CALCULATION COVER SHEET

PROJECT DAVIS-BESSE, UNIT-1 JOB NO. 12501 CALC. NO. M-8

SUBJECT PRESSURIZER SURGE LINE - CLASS-I PIPING ANALYSIS

COMPUTER PROGRAM: ☐ NONE ☒ SCP ☐ OTHER

PROGRAM NO(S) ME-101, ME-210 VERSION/RELEASE NO. K1/4-15-84, 5/12-15-82

TOTAL NO. OF SHEETS 8 (Excluding Attachments)

ATT. NO. 1 = 3 SHTS., ATT. NO. 2 = 14 SHTS., ATT. NO. 3 = 4 SHTS., ATT. NO. 4 = 2 SHTS., ATT NO 5 = 1 SHT.

☐ PRELIMINARY CALC. ☐ COMMITTED PRELIMINARY CALC.

☐ SUPERSEDED CALC. ☒ FINAL CALC.

NO.	DESCRIPTION	BY	DATE	CHKD.	DATE	APPROVED	DATE	
01	PRESSURIZER SURGE LINE	SPL	1-31-85	[illegible]	1-31-85	ASW	1-31-85	

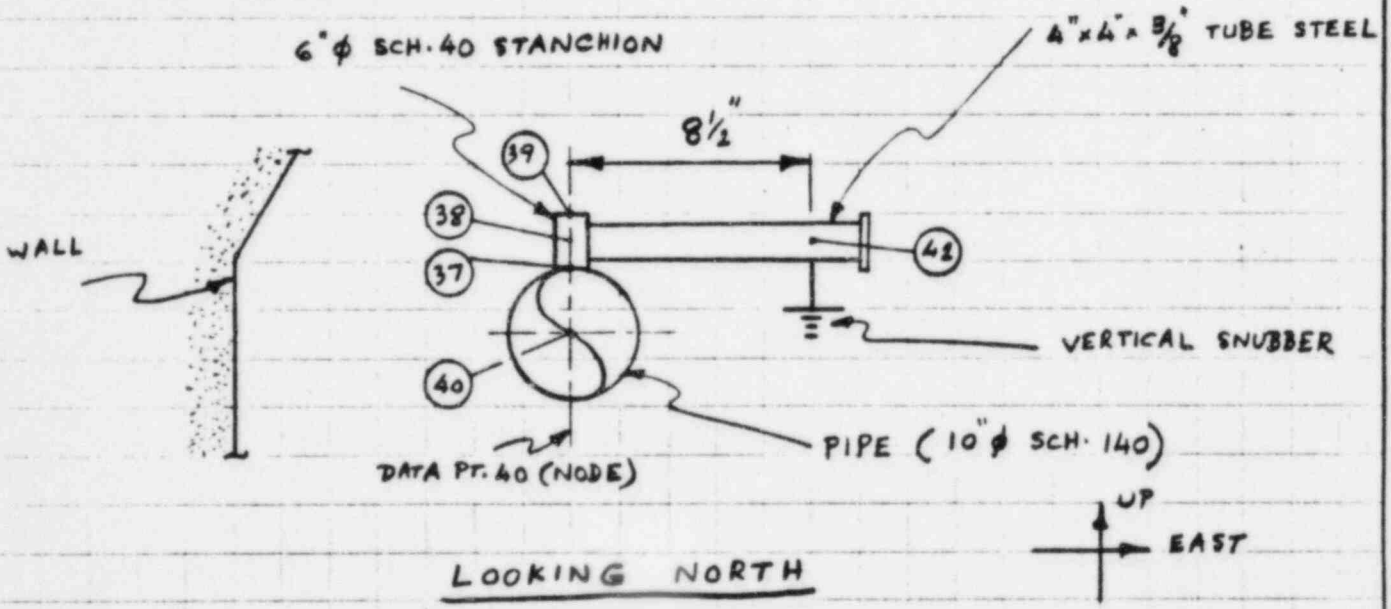
REVISIONS

CALCULATION SHEET

JOB NO. 12501 DAVIS-BESSE, UNIT 1	CALC. NO. M-8	REV. NO. 01	SHEET NO. 1
PRESSURIZER SURGE LINE			

ORIGINATOR	DATE	CHECKED	DATE
Siva P. Lingam	1-30-85	[signature]	1-31-85

AS-BUILT CONDITION OF VERTICAL SNUBBER (PSU-R1) ON PRESSURIZER SURGE LINE



LOOKING NORTH

THE PURPOSE OF THIS CALCULATION IS TO CHECK THE PRIMARY PIPE STRESSES (CATASTROPHIC FAILURE) ON THE PRESSURIZER SURGE LINE FOR LONG-TERM OPERATION. CRITERIA EXCLUSIVE OF FINAL CLASS-I FATIGUE ANALYSIS.

ORIGINAL ANALYSIS OF THIS LINE WAS DONE BY B&W [1] MAY 3, 1974 (STRESS ANALYSIS OF SURGE LINE, REPORT #6, REV. 1). ALL POINTS WERE ANALYZED BY USING THE SIMPLIFIED METHOD PER USAS B31.7, 1968 (1-705 & TABLE D-201, APPENDIX-D). IN THIS ANALYSIS, VERTICAL SNUBBER PSU-R1 IS CONSIDERED AT THE CENTER LINE OF PIPE.

AS PER NCR 84-180, THE WEST SIDE VERTICAL SNUBBER (CLOSE TO THE WALL) FAILED. THE REASON OF FAILURE IS DETERMINED AS THERMAL INTERFERENCE BETWEEN WALL AND THE FAILED SNUBBER*. AS A RESULT, BECHTEL MODIFIED THIS SNUBBER AS SHOWN ABOVE TO MAKE THE REMAINING SNUBBER ALONE CAPABLE OF CARRYING THE ORIGINAL LOAD. HOWEVER THIS MODIFICATION CAUSES AN UNBALANCED MOMENT (TORSION ON PIPE) AT PIPE AND STANCHION INTERFACE.

* Ref. calc. M-8, REV. C3

CALCULATION SHEET

JOB NO. 12501 DAVIS-BESSE, UNIT-1	CALC. NO. M-8	REV. NO.	SHEET NO.
PRESSURIZER SURGE LINE		01	2

ORIGINATOR	DATE	CHECKED	DATE
Siva P. Lingam	1-30-85	[signature]	1-31-85

BECHTEL MADE TWO SEISMIC RUNS OF PRESSURIZER SURGE LINE (BY DECOUPLING FROM HOT LEG), ONE WITH VERTICAL SNUBBER AT THE CENTER LINE OF PIPE AND OTHER WITH VERTICAL SNUBBER MODELED THROUGH STANCHION & TUBE STEEL TO REFLECT THE MODIFICATION AND AT THE SAME TIME CONSIDER THE EFFECT OF AN UNBALANCED MOMENT ON THE SYSTEM AS A WHOLE. THE DYNAMIC PROPERTIES (EIGEN VALUES & EIGEN VECTORS) WERE THEN COMPARED FOR THE TWO RUNS. THERE IS NO SIGNIFICANT CHANGE IN THE DYNAMIC PROPERTIES LEADING TO THE CONCLUSION THAT THE RESULTS OF THE ORIGINAL ANALYSIS REMAIN UNCHANGED INCLUDING NOZZLE LOADS.

THE COMPARISON OF EIGEN VALUES (NATURAL FREQUENCIES UPTO 33 Hz) IS SHOWN BELOW (SEE ATTACHMENT NO. 1):

WITH SNUBBER AT CENTER LINE OF PIPE	WITH SNUBBER ACTUALLY MODELED	DIFFERENCE IN %	SOURCE
10.031 Hz.	9.805 Hz.	2.253%	BECHTEL COMPUTER RUNS G7399 (11-28-84) AND G7397 (11-28-84)
16.265	16.327	0.381	
19.021	18.914	0.563	
21.418	20.054	6.37 (HIGHER MODE)	
27.479	26.913	2.06	

HOWEVER, THE EFFECT OF ADDITIONAL TORSION MOMENT HAS TO BE CHECKED LOCALLY BY ADDING TO THE ORIGINAL RESULTS. SINCE THE MAXIMUM SEISMIC STRESS AND MAX. PRIMARY STRESS INTENSITY (EQ. 9 OF 1-705.1 OF B 31.7, 1968) OCCUR VERY CLOSE TO THIS SNUBBER (4¼" AWAY) IN THE ORIGINAL ANALYSIS, THE CORRESPONDING MOMENTS ARE CONSIDERED AT THE SNUBBER AND ARE NOTED BELOW (B&W DATA PT. 3 _* SEE ATTACHMENT #2):

LOAD TYPE	MOMENT IN INCH-POUNDS			
	M_X *	M_Y *	M_Z *	TORSIONAL MOMENT (M_X) *
WEIGHT	12615.24	4661.04	51039.12	—
SEISMIC (OBE)	8872.8	22011.6	244343.04	20400 (2400 × 8.5)
SEISMIC (SSE)	15204.6	38394.	451370.28	33150 (3900 × 8.5)
WEIGHT + OBE	21488.04	26672.64	295382.16	20400
WEIGHT + SSE	27819.84	43055.04	502409.4	33150

CALCULATION SHEET

JOB NO. 12501 DAVIS-BESSE, UNIT-1	CALC. NO. M-8	REV. NO.	SHEET NO.
PRESSURIZER SURGE LINE		01	3

ORIGINATOR	DATE	CHECKED	DATE
Sura P. Singam	1-30-85	[illegible]	1-31-85

EQUATION-9

$$B_1 \frac{PD_o}{2t} + B_2 \frac{D_o}{2I} M_i \leq 1.5\, S_m \quad \text{(UPSET)}$$

$$B_1 \frac{PD_o}{2t} + B_2 \frac{D_o}{2I} M_i \leq 2.25\, S_m \quad \text{(FAULTED PER B\&W ANALYSIS)}$$

SEE ATTACH. NO. 2, SHT. NO. 13

$B_1 = 1.0$ (elbow) (conservative as stanchion is on straight pipe) → Ref. table D-201 of APPX. D

$P = 2500$ psi — no hole on the run pipe – this causes only longitudinal pressure stress

$D_o = 10.75''$

$t = 1.0''$

$I = 368\ in^4$

$M_i = \sqrt{(21488.04 + 8040.0)^2 + (26672.64)^2 + (295382.16)^2}$

$= 299527.4$ in-lbs (upset)

$B_2 = 0.75\, C_2 \cdot 0.75 \left[\frac{1.95}{\left(\frac{tR}{r_2}\right)^{2/3}}\right]$

$M_i = \sqrt{(27819.84 + 33150)^2 + (43055.04)^2 + (502409.4)^2}$

$= 507923.5$ in-lbs (Faulted)

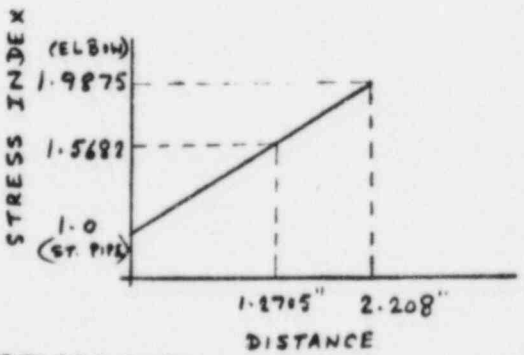
$B_2 = 1.9875$ (FOR ELBOW)

$B_2 = 1.5$ (FOR WTEE)

$\sqrt{rt} = \sqrt{4.875 \times 1.0} = 2.208''$

ACTUAL DISTANCE BETWEEN ELBOW WELD & NEAREST STANCHION WELD

$= 0.9875''$



ASSUMING LINEAR DISTRIBUTION OF STRESS INDEX,

$$\frac{0.9875}{B} = \frac{2.208}{1.2705}$$

$B = 0.5682$

$B = 1.0 + 0.5682 = 1.5682$

SEE ATTACHMENT NO. 5 FOR FURTHER DISCUSSION

$B_2 = 1.5682 \times 1.5 = 2.3523$ (multiplication of overlapping stress index is not required but is implied in note 2 of table D-201)

If assumed as an unreinforced tee (UTEE), $i = \frac{0.9}{h^{2/3}}$ where

$h = \frac{t_n}{r}$ (from class-2)

$t_n = 1.0$, $r_2 = 4.875$

$i = 2.5877$

$B_2 = 2.5877$ (conservative – no hole on the run pipe)

CALCULATION SHEET

JOB NO. 12501 DAVIS-BESSE, UNIT-1	CALC. NO. M-8	REV. NO.	SHEET NO.
PRESSURIZER SURGE LINE		01	4

ORIGINATOR	DATE	CHECKED	DATE
Sina P. Dingani	1-30-85	[signature]	1-31-85

CONSIDER THE HIGHEST VALUE OF $B_2 = 2.5877$ (UTEE)

$$B_1 \frac{PD_o}{2t} + B_2 \frac{D_o}{2I} M_i \leq 1.5\, S_m$$

$$1.0 \times \frac{2500 \times 10.75}{2 \times 1.0} + 2.5877 \times \frac{10.75}{2 \times 368} \times 299527.4 \leq 24,800 \text{ psi}$$

$$24,759 \leq 24,800 \text{ psi}$$

(UPSET CONDITION)

$$1.0 \times \frac{2500 \times 10.75}{2 \times 1.0} + 2.5877 \cdot \frac{10.75}{2 \times 368} \times 507923.5 \leq 37,575 \text{ psi}$$

$$32,635 \leq 37,575 \text{ psi}$$

(Faulted condition).

SEE ATTACH. NO. 2

CALCULATION SHEET

JOB NO. 12501 DAVIS-BESSE, UNIT-1	CALC. NO. M-8	REV. NO.	SHEET NO.
PRESSURIZER SURGE LINE		01	5

ORIGINATOR	DATE	CHECKED	DATE
Siva P. Gingam	1-30-85	[illegible]	1-31-85

BECHTEL PROGRAM ME-210 ALSO CALCULATES THE LOCAL STRESSES AT THE STANCHION & PIPE INTERFACE. Ref.: WRC-107

CHECKS 1A, 1B, 2A & 2B OF ME-210 DEAL WITH UPSET PRIMARY (CIRCUMFERENTIAL), FAULTED PRIMARY (CIRCUMFERENTIAL), UPSET PRIMARY (LONGITUDINAL) & FAULTED PRIMARY (LONGITUDINAL) RESPECTIVELY. (SEE SHT. 4 OF ATTACH. NO. 3)

1A → $\frac{PD_o}{2t}$ + stresses from ME-210 = 14,030 psi

13437.5 + stresses from ME-210 = 14,030

stress from ME-210 = 14030 - 13437.5 = 592.5

Applying stress index of 2.5877,

1A → 13437.5 + (2.5877 · 592.5) = 14,971 psi (< 24,720 psi)

1B → 13437.5 + 2.5877 × (14400 - 13437.5) = 15,929 psi (< 37,575 psi)

B&W = 2.255

2A → $\frac{PD_o}{4t}$ + stresses from ME-210 including ME-101 stresses = 12,970

6718.75 + stresses from ME-210 including ME-101 stresses = 12,970

stresses from ME-210 including ME-101 stresses = 6251.25

Applying stress index of 2.5877,

2A → 6718.75 + (2.5877 × 6251.25) = 22,896 psi (< 24,720 psi)

2B → 6718.75 + 2.5877 × (17390 - 6718.75) = 34,332 psi (< 37,575 psi)

CALCULATION SHEET

JOB NO. 12501	CALC. NO.	REV. NO.	SHEET NO.
DAVIS-BESSE UNIT ONE	M-8	01	6

ORIGINATOR	DATE	CHECKED	DATE
W. [illegible]	1-31-85	Sira P. Dingam	1-31-85

REANALYSIS USING CODE CASE N-411 RESULTED IN THE SYSTEM EXPERIENCING THE FOLLOWING REDUCTIONS IN DISPLACEMENTS, LOADINGS AND STRESSES (WHEN COMPARED TO THE ORIGINAL ANALYSIS): (CODE CASE N-411 CALLS OUT FOR 5% DAMPING FOR 0-10CPS, A LINEAR DECREASE FROM 5% TO 2% DAMPING FOR 10-20CPS, AND 2% DAMPING FOR FREQUENCIES GREATER THAN 20CPS - SEE ATTACHMENT #4)

SUPPORTS: @ BECHTEL D.P. (42) : 64% REDUCTION IN LOAD (Y-SNUBBER) - PSU-RI
@ " " (55) : 11% REDUCTION IN LOAD (X-SNUBBER)
@ " " (60) : 70% REDUCTION IN LOAD (Z-SNUBBER)

DISPLACEMENTS : ALL DATA POINTS : 60% TO 75% REDUCTION IN DISPLACEMENT

MOMENTS IN THE PIPE: FOR M_X: 51% TO 70% REDUCTION IN LOADING
FOR M_Y: 62% TO 70% REDUCTION IN LOADING
FOR M_Z: 48% TO 70% REDUCTION IN LOADING

STRESSES IN THE PIPE: AN OVERALL REDUCTION OF 64% TO 69% IN STRESSES.

NOZZLE LOADS: FOR HOT LEG (BECHTEL D.P. (5)): 49% TO 69% REDUCTION IN LOADING
FOR PRESSURIZER (BECHTEL D.P. (100)): 11% TO 70% REDUCTION IN LOADING

THE REDUCTIONS SHOWN ABOVE REFLECT OBE AND SSE CONDITIONS. IN GENERAL, THE MORE SIGNIFICANT LOADINGS EXPERIENCED APPROXIMATELY A 65% REDUCTION IN LOADINGS.

REFER TO: SNUBB N° G0087 DATED 1-30-85 - OBE USING CODE CASE N-411
SNUBB N° G0096 DATED 1-31-85 - SSE USING CODE CASE N-411

CALCULATION SHEET

JOB NO. 12501 DAVIS-BESSE, UNIT-1	CALC. NO. M-8	REV. NO.	SHEET NO.
PRESSURIZER SURGE LINE		01	7

ORIGINATOR	DATE	CHECKED	DATE
Sira P. Dingan	1-31-85	[signature]	1-31-85

IT IS EVIDENT FROM THE PREVIOUS SHEET THAT AT LEAST 40% REDUCTION IN Y-LOAD, MOMENTS & STRESSES CAN BE ATTAINED FOR CODE CASE N-411 WHICH PERMITS THE USE OF HIGHER DAMPING (5% TO 2% OF CRITICAL DAMPING). APPLYING THIS REDUCTION IN EQUATION-9, WE GET THE FOLLOWING:

$$B_1 \frac{PD_o}{2t} + B_2 \frac{D_o}{2I} M_i \leq 1.5 S_m$$

$$1.0 \times \frac{2500 \times 10.75}{2 \times 1.0} + 2.5877 \times \frac{10.75}{2 \times 368} \times (299527.4) \times 0.6 \leq 24,800 \text{ psi}$$

$$20,231 \leq 24,800 \text{ psi}$$

(upset condition)

$$1.0 \times \frac{2500 \times 10.75}{2 \times 1.0} + 2.5877 \times \frac{10.75}{2 \times 368} \times (507923.5) \times 0.6 \leq 37,575 \text{ psi}$$

$$24,956 \leq 37,575 \text{ psi}$$

(Faulted condition)

IN A SIMILAR WAY, ME-210 STRESSES (CHECKS 1A, 1B, 2A & 2B) WILL BE MUCH WITHIN THE ALLOWABLES.

CONCLUSIONS

, EVEN WITH CONSERVATIVE PRIMARY STRESS INDICES (B_1 FOR AN ELBOW ALTHOUGH STANCHION IS ON A STRAIGHT PIPE AND B_2 FOR AN UNREINFORCED TEE ALTHOUGH THERE IS NO HOLE IN THE PIPE), CONDITION FOR CATASTROPHIC FAILURE IS SATISFIED FOR LONG TERM OPERATION. IN ADDITION, WE HAVE SHOWN THAT SEISMIC ANALYSIS USING 5% DAMPING WOULD REDUCE STRESS LEVELS AN ADDITIONAL 18% (AT LEAST) AND MATERIAL TEST REPORTS SHOW THE ACTUAL YIELD STRENGTH TO BE GREATER THAN THE ALLOWABLE DESIGN VALUES.

TITLE : PRESSR. SURGE LINE
PROJECT NUMBER : 12501
PROBLEM NUMBER : M8
USER : SPL
LOAD CASE : SEIS1

EIGEN SOLVER : DETERMINANT SEARCH

FREQUENCIES FOR THE SEIS1 LOAD CASE (CPS)

10.0313238	16.2646813	19.0205320	21.4183087	27.4791067

PERIODS FOR THE SEIS1 LOAD CASE (SEC)

.0996877	.0614829	.0525748	.0466890	.0363913

EIGEN VALUES (natural frequencies)

SEISMIC

WITHOUT BROKEN SNUBBER

PRESSURIZER SURGE LINE

ATTACHMENT NO. 1

PROB. NO. M-8 (01)

SHT. NO. 1 OF 3

Added by: Siva g. Lingam Date: 1-30-85

ch'kd by: [signature] Date: 1-31-85

TITLE : PRESSR. SURGE LINE
PROJECT NUMBER : 12501
PROBLEM NUMBER : M8
UBEN : SPL
LOAD CASE : SEIS1

EIGEN SOLVER : DETERMINANT SEARCH

FREQUENCIES FOR THE SEIS1 LOAD CASE (CPS)

9.8041866 16.326798O 18.9134386 20.0543249 26.9129386

PERIODS FOR THE SEIS1 LOAD CASE (SEC)

.1019975 .0612890 .0528719 .0498646 .0371568

EIGEN VALUES (natural frequencies)

SEISMIC

WITH BROKEN SNUBBER

= 2.3% - first frequency

PRESSURIZER SURGE LINE

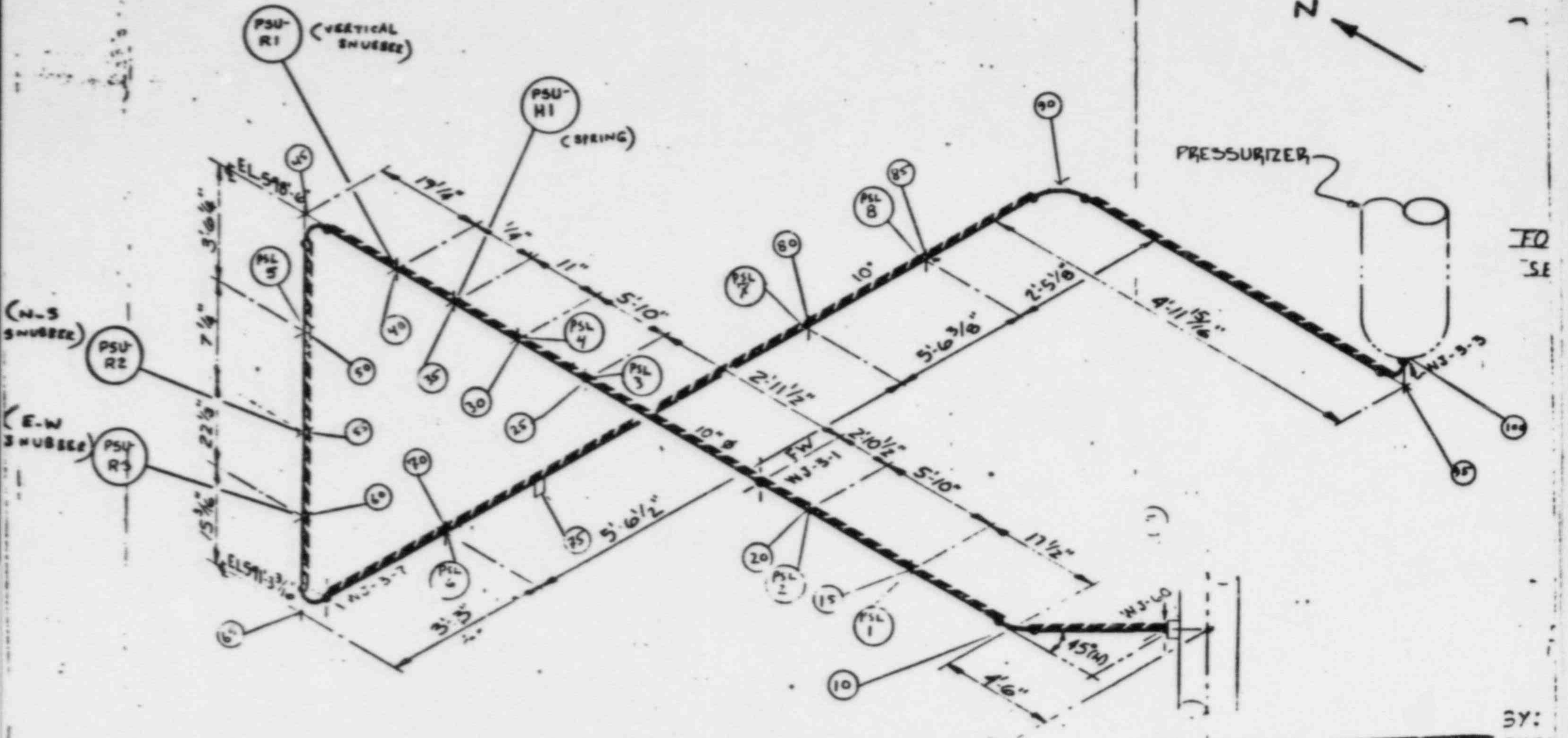
ATTACHMENT NO. 1

PROB. NO. M-8(01)

SHT. NO. 2 OF 3

Added by: Siva P. Gingam Date: 1-30-85

ch'kd by: [signature] Date: 1-31-85



PROB. NO. M-8 (01)

ATTACHMENT # 1

SHT. NO. 3 OF 3

Added by: Siva P. Lingam Date: 1-30-85

ch'ed by: [signature] Date: 1-31-85

Roody Kies PREPARED BY: SIVA LINGAH

Babcock & Wilcox
a McDermott company
Nuclear Power Generation Division

GENERAL CALCULATIONS

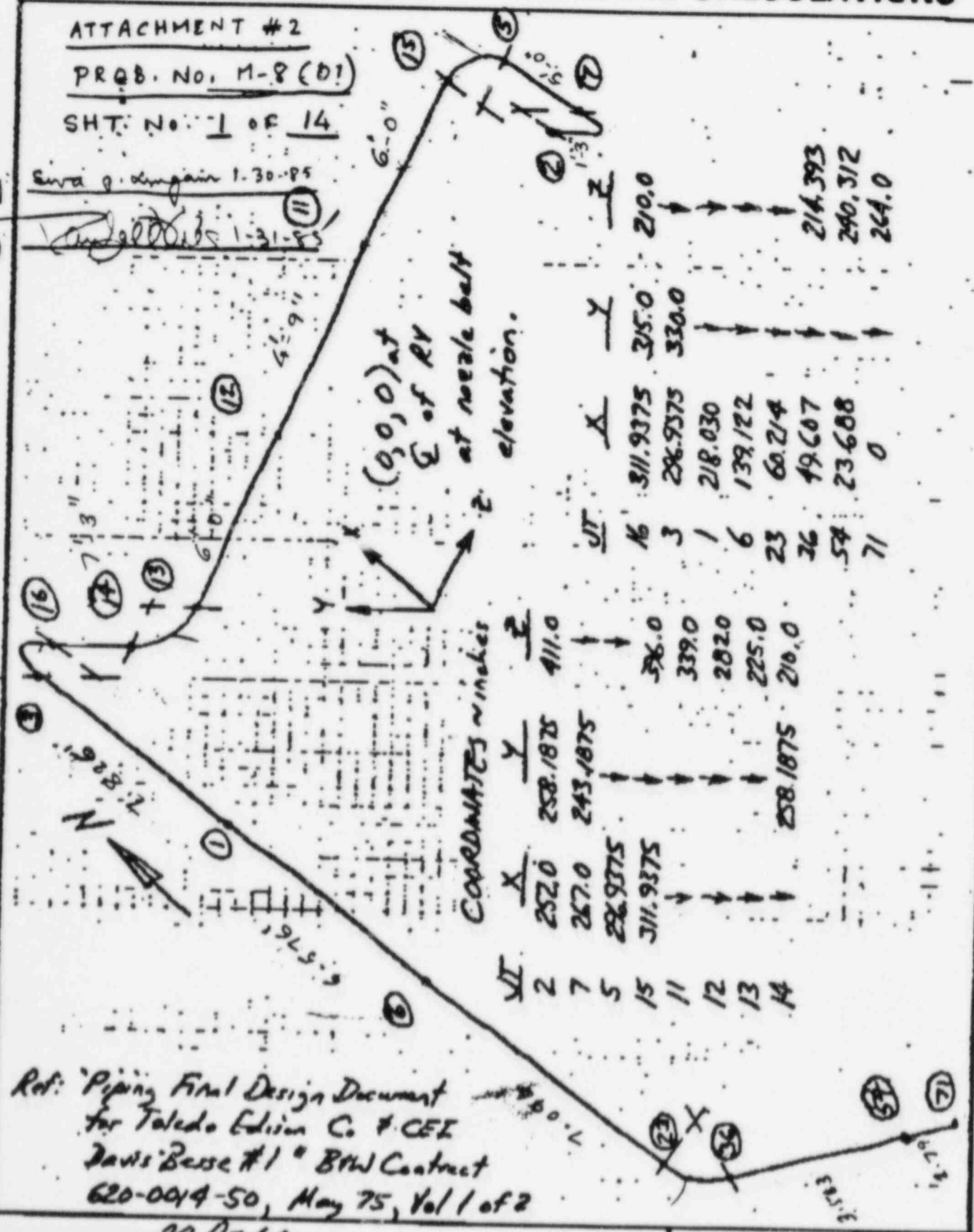
ATTACHMENT #2

PROB. NO. M-8 (D1)

SHT. No. 1 of 14

Added by: Siva g. Lingam 1-30-85

Ch'ed by: [signature] 1-31-85



JT	X	Y	Z
16	311.9375	315.0	210.0
3	296.9375	330.0	
1	218.030		
6	139.122		
23	60.214		
26	49.607		214.393
54	23.608		240.312
71	0		264.0

JT	X	Y	Z
2	282.0	258.1875	411.0
7	267.0	243.1875	
5	282.9375		396.0
15	311.9375		339.0
11			282.0
12			225.0
13		258.1875	210.0
14			

PREPARED BY: RP Robertson DATE: 6/25/82

REVIEWED BY: _____ DATE: _____

DOC. NO. _____

PAGE NO. _____

SURGE LINE SUPPRESSOR/HANGER LOADS

(See Figure 4)

Type of Loading	Forces (Kips)			Moments (Ft-Kips)		
	Fx	Fy	Fz	Mx	My	Mz
Dead Weight	0	-3.8	0	0	0	0
OBE	7.5	(2.4)	3.2	0	0	0
DBE	13.7	(3.9)	5.8	0	0	0

PROB. NO. M-8(01)

ATTACHMENT #2

SHT. NO. 2 OF 14

Added by: Siva P. Singam Date: 1-30-85

ch'ed by: Randall Ries Date: 1-31-85

Introduction

This report contains the stress analysis of the surge line. All points in the surge line are analyzed including the bimetallic weld at the hot leg surge nozzle. The analysis of the intersection at the pressurizer end is contained in pressurizer Design Report "Surge Nozzle Analysis". The branch intersection analysis is contained in this Design Report under a different section "Surge Nozzle".

Results

All points in the surge line satisfy primary stress limits either in accordance with equation 9 or per Appendix F of the B31.7 code.

Per equation 9 simplified analysis

Maximum Primary Stress = 22074.96 psi < 1.5 S_m = 24800. psi @670°F
Maximum for an elbow (joint 3) = 22074.96 psi < 24800. psi
Maximum for a straight (joint 1) = 10220.54 psi < 24800. psi

All points in the surge line do not satisfy the 3 S_m primary plus secondary stress limit. However, calculations are provided showing that an Elastic-Plastic Analysis is applicable.

Maximum primary plus secondary stress (Bimetallic Weld) (joint 54)
= 75997.62 psi > 3 S_m = 50100. psi @650.°F (PAGE C-11)
Maximum primary plus secondary stress for an elbow (joint 2)
= 67368.71 psi > 50100. psi (PAGE C-13)
Primary plus secondary stress for cycles occurring more than 240 times:
Joint 2 = 36860.4 psi < 3 S_m = 50100. psi
Joint 3 = 33789.9 psi < 3 S_m = 50100. psi
Joint 19 = 36929.7 psi < 3 S_m = 50100. psi

Maximum Usage Factors:

Usage Factor at Bimetallic weld (joint 2) = 0.87 < 1.0 = allowable
Usage Factor for joint 3 = 0.046 < 1.0 = allowable
Usage Factor for joint 19 = 0.036 < 1.0 = allowable

PROB. NO. M-8 (01)

ATTACHMENT # 1

SHT. NO. 3 OF 14

Ref: "Stress Analysis of Surge Line, Report #6, for Toledo Edison Company, Davis-Besse," 620-0014-50, Jun 1972 (Rev 1, 5/3/74). RP 7/2/82

Added by: Sivra P. Kingam Date: 1-30-85

ch'ed by: [signature] Date: 1-31-85

This section demonstrates that all points in the surge line satisfy primary stress limits according to either Equation 9 or Appendix F of B31.7. A flexibility analysis was run for dead weight, and either (x + y) or (z + y) earthquakes. The moments generated by this analysis are shown on Pages A-4 thru A-7.

These moments are then combined with design pressure of 2500 psi to generate primary stresses in accordance with equation 9 using applicable indicies. The indicies used are listed in the stress output. Two cases were ran: 1) pressure, deadload, (x + y) earthquake; 2) pressure, deadload, (z + y) earthquake.

The results are then compared to 1.5 S_m at 670°F for SA-376-TP-316 (straights) and A-403-WP-316 (bends). Part of the surge line actually has a design temperature of 650°F. S_m = 16,500 psi. for both materials thus the allowable primary stress is 1.5 (16,500.) = 24,800. psi.

The largest primary stress is 22074.96 psi at joint 3 for the x + y earthquake at an elbow juncture. Complete results are tabulated on Page A-8 and 9.

PROB. NO. M-8 (01)

ATTACHMENT # 2

SHT. NO. 4 OF 14

Added by: Siva P. Gingam date: 1-30-85

ch'kd by: Randall Ebs date: 1-31-85

STRESS INDICES

(JOINT CLASSIFICATION)

TYPE	DESCRIPTION
1	STRAIGHT PIPE, REMOTE FROM WELDS OR OTHER DISCONTINUITIES
2	GIRTH BUTT WELD BETWEEN STRAIGHT PIPE OR BETWEEN PIPE AND BUTT-WELDING COMPONENTS. FLUSH
3	GIRTH BUTT WELD BETWEEN STRAIGHT PIPE OR BETWEEN PIPE AND BUTT-WELDING COMPONENTS. AS WELDED
4	GIRTH FILLET WELD TO SOCKET WELD FITTINGS, SLIP-ON FLANGES, OR SOCKET-WELDING FLANGES
5	LONGITUDINAL BUTT WELDS IN STRAIGHT PIPE. FLUSH
6	LONGITUDINAL BUTT WELDS IN STRAIGHT PIPE. AS WELDED
7	TAPERED TRANSITION JOINTS PER SUBPAR. 1-727.4.2(C) AND FIG.1-727.3.1
8	BRANCH CONNECTIONS PER SUBDIV. 1-704.3
9	CURVED PIPE OR BUTT-WELDING ELBOWS PER USAS B16.9, USAS B16.28, OR MSS SP48
10	BUTT-WELDING TEES PER USAS B16.9 OR MSS SP48
11	BUTT-WELDING REDUCERS PER USAS B16.9 OR MSS SP48

PROB. NO. M-8(01)

ATTACHMENT #2

SHT. NO. 5 OF 14

Added by: Siva P. Kingam Date: 1-30-85

ch'kd by: [signature] Date: 1-31-85

D.
1)

TOLEDO SURGE LINE

SECTION PROPERTIES

SECTION	OUTSIDE RADIUS (IN)	OUTSIDE DIAMETER (IN)	THICKNESS (IN)	MOMENT OF INERTIA (IN**4)	BEND RADIUS (IN)	DESCRIPTION
1	5.3750	10.7500	1.0000	367.805		SURGE LINE ST.
2	5.3750	10.7500	1.0000	367.805	15.0000	SURGE LINE CR.

PROB. NO. M-8 (01)

ATTACHMENT # 2

SHT. NO. 6 OF 14

Added by: Sivra P. Lingam date: 1-30-85

ch'kd by: Randall Pyles date: 1-31-85

DEAD LOAD MOM. ( ) (FT-LBS)

JOINT	M(X)	M(Y)	M(Z)
1	1051.27	190.21	2956.52
2	48.76	575.73	5475.20
3	1051.27	388.42	4253.26
5	11.08	462.85	162.55
6	1051.27	8.60	4545.22
7	11.08	538.05	3365.43
11	4009.10	120.24	1611.11
12	3647.55	121.16	1611.11
13	352.88	362.57	1611.11
14	870.89	426.09	1674.64
15	1437.53	361.65	1611.11
16	1013.59	426.09	1915.25
18	942.24	426.09	1794.94
23	1051.27	206.20	512.79
36	780.06	251.45	142.01
54	1677.71	426.33	2599.77

PROB. NO. M-8 (01)

ATTACHMENT NO. 2

SHT. NO. 7 OF 14

Added by: Siva P. Lingam Date: 1-30-85

Ch'kd by: [signature] Date: 1-31-85

X EARTHQUAKE MOMENTS (FT-LBS)

JOINT	M(X)	M(Y)	M(Z)
1	552.91	5774.54	13644.50
2	1091.14	3150.34	8890.93
3	552.91	1462.31	19615.80
5	803.58	3093.78	5837.96
6	552.91	2393.62	4150.89
7	803.58	2984.70	7184.48
11	2332.90	3832.01	5367.42
12	2374.86	4664.09	5367.42
13	1686.72	2087.29	5367.42
14	1926.39	1927.74	5317.74
15	316.78	2491.91	5367.42
16	762.69	1927.74	10767.60
18	2770.96	1927.74	5636.34
23	552.91	2913.27	5693.95
36	737.77	2680.95	7000.95
54	4852.93	7976.70	10344.10

ATTACHMENT #2

PROB. NO. M-8(01)

SHT. NO. 8 OF 14

added by: Siva P. Lingam Date: 1-30-85

ch'kd by: Randall Bell's Date: 1-31-85

A-5

Y EARTHQUAKE MOMENTS (FT-LBS)

JOINT	M(X)	M(Y)	M(Z)
1	186.49	1510.79	1828.76
2	314.57	812.57	1047.93
3	186.49	371.99	746.12
5	403.67	702.55	235.87
6	186.49	613.02	711.74
7	403.67	744.95	767.22
11	1145.29	1185.50	496.78
12	881.24	1481.76	496.78
13	948.49	471.82	496.78
14	1066.14	571.52	301.27
15	117.58	410.45	496.78
16	221.74	571.52	445.15
18	773.30	571.52	711.91
23	186.49	780.29	522.38
36	241.32	811.28	768.08
54	1042.90	1347.92	1561.55

PROB. NO. M-8(01)

ATTACHMENT # 2

SHT. NO. 9 OF 14

Added by: Siva P. Gingam Date: 1-30-85

ch'kd by: [signature] Date: 1-31-85

A-6

Z EARTHQUAKE MOMENTS (FT-LBS)

JOINT	M(X)	M(Y)	M(Z)
1	2433.64	7961.39	4184.12
2	3388.12	8215.63	10092.10
3	2433.64	2335.07	3456.56
5	3399.73	2767.35	1725.99
6	2433.64	4134.19	2241.79
7	3399.79	5695.74	6636.94
11	6557.96	5244.52	943.78
12	8413.33	5365.99	943.78
13	6341.99	2892.85	943.78
14	4395.61	3892.77	1680.56
15	1445.88	3424.23	943.78
16	1675.18	3892.77	2984.50
18	3877.61	3892.77	4513.19
23	2433.64	3949.75	1820.32
36	2629.71	4271.87	1651.72
54	4643.93	9844.89	3448.70

PROB. NO. M-8 (01)

ATTACHMENT # 2

SHT. NO. 10 OF 14

Added by: Siva P. Lingam Date: 1-30-85

ch'kd by: [signature] Date: 1-31-85

D-2

TOLEDO SURGE LINE

EQUATION 9 - PRIMARY STRESSES

CONDITION . . . PRESSURE, X+Y EQ , DEAD WT.
EQ 9

MOMENTS IN FT-LBS. STRESSES IN PSI.

JOINT	TYPE	MX	MY	MZ	M(I)	B1	B2	PRIMARY STRESS	RATIO TO ALLOWABLE
1	1	1790.67	7475.54	18429.78	19968.65	.5	1.0	10220.54	.413
2	9	1454.47	4538.64	15454.06	16172.28	1.0	2.0	19074.58	.771
3	9	1790.67	2222.71	24615.18	24780.11	1.0	2.0	22074.96	.892
5	9	1223.34	4256.18	6236.38	7648.80	1.0	2.0	16103.60	.651
6	1	1790.67	3011.64	9407.85	10039.13	.5	1.0	8479.26	.343
7	9	1223.34	4271.70	11317.13	12158.18	1.0	2.0	17675.41	.714
11	1	7487.29	5137.75	7475.31	11761.64	.5	1.0	8781.32	.355
12	1	5902.85	6267.01	7475.31	11950.11	.5	1.0	8814.37	.356
13	9	2988.09	2921.68	7475.31	8564.18	1.0	2.0	16422.67	.664
14	9	3863.42	2925.35	7293.65	8756.77	1.0	2.0	16489.80	.666
15	9	1871.89	3264.00	7475.31	8368.87	1.0	2.0	16354.59	.661
16	9	1998.02	2925.35	13127.99	13597.57	1.0	2.0	18177.13	.734
18	1	4486.50	2925.35	8143.19	9746.68	.5	1.0	8427.97	.341
23	9	1790.67	3899.76	6729.12	7980.96	1.0	2.0	16219.38	.655
36	9	1759.15	3743.67	7911.04	8927.17	1.0	2.0	16549.19	.669
54	3	6773.54	9750.94	14505.42	18744.84	.5	1.0	10005.93	.404

PROB. NO. M-8(01)

ATTACHMENT #2

SHT. NO. 11 OF 14

Added by: Siva P. Lingam date: 1-30-85

ch'kd by: [signature] date: 1-31-85

P-7

TOLEDO SURGE LINE

EQUATION 9 - PRIMARY STRESSES

CONDITION . . . PRESSURE , Z+Y EQ , DEAD WT.
EQ 9
MOMENTS IN FT-LBS. STRESSES IN PSI.

JOINT	TYPE	MX	MY	MZ	M(I)	B1	B2	PRIMARY STRESS	RATIO TO ALLOWABLE
1	1	3671.40	9662.39	8969.40	13685.44	.5	1.0	9118.69	.368
2	9	3751.45	9603.93	16655.23	19588.40	1.0	2.0	20265.32	.819
3	9	3671.40	3095.47	8455.93	9724.40	1.0	2.0	16827.08	.680
5	9	3819.54	3932.76	2124.41	5879.51	1.0	2.0	15486.89	.626
6	1	3671.40	4752.21	7498.75	9606.98	.5	1.0	8483.47	.340
7	9	3819.54	6978.74	10769.59	13389.39	1.0	2.0	18104.56	.731
11	1	11712.35	6550.26	3051.67	13762.19	.5	1.0	9132.15	.369
12	1	12942.72	6968.91	3051.67	15013.08	.5	1.0	9351.51	.378
13	9	7643.36	3727.24	3051.67	9034.71	1.0	2.0	16586.68	.670
14	9	6332.64	4890.38	3656.47	8797.04	1.0	2.0	16503.83	.667
15	9	3000.99	4196.32	3051.67	5993.98	1.0	2.0	15526.79	.627
16	9	2910.51	4890.38	5344.89	7807.36	1.0	2.0	16158.87	.653
18	1	5593.15	4890.38	7020.04	10221.55	.5	1.0	8511.25	.344
23	9	3671.40	4936.24	2855.49	6782.30	1.0	2.0	15801.57	.638
36	9	3651.09	5334.59	2561.81	6953.50	1.0	2.0	15861.24	.641
54	3	7364.54	11619.13	7618.02	15721.11	.5	1.8	9475.67	.383

PROB. NO. M-8(01)

ATTACHMENT NO. 2

SHT. NO. 12 OF 14

Added by: Sivaprasad Dingam date: 1-30-85

Ch'kd by: Randall Lewis date: 1-31-85

A-9

TOLEDO SURGE LINE

EQUATION 9 - PRIMARY STRESSES

CONDITION . . . X+Y OBE, DEAD WT. ,PRESSURE
EQ 9
MOMENTS IN FT-LBS. STRESSES IN PSI.

JOINT	TYPE	MX	MY	MZ	M(I)	B1	B2	PRIMARY STRESS	RATIO TO ALLOWABLE	ALLOWABLE 2.25 Sm
1	1	2318.32	12877.09	30757.68	33424.98	.5	1.0	12580.30	.297	< 37.575 KSI
2	9	2432.40	7482.58	23461.15	24790.29	1.0	2.0	22064.57	.521	< 37.575 KSI
3	9	2318.32	3587.92	41867.45	42004.81	1.0	2.0	28106.76	.664	< " "
5	9	2024.62	7120.80	11374.37	13571.34	1.0	2.0	18167.98	.429	< " "
6	1	2318.32	5246.59	13197.06	14389.71	.5	1.0	9242.19	.218	< " "
7	9	2024.62	7058.11	17759.43	19217.53	1.0	2.0	20136.04	.475	< " "
11	1	9803.24	8767.98	12269.16	17986.47	.5	1.0	9872.94	.233	< " "
12	1	9188.59	10695.21	12269.16	18690.91	.5	1.0	9996.47	.236	< " "
13	9	4692.66	4855.58	12269.16	14004.64	1.0	2.0	18319.02	.433	< " "
14	9	5805.91	4745.36	11995.40	14146.26	1.0	2.0	18368.38	.434	< " "
15	9	2176.89	5534.58	12269.16	13634.61	1.0	2.0	18190.04	.429	< " "
16	9	2717.00	4745.36	22607.09	23259.00	1.0	2.0	21544.76	.509	< " "
18	1	7090.56	4745.36	13224.78	15738.15	.5	1.0	9478.66	.224	< " "
23	9	2318.32	6629.38	11813.46	13743.40	1.0	2.0	18227.96	.430	< " "
36	9	2461.35	6278.92	14193.89	15714.63	1.0	2.0	18915.06	.447	< " "
54	3	10560.31	17027.65	23895.17	31183.98	.5	1.0	12187.31	.288	< " "

PROB. NO. M-8(01)

ATTACHMENT NO. 2

SHT. NO. 13 OF 14

Added by: Siva P. Gingam Date: 1-30-85

ch'kd by: [signature] Date: 1-31-85

TOLEDO SURGE LINE

EQUATION 9 - PRIMARY STRESSES

CONDITION . . . Z+Y DOE, DEAD WT. ,PRESSURE
EQ 9

MOMENTS IN FT-LBS. STRESSES IN PSI.

JOINT	TYPE	MX	MY	MZ	M(I)	B1	B2	PRIMARY STRESS	RATIO TO ALLOWABLE	ALLOWABLE 2.25 Sm
1	1	5835.29	16966.50	13066.77	22195.79	.5	1.0	10611.10	.251	< 37.575 KSI
2	9	6777.76	15954.67	25707.34	31531.99	1.0	2.0	24428.42	.577	< " "
3	9	5835.29	5219.98	11649.67	14036.16	1.0	2.0	18330.00	.433	< " "
5	9	6879.53	6516.80	3684.99	10166.87	1.0	2.0	16981.31	.401	< " "
6	1	5835.29	8501.46	9627.05	14106.93	.5	1.0	9192.61	.217	< " "
7	9	6879.53	12120.27	15735.53	21778.59	1.0	2.0	21028.74	.496	< " "
11	1	17704.10	11409.37	3996.96	21437.92	.5	1.0	10478.20	.247	< " "
12	1	20483.15	12007.76	3996.96	24077.41	.5	1.0	10941.07	.258	< " "
13	9	13398.91	6361.97	3996.96	15360.90	1.0	2.0	18791.76	.444	< " "
14	9	10423.35	8419.97	5193.87	14370.75	1.0	2.0	18440.63	.436	< " "
15	9	4288.30	7278.01	3996.96	9345.30	1.0	2.0	16694.94	.394	< " "
16	9	4423.36	8419.97	8052.70	12462.26	1.0	2.0	17781.40	.420	< " "
18	1	9159.99	8419.97	11124.49	16585.99	.5	1.0	9645.58	.228	< " "
23	9	5835.29	8567.60	4569.77	11326.60	1.0	2.0	17386.25	.410	< " "
36	9	5999.27	9253.94	4190.83	11797.87	1.0	2.0	17549.82	.414	< " "
54	3	11665.48	20521.17	11000.78	26042.64	.5	1.0	11285.70	.266	< " "

PROB. NO. M-8(01)

ATTACHMENT # 2

SHT. NO. 14 OF 14

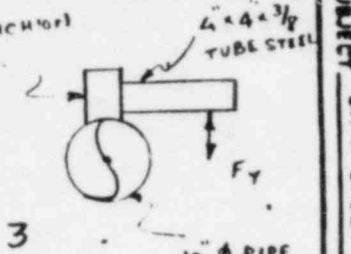
Added by: siva p. lingam date: 1-30-85

ch'kd by: Randall Kibbs date: 1-31-85

A-11

FOR LONG TERM

TO BE FILLED IN BY STRESS GROUP:



STRESS PROBLEM NO. M-8 ISSUE C2 DATA POINT 40
PIPE SUPPORT NO. PSU-R1
TYPE OF SUPPORT:

VERTICAL	X	Z	SKEW	ANCHOR
☒ (SNUBBER LOAD)	☐	☐	☐	☐

ATTACH NO. 3
SHT. NO. 1 OF 4
PROB. NO. M-8 (01)
Added by: Siva P. Singam 1-30-85
ch'ed by: [illegible] 1-31-85

PIPE OUTSIDE DIAMETER 10.75 in
OPERATING PRESSURE 2750 psig
PIPING MATERIAL S.S.SA376-TP316
PIPE WALL THK 1.0 in
DESIGN PRESSURE 2500 psig
TEMPERATURE 670 °F
Sm 16.48 ksi

ME-101 LOAD CASE	SUPPORT LOADS						PIPE STRESS (psi)*
	FORCES (lbs)			MOMENTS (in-lbs)			
	X	Y	Z	X	Y	Z	
WEIGHT		—					825
OBE		2400					4415
SSE		3900					8203
THERMAL		—					4546
SAM		—					—

Note 1) The stresses are at the center line of P.I.P.
2) The loads are as shown in figure.

* KSI FOR ME 210 INPUT

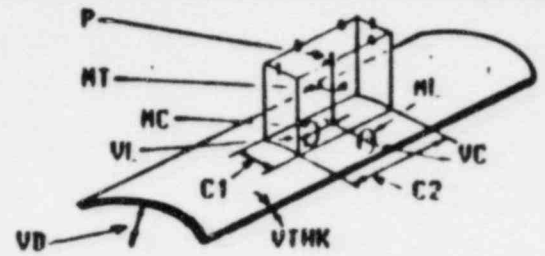
CALCULATION SHEET

ORIGINATOR Siva P. Singam DATE 11-30-84 CHECKED [illegible] DATE 12-5-84
PROJECT DAVIS-BESSE UNIT 1 JOB NO. 1501
SUBJECT DATA SHEET FOR LOCAL STRESS CHECK SHEET NO 11
CALC NO. PS/PSU-1 REV. NO. 1

-> TYPE CALL 816566+PROG.210IN

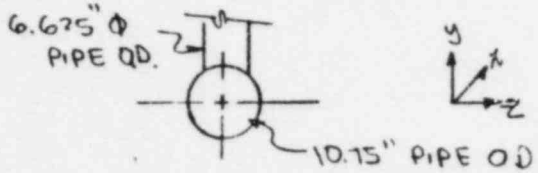
1> TITLE, SUPPORT NUMBER PSU-R1

2> NUMBER OF LOADING CASES ;3



LOADING COMBINATIONS

	CASE NUMBER	TYPE OF COMBINATION	P lbs	ML in-lbs	MC in-lbs	MT in-lbs	VL lbs	VC lbs	COMMENTS
3>	1	WEIGHT+ OBE	2400 ;	0 ;	20400 ;	0 ;	0 ;	0	
4>	2	WEIGHT+ SSE	3900 ;	0 ;	33150 ;	0 ;	0 ;	0	
5>	3	WEIGHT+THRM+ ORE+SAM	2400 ;	0 ;	20400 ;	0 ;	0 ;	0	



GEOMETRY

	PIPE WALL THICKNESS ACTUAL ☐ EFFECTIVE ☐ in	PIPE DIAMETER ACTUAL MEAN ☐ ADJUSTED ☒ in	ATTACHMENT DIMENSIONS C1 in	C2 in	SHAPE 0.0 RECTANGULAR 1.0 CIRCULAR 2.0 ELIPTICAL
6> A	1.0 ;	13.25 ;	6.625 ;	6.625 ;	1.0
B	;	;	;	;	

GEOMETRIC PARAMETERS
β AND γ CHECK

	A	B
β =C1/VD=	.5	
β =C2/VD=	.5	
$\gamma = \frac{VD}{(2)(VTHK)}$ =	6.625	

0.01 < β < 0.5
5 < γ < 300
IF NOT, ADJUST VD.

FOR POINT B:

$VT = \sqrt{VT^2 + VTU^2}$

= ---------- = -----

7> TYPE *CALL 816566+PROG.END

-> TYPE PXOT ADD 816566+210RUN.

-> TYPE CALL 816566+PROG.210SUB ADJUST PAPER, HIT RETURN

ATTACH. NO. 3
SHT. NO. 2 OF 4
PROB. NO. M-8(01)

Added by: Siva P. Lingam 1-31-84
ch'kd by: [signature] 1-31-84

CALCULATION SHEET

CALC. NO. PSI/PSU-1 REV. NO. 1

ORIGINATOR [signature] DATE 11/22/84 CHECKED T. Lui DATE 12/11/84

PROJECT JAMES BESSE UNIT 1 JOB NO. 12501

SUBJECT SEISMIC INPUT DATA SHEET NO. 12

ORIGINATOR C.H. Abud-- DATE 11/30/84 CHECKER T. Lin DATE 12/11/84 CALC NUM. PS/PSU-1
PROJECT DAVIS BESSE UNIT 1 JOB # 13501 STANDARD COMPUTER PROGRAM ME-210 REV NUM. 1 SHEET -13 OF

VERSION : 5
RELEASED : DEC 15, 1982
USER MANUAL VERSION : 1
THEORETICAL MANUAL VERSION : 1
VERIFICATION MANUAL VERSION : 5

B I J L A A R D S T R E S S A N A L Y S I S F O R C Y L I N D E R S

PSU-R1

ATTACH. NO. 3
SHT. NO. 3 OF 4
PROB. NO. M-8 (01)

Added by: Siva P. Arigam 1-30-85
ch'kd by: Randall Bass 1-31-85

I N P U T D A T A

	P (LBS)	ML (IN-LBS)	MC (IN-LBS)	MT (IN-LBS)	VL (LBS)	VC (LBS)	MA (FT-LBS)	MB (FT-LBS)
1	2400.	0.	20400.	0.	0.	0.	0.	0.
2	3900.	0.	33150.	0.	0.	0.	0.	0.
3	2400.	0.	20400.	0.	0.	0.	0.	0.

	VESTHK (IN)	VESDIA (IN)	C1 (IN)	C2 (IN)	SHAPE	PRESSURE (PSI)	SM (KSI)	BEND R (IN)
1	1.0000	13.2500	6.6250	6.6250	CIRCULAR	.0000	.0000	.0000
2	1.0000	13.2500	6.6250	6.6250	CIRCULAR	.0000	.0000	.0000
3	1.0000	13.2500	6.6250	6.6250	CIRCULAR	.0000	.0000	.0000

MAXIMUM PRIMARY PLUS SECONDARY STRESS INTENSITY

1.0000	-1.18	.63	-1.18	.63	-5.06	3.87	2.71	-2.61

MAXIMUM PRIMARY PLUS SECONDARY STRESS INTENSITY

1.0000	-1.91	1.03	-1.91	1.03	-8.21	6.30	4.40	-4.25

MAXIMUM PRIMARY PLUS SECONDARY STRESS INTENSITY

1.0000	-1.18	.63	-1.18	.63	-5.06	3.87	2.71	-2.61

ORIGINATOR S. H. O. ... DATE 11/30/84 CHECKER T. J. ... DATE 12/1/84 CALC NUM. PS/PSU-1

PROJECT. DAVIS BESSE UNIT 1 JOB # 13501 STANDARD COMPUTER PROGRAM ME-210 REV NUM. 1 SHEET - 14 OF

PROB. NO. M-8(01)

ATTACH. NO. 3

SHT. NO. 4 OF 4

Added by: Siva P. Gingam 1-30-85

ch'kd by: [illegible] 1-30-85

```
********* ME-210 POST-PROCESSOR  (VERS. B)  12/8/81 ********

DO YOU WANT TO ENTER PRESSURES AND OTHER STRESSES (YES OR NO)? >YES
ENTER ACTUAL PIPE O.D. AND WALL (INCHES) O.D.,W? >10.75,1.0
ENTER OPERATING AND DESIGN PRESSURE (PSIG) P-OP.,P-DES.? >2750,2500
IS ALL DATA O.K. SO FAR (YES OR NO)? >YES
ENTER FOLLOWING STRESSES WT,OBE,SSE,THRM,SAM (KSI)? >.825,4.415,8.203,4.546,0.0
ENTER SM STRESS ALLOWABLE (KSI)? >16.48
IS ALL DATA O.K. (YES OR NO)?   >YES
PIPE O.D. =    10.75
PIPE WALL =  1.000
DESIGN PRESSURE =  2500
OPERATING PRESSURE =  2750
WEIGHT STRESS =      .825
OBE STRESS =     4.415
SSE STRESS =     8.203
THERMAL STRESS =     4.546
SAM STRESS =     0.000
ALLOWABLE STRESS (SM) =   16.480

CHECK              VALUE       ALLOWABLE
-----              -----       ---------

  1A                14.03         24.720   -> upset primary in circumferential direction
  1B                14.40         49.440   -> Faulted primary   "
  2A                12.97         24.720   -> upset primary in longitudinal direction
  2B                17.39         49.440   -> OK Faulted primary   "

  3A     5.064      14.78 =  <     49.440
  3B     5.064      17.18 =  <     49.440

FOR CHECK 3A AND 3B YOU MUST ADD THE MAX PRI + SEC STRESS INTENSITY
FROM THE ME-210,RUN FOR LOAD CASE #3 AND MUST STILL
BE BELOW THE SPECIFIED ALLOWABLE


 TIME =    .044
FURPUR 28R3A-U1 S74T11 11/30/84 10:47:25
END PACK. TEXT=7,TOC=1,SYM=9
```

Annex 84-371

Code Case N-411 Alternative Damping Values for Seismic Analysis of Piping Section III, Division 1 Class 1, 2, and 3.

Question:

What alternatives to the damping values given in Table N-1230-1, Appendix N, Section III Division 1 are acceptable for use in seismic analysis of Class 1, 2 and 3 piping?

Reply:

It is the opinion of the Committee that for Section III, Division 1, Class 1, 2, and 3, construction, the damping value for seismic analysis of piping shown in Figure 1 may be used as an alternative to those given in Table N-1230-1, Appendix N.

The damping value in Figure 1 is applicable to both OBE and SSE, and is independent of pipe diameter.

This Code Case number shall be shown in the documentation for this analysis and on the Code Data Report.

PROB. NO. M-8(01)

ATTACH. NO. 4

SHT. NO. 1 OF 2

Added by: Siva P. Gingam date: 1-30-85

ch'kd by: [signature] date: 1-31-85

PROB. NO. M-8 (01)

ATTACH. NO. 4

SHT. NO. 2 OF 2

Added by: Uma P. Kingaonkar 1-30-85

Chkd by: [illegible] 1-31-85

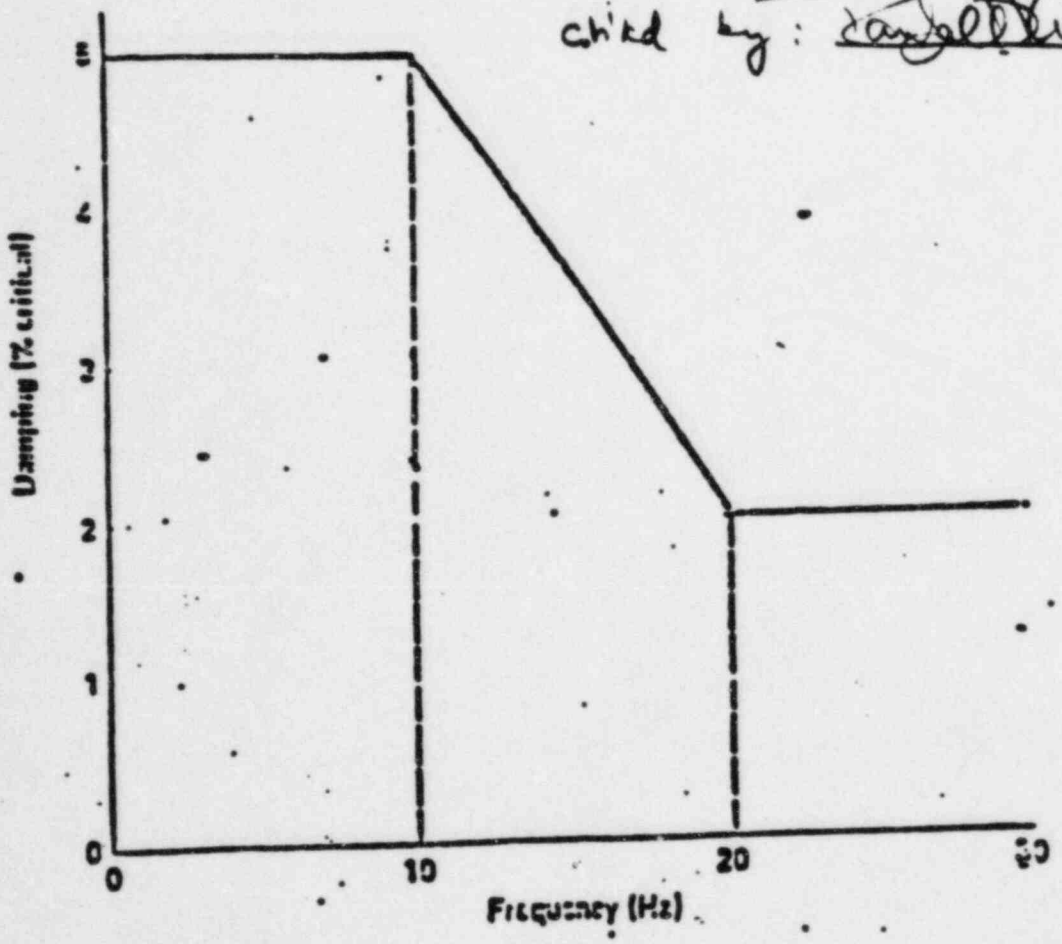


Figure 1

Damping Value for Seismic Analysis of Piping

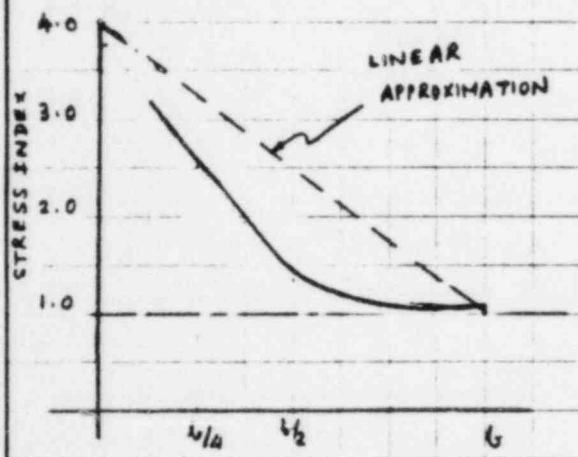
(Applicable to both OBE & SSE, Independent of Pipe Diameter)

ATTACHMENT # 5

CALCULATION SHEET

JOB NO. 12501 DAVIS-BESSE, UNIT-1	CALC. NO. M-8	REV. NO. 01	SHEET NO. 1 OF 1
PRESSURIZER SURGE LINE			
ORIGINATOR: Ewa P. Kingam	DATE: 1-30-85	CHECKED: [signature]	DATE: 1-31-85

1) ST. VENANT'S PRINCIPLE STATES THAT AT A DISTANCE EQUAL TO OR GREATER THAN THE MEMBER WIDTH (WALL THICKNESS IN THE CASE OF A PIPE) THE MEMBER STRESSES ARE UNAFFECTED BY LOAD APPLICATION OR GEOMETRIC DISCONTINUITY. REFERENCING WELDING RESEARCH COUNCIL (WRC) BULLETIN 198, THE INTERFERENCE DISTANCE TO "ANY OTHER WELD OR DISCONTINUITY" IS DEFINED AS $\sqrt{rt}$. SINCE $\sqrt{rt} = 2.208"$ IS GREATER THAN $t = 1.0$, WE EVALUATED THE EFFECT OF ADJACENT DISCONTINUITY OUT TO A DISTANCE OF 2.208"



PLOT OF STRESS INDEX VS. DISTANCE FROM SOURCE
(REF.: BEER & JOHNSON - "MECHANICS OF MATERIALS", PAGE 79)

AT b, $\frac{\sigma_{max.}}{\sigma_{av.}} = 1.027$

AT $\frac{b}{2}$, $\frac{\sigma_{max.}}{\sigma_{av.}} = 1.387$

AT $\frac{b}{4}$, $\frac{\sigma_{max.}}{\sigma_{av.}} = 2.575$ WHERE b = MEMBER WIDTH

AS CAN BE SEEN, A LINEAR DISTRIBUTION OF STRESS INDEX AWAY FROM THE POINT OF STRESS CONCENTRATION IS VERY CONSERVATIVE.

2) USE OF CLASS-II FORMULA IN CLASS-I ANALYSIS CAN BE JUSTIFIED BY THE FOLLOWING FORMULA:

$$B, C, K \text{ or } i = \frac{\sigma}{S} = \frac{\text{Elastic stress}}{\text{nominal stress}}$$

(Ref: D-101 of Appendix-D)