	.000	.000	.000	.0000	.0000	.0000
	5	895.	67.	2494.	1206.	4505.	83.	.039	.002	.001	.0000	.0008	.0000
FGRUN	5	858.	9.	2494.	1206.	4505.	83.	.039	.002	.001	.0000	.0008	.0000
	10	858.	9.	2494.	1793.	60713.	83.	.070	.003	.001	.0000	.0002	.0000
FGRUN	10	826.	43.	2493.	1793.	60713.	83.	.070	.003	.001	.0000	.0002	.0000
	15	826.	43.	2493.	1047.	114918.	83.	.029	.001	.002	.0000	.0031	.0000
FGRUN	15	2012.	13.	2492.	1087.	114918.	83.	.029	.001	.002	.0000	.0031	.0000
	20	2012.	13.	2492.	439.	54117.	83.	.394	.001	.003	.0000	.0044	.0000
ELBOW	20	1856.	31.	2491.	439.	54117.	83.	.394	.001	.003	.0000	.0044	.0000
	25	1856.	31.	2491.	219.	46526.	295.	.429	.001	.016	.0000	.0004	.0000
FGRUN	25	1717.	14.	697.	219.	46526.	295.	.429	.001	.018	.0000	.0004	.0000
	30	1717.	14.	697.	219.	5036.	775.	.430	.000	.014	.0000	.0004	.0000
FGRUN	30	1600.	20.	701.	219.	5036.	775.	.430	.000	.014	.0000	.0004	.0000
	35	1600.	20.	701.	219.	6451.	861.	.430	.000	.013	.0000	.0004	.0000
ELBOW	35	1560.	24.	866.	219.	6451.	861.	.430	.000	.013	.0000	.0004	.0000
	40	1560.	24.	866.	202.	19211.	1063.	.425	.000	.012	.0000	.0008	.0000
FGRUN	40	1525.	24.	877.	202.	19211.	1063.	.425	.000	.012	.0000	.0008	.0000
	45	1525.	24.	877.	253.	23307.	1063.	.423	.000	.012	.0000	.0008	.0001
VALVE	45	1501.	24.	871.	253.	23307.	1063.	.423	.000	.012	.0000	.0008	.0001
	50	1501.	24.	871.	510.	40436.	1063.	.415	.000	.012	.0000	.0009	.0001
RUN	50	767.	35.	329.	0.	10531.	1131.	.415	.000	.012	.0000	.0009	.0001
	55	767.	35.	329.	0.	0.	0.	.415	.002	.036	.0000	.0009	.0001
VALVE	50	687.	20.	603.	510.	38205.	974.	.415	.000	.012	.0000	.0009	.0001
	60	687.	20.	603.	451.	46110.	974.	.406	.000	.012	.0000	.0009	.0001
FGRUN	60	657.	21.	594.	451.	46110.	974.	.406	.000	.012	.0000	.0009	.0001
	65	657.	21.	594.	489.	51817.	974.	.397	.000	.012	.0000	.0011	.0001
FGRUN	65	631.	18.	566.	489.	51817.	974.	.397	.000	.012	.0000	.0011	.0001
	70	631.	18.	566.	512.	57316.	974.	.387	.000	.012	.0000	.0013	.0001
VALVE	70	600.	18.	577.	512.	57316.	974.	.387	.000	.012	.0000	.0013	.0001
	75	600.	18.	577.	615.	64324.	974.	.371	.000	.012	.0000	.0014	.0001

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LOFT CIS ANALYSIS - S-TA PENETRATION DUCT (S-W-172-AB) WX3-05

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	OX	OY	OZ	RX	RY	RZ
RUN	75	599.	30.	324.	0.	10377.	974.	.371	.000	.012	.0000	.0014	.0001
	80	599.	30.	324.	0.	0.	0.	.372	.002	.054	.0000	.0015	.0001
VALVE	75	218.	16.	279.	615.	62338.	0.	.371	.000	.012	.0000	.0014	.0001
	85	218.	16.	279.	464.	60053.	0.	.354	.000	.012	.0000	.0015	.0001
FGPUN	85	248.	17.	267.	464.	60053.	0.	.354	.000	.012	.0000	.0015	.0001
	90	248.	17.	267.	373.	57386.	0.	.334	.001	.012	.0000	.0019	.0001
FGPUN	90	312.	45.	241.	373.	57386.	0.	.334	.001	.012	.0000	.0019	.0001
	95	312.	45.	241.	1566.	45169.	0.	.234	.001	.012	.0000	.0029	.0001
VALVE	95	360.	32.	215.	1566.	45169.	0.	.234	.001	.012	.0000	.0029	.0001
	100	360.	32.	215.	1952.	41078.	0.	.200	.001	.012	.0000	.0029	.0001
VALVE	100	553.	45.	52.	1952.	41078.	0.	.200	.001	.012	.0000	.0029	.0001
	105	553.	45.	52.	1418.	33239.	0.	.164	.001	.012	.0000	.0030	.0001
FGPUN	105	582.	52.	35.	1418.	33239.	0.	.164	.001	.012	.0000	.0030	.0001
	110	582.	52.	35.	173.	16679.	0.	.088	.001	.012	.0000	.0033	.0001
FGRUN	110	703.	7.	12.	173.	16679.	0.	.088	.001	.012	.0000	.0033	.0001
	115	703.	7.	12.	0.	0.	0.	.007	.000	.012	.0000	.0034	.0001

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

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 WK-172-AB) WX8-05

ASME SECTION III CLASS 2 OF 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	1	1.000	1931.	5085.	1458.	3389.
	5	1.000	1319.	1587.	23.	1342.
FGRUN	5	1.000	1319.	1587.	23.	1342.
	10	1.000	1514.	4997.	1504.	3018.
FGRUN	10	1.000	1514.	4997.	1504.	3018.
	15	1.000	1348.	7940.	2985.	4333.
FGRUN	15	1.000	1348.	7940.	2985.	4333.
	20	1.000	1028.	4132.	3813.	4841.
ELBOW	20	2.440	1047.	6727.	9305.	10351.
	25	2.440	1239.	6123.	15586.	16825.
FGRUN	25	1.000	1133.	3001.	6360.	7521.
	30	1.000	1207.	1500.	2404.	3611.
FGRUN	30	1.000	1207.	1500.	2404.	3611.
	35	1.000	1237.	1611.	2042.	3279.
ELBOW	35	2.440	1430.	2114.	4981.	6411.
	40	2.440	1630.	3549.	4693.	6322.
FGRUN	40	1.000	1345.	2450.	1923.	3269.
	45	1.000	1349.	2587.	1894.	3243.
RUN	50	1.000	1324.	1932.	0.	1324.
	55	1.000	1004.	1004.	0.	1004.
FGRUN	60	1.000	1028.	3573.	1657.	2685.
	65	1.000	1111.	4083.	1558.	2679.
FGRUN	65	1.000	1111.	4083.	1558.	2679.
	70	1.000	1071.	4360.	1479.	2551.
RUN	75	1.000	1025.	1023.	0.	1025.
	80	1.000	1004.	1004.	0.	1004.
FGRUN	85	1.000	1110.	4554.	1243.	2352.
	90	1.000	1210.	4501.	1124.	2334.

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ASME SECTION III CLASS 2 OR ANSI B31.1.5 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIFY FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
FGRUN	90	1.000	1210.	4501.	1124.	2334.
	95	1.000	1851.	4443.	710.	2561.
FGRUN	105	1.000	1779.	3068.	473.	2253.
	110	1.000	1088.	2056.	237.	1325.
FGRUN	110	1.000	1088.	2056.	237.	1325.
	115	1.000	1004.	1004.	0.	1004.

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APPENDIX G
LEVEL C SERVICE CONDITIONS
STRESS ANALYSIS RESULTS

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LOFT CIS ANALYSIS - S-7A PENETRATION DUCT (8 KW-172-AB) WXB-05

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	1	1.000	1931.	8239.	0.	1931.
	5	1.000	1319.	1854.	0.	1319.
FGRUN	5	1.000	1319.	1854.	0.	1319.
	10	1.000	1514.	8481.	0.	1514.
FGRUN	10	1.000	1514.	8481.	0.	1514.
	15	1.000	1348.	14532.	0.	1348.
FGRUN	15	1.000	1348.	14532.	0.	1348.
	20	1.000	1028.	7236.	0.	1028.
ELBOW	20	2.440	1047.	12407.	0.	1047.
	25	2.440	1239.	11006.	0.	1239.
FGRUN	25	1.000	1133.	6470.	0.	1133.
	30	1.000	1207.	1792.	0.	1207.
FGRUN	30	1.000	1207.	1792.	0.	1207.
	35	1.000	1237.	1984.	0.	1237.
ELBOW	35	2.440	1430.	2797.	0.	1430.
	40	2.440	1630.	5669.	0.	1630.
FGRUN	40	1.000	1346.	3553.	0.	1346.
	45	1.000	1349.	4026.	0.	1349.
RUN	50	1.000	1324.	2539.	0.	1324.
	55	1.000	1004.	1004.	0.	1004.
FGRUN	60	1.000	1028.	6318.	0.	1028.
	65	1.000	1111.	7056.	0.	1111.
FGRUN	65	1.000	1111.	7056.	0.	1111.
	70	1.000	1071.	7648.	0.	1071.
RUN	75	1.000	1025.	2221.	0.	1025.
	80	1.000	1004.	1004.	0.	1004.
FGRUN	85	1.000	1110.	7999.	0.	1110.
	90	1.000	1210.	7793.	0.	1210.

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~~LOFT CTS ANALYSIS - S-7A PENETRATION DUCT (8 WW-172-AB) WXB-05~~

ASME SECTION III CLASS 2 OR ANSI B31.1, B 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	90	1.000	1210.	7793.	0.	1210.
	95	1.000	1851.	7035.	0.	1851.
FGRUN	105	1.000	1779.	5596.	0.	1779.
	110	1.000	1088.	3024.	0.	1088.
FGRUN	110	1.000	1088.	3024.	0.	1088.
	115	1.000	1004.	1004.	0.	1004.

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APPENDIX H
LEVEL D SERVICE CONDITIONS
STRESS ANALYSIS RESULTS

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Level D service conditions do not apply to this line.

APPENDIX I
COMPONENT SUPPORT ANALYSIS RESULTS

Support/restraint loads and locations are listed in the body of the report. Support designs were not available at the time of the analysis.