OCT 28 1966

UNCLASSIFIED

CLASSIFICATION LEVEL
(S, C OR U)

MASTER

ATOMICS INTERNATIONAL
A Division of North American Aviation Inc.

NAA-SR-MEMO COVER SHEET

PORT TITLE

AUTHOR

NAA-SR-MEMO 11961

(This Document Contains 40 Pages.)
(This is Copy of Series)

RELEASED FOR ANNOUNCEMENT
IN NUCLEAR SCIENCE ABSTRACTS

CLASSIFICATION TYPE
(RD OR DI)

*NAA-SR-MEMOs are working papers and may be expanded,
modified, or withdrawn at any time, and are intended for
internal use only.*

THIS REPORT MAY NOT BE PUBLISHED WITHOUT THE APPROVAL OF THE PATENT BRANCH, AEC.

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

UNCLASSIFIED

CLASSIFICATION LEVEL
(S, C OR U)

DO NOT REMOVE THIS SHEET

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

N.C. 2.00 - 50

D41E

ATOMICS INTERNATIONAL A Division of North American Aviation, Inc. TECHNICAL DATA RECORD		NAA-SR TDR NO 11961	APPROVALS 5/10/66
		PAGE 1 OF 40	<i>[Signature]</i>
AUTHOR K. A. Bonyhady		DEPT & GROUP NO 731-143	
		DATE 5/10/66	
		GO NO 7593	
TITLE ANALYSIS OF SAFETY AND RELIEF VALVE INSTALLATIONS IN THE SCTI MAIN STEAM LINES		S/A NO 1323	RECOMMENDED FOR OUTSIDE DISTRIBUTION ☐ YES ☐ NO
		TWR	
PROGRAM SODIUM COMPONENT DEVELOPMENT	SUBACCOUNT TITLE SCTI OPERATIONS AND MAINTENANCE		SIGNATURE
DISTRIBUTION USE AN ASTERISK (*) TO INDICATE THOSE WHO ARE TO RECEIVE COMPLETE COPIES CANO	STATEMENT OF PROBLEM Analyze and provide improvements for the safety valves in the main steam line sections of the SCTI.		
* K.A. Bonyhady 5 * D.F. Casey 2 * C.C. Conners 2 * D.J. Cockeram 2 * C.V. DiPol 2 * R.W. Dickinson 8038 * R.J. Gimera 5 * J. Hagelston 2 * A. Karwowski 2 * G. Landler 2 * J. Leppard 8355 * M. Silberman 5 * J. Susnir 5 * S. Westerman 2 * L. J. Zimmer 2	ABSTRACT Vibration in a 4-in. main steam pipeline is not usually of particular concern in the design of a steam loop. However, during startup of the SCTI steam section, some safety valves showed undesirable vibrational behavior. This analysis determines improvements which will correct the dynamic load problems encountered. The modifications recommended will permit keeping the plant down time to a minimum and will involve minimum labor and material costs. They will assure proper operation of the main steam line at the rated plant conditions. The following improvements are recommended: <ol style="list-style-type: none"> 1. Move the two high-pressure steam safety valves (PSV-208, 212) next to the steam generator steam outlet nozzles. 2. Anchor two points of the main steam lines at the intermediate and at the low pressure section safety valves (PSV 202, 206). 3. Adjust hanger loads (affected by the above modifications) to agree with the detailed piping hangerload and thermal stress computations. The computer program used for this analysis is based on the analytical methods developed by The M. W. Kellogg Company. 4. Add vibration dampeners (snubbers) to reduce the expected vibrations and resist the additional piping loads from the electromatic safety valve (PSV-200). 5. The modifications relocating safety valves PSV-208 and-212 were reviewed by C. F. Braun and Company. Mr Lee Wright of Braun Company reported that he concurred with the approach taken to the problems. (See Appendix A) 		

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. NAA-SR-TDR-11961
DATE 5-10-1966
PAGE 2 OF 40

TABLE OF CONTENTS

TITLE	<u>Page</u>
	<u>1</u>
STATEMENT OF PROBLEM	1
ABSTRACT	1
DISCUSSION	3
SAFETY VALVE OPERATION IN GENERAL	3
MODIFICATIONS TO HIGH PRESSURE SECTION OF THE MAIN LINE	3
MODIFICATIONS TO THE INTERMEDIATE PRESSURE SECTION OF THE MAIN STEAM LINE	5
STRESS REVIEW OF THE LOW PRESSURE SECTION OF THE MAIN STEAM LINE	5
ELECTRICALLY OPERATED VENT VALVE IN THE MAIN STEAM LINE	5
CONCLUSION AND PROPOSAL	6
REFERENCES	7
APPENDIX "A" Consultation on SCTI Piping Modification	8
APPENDIX "B" Problem Nos. 1 thru 9 and Sketch Nos. 1 thru 6	11
APPENDIX "C" Drawing Nos. - M5-7593-448518 303-356-S51 303-356-S52	37

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. NAA-SR-TDR-11961

DATE 5-10-66

PAGE 3 OF 40

DISCUSSION

SAFETY VALVE OPERATION IN GENERAL

The main steam generator and the piping up to the main steam condenser in the SCTI was safeguarded against possible overpressures with the inclusion of pressure relief and safety valves in accordance with the ASME Code for Pressure Piping. The safety valves generate vibrations during their actuation; this was experienced with the two spring-loaded safety valves, PSV-208 and 212, in the high pressure section of the main steam line when their set points were tested. These reaction forces, static and dynamic, must be kept within safe limits.

In general there are three basic methods for the absorption of this sudden additional piping load and the coincidental vibrations: (a) Anchoring the pipe line next to the safety valve, (b) placing the safety valves next to a heavy tank or vessel nozzle, and (c) applying snubbers. These 3 methods were applied in this present case.

MODIFICATIONS TO HIGH PRESSURE SECTION OF THE MAIN STEAM LINE

1. The two high pressure safety valves, PSV-208 and 212, are moved next to the steam generator steam outlet nozzle where the additional bending, shear and torsional stresses generated by the static and dynamic reactions will be kept within acceptable limits. This also results in a minimum of influence on the constant load hanger located near these valves. At this location the heavy mass of the steam generator can absorb the dynamic forces and the resulting vibrations without transferring them to the connected pipe system. See Drawing M5-7593-448518.

The two safety valves combined are required to meet the total flow capacity. The larger size valve is placed next to the steam generator nozzle and the smaller size valve followed it at a minimum safe distance.

The reaction forces from these valves were obtained from the manufacturer. They were used to analyze the piping system stress conditions. Four different stress analyses were performed using the PSA-2 (IBM) piping stress computer program:

- a. The thermal stresses in the piping system, with no safety valves actuated, was computed first. The resulting thermal stress, 7,006 psi, is well below 26,010 psi which is the allowable ASME Pressure Piping Code stress for thermal expansions of the high pressure main steam section. (Problem #1, Problems & Sketches), Appendix B.

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. NAA-SR-TDR-11961

DATE 5-10-66

PAGE 4 OF 40

- b. A second computation was performed considering the stresses when all the hanger loads are applied but neither of the safety valves are actuated. A stress of 1,359 psi is the result at the steam generator steam outlet nozzle, which is far below the 7,990 psi allowed by the Code for Pressure Piping. This code allowed value is computed as a difference of the 10,300 psi allowable hot condition stress and 2,310 psi piping pressure stress. (Problem #2, Appendix B)
- c. The third computation (Problem #3) is the force generated with the larger size safety valve discharging. The stress at the steam outlet nozzle was 6,866 psi. This is less than the allowable 7,990 psi. Since the set pressure point of the smaller safety valve is 20 psig higher than that of the larger size, this valve should not discharge alone. But even if the safety valve should malfunction and the smaller valve opens first, the reaction forces will be smaller. The smaller reactive forces and vibrations would cause lower stress than the above.
- d. Assuming that both safety valves are actuated at the same time, the maximum stress at the steam outlet nozzle is computed to be 4,210 psi, somewhat less than the previous case because the moments generated by the two valves partially cancel each other. (Problem #4)

Each of the three computed stresses generated by pipe support loads is below the code allowable value; therefore the new location of the safety valves is considered adequate. The new location and the modified installation of the two safety valves are shown on Dwg. M5-7593-448518 (Appendix C)

- 2. An anchor was placed next to the intermediate section safety valve (PSV-202) to prevent the dynamic forces from vibrating the piping system excessively. This anchor was designed to resist the thermal forces and moments in the piping system as well as the piping support loads and the sudden load and vibration of the intermediate stage steam safety valve.

Computations in connection with the high pressure safety valves (Problems #1 to #4) also determined the stresses at this anchor. The actual thermal stress is 19,970 psi compared to 26,010 psi allowable. Pipe support stresses were also computed with:

- a. No safety valve discharges
- b. The larger valve actuated, and
- c. Both valves discharging.

The stresses are as follows: 6,170 psi, 6,050 psi, and 6,108 psi. These values are below the code allowed 7,990 psi stress limit.

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. NAA-SR-TDR-11961

DATE 5-10-66

PAGE 5 OF 40

Four IBM tabulation sheets marked as Problem #1 to 4 and three isometric diagrams of this section as Sketch No. 1 to 4, Dwg. No. 303-356-S51, show the details of this anchor and its structural sections.

MODIFICATIONS TO THE INTERMEDIATE PRESSURE SECTION OF THE MAIN STEAM LINE

A second anchor is designed to absorb the dynamic forces and vibrations of safety valve PSV-206 in the low pressure section of the main steam line. Merely by inspection it could be seen that the piping system stresses between the first and second new anchors are within the code allowed range. However, a computer analysis (see Problem #5) gave the value of 1,573 psi for thermal expansion stress at the first anchor and 2,326 psi (also as section max.) at the second anchor point. These stresses are far below the allowable 22,500 psi. Checking now the stresses in the piping resulting from the pipe supports (Problem #6) it can be seen that the 6,532 psi calculated for the first anchor and the maximum section stress of 9,410 psi at the second anchor are less than the allowable 13,100 psi, which is the difference of 15,000 psi maximum code allowable hot stress and the pipe pressure stress of 1,900 psi. Sketch No. 4 and 5 show the isometric picture of this intermediate pressure sections and dwg. 303-356-S52 gives the structural details of the second anchor.

STRESS REVIEW OF THE LOW PRESSURE SECTION OF THE MAIN STEAM LINE

A stress check was performed for the low pressure section of the steam line. This section starts at the second anchor described above and has two branch lines. One branch ends at the main condenser, the other branch ends at the low pressure flash tank. Considering the fairly large pipe sizes (18 in. and 24 in.) and the moderately low temperatures (650°F max.) the expected thermal stresses could, by observation, be expected to be within the allowable limits. Problem #7 calculated the thermal expansion stresses in this section. The calculations resulted in a maximum stress of 6,726 psi near the main condenser junction. This value is less than the allowable 22,500 psi. The existing pipe hangers are to be adjusted to match the new pipe load distribution in both branches; therefore there is no need to make a pipe support stress computation for either branch. Sketch No. 6 depicts isometrically this section.

ELECTRICALLY OPERATED VENT VALVE IN THE MAIN STEAM LINE

There is one electrically operated vent valve in the high pressure section of the main steam line. This valve is provided to immediately release the steam pressure in the steam generator if a leak occurs between the sodium and water sides of the steam generator.

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. NAA-SR-TDR-11961

DATE 5-10-66

PAGE 6 OF 40

The location of this valve does not allow the pipe to be anchored because the cold to hot movement at its point is close to 6 inches. Therefore a group of snubbers are added to absorb both the sudden reaction forces and the accompanying vibrations.

Calculations performed on the enclosed sheets of Problem #8 and 9 show, that the axial forces in each snubber are within the allowable maximum of 7,500 lb. (actual forces 2,242 lbs., 508 lbs., 6,388 lbs., and 4,642 lbs.). All the expected movements: 0.04 in., 0.04 in., 5.82 in., 5.36 in., are less than the ± 10 in., allowable for the snubbers. During discharge of this vent valve the stresses generated by pipe supports, pipe internal pressure, thermal expansion and vent valve reaction is 36,141 psi. This is less than the allowable 39,374 psi for the 347SS material at 1100°F, with a 20% additional allowance for short time overloading.

The two snubbers located close to the ground level included a force transfer pipe stub. A stress of 23,900 psi was calculated for the worst expected case. The code allowable is 36,312 psi stress, (Problem #8).

Proper operation of the snubbers require that the temperature at their welding joints be less than 700°F. The expected maximum main steam line temperature could be 1100°F. A calculation was made to determine the necessary cooling for the connecting pipe pieces. The results shows that with the selected dimensions a bare pipe would maintain this requirement, however an additional rin is added to lower this temperature even further, (Problem #9).

CONCLUSION AND PROPOSAL

As was mentioned previously a 4 in. steam line usually is no particular concern for vibration. In this case vibrations were encountered during safety valve testing and modifications are recommended. Calculations show that the modifications have all the critical stresses within the allowable limits for any foreseeable problem, and the future operation of the main steam line can be expected as safe for any safety and vent valve actuation.

Because of the unexpected vibrational problems in the main steam line, it is proposed to perform a similar analysis for the other steam lines and the boiler feed pipe lines where safety and safety relief valves are installed.

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. NAA-SR-TDR-11961
DATE 5-10-66
PAGE 7 OF 40

REFERENCES

1. "Heat Transmission" by W. H. McAdams (3rd ed.) p.179, 446, 447
2. "Design of Piping System" by M. W. Kellogg Co. (2nd ed.)
3. Code for Pressure Piping (ASA B.31.1-1955) by ASME
4. Crosby-Ashton Valve Catalog Nos. 301, 401 and Bulletin 401 HPV
5. Barco Hydraulic Vibration Snubber Catalog No. 229A
6. Steam and Feedwater P&I Diagram SCTI by A.I. Dwg. #7593-448511
7. Heat Balance Diagram, SCTI. Max. Predicated Capability by A.I. Dwg. #7593-44851
8. Piping Dwgs: 7593-448518, -448522, -448524, -448526, by A.I.

APPENDIX "A"

CONSULTATION ON SCTI
PIPING MODIFICATION

C F BRAUN & CO
Engineers
ALHAMBRA CALIFORNIA

APR 15 1966

April 11, 1966

Joe Carey
Atomics International
Purchasing Department
Box 309
Canoga Park, California

Dear Mr Carey

CONSULTING ON PIPING
SCTI UNIT MODIFICATIONS
PROJECT 2929-P

On Friday, April 8, I reviewed with you, Mr C C Conners, and engineers from his group, the proposed modification drawings showing the relocation of the safety valves on the outlet from the ALCO steam boiler. We decided that the following engineering investigation should be made.

- 1 Check nozzles for pressure reinforcement
- 2 Recheck nozzles for bending moment
- 3 Redesign outlet piping to short radius ells to reduce moment arm
- 4 Recalculate deadload, pressure, and relief valve thrust acting simultaneously on the piping system
- 5 Investigate snubbing device on system near boiler outlet to eliminate possible lateral movement during relief valve discharge

Mr Conners indicated AI would perform all the calculations. If necessary, he will want Braun to make a computer deadload calculation, or a seismic calculation to determine the safe level of lateral loads.

TDR 11951
STANDARD
Page 10. 40

C F BRAUN & CO

Project 2929-P

Joe Carey

Page 2

April 11, 1966

I concurred that I felt IA were approaching the problems in a sound and reasonable manner. I hope my contribution to your discussions has helped even further. Please call me if there are any additional questions.

Yours very truly

LEW CM

Lee E Wright
Piping Engineering

APPENDIX "B"

Problem Nos. 1 through 9 and
Sketch Nos. 1 through 6

PSA PROBLEM, SCTI LINE 100 ANCHOR AT POINT 100 CASE 1

ACTIONS AT CONSTRAINTS

SECT	POINT	X	Y	Z	F-X	F-Y	F-Z	M-X	M-Y	M-Z
1	1	146.50	-148.50	0.	-1300.	749.	-363.	-18215.	-38256.	-21689.
2	0	-103.00	-48.00	-111.00	1300.	-749.	363.	64895.	92072.	-34510.
TOTAL EXT. ACTION					-0.	0.	-0.	0.	0.	-0.

MOMENTS AND STRESSES AT SIGNIFICANT POINTS

SECT	POINT	POS	X	Y	Z	BM	TM	SIG-B	SIG-I	SIG-C
1	10		146.50	-148.50	0.	47074.	7048.	6928.3292	518.6548	7005.5518
1	20	I	108.17	-121.62	0.	37345.	7048.	5496.4175	518.6548	5593.4441
1	20	M	102.71	-118.93	0.	36108.	-407.	5314.3364	-29.9415	5314.6737
1	20	F	96.69	-118.00	0.	31391.	-7152.	4620.1290	-526.2787	4738.5091
1	30	I	20.01	-118.00	0.	34252.	-7152.	5041.1929	-526.2787	5149.9031
1	30	M	5.86	-112.14	0.	36778.	-12576.	5412.9706	-925.4577	5720.6763
1	30	F	0.	-97.99	0.	22363.	-14885.	3291.3165	-1095.4062	3953.7859
1	40	I	0.	-20.01	0.	83971.	-14885.	12358.7435	-1095.4062	12551.4221
1	40	M	-5.86	-5.86	0.	99659.	11677.	14667.6973	859.3189	14768.0416
1	40	F	-20.01	0.	0.	92738.	35651.	13648.9706	2623.5567	14622.8107
1	50	I	-181.99	0.	0.	86730.	35651.	12764.7909	2623.5567	13801.1624
1	50	M	-196.14	0.	-5.86	78770.	51704.	11593.1731	3804.8812	13867.5934
1	50	F	-202.00	0.	-20.01	65488.	46249.	9638.3632	3403.3988	11799.5990
1	60	I	-202.00	0.	-90.99	44326.	46249.	6523.7476	3403.3988	9428.2435
1	60	M	-196.14	0.	-105.14	50675.	60071.	7458.2183	4420.5676	11566.7925
1	60	F	-181.99	0.	-111.00	70706.	47484.	10406.4165	3494.2687	12535.2765
1	70		-142.00	0.	-111.00	77937.	47484.	11470.5743	3494.2687	13431.8179
1	70		-142.00	0.	-111.00	77937.	47484.	8940.4037	2723.5056	10469.0376
1	75		-127.00	0.	-111.00	83955.	47484.	9630.8182	2723.5056	11064.4742
1	75		-127.00	0.	-111.00	48509.	-83367.	5564.6938	-4781.6518	11064.4742
1	80		-127.00	-13.00	-111.00	52664.	-83367.	6041.2316	-4781.6518	11311.6423
2	80		-127.00	-13.00	-111.00	52664.	-83367.	8926.4459	-7065.3071	16713.9370
2	90	I	-127.00	-28.47	-111.00	63846.	-83367.	10821.9279	-7065.3071	17798.5498
2	90	M	-121.28	-42.28	-111.00	112483.	-15996.	19065.8977	-1355.6179	19257.7061
2	90	F	-107.47	-48.00	-111.00	98054.	64895.	16620.0823	5499.8287	19930.3687
2	100		-103.00	-48.00	-111.00	98327.	64895.	16666.4275	5499.8287	19969.0325

SKETCH NO. 1

INPUT DATA	SECTION			
	10-70	70-80	80-100	
M	0			
D	0			
IG	0			
Icer	0			
Ubres	0			
O.D.	4.5	4.5	4.5	
THICK	.674	1.348	.531	
ARG	ACPOE4	B4VANA	C4CPOB	
R	20		20	
DAV	3.826		3.969	
R/DAV	5.23		4.92	
E · 10 ⁴	27.4	→		
MU	.3			
MAT'L.	3475	→		
TEMP.	1100°	→	1075°	
Lambda	.01070	→	.01072	

POINT	CALC. FOR Δx , Δy & Δz		
10	Δx	$-.01070 (25'') = -0.2675$	
	Δy	$.01128 (494) = 5.56''$	
	Δz	0	
100	Δx	0	
	Δy	0	
	Δz	0	
	Δx		
	Δy		
	Δz		

PIPE HANGERS	POINT					
	LOAD					
	MOVEMENT					

<u>SECTION</u>	<u>POINT</u>
1	10-80
2	80-100

CONVENTION FOR POSITIVE
FORCES & MOMENTS

MAXIMUM STRESS = 19,969
@ POINT 100

REACTIONS ON THE PIPING

$Sc = 18750$
 $Sh = 10,300 \text{ (110°F)}$
 $SA = 1.25 Sc + .25 Sh$
 $SA = \frac{26,010}{2} = 13,005$

PREPARED BY: JFH

CHECKED BY: A.K.S.

0121...

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.
Thermal Stages
SC-1 - MAIN STREAM LINE 100 -

PROBLEM NO. 1
PAGE NO. OF
REPORT NO. TDR-11961

PSA PROBLEM, SCTI LINE 100 TO ANCHOR WEIGHT ONLY CASE

1 (A)

DEAD WEIGHT ONLY
APPENDIX "B"
TDR 11961

PROBLEM #2
Page 14 of 40

ACTIONS AT CONSTRAINTS

SECT POINT	X	Y	Z	F-X	F-Y	F-Z	M-X	M-Y	M-Z
1 1	142.00	-150.50	0.	45.	550.	15.	-1182.	1779.	8981.
18 0	-103.00	-48.00	-111.00	-45.	-433.	-15.	-11134.	-3115.	36239.
TOTAL EXT. ACTION				0.	-0.	0.	0.	-0.	-0.

MOMENTS AND STRESSES AT SIGNIFICANT POINTS

SECT POINT	PJS	X	Y	Z	BM	TM	SIG-B	SIG-I	SIG-C
1 10		142.00	-150.50	0.	9014.	-1996.	1326.5948	-146.8556	1358.7200
1 20		136.75	-146.75	0.	12054.	-1996.	1774.0872	-146.8556	1798.2357
2 20		136.75	-146.75	0.	12056.	-1982.	1774.4234	-145.8366	1798.2357
2 30		122.50	-137.00	0.	14186.	-1982.	2087.9113	-145.8366	2108.1857
4 40		120.25	-135.00	0.	13835.	-1989.	2036.2230	-146.3583	2057.1551
4 50	I	103.69	-123.58	0.	7963.	-1989.	1172.0480	-146.3583	1208.0478
4 50	M	98.21	-120.92	0.	6001.	-1884.	883.2597	-138.6124	925.7436
4 50	F	92.19	-120.00	0.	3838.	-1631.	564.8980	-120.0220	613.7840
4 50		86.50	-120.00	0.	1783.	-1631.	262.4581	-120.0220	355.6759
5 60		86.50	-120.00	0.	1783.	-1631.	262.4582	-120.0220	355.6760
5 70		74.00	-120.00	0.	4479.	-1631.	659.2628	-120.0220	701.6042
6 70		74.00	-120.00	0.	4479.	-1631.	659.2628	-120.0220	701.6042
6 80		47.00	-120.00	0.	741.	-1631.	109.0720	-120.0220	263.6623
7 80		47.00	-120.00	0.	741.	-1631.	109.0720	-120.0220	263.6623
7 90	I	20.01	-120.00	0.	446.	-1631.	65.6736	-120.0220	248.8656
7 90	M	5.86	-114.14	0.	1502.	-1055.	221.0625	-77.6167	270.1222
7 90	F	0.	-99.99	0.	2267.	312.	333.6123	22.9549	336.7564
7 100		0.	-60.00	0.	3897.	312.	573.4979	22.9549	575.3325
8 100		0.	-60.00	0.	3897.	312.	573.4979	22.9549	575.3325
8 110	I	0.	-20.01	0.	5680.	312.	836.0221	22.9549	837.2817
8 110	M	-5.86	-5.86	0.	2587.	-2060.	395.4460	-151.5885	498.2909
8 110	F	-20.01	0.	0.	10777.	-3398.	1586.1867	-250.0328	1663.1458
8 120		-30.00	0.	0.	18968.	-3398.	2791.6110	-250.0328	2836.0461
9 120		-30.00	0.	0.	18968.	-3398.	2791.6109	-250.0328	2836.0460
9 140		-43.00	0.	0.	40440.	-3398.	5951.9314	-250.0328	5972.9015
10 140		-43.00	0.	0.	40440.	-3398.	5951.9316	-250.0328	5972.9017
10 150		-67.00	0.	0.	22516.	-3398.	3313.8630	-250.0328	3351.3809
11 150		-67.00	0.	0.	22516.	-3398.	3313.8629	-250.0328	3351.3808
11 160		-97.00	0.	0.	11423.	-3398.	1681.2757	-250.0328	1754.0678
12 160		-97.00	0.	0.	11423.	-3398.	1681.2757	-250.0328	1754.0677
12 170		-151.00	0.	0.	12313.	-3398.	1812.1662	-250.0328	1879.8968
13 170		-151.00	0.	0.	12313.	-3398.	1812.1665	-250.0328	1879.8971

						APPEAL "P"		PROBLEM #2		
						TIF 1.0		Page 50-240		
13	180		-176.00	0.	0.	12686.	-3398.	1867.1586	-250.0328	1932.9633
14	180		-176.00	0.	0.	12686.	-3398.	1867.1588	-250.0328	1932.9634
14	190	I	-181.99	0.	0.	13050.	-3398.	1920.7182	-250.0328	1984.7478
14	190	M	-196.14	0.	-5.86	12567.	6925.	1849.6250	509.6203	2111.8628
14	190	F	-202.00	0.	-20.01	5166.	13882.	760.2980	1021.5917	2180.0577
14	200		-202.00	0.	-55.50	6719.	13882.	988.8589	1021.5917	2269.8988
15	200		-202.00	0.	-55.50	6719.	13882.	988.8590	1021.5918	2269.8989
15	210	I	-202.00	0.	-90.99	4332.	13882.	637.5538	1021.5918	2140.3443
15	210	M	-196.14	0.	-105.14	17254.	4996.	2539.3564	367.6607	2643.6771
15	210	F	-181.99	0.	-111.00	20141.	-10428.	2964.3646	-767.3611	3338.0876
15	220		-176.00	0.	-111.00	21987.	-10428.	3235.9510	-767.3611	3581.4453
16	220		-176.00	0.	-111.00	21987.	-10428.	3235.9508	-767.3611	3581.4451
16	230		-151.00	0.	-111.00	33854.	-10428.	4982.5464	-767.3611	5213.5535
17	230		-151.00	0.	-111.00	33854.	-10428.	4982.5457	-767.3613	5213.5530
17	240		-142.00	0.	-111.00	12475.	-10428.	1836.0520	-767.3613	2393.0023
17	240		-142.00	0.	-111.00	12475.	-10428.	1431.0571	-598.0973	1865.1557
17	250		-127.00	0.	-111.00	23871.	-10428.	2738.3293	-598.0973	2988.1982
17	250		-127.00	0.	-111.00	25902.	2762.	2971.3570	158.4032	2988.1982
17	260		-127.00	-13.00	-111.00	26509.	2762.	3040.9978	158.4032	3057.4555
18	260		-127.00	-13.00	-111.00	26509.	2762.	4493.3386	234.0546	4517.6561
18	270	I	-127.00	-27.96	-111.00	27208.	2762.	4611.7514	234.0546	4635.4478
18	270	M	-121.13	-42.13	-111.00	29795.	-5798.	5050.3107	-491.3880	5145.0448
18	270	F	-106.96	-48.00	-111.00	34661.	-11134.	5875.0560	-943.6321	6170.7413

PSA PROBLEM, SCTI LINE 100 TO ANCHOR WEIGHT ONLY CASE

2 (A)

APPENDIX "B"

PSV 208 DISCHARGING
TIP 1961

PROBLEM #3

Page 16 of 40

ACTIONS AT CONSTRAINTS

SECT POINT	X	Y	Z	F-X	F-Y	F-Z	M-X	M-Y	M-Z
1 1	142.00	-150.50	0.	27.	2433.	12.	-1962.	1775.	-46578.
18 0	-103.00	-48.00	-111.00	-27.	-416.	-12.	-12530.	-1735.	35023.
TOTAL EXT. ACTION				0.	-0.	0.	0.	0.	-0.

MOMENTS AND STRESSES AT SIGNIFICANT POINTS

SECT POINT	PJS	X	Y	Z	BM	TM	SIG-B	SIG-I	SIG-C
1 10		142.00	-150.50	0.	46579.	-2629.	6855.4235	-193.4365	6866.3310
1 20		136.75	-146.75	0.	33708.	-2629.	4961.0486	-193.4365	4976.1103
2 20		136.75	-146.75	0.	33708.	-2624.	4961.1072	-193.0623	4976.1105
2 30		122.50	-137.00	0.	4911.	-2624.	722.7353	-193.3623	819.4135
4 40		120.25	-135.00	0.	20465.	-2628.	3012.0319	-193.4102	3036.7690
4 50	I	103.69	-123.58	0.	14109.	-2628.	2076.5353	-193.4102	2112.2568
4 50	M	98.21	-120.92	0.	11983.	-2590.	1763.6625	-190.5757	1804.3785
4 50	F	92.19	-120.00	0.	9646.	-2334.	1419.6139	-171.7434	1460.5776
4 50		86.50	-120.00	0.	7367.	-2334.	1084.3329	-171.7434	1137.4361
5 60		86.50	-120.00	0.	7367.	-2334.	1084.3330	-171.7434	1137.4362
5 70		74.00	-120.00	0.	1495.	-2334.	219.9580	-171.7434	407.8783
6 70		74.00	-120.00	0.	1495.	-2334.	219.9580	-171.7434	407.8783
6 80		47.00	-120.00	0.	5771.	-2334.	849.3790	-171.7434	916.2029
7 80		47.00	-120.00	0.	5771.	-2334.	849.3790	-171.7434	916.2029
7 90	I	20.01	-120.00	0.	5090.	-2334.	749.1481	-171.7434	824.1395
7 90	M	5.86	-114.14	0.	5154.	-1784.	758.5288	-131.2535	802.6680
7 90	F	0.	-99.99	0.	5738.	-46.	844.4376	-3.3728	844.4646
7 100		0.	-60.00	0.	6904.	-46.	1016.0698	-3.3728	1016.0922
8 100		0.	-60.00	0.	6904.	-46.	1016.0698	-3.3728	1016.0921
8 110	I	0.	-20.01	0.	8070.	-46.	1187.7276	-3.3728	1187.7468
8 110	M	-5.86	-5.86	0.	3794.	-2615.	558.4337	-192.4387	678.2173
8 110	F	-20.01	0.	0.	8980.	-3795.	1321.6068	-279.2808	1434.7946
8 120		-30.00	0.	0.	17345.	-3795.	2552.8227	-279.2808	2613.2154
9 120		-30.00	0.	0.	17345.	-3795.	2552.8227	-279.2808	2613.2154
9 140		-43.00	0.	0.	39046.	-3795.	5746.7331	-279.2808	5773.8143
10 140		-43.00	0.	0.	39046.	-3795.	5746.7332	-279.2808	5773.8143
10 150		-67.00	0.	0.	21520.	-3795.	3167.3222	-279.2808	3216.1967
11 150		-67.00	0.	0.	21520.	-3795.	3167.3222	-279.2808	3216.1967
11 160		-97.00	0.	0.	10895.	-3795.	1603.5182	-279.2808	1698.0169
12 160		-97.00	0.	0.	10895.	-3795.	1603.5181	-279.2808	1698.0169
12 170		-151.00	0.	0.	12654.	-3795.	1862.3957	-279.2808	1944.3530
13 170		-151.00	0.	0.	12654.	-3795.	1862.3959	-279.2808	1944.3532

ADDITIONAL B
TID 1961

PROBLEM 11
Page 1 of 110

13	180		-176.00	0.	0.	11632.	-3795.	1711.9242	-279.2808	1800.7430
14	180		-176.00	0.	0.	11632.	-3795.	1711.9242	-279.2808	1800.7430
14	190	I	-181.99	0.	0.	11890.	-3795.	1750.0183	-279.2808	1836.9962
14	190	M	-196.14	0.	-5.86	11746.	5827.	1728.6859	428.8307	1929.7508
14	190	F	-202.00	0.	-20.01	4998.	12525.	735.5835	921.7024	1984.7478
14	200		-202.00	0.	-55.50	6181.	12525.	909.7635	921.7024	2055.6776
15	200		-202.00	0.	-55.50	6181.	12525.	909.7635	921.7024	2055.6777
15	210	I	-202.00	0.	-90.99	5436.	12525.	800.0715	921.7024	2009.5411
15	210	M	-196.14	0.	-105.14	17309.	3106.	2547.4986	228.5723	2588.1906
15	210	F	-181.99	0.	-111.00	19050.	-11945.	2803.7521	-879.0560	3309.3781
15	220		-176.00	0.	-111.00	21000.	-11945.	3090.7427	-879.0560	3555.7908
16	220		-176.00	0.	-111.00	21000.	-11945.	3090.7426	-879.0560	3555.7907
16	230		-151.00	0.	-111.00	33311.	-11945.	4902.5809	-879.0560	5208.2874
17	230		-151.00	0.	-111.00	33311.	-11945.	4902.5801	-879.0560	5208.2866
17	240		-142.00	0.	-111.00	11958.	-11945.	1759.9477	-879.0560	2487.6442
17	240		-142.00	0.	-111.00	11958.	-11945.	1371.7398	-685.1545	1938.9216
17	250		-127.00	0.	-111.00	23818.	-11945.	2732.2157	-685.1545	3056.5911
17	250		-127.00	0.	-111.00	26606.	1442.	3052.1103	82.7227	3056.5912
17	260		-127.00	-13.00	-111.00	26985.	1442.	3095.5937	82.7227	3100.0117
18	260		-127.00	-13.00	-111.00	26985.	1442.	4574.0090	122.2300	4580.5369
18	270	I	-127.00	-27.96	-111.00	27421.	1442.	4647.9308	122.2300	4654.3551
18	270	M	-121.13	-42.13	-111.00	29062.	-7739.	4926.0345	-655.8887	5097.7029
18	270	F	-106.96	-48.00	-111.00	33421.	-12530.	5664.8616	-1061.9142	6049.9011

PSA PROBLEM, SCTI LINE 100 TO ANCHOR WEIGHT ONLY CASE

3(A)

APPENDIX "B" PROBLEM #4
PSV 208 (PSV 212) DISCHARGING
TDR 11961 Page 18 of 40

ACTIONS AT CONSTRAINTS

SECT POINT	X	Y	Z	F-X	F-Y	F-Z	M-X	M-Y	M-Z
1 1	142.00	-150.50	0.	36.	5166.	14.	-1571.	1792.	1252.
18 0	-103.00	-48.00	-111.00	-36.	-424.	-14.	-11867.	-2447.	35619.
TOTAL EXT. ACTION				0.	-0.	0.	0.	-0.	-0.

MOMENTS AND STRESSES AT SIGNIFICANT POINTS

SECT POINT	PSS	X	Y	Z	BM	TM	SIG-B	SIG-I	SIG-C
1 10		142.00	-150.50	0.	1365.	-2320.	200.9102	-170.7022	396.1336
1 20		136.75	-146.75	0.	28511.	-2320.	4196.1460	-170.7022	4210.0116
2 20		136.75	-146.75	0.	27098.	-2310.	3988.1935	-169.9872	4002.6579
2 30		122.50	-137.00	0.	3300.	-2310.	485.7431	-169.9872	592.8988
4 40		120.25	-135.00	0.	17225.	-2316.	2535.0862	-170.4280	2557.8985
4 50	I	103.69	-123.58	0.	11108.	-2316.	1634.8488	-170.4280	1670.0040
4 50	M	98.21	-120.92	0.	9061.	-2242.	1333.5247	-164.9538	1373.7275
4 50	F	92.19	-120.00	0.	6795.	-1985.	1000.1275	-146.0409	1041.9053
4 60		86.50	-120.00	0.	4580.	-1985.	674.0381	-146.0409	734.6014
5 60		86.50	-120.00	0.	4580.	-1985.	674.0382	-146.0409	734.6014
5 70		74.00	-120.00	0.	1791.	-1985.	263.5807	-146.0409	393.4292
6 70		74.00	-120.00	0.	1791.	-1985.	263.5806	-146.0409	393.4292
6 80		47.00	-120.00	0.	3277.	-1985.	482.2522	-146.0409	563.8076
7 80		47.00	-120.00	0.	3277.	-1985.	482.2522	-146.0409	563.8076
7 90	I	20.01	-120.00	0.	2807.	-1985.	413.1142	-146.0409	505.9399
7 90	M	5.86	-114.14	0.	3163.	-1421.	465.5870	-104.5350	510.3739
7 90	F	0.	-99.99	0.	3914.	135.	576.1137	9.9086	576.4544
7 100		0.	-60.00	0.	5412.	135.	796.5417	9.9086	796.7882
8 100		0.	-60.00	0.	5412.	135.	796.5417	9.9086	796.7882
8 110	I	0.	-20.01	0.	6925.	135.	1019.2276	9.9086	1019.4202
8 110	M	-5.86	-5.86	0.	3156.	-2347.	464.4474	-172.6999	578.8026
8 110	F	-20.01	0.	0.	9815.	-3613.	1444.6059	-265.8457	1539.3447
8 120		-30.00	0.	0.	18098.	-3613.	2663.5831	-265.8457	2716.1315
9 120		-30.00	0.	0.	18098.	-3613.	2663.5831	-265.8457	2716.1316
9 140		-43.00	0.	0.	39590.	-3613.	5841.5359	-265.8457	5865.6830
10 140		-43.00	0.	0.	39690.	-3613.	5841.5361	-265.8457	5865.6832
10 150		-67.00	0.	0.	21975.	-3613.	3234.1932	-265.8457	3277.6060
11 150		-67.00	0.	0.	21975.	-3613.	3234.1932	-265.8457	3277.6060
11 160		-97.00	0.	0.	11128.	-3613.	1637.7292	-265.8457	1721.8747
12 160		-97.00	0.	0.	11128.	-3613.	1637.7291	-265.8457	1721.8747
12 170		-151.00	0.	0.	12472.	-3613.	1835.6029	-265.8457	1911.0556
13 170		-151.00	0.	0.	12472.	-3613.	1835.6030	-265.8457	1911.0557

APPENDIX "B"
 ID 261

PROBLEM # 1
 Page 19 of 40

13	180		-176.00	0.	0.	12158.	-3613.	1789.3787	-265.8457	1866.7038
14	180		-176.00	0.	0.	12158.	-3613.	1789.3788	-265.8457	1866.7009
14	190	I	-181.99	0.	0.	12467.	-3613.	1834.9057	-265.8457	1910.3860
14	190	M	-196.14	0.	-5.86	12160.	6359.	1789.6874	467.9767	2019.6509
14	190	F	-202.00	0.	-20.01	5091.	13191.	749.3137	970.7165	2081.0173
14	200		-202.00	0.	-55.50	6444.	13191.	948.3814	970.7165	2160.6919
15	200		-202.00	0.	-55.50	6444.	13191.	948.3814	970.7165	2160.6920
15	210	I	-202.00	0.	-90.99	4886.	13191.	719.1450	970.7165	2070.3458
15	210	M	-196.14	0.	-105.14	17286.	4025.	2544.0787	296.1831	2612.1321
15	210	F	-181.99	0.	-111.00	19584.	-11216.	2882.3874	-825.3655	3321.6065
15	220		-176.00	0.	-111.00	21485.	-11216.	3162.0928	-825.3655	3567.0358
16	220		-176.00	0.	-111.00	21485.	-11216.	3162.0926	-825.3655	3567.0356
16	230		-151.00	0.	-111.00	33586.	-11216.	4943.0739	-825.3655	5211.4194
17	230		-151.00	0.	-111.00	33586.	-11216.	4943.0731	-825.3659	5211.4189
17	240		-142.00	0.	-111.00	12216.	-11216.	1797.9109	-825.3659	2440.7783
17	240		-142.00	0.	-111.00	12216.	-11216.	1401.3291	-643.3073	1902.3933
17	250		-127.00	0.	-111.00	23819.	-11216.	2732.3551	-643.3073	3020.1228
17	250		-127.00	0.	-111.00	26242.	2121.	3010.3038	121.6686	3020.1228
17	260		-127.00	-13.00	-111.00	26739.	2121.	3067.2820	121.6686	3076.9192
18	260		-127.00	-13.00	-111.00	26739.	2121.	4532.1754	179.7759	4546.4152
18	270	I	-127.00	-27.96	-111.00	27310.	2121.	4629.0486	179.7759	4642.9913
18	270	M	-121.13	-42.13	-111.00	29435.	-6779.	4989.1716	-574.4934	5119.7659
18	270	F	-106.96	-48.00	-111.00	34026.	-11867.	5767.3491	-1005.7321	6108.0523

SKETCH NO 2

POINT	LOAD*	DESCRIPTION
20 -	430	PSV-212 DEADWEIGHT
30 -	315	PSV-208 " "
40 -	190	PIPE WEIGHT
60 -	88	" "
70 -	660	CSH-288 (W/10% ADJUSTMENT)
80 -	194	HORIZONTAL PIPE
100 -	813	VERT. PIPE + 2 BENDS
120 -	832	PSV-200 + HORIZ. PIPE
140 -	2400	CSH-1
150 -	375	1" FLANGES
160 -	387	HORIZONTAL PIPE
170 -	398	CSH-2
180 -	917	HORIZ PIPE + 1/2 BEND + 2 SETS FLG'S
200 -	367	HORIZ PIPE + TWO - 1/2 BENDS
220 -	167	HORIZ PIPE + 1/2 BEND
230 -	2870	CSH-3
260 -	1962	PRC-200V + BEND

CASE 1(A)
DEADWEIGHT ONLY - USING ALL
EXISTING HANGERS
PT 230 = $3400' - 10\% - 190'$
= 2870'

CASE 2(A)
INCLUDES PSV 208 (@ PT 30)
DISCHARGING
ADD 1900' WEIGHT AND
MOMENT OF 25,800"'

CASE 3(A)
INCLUDES BOTH PSV 208 AND
PSV 212 (@ PT 20, DISCHARGING
PT 30 - ADD 535' WEIGHT AND
20,900" MOMENT
PT 20 - ADD 3090' WEIGHT AND
55,600' MOMENT

PSA PROBLEM, SCTI LINE 100 ANCHOR AT PRC 201V CASE 1

ACTIONS AT CONSTRAINTS

SECT	POINT	X	Y	Z	F-X	F-Y	F-Z	M-X	M-Y	M-Z
1	1	130.00	0.	-48.00	.222.	5.	1.	-223.	8757.	-1704.
2	0	0.	48.00	-20.00	-222.	-5.	-1.	122.	-2414.	-9637. ←
TOTAL EXT. ACTION					0.	0.	0.	0.	-0.	-0.

MOMENTS AND STRESSES AT SIGNIFICANT POINTS

SECT	POINT	POS	X	Y	Z	BM	TM	SIG-B	SIG-I	SIG-C
1	10		130.00	0.	-48.00	8921.	223.	1572.3014	19.6666	1572.7933
1	20		142.00	0.	-48.00	8946.	223.	1576.7898	19.6666	1577.2803
1	20		142.00	0.	-48.00	8946.	223.	250.9161	3.1296	250.9941
1	30	I	519.01	0.	-48.00	9943.	223.	278.8796	3.1296	278.9498
1	30	M	535.97	0.	-40.97	8083.	2902.	226.7072	40.6985	240.8768
1	30	F	543.00	0.	-24.01	3891.	3958.	109.1431	55.5019	155.6729
1	40	I	543.00	0.	-24.01	3891.	3958.	109.1431	55.5019	155.6729
1	40	M	535.97	0.	-7.03	2774.	2772.	77.7957	38.8697	109.9799
1	40	F	519.01	0.	0.	4094.	39.	114.8273	0.5433	114.8325
1	45		153.00	0.	0.	2603.	39.	72.9954	0.5433	73.0035
2	45		153.00	0.	0.	2603.	39.	441.1452	3.2834	441.1541
2	50	I	19.53	0.	0.	2279.	39.	386.3046	3.2834	386.3604
2	50	M	5.72	5.72	0.	1419.	1444.	240.5114	122.4142	343.2007
2	50	F	0.	19.53	0.	3331.	2016.	564.5248	170.8853	659.9207
2	60		0.	34.00	0.	6536.	2016.	1107.8897	170.8853	1159.4079
2	60		0.	34.00	0.	6536.	2016.	791.9840	122.1588	828.8122
2	70		0.	48.00	0.	9637.	2016.	1167.7374	122.1588	1193.0220
2	70		0.	48.00	0.	2016.	9637.	244.3227	583.8681	1193.0221
2	80		0.	48.00	-8.00	251.	9637.	30.3924	583.8681	1168.1317
2	80		0.	48.00	-8.00	251.	9637.	58.7087	1127.8506	2256.4650
2	90		0.	48.00	-20.00	2417.	9637.	565.6884	1127.8506	2325.5518

PSA PROBLEM, SCTI STEAM LINE BETWEEN ANCHOR DW CASE 3

ACTIONS AT CONSTRAINTS

SECT	POINT	X	Y	Z	F-X	F-Y	F-Z	M-X	M-Y	M-Z
1	1	0.	0.	-48.00	95.	178.	-10.	1128.	3695.	-38341.
16	0	-117.00	48.00	-31.00	-95.	-1880.	10.	55385.	-3277.	1895.

TOTAL EXT. ACTION	0.	0.	-0.	-0.	-0.	-0.
-------------------	----	----	-----	-----	-----	-----

MOMENTS AND STRESSES AT SIGNIFICANT POINTS

SECT	POINT	POS	X	Y	Z	BM	TM	SIG-B	SIG-I	SIG-C
1	10		0.	0.	-48.00	38519.	-1128.	6528.9319	-95.5749	6531.7294
1	15		21.00	0.	-48.00	42232.	-1128.	7158.2805	-95.5749	7160.8322
1	15		21.00	0.	-48.00	42232.	-1128.	1184.4657	-15.8146	1184.8879
1	20		36.00	0.	-48.00	44888.	-1128.	1258.9635	-15.8146	1259.3607
2	20		36.00	0.	-48.00	44888.	-1128.	1258.9635	-15.8146	1259.3607
2	30		60.00	0.	-48.00	39873.	-1128.	1118.3040	-15.8146	1118.7511
3	30		60.00	0.	-48.00	39873.	-1128.	1118.3040	-15.8146	1118.7512
3	40		144.00	0.	-48.00	42493.	-1128.	1191.7818	-15.8146	1192.2014
4	40		144.00	0.	-48.00	42493.	-1128.	1191.7818	-15.8146	1192.2014
4	50		228.00	0.	-48.00	19403.	-1128.	544.1920	-15.8146	545.1103
5	50		228.00	0.	-48.00	19403.	-1128.	544.1920	-15.8146	545.1104
5	60		312.00	0.	-48.00	54940.	-1128.	1540.8804	-15.8146	1541.2050
6	60		312.00	0.	-48.00	54940.	-1128.	1540.8804	-15.8146	1541.2050
6	70		396.00	0.	-48.00	14751.	-1128.	413.7164	-15.8146	414.9237
7	70		396.00	0.	-48.00	14751.	-1128.	413.7165	-15.8146	414.9238
7	80	I	404.51	0.	-48.00	10555.	-1128.	296.0204	-15.8146	297.7054
7	80	M	421.47	0.	-40.97	2123.	-4788.	59.5375	-67.1468	146.8995
7	80	F	428.50	0.	-24.01	13291.	1289.	372.7785	18.0774	374.5277
8	90	I	428.50	0.	-24.00	13298.	1289.	372.9769	18.0774	374.7252
8	90	M	421.47	0.	-7.03	4544.	6990.	127.4419	98.0245	233.8304
8	90	F	404.51	0.	0.	12832.	2420.	359.9054	33.9372	366.2497
8	100		396.00	0.	0.	16322.	2420.	457.7666	33.9372	462.7712
9	100		396.00	0.	0.	16322.	2420.	457.7665	33.9372	462.7711
9	110		312.00	0.	0.	50058.	2420.	1403.9693	33.9372	1405.6090
10	110		312.00	0.	0.	50058.	2420.	1403.9693	33.9372	1405.6090
10	120		228.00	0.	0.	11578.	2420.	324.7347	33.9372	331.7522
11	120		228.00	0.	0.	11578.	2420.	324.7346	33.9372	331.7522
11	130		144.00	0.	0.	54385.	2420.	1525.3101	33.9372	1526.8195
12	130		144.00	0.	0.	54385.	2420.	1525.3101	33.9372	1526.8195
12	140		60.00	0.	0.	6854.	2420.	192.2391	33.9372	203.8696
13	140		60.00	0.	0.	6854.	2420.	192.2391	33.9372	203.8696
13	145		48.00	0.	0.	2182.	2420.	61.1912	33.9372	91.3855
14	145		48.00	0.	0.	2182.	2420.	61.1912	33.9372	91.3855

14	150		36.00	0.	0.	1393.	2420.	39.0638	33.9372	78.3130
14	150		36.00	0.	0.	1393.	2420.	236.0809	205.0985	473.2819
14	155		-34.50	0.	0.	14819.	2420.	2511.8539	205.0985	2545.1270
15	155		-34.50	0.	0.	14819.	2420.	2511.8539	205.0985	2545.1270
15	160	I	-97.47	0.	0.	1417.	2420.	240.1215	205.0985	475.3103
15	160	M	-111.28	5.72	0.	4837.	1552.	819.7856	131.4980	860.9386
15	160	F	-117.00	19.53	0.	5285.	-342.	895.8237	-28.9986	897.6992
15	170		-117.00	34.00	0.	4245.	-342.	719.6040	-28.9986	721.9374
15	170		-117.00	34.00	0.	4245.	-342.	514.4148	-20.7299	516.0828
15	180		-117.00	48.00	0.	3472.	-342.	420.6520	-20.7299	422.6902
16	180		-117.00	48.00	0.	2929.	-1895.	354.8545	-114.8317	422.6901
16	190		-117.00	48.00	-8.00	12185.	-1895.	1476.3777	-114.8317	1494.1339
16	190		-117.00	48.00	-8.00	12185.	-1895.	2065.2736	-160.6356	2090.1125
16	200		-117.00	48.00	-31.00	55481.	-1895.	9404.0743	-160.6356	9409.5604

END OF FILE A2 ,JOB COMPLETED.

PSA PROBLEM, SCT1 ANCHOR TO CONDENSER CASE 1

ACTIONS AT CONSTRAINTS

SECT	POINT	X	Y	Z	F-X	F-Y	F-Z	M-X	M-Y	M-Z
1	1	0.	0.	317.00	→ -59.	→ 41.	→ -1780.	4386.	16047.	4243.
2	0	-147.00	70.00	-258.00	-54.	-52.	1369.	-56096.	-301060.	-16099.
3	0	-246.00	-95.00	223.00	113.	12.	412.	23916.	-37943.	-7480.
TOTAL EXT. ACTION					-0.	-0.	0.	0.	-0.	-0.

MOMENTS AND STRESSES AT SIGNIFICANT POINTS

SECT	POINT	POS	X	Y	Z	BM	TM	SIG-B	SIG-I	SIG-C
1	10		0.	0.	317.00	→ 16636.	→ 4243.	1360.6249	173.5255	1404.1882
1	20		0.	0.	184.00	8256.	4243.	675.2807	173.5255	759.2419
1	20		0.	0.	184.00	8256.	4243.	412.2039	105.9232	463.4554
1	30		0.	0.	164.00	7245.	4243.	361.6973	105.9232	419.1703
1	30		0.	0.	164.00	7245.	4243.	195.7300	57.3196	226.8311
1	40		0.	0.	144.00	6396.	4243.	172.7919	57.3196	207.3625
1	40		0.	0.	144.00	6396.	4243.	39.5046	13.1047	47.4083
1	50		0.	0.	120.00	5694.	4243.	35.1696	13.1047	43.8616
2	50		0.	0.	120.00	81885.	4641.	505.7739	14.3331	506.5856
2	60	I	0.	0.	35.91	87425.	4641.	2309.8819	14.3331	2310.0598
2	60	M	10.52	0.	10.52	72563.	21068.	1917.2097	65.0657	1921.6210
2	60	F	35.91	0.	0.	36855.	26252.	973.7517	81.0733	987.1595
2	70	I	151.09	0.	0.	120939.	26252.	3195.3669	81.0733	3199.4782
2	70	M	176.48	0.	-10.52	156659.	15721.	4139.1274	48.5524	4140.2662
2	70	F	187.00	0.	-35.91	170439.	-5116.	4503.2151	-15.7994	4503.3259
2	80	I	187.00	0.	-222.09	162495.	-5116.	4293.3203	-15.7994	4293.4365
2	80	M	187.00	10.52	-247.48	116646.	107556.	3081.9322	332.1677	3152.7206
2	80	F	187.00	35.91	-258.00	9956.	156084.	263.0507	482.0401	999.3229
2	90	I	187.00	94.09	-258.00	89068.	156084.	2353.2838	482.0401	2543.1074
2	90	M	176.48	119.48	-258.00	12775.	187744.	337.5446	579.8165	1207.7604
2	90	F	151.09	130.00	-258.00	107002.	138218.	2827.1250	426.8614	2953.2149
2	100	I	-111.09	130.00	-258.00	252515.	138218.	6671.7807	426.8614	6726.1802
2	100	M	-136.48	119.48	-258.00	116581.	290258.	3080.2137	896.4111	3563.9763
2	100	F	-147.00	94.09	-258.00	90752.	301060.	2397.7809	929.7724	3034.3467
2	110		-147.00	94.00	-258.00	90630.	301060.	1202.3117	1996.9541	4170.9539
2	120		-147.00	70.00	-258.00	58360.	301060.	774.2151	1996.9541	4068.2567
3	130	I	0.	0.	120.00	16402.	74990.	863.7935	497.4130	1317.5045
3	130	M	-7.93	35.07	120.00	29255.	72524.	1540.6323	481.0544	1816.3703
3	130	F	-27.06	43.00	120.00	64091.	34101.	3375.2215	226.1924	3405.4034
3	140	I	-51.94	43.00	120.00	53928.	34101.	2839.9665	226.1924	2875.7715
3	140	M	-71.07	35.07	120.00	54389.	-10530.	2864.2795	-69.8453	2867.6838
3	140	F	-79.00	15.94	120.00	23170.	-42465.	1220.2169	-281.6768	1343.9853

3	150	I	-79.00	-29.94	120.00	4567.	-42465.	240.5152	-281.6768	612.5478
3	150	M	-79.00	-49.07	127.93	26687.	-32386.	1405.3974	-214.8214	1469.6036
3	150	F	-79.00	-57.00	147.06	40089.	-5130.	2111.2193	-34.0245	2112.3156
3	160	I	-79.00	-57.00	260.94	27914.	-5130.	1470.0153	-34.0245	1471.5894
3	160	M	-86.93	-57.00	280.07	21270.	-9882.	1120.1182	-65.5466	1127.7633
3	160	F	-106.06	-57.00	288.00	13222.	-9030.	696.3149	-59.8998	706.5454
3	170	I	-218.94	-57.00	288.00	34334.	-9030.	1808.1268	-59.8998	1812.0912
3	170	M	-238.07	-57.00	280.07	42034.	-4006.	2213.5967	-26.5722	2214.2345
3	170	F	-246.00	-57.00	260.94	43125.	3180.	2271.0752	21.0936	2271.4669
3	180	I	-246.00	-57.00	241.04	40874.	3180.	2820.6131	21.0936	2820.9285
3	180	M	-246.00	-62.28	228.28	26733.	29924.	1844.7876	198.4868	1887.0160
3	180	F	-246.00	-75.04	223.00	16545.	37943.	1141.7318	251.6771	1247.7648
3	190		-246.00	-75.00	223.00	16527.	37943.	674.0243	773.7035	1687.8321
3	200		-246.00	-95.00	223.00	25059.	37943.	1021.9588	773.7035	1854.4185 ←

SKETCH NO 6

INPUT DATA	SECTION			
	10-20	20-30	30-40	40-110
M	0			
D	0			
IG	0			
Icer	0			
U6res	0			
O.D.	6.625	6.625	12.75	24
THICK	.432	.864	.312	.375
ARG	F6CΦD	VALVEC	REDUCE	H24R1P
R	—	—	—	36
DAV	—	—	—	23.625
R/DAY	—	—	—	1.52
E·10 ⁶	29.9	29.9	—	—
MU	.3	.3	—	—
MAT'L	A106	A106	—	—
TEMP.	518°	518°	376°	376°
Lambda	.00317	.00317	.00208	.00208

50-190
18
190-200
8.625
.500
300°
PYAVEO
.00152
110-120
(18")
MTOTAK
376°
MTOTAK
27
17.688
1.53
300°
0.0152

SECTION	POINT
1	10-50
2	50-120
3	50-200

POINT	CALC. FOR Δx, Δy & Δz		
10	Δx	0	
	Δy	0	
	Δz	0	
120	Δx	0	
	Δy	0	
	Δz	0	
200	Δx	0	
	Δy	0	
	Δz	0

CONVENTION FOR POSITIVE
FORCES & MOMENTS
MAXIMUM STRESS = 6726
@ POINT 100

REACTIONS ON THE PIPING

PIPE HANGERS	POINT
	LOAD
	MOVEMENT

SC 15000	SA 15000	SA 1.25 SC + .25 SA	SA 2.25 SC + .25 SA
----------	----------	---------------------	---------------------

PREPARED BY: J.F.L.
CHECKED BY: A.K.S.
DATE: 4/12/64

ATOMIC INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.
THERMAL STRESS
SECTION - MAIN STEAM - ANCHOR TO
CANDIDIZER & L.P. FLASH TANK

PROBLEM NO 7
PAGE NO. 19 OF
REPORT NO TDR 196'

PREPARED BY: K.A. Bonyhady	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC. APPENDIX "B"	PAGE NO. 31 OF 40
CHECKED BY:		REPORT NO. TDR 11961
DATE: 5-2-66	SCTI- SNUBBER (1 & 2) FORCES	MODEL NO. Problem No. 8

Allowable snubber force = 7500 lb (Barco assembly No. 10-50512)

SNUBBER NO. 1

Full structural length = $\sqrt{130^2 + 43^2} = 136.9$ in

Force in x direction assuming 33.33% unbalance

$$F_{x1} = \frac{2400 \times 0.3333 \times 14.81}{25.75} = 460 \text{ lb}$$

$$\text{Force in the snubber: } F_{sx1} = \frac{F_x}{\cos(90^\circ - \alpha_1)} = \frac{F_{x1}}{\sin \alpha_1} = \frac{136.9 \times 460}{130} = 484 \text{ lb.}$$

$$\sin \alpha_1 = \frac{130}{136.9}$$

Force in the y direction

$$F_{y1} = \frac{4800 \times 30}{25.75} = 5590 \text{ lb.}$$

$$\text{Force in the snubber: } F_{sy1} = F_{y1} \cos \alpha_1 = \frac{5590 \times 43}{136.9} = 1758 \text{ lb}$$

$$\cos \alpha_1 = \frac{43}{136.9}$$

$$\text{Max. force in the snubber} = F_{s1} = 484 + 1758 = 2,242 \text{ lb.} < 7500 \text{ lb.}$$

SNUBBER NO. 2

$$F_{x2} = \frac{2400 \times 0.3333 \times 14.8}{116} = 102 \text{ lb}$$

$$\text{Force in x direction: } F_{sx2} = \frac{F_x}{\sin \alpha_2} = \frac{102 \times 135.1}{130} = 106 \text{ lb}$$

$$\text{Structural length: } \sqrt{130^2 + 37^2} = 135.1$$

$$\sin \alpha_2 = \frac{130}{135.1}$$

Force in y direction

$$F_{y2} = \frac{4800 \times 30}{98.25} = 1470 \text{ lb}$$

$$\cos \alpha_2 = \frac{37}{135.1}$$

$$\text{Force in the snubber: } F_{sy2} = \frac{1470 \times 37}{135.1} = 402 \text{ lb}$$

$$\text{Max. force in the snubber} = F_{s2} = 106 + 402 = 508 \text{ lb} < 7500 \text{ lb.}$$

Snubbers 1 & 2 are applied to absorb only horizontal plane forces.

PREPARED BY: <u>K.A. Bonyhady</u>	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC. APPENDIX "B"	PAGE NO. <u>32</u> OF <u>40</u>
CHECKED BY:		REPORT NO. <u>TDR 11961</u>
DATE: <u>5-2-66</u>	<u>SCTI- SNUBBER(3&4) FORCES</u>	MODEL NO. <u>Problem No. 8</u>

SNUBBER No. 3

$$\text{Full structural length} = \sqrt{94^2 + 43^2 + 98.5} = 142.8 \text{ in}$$

$$\text{Force in the vertical direction: } F_{z3} = \frac{4800 \times 1.333}{2} = 3200 \text{ lb}$$

$$\text{Force in the snubber: } F_{sz3} = \frac{F_{z3}}{\cos \alpha_3} = \frac{3200 \times 142.8}{98.5} = 4630 \text{ lb}$$

$$\cos \alpha_3 = \frac{98.5}{142.8}$$

$$\text{Force in the y direction is the same as } F_{sy1} = 1758 \text{ lb}$$

$$\text{Max. force in the snubber} = F_{s3} = 4630 + 1758 = \underline{6,388} < 7500 \text{ lb}$$

SNUBBER No. 4

$$\text{Full structural length} = \sqrt{94^2 + 37^2 + 116^2} = 153.8 \text{ in}$$

$$\cos \alpha_4 = \frac{116}{153.8}$$

$$\text{Force in the snubber} = F_{sz4} = \frac{3200 \times 153.8}{116} = 4,240 \text{ lb}$$

$$\text{Force in the y direction is the same as } F_{sy2} = 402 \text{ lb}$$

$$\text{Max. force in the snubber} = F_{s4} = 402 + 4,240 = \underline{4,642} < 7500 \text{ lb}$$

Check for max. movement.

Allowable max. movement ± 10 in

Vertical movement at snubber junction 1 and 3 =

$$\Delta_{1v} = 3.875 + 1.25 \frac{25.75}{142} = 3.875 + 0.227 = 4.102 \text{ in}$$

Movement reduced into snubber direction

$$L_1 = \sqrt{136.9^2 - 4.102^2} = \sqrt{18,749 - 16.81} \approx \sqrt{18,732.2} = 136.86$$

$$\Delta_1 = L_1 - L_1 = 136.90 - 136.86 = \underline{0.04 \text{ in}} < 20 \text{ in}$$

$$\Delta_{2v} = 3.875 + 1.25 \times \frac{20}{142} = 3.875 + 0.176 = 4.051 \text{ in}$$

Since the magnitude of the deflection is less than before, the snubber movement will be not more than in snubber No. 1.

$$\Delta_2 < \Delta_1$$

$$\Delta_3 = \frac{\Delta_{3v}}{\cos \alpha_3} = \frac{\Delta_{1v}}{\cos \alpha_3} = \frac{4.102 \times 142.8}{98.5} = \underline{5.82 \text{ in}} < 20 \text{ in}$$

$$\Delta_4 = \frac{\Delta_{4v}}{\cos \alpha_4} = \frac{\Delta_{2v}}{\cos \alpha_4} = 4.05 \times \frac{153.8}{116} = \underline{5.36 \text{ in}} < 20 \text{ in}$$

PREPARED BY: K.A. Bonyhady	ATOMIC INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC. APPENDIX "B"	PAGE NO. 23 of 40
CHECKED BY:		REPORT NO. TDR 11961
DATE: 5-2-66	SCTI-SNUBBER CAUSED STRESS	MODEL NO. Problem No. 8

Dynamic stress in the main steam pipe during vent valve discharge:

The actual piping load analysis is calculated with for 2400 lb hanger pull although the actual piping load is 1800 lb. at this point. I.e. This section is relieved by $2400 - 1800 = 600$ lb during vent valve operation. All the other loads are balanced. During discharge the additional stress caused by this vent valve at point "A":

$$S_v = \frac{4800 \times 30 - 600 \times 43}{6.79} = \frac{144,000 - 25,800}{6.79} = \frac{118,200}{6.79} = 17,400 \text{ psi}$$

The total max. stress at this point:

Max. pipe support stress (Problem #2-1)	1,663 psi
Max. thermal expansion stress	14,768 "
Piping pressure stress (Sketch No.2)	2,310 "
Additional PSV-200 discharge stress	17,400 "
Total max. stress	36,141 " < 39,374 psi

ASME Code for Pressure piping: allowable cold stress at 100°F for A 312 TP 347 SS = 15,950 psi
allowable hot stress at 1100°F for A 312 TP 347 SS = 10,300 psi
allowable combined stress range for thermal expansion,

longitudinal pipe pressure and pipe support $S_A = 1.25(15,950 + 10,300) = 32,812$ psi

Par. 6078 allowance for short time overloading = $1.20 \times 32,812 = 39,374 > 36,141$ psi

CHECKING THE STRENGTH OF THE STUB FOR SNUBBER NO 2 AND 4

Max. bending force from snubber No.4 is 4240 lb.

$$S_s = \frac{4240 \times 6}{1.064} = 23,900 \text{ psi} = \text{actual stress}$$

The allowable stress:

$$S_A = 1.25(18,750 + 10,300) = 36,312 \text{ psi} > 23,900 \text{ psi}$$

Pipe size is adequate.

PREPARED BY: <i>Bonyhady</i>	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC. APPENDIX "B"	PAGE NO. <i>34</i> OF <i>40</i>
CHECKED BY:		REPORT NO. <i>TDR 11961</i>
DATE: <i>4-19-1966</i>	CONNECTION FOR SNUBBERS (1)	MODEL NO. <i>Problem No. 9</i>

Proper operation of the snubber requires max. 700°F at the connection point (t_3)

Assumptions: (1) q_1 heat flows along the wall of the 2 1/2 in. sch. 40 SS 304 pipe without any loss until the edge of the insulation (3 in thick at this point).

(2) q_2 is the sum of the convective and radiation heat losses in the adjoining 2 1/2 Sch. 40 pipe section. Effect of the fin plate is disregarded.

$$q_1 = \frac{k A_1 (t_1 - t_2)}{x_1} \quad (1)$$

$$q_2 = h_{\text{cor}} A_2 (t_3 - t_2) \quad (2)$$

In steady state condition the outflow from the heat source shall be equal with the dissipated heat, therefore

$$q_1 = q_2 = \frac{k A_1 (t_1 - t_2)}{x_1} = h_{\text{cor}} A_2 (t_3 - t_2) \quad (3)$$

where $t_1 = 1100^\circ\text{F} = 1560^\circ\text{R}$

t_2 = pipe wall temperature at the edge of insulation

$t_3 = 700^\circ\text{F} = 1160^\circ\text{R}$

k = average thermal conductivity of SS 304 pipe material (Mc Adams 3rd ed. p. 446, 447)

A_1 = metal area of 2 1/2 Sch. 40 pipe = $1.704 \text{ in}^2 = 0.1184 \text{ ft}^2$

A_2 = outside surface area of the 2 1/2 Sch. 40 pipe = $0.753 \text{ ft}^2/\text{ft. length}$

x_1 = length of 2 1/2 Sch. 40 pipe within the insulation = $3 \text{ in} = 1/4 \text{ ft}$

x_2 = length of the uninsulated section of the 2 1/2 Sch. 40 pipe (including fin plate length) = $3 \text{ in} = 1/4 \text{ ft}$

PREPARED BY: <i>Bonyhady</i>	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC. APPENDIX "B"	PAGE NO. <i>35</i> of <i>40</i>
CHECKED BY:		REPORT NO. <i>TDR 11961</i>
DATE: <i>4-19-1966</i>	CONNECTION FOR SNUBBERS (2)	MODEL NO. <i>Problem No.9</i>

h_{c+r} = combined heat transfer coefficient of natural convection and the radiation, reduced as a part of the convection coefficient.
(Mc Adams Heat transmission 3rd. ed. p.179) Fig.

$$\text{From eq. (3)} \quad t_2 = \frac{k A_1 t_1 + h_{cr} A_2 x_1 t_3 x_2}{k A_1 + h_{cr} A_2 x_1 x_2}$$

Assuming that $t_2 = 860^\circ\text{F}$, the average temp. in the first section = $\frac{1100 + 860}{2} = 980^\circ\text{F}$

$$k = 12.6 \text{ Btu/hr ft}^2 \cdot ^\circ\text{F/ft}$$

$$\frac{t_2 + t_3}{2} = \frac{860 + 700}{2} = 780^\circ\text{F}$$

$$h_{c+r} = 7.89 \text{ Btu/hr.ft}^2 \cdot ^\circ\text{F/ft}$$

$$t_2 = \frac{12.6 \times 0.01184 \times 1100 + 7.89 \times 0.753 \times 0.25 \times 700 \times x_2}{12.6 \times 0.01184 + 7.89 \times 0.753 \times 0.25 \times x_2} = \frac{164 + 1040 x_2}{0.1491 + 1.485 x_2}$$

$$x_2 = \frac{1}{12} = 1"$$

$$\frac{1}{6} = 2"$$

$$\frac{1}{4} = 3"$$

$$t_2 = \frac{164 + 86.6}{.1491 + .1238} = \frac{250.6}{.2729}$$

$$885^\circ\text{F}$$

$$\frac{164 + 173.3}{.1491 + .2475} = \frac{337.3}{.3966}$$

$$850^\circ\text{F}$$

$$\frac{164 + 260}{.1491 + .37125} = \frac{424}{.5203}$$

$$815^\circ\text{F}$$

Since $850^\circ\text{F} < 860^\circ\text{F}$ therefore the 2" uninsulated pipe length is adequate.

checking if only radiation losses are considered

$$q_r = 0.171 A_r \left[\mu_1 \left(\frac{T_1}{100} \right)^4 - \mu_2 \left(\frac{T_2}{100} \right)^4 \right]$$

$$\text{where } A_r = A_2 x_2 = 0.753 \times \frac{2.5}{12} = 0.1566 \text{ ft}^2$$

$$\mu_1 = \text{emissivity of 304 SS pipe surface at } 780^\circ\text{F} = 0.40$$

$$\mu_2 = \text{emissivity of the surrounding} = 0.50$$

$$q_r = 0.171 \times 0.1566 \left[\left(\frac{860 + 700}{200} + 4.6 \right)^4 \times 0.4 - \left(\frac{560}{100} \right)^4 \times 0.5 \right] =$$

$$q_r = 0.171 \times 0.1566 (0.4 \times 12.4^4 - 0.5 \times 5.6^4) = 0.171 \times 0.1566 (0.4 \times 23,600 - 0.5 \times 985)$$

$$q_r = 0.171 \times 0.1566 (9440 - 492) = 0.171 \times 0.1566 \times 8948 = 240 \text{ Btu/hr}$$

The same section with the combined coefficient will loose heat at a rate:

$$q_{r+c} = 7.89 \times 0.753 \times \frac{2.5}{12} (860 - 700) = \frac{7.89 \times 0.753 \times 2.5 \times 160}{12} = 198.2 \text{ Btu/hr}$$

This seems to be a more conservative value, therefore the cooling surface dimensions are acceptable.

PREPARED BY: <i>Bonyhady</i>	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC. APPENDIX "B"	PAGE NO. <i>36 of 40</i>
CHECKED BY:		REPORT NO. <i>DR 11961</i>
DATE: <i>4-19-66</i>	CONNECTION FOR SNUBBERS (3)	MODEL NO. <i>Problem No. 9</i>

checking the stress increase.

Max. deflection of the pipe at the snubber end is 10°

Excentricity of the 5.5" in long connecting pipe:

$$L_1 = 5.5" \sin 10^\circ = 5.5 \times 0.1736 = 0.867 \text{ in}$$

Max expected vibration force at 30° direction

$$7000 \times \cos 30^\circ = 7000 \times 0.5 = 3500 \text{ *}$$

$$25\% \text{ of this force} = 3500 \times 0.25 = 875 \text{ *}$$

Additional stress caused by this bending moment

$$\frac{875 \times 0.867}{1.064} = 712 \text{ psi}$$

where 1.064 is the section modulus of the 2½ Sch. 40 SS 304 pipe

ATOMICS INTERNATIONAL
A Division of North American Aviation, Inc.

NO. NAA-SR-TDR 11961
DATE 5-10-1966
PAGE 37 OF 40

APPENDIX " C "

Drawing Nos. M5-7593-448518
303-356-S51
303-356-S52

4. FIELD ADJUSTMENTS ARE REQUIRED FOR THE FOLLOWING HANGERS
CSH	200 - MAX LOAD CAPACITY
CSH-2	- MAX
CSH-3	- MIN
CSH-4	- MIN
CSH-10	- MIN
CSH-11	- MIN
CSH-1	- DECREASE LOAD BY 300

1. B. BARCO MFG CO. "VIBRASNUB" SIZE 2 1/2" ASSEMBLY NO. 10-50512 THE ELEV OF THE POINTS OF ATTACHMENT TO LINE 100 4" A ARE THE HOT OR OPERATING POSITIONS THE SNUBBERS MUST BE INSTALLED SO THAT THE FLEX BALL JTS ARE IN THE STRAIGHT POSITION (AS SHOWN) WHEN THE SYSTEM IS UP TO TEMP (100°F). AT INSTALLATION THE PTS OF ATTACHMENT WILL BE DET BY THE SYSTEM TEMP AT THAT TIME
2. FABRICATION, WELDING AND TESTING REQUIREMENTS PER ASA B 31.1
3. ALL WELDS SHALL BE DONE BY THE INERT GAS TUNGSTEN ARC PROCESS COATED WELDING ROD SHALL NOT BE USED FOR ANY STAINLESS STEEL WELDING
- NOTES: UNLESS OTHERWISE SPECIFIED

NOTE FOR A.I. INFORMATION ONLY - FOR BASE CONFIGURATION SEE DWG 7593-44851B

ATOMIC INTERNATIONAL
A DIVISION OF BOSTON AMERICAN AIRPAC INC.
2000 BOSTON AVENUE BOSTON, MASS 02114

SETI - RELOCATION OF PRESSURE SAFETY VALVES 208 & 212

ENGINEER: J. F. KELLEY
CHECKED: J. F. KELLEY
DATE: 5-10-66
SHEET NO. 38 OF 40

- SUGGESTED PROCEDURE
- 1 — WELD S.S. RS TO PIPE, PSV, & FLG AND TO -
15" x 1" x 1/4 S.S. PL AS SHOWN SECTIONS 6, 7, 8, & 9.
 - 2 — WELD 15 M & BWF TOGETHER. NOT WELDED TO COLS.
& STRUTS NOT IN PLACE YET,
 - 3 — BOLT T AND MARINITE TO ANCHOR PL AS SHOWN SECT. 4
 - 4 — INSTALL 3/2 x 3/2 x 1/2 & 3 x 3 x 3/8 CONNECTION L³ AND CLAMP
IN PLACE.
 - 5 — WELD OR BOLT CONNECTION L³ TO COLS & T ASSEMBLY.
 - 6 — INSTALL STRUTS.
 - 7 — GROUT COLS. IN PLACE.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
	NAA-SR-TDR 11961 5-10-1966 Page 39 of 40		

NAA-SR-TDR 11961
5-10-1966
Page 39 of 40

STAINLESS STEEL PLS TO BE TYPE 304
STAINLESS STEEL BOLTS TO BE TYPE 316
NOTE: 1" THICK STAINLESS STEEL PLS ARE SHOWN
AS THEY ARE AVAILABLE, 5/8" THICK PLS MAY
BE SUBSTITUTED, TYPE 347.

ATOMIC INTERNATIONAL	
	A DIVISION OF NORTH AMERICAN AVIATION, INC. 8900 DESOTO AVENUE, CANOGA PARK, CALIF.	
S. C. T. 1.		
STEEL FOR ANCHOR "A" FOR LINE 100-4		
PLANS & SECTIONS		
DRAWN	M.S.	4-66 DWG
CHECKED	3205 LOW	5-66 SIZE
ENGINEER	M. J. Wilson	4-66 SCALE
APPROVED	W. H. Wilson	4-66 NOTED
		SHEET NO. <u> </u> OF <u> </u>

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
<p>NAA-SR-TDR 11961 5-10-1966 Page 40 of 40</p>

DET (A)
N.T.S.

PLAN DET (B)
1/2" = 1'-0"
BACK UP MEMBER FOR SNUBBER
LOAD AT COL C5

- SUGGESTED PROCEDURE
- 1 - WELD 5/8" ANCHOR PLS TO PIPE AS SHOWN SECTIONS 1, 4, & 6.
 - 2 - WELD 8WF31 & 15M 33.9 TOGETHER. DO NOT WELD ANY BRACES OR STRUTS TO IT AT THIS TIME.
 - 3 - BOLT TYP TO ANCHOR PL AS SHOWN SECT 2.
 - 4 - INSTALL THE CONNECTION ANGLES AND CLAMP IN PLACE.
 - 5 - WELD OR BOLT CONNECTION 1/2" TO COLS & T ASSEMBLY.
 - 6 - INSTALL THE BRACING ANGLES.

NOTE: ALL STEEL TO BE CARBON STEEL.

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.
8900 DESOTO AVENUE, CANOGA PARK, CALIF.

S. C. T. 1.
STEEL FOR ANCHOR 'B' FOR 105-G
PLANS & SECTIONS

DRAWN	M.S.	4-66	DWG	D	303-356-552
CHECKED	P. J. SLOAN	5-66	SIZE		
ENGINEER	M. J. SLOAN	4-66	SCALE		
APPROVED	M. J. SLOAN	5-66	NOTED		

SHEET NO. _____ OF _____