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CORPORATION

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SUBJECT: Crystal River Unit 3  
Quality Document Transmittal - Analysis/Calculation

TO: Records Management - NR2A

The following analysis/calculation package is submitted as the QA Record copy:

DOCNO (FPC DOCUMENT IDENTIFICATION NUMBER)	REV	SYSTEM(S)	TOTAL PAGES TRANSMITTED
S 96-0129	0	MS	144

TITLE

Evaluation of the Effect of a Bent Hanger Rod on Piping Analysis CR-5

KEYS (IDENTIFY KEYWORDS FOR LATER RETRIEVAL)

Piping Analysis, support, hanger

DXREF (REFERENCES OR FILES - LIST PRIMARY FILE FIRST)

PR-96-0180

CS-95-014

M75-0012

CS-94-008

VEND (VENDOR NAME)

FPC

VENDOR DOCUMENT NUMBER (DXREF)

N/A

SUPERSEDED DOCUMENTS (DXREF)

N/A

TAG

MSH-27B

PART NO.

COMMENTS (USAGE RESTRICTIONS, PROPRIETARY, ETC.)

## NOTE:

Use Tag number only for valid tag numbers (i.e., RCV-8, SWV-34, DCH-99), otherwise; use Part number field (i.e., CSC14599, AC1459). If more space is required, write "See Attachment" and list on separate sheet.

DESIGN ENGINEER	DATE	VERIFICATION ENGINEER	DATE	SUPERVISOR, NUCLEAR ENG	DATE
<i>[Signature]</i>	8/1/96	<i>[Signature]</i>	8/1/96	<i>[Signature]</i>	8/1/96

cc: MAR Office (If MAR Related) ☐ Yes ☒ No  
Mgr. Nucl. Conting. Mgt.  
Mgr., Nucl. Eng. Design  
(Original) w/attach

Plant Document Updates Required ☐ Yes ☒ No (If Yes, send copy of the Calculation Review form to Nuclear Licensing and a copy of the Calculation to the Responsible Organization(s) identified in Part III on the Calculation Review form.)

AE ☐ Yes ☒ No  
(If yes, 1 encl w/attach)

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PDR ADOCK 05000302  
PDR  
P



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## ANALYSIS/CALCULATION SUMMARY

DOCUMENT IDENTIFICATION NUMBER	DISCIPLINE S	CONTROL NO 96-0129	REVISION LEVEL 0
TITLE Evaluation of the Effect of a Bent Hanger Rod on Piping Analysis CR-5			CLASSIFICATION (CHECK ONE) <input checked="" type="checkbox"/> Safety Related <input type="checkbox"/> Non Safety Related
			MAR/SP/CGWR/PEERE NUMBER n/a
			VENDOR DOCUMENT NUMBER n/a

	REVISION APPROVALS	ITEMS REVISED
Design Engineer	D. Jopling <i>[Signature]</i>	Original Issue
Date	8/1/96	
Verification Engineer	<i>[Signature]</i>	
Date/Method*	8/1/96 R	
Supervisor	<i>[Signature]</i>	
Date	8/1/96	

\*VERIFICATION METHODS: R - Design Review; A - Alternate Calculation; T - Qualification Testing

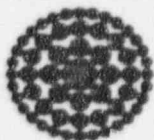
DESCRIBE BELOW IF METHOD OF VERIFICATION WAS OTHER THAN DESIGN REVIEW

### PURPOSE SUMMARY

See Sheet 1

### RESULTS SUMMARY

See Sheet 5



# DESIGN ANALYSIS/CALCULATION

## Crystal River Unit 3

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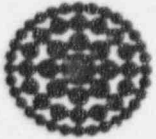
REVISION  
0

### I Purpose:

This calculation will evaluate the significance of a bent rod hanger with respect to piping analysis efforts and the results of those efforts. This evaluation is prompted by the discovery of two Main Steam supports with bent rods. The supports (MSH-13B and MSH-27B) were constructed of 2" diameter steel eye rod, 2" diameter hanger rod, a forged clevis, a turnbuckle, a pipe clamp and end brackets. The total assembly is approximately 10' long, from top of pipe to beam attachment. In the as-found condition the hanger rod was bent to result in approximately 2" out of alignment. This calculation will determine the change in support stiffness that will result from the bent condition of the rod and how this will affect the piping analysis. As this is intended to be an investigational tool, this calculation will be limited to an evaluation of one to the two MS piping runs containing one of the bent hanger rods (MSH-27B).

### II Design Inputs:

- A. Piping analysis will be based on the configuration of the piping as shown on drawings 305-752 and 305-825, using dimensional information derived from 79-14 field walkdowns. The use of 79-14 information differs from that contained in the existing analysis of record.
- B. Valve weight and CG information will be based on that information shown on 305 drawings or developed from original analysis inputs.
- C. Response spectra used in the analyses will be based on ESQPM requirements and the spectra used in original analysis efforts. Original analysis efforts used spectra CRW2. This spectra is not currently included in the CR3 ESQPM. However, a copy of this information is included in Calculation S73-0001. Based on MDG-1 section 7.4 1.1 (ref D) the vertical spectra was taken as the Ground Response Spectra (GRS) and CRW2 was used as the horizontal spectra. CRW2 envelops the GRS. A portion of the analyzed piping is supported from the Turbine building structure. The ESQPM does not provide spectra for the TB. As the piping model included this portion of piping solely for the purpose of evaluating the "non safety" piping effect of the "safety related" piping, the use of the selected spectra does not affect the conservatism of this analysis.
- D. A portion of 6" auxiliary steam piping, from MSV-56, is included in the model. This is in an effort to account for the affects of this piping on the 24" piping. Analysis CR-56 includes a complete analysis of the 6" piping from the connection to the 24" MS piping. This piping is modeled with a free end on CR-5. Because of the independent qualification of the 6" piping and the incomplete modeling, support loads and stresses applicable to this piping will not be evaluated.
- E. A portion of 6" non-safety piping connecting 24" non-safety Main Steam piping to the Moisture Separator is also included in the model. The model does not include the complete piping configuration and only one spring support was accounted for. As with the Aux Steam, the piping was modeled as a free end. The model is not representative of the complete piping support scheme and the piping was included for modeling purposes only. As a result, support loads and stresses applicable to this piping will not be evaluated.
- F. Piping analyses typically model supports as rigid (stiffness, K). Where K is in the range of 10E9 pounds per inch. For this evaluation an approximate K for the straight rod (MSH-27B) will be established. This value will be used in the piping analysis in lieu of the rigid assumption. A K for the bent rod also will be established and additional analyses will determine support loads and pipe stresses with the modified support stiffness. A comparison of the analyses results will determine the significance of the bent rod.



# DESIGN ANALYSIS/CALCULATION

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## II Design Inputs: (Cont.)

- G. Dimensions for relief valves MSV-48F, MSV-45F, MSV-41F, and MSV-36F are taken from drawing 305-750, Table A. Some minor dimensional discrepancies exist between drawings 305-750, 305-752, and the various piping analysis. Also, a discrepancy exists between valve weight listed on 305-812 for MSV-41F (857#) and weight shown on 305-752 (1257#). This analysis will use the more conservative weight of 1257 pounds. These discrepancies are considered minor for the purpose of this calculation.

## III Assumptions:

As stated in the calculation (none that require future verification).

## IV References:

- A. Calculation M 75-0012, revision 0 (CR-5)
- B. Calculation M 92-0016, revision 0 (CR56)
- C. CR3 ESQPM, revision 8
- D. CR3 Mechanical Design Guide MDG-1, revision 0
- E. CAEPIPE User Manual
- F. STAAD III Reference Manual
- G. Drawing 305-752, revision 2
- H. Drawing 305-812, revision 0
- I. Drawing 305-825, revision 4
- J. PR 96-0180
- K. Drawing 305-750, revision 1
- L. Calculation S73-0001, revision 0
- M. MSH-220 revision 6
- N. MSH-27B revision 1
- O. MSH-28 revision 3
- P. MSH-216 revision 4
- Q. MSH-244 revision 3
- R. MSH-17 revision 4
- S. MSH-18 revision 4
- T. MSH-19 revision 4
- U. MSH-20 revision 3
- V. MSH-21 revision 3
- W. MSH-22 revision 4
- X. MSH-23 revision 3
- Y. MSH-24 revision 3
- Z. MSH-25 revision 4
- AA. MSH-26 revision 4
- BB. MSH-228 revision 2
- CC. MSH-229 revision 3
- DD. MSH-230 revision 3
- EE. MSH-231 revision 2
- FF. MSH-117 revision 2
- GG. MSH-119 revision 2
- HH. MSH-232 revision 4
- II. MSH-121 revision 3





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0

### IV References:(Cont.)

JJ. MSH-124 revision 1

Computer software:

STAAD-III CS-94-008

CAEPIPE CS-95-014

### V Detailed Calculations:

Per attachment E, a 2" diameter x 10' straight rod hanger similar to MSH-27B will see an elongation = .00132 under a 1000 lb load. This indicates a stiffness (K) of  $1000/.00132 = 7.576 \times 10^5$  lbs/inch

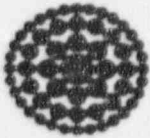
Per attachment F, a 2" diameter x 10' rod hanger with a bend resulting in a 2" deformation at the mid point will see an elongation of .00835" under a 1000 lb. load. This indicates the  $K = 1000/.00835 = 1.198 \times 10^5$  lbs/inch

These values were used in the attached evaluations of the piping loads and stresses. Attachments A and B evaluate the piping using the K for the straight rod (XY and YZ seismic). Attachments C and D evaluate the piping using the stiffness of the bent rod.

Based on an inspection of the stress reports (Attachments A, B, C, and D), All 24" piping stress levels are within the code established allowables. This applies to all four analysis runs. An inspection of the reports show some code allowables being exceeded. However, these stresses are for the small pipe that is modeled in. See Design Inputs, Section II, items D and E for a discussion on these two pipes. The stresses listed for all four reports are approximately the same. Therefore, it appears the bent rod does not affect the piping stresses.

Based on an inspection of the support loading (see attachment G) it appears the addition of the actual stiffness of the hanger has an affect on the deadweight loadings on MSH-27B and the supports in the area of MSH-27B. This change is most dramatic when the original analysis loads are compared with the analysis modeling the hanger stiffness. The differences between the analysis modeling the straight rod versus the bent rod is not as significant. The large differences between the original analysis and the new analysis is attributed to the increase in flexibility. With the original analysis, MSH-27B was modeled as a rigid support. The flexible support resulted in a redistribution of the pipe deadweight to adjacent supports that maintained the stiffness of the original analysis.

Thermal and seismic loadings are not dramatically different. The differences can be due to several factors, the changes in the model based on the as-built dimensions, the stiffness changes or the shift in response due to frequency changes. The piping is very flexible with about 50 modes less than 50 hz. The mass participating with each mode varies. The two peaks in the CRW2 spectra can affect the support loading a great deal with small shifts in response. As a result it is difficult to assess the significance/reason for the support loading differences. A further explanation on differences between the existing analysis and the new runs contained in this calculation is the difference in computer software and computer technology over the approximate twenty year time span between analyzes.



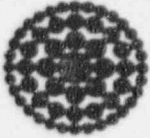
# DESIGN ANALYSIS/CALCULATION

## Crystal River Unit 3

### V Detailed Calculations: (cont)

Based on an inspection of the support loads the following can be observed.

- 1) Spring loads are in reasonable agreement with the original analysis loadings. Except, for MSH-22 that shows new loads about half the original analysis loads and MSH-23 that shows new loads that are about double the original analysis loads. These two hangers are adjacent springs on the 24" diameter run of pipe and the new loads appear to be simply redistribution of the loads. This redistribution seems to be due to the difference in original dimensions versus the 79-14 dimensions used in the newer analyses. Again, the new loads are in reasonable agreement with loads shown on hanger drawings. This has apparently already been addressed in the 79-14 files.
- 2) MSH-220 (an Fx, Fy and Mz support) The new Fx and Mz loadings are less than the original analysis results. The Maximum Fy loading from the new analysis is 32% greater than the original design value but this is a compression load applied to a structure that can support significantly larger compressive loading.
- 3) MSA-18 (an anchor/six way restraint) All of the original design loads are greater than the results of the new analyses.
- 4) The original design loading on MSH-244 was greater than the new analysis results.
- 5) The original analysis loading for MSH-216 was -22,676. The maximum new loading is -23,801 which is greater. The support is constructed of 2-2" dia. rod hangers. As a result the supports capacity exceeds 40,000 lbs.
- 6) The original analysis loading for MSH-28 was -11,115. The maximum new loading is -11,241 which is greater. Again, the support is constructed of 2-2" dia. rod hangers. As a result the supports capacity exceeds 40,000 lbs.
- 7) The maximum new load applied to MSH-28B is lower than the original analysis loading.
- 8) With the exception of MSH-121, the loads on snubbers are in general agreement and less than 10,000 lbs. With the exception of MSH-119, 121 and 124, the snubbers installed are 5" bore units. These snubbers have a catalog (assumed to be upset values) capacity of 49,400 pounds. MSH-119, 121 and 124 are 2-1/2" bore units. The catalog capacity of the 2-1/2" snubbers is 10,200 pounds. This is less than the 10,415 pound faulted loading. As the 10,200 is an upset value the faulted capacity is approximately  $1.33 \times 10,200 = 13,566$  pounds.



# DESIGN ANALYSIS/CALCULATION

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### VI Results and Conclusions:

The piping analysis runs documented in this calculation show that the 24" diameter Main Steam piping system is adequate. Pipe stresses in the areas of adequate modeling and of interest are within code allowables. The support loads have not been verified to the level of standard qualification but the loadings appear to be within the load margins provided with original design. It is acknowledged that there are some differences between the piping analysis of record and the analysis runs in this calculation. This is the result of several factors. The actual support spacing used in the new analysis resulted in a redistribution of support loading. Modeling the stiffness of MSH-27B also resulted in a redistribution of support loading. The shifts in seismic response due to small changes in the piping model (This is especially true with respect to piping that is supported in a manner to provide maximum flexibility for thermal growth). Despite the differences in the modeling and the analysis results, the qualification of the pipe or pipe supports has not changed.

The results, also, indicate that the piping is adequately supported to insure code compliance and the supports provided are also adequate for design loading, despite the bend in rod hanger MSH-27B.

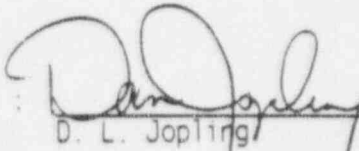
### VII Attachments:

- A. CR5A Straight Rod XY seismic analysis, 31 pages
- B. CR5B Straight Rod ZY seismic analysis, 31 pages
- C. CR5C Bent Rod XY seismic analysis, 31 pages
- D. CR5D Bent Rod ZY seismic analysis, 28 pages
- E. STAAD Analysis for Straight Rod Stiffness, 6 pages
- F. STAAD Analysis for Bent Rod Stiffness, 6 pages
- G. EXCEL Spreadsheet for comparison of original and new analysis support loading, 4 pages

CAEPIPE  
Version 3.72

Client : F. P. C.  
Project : Evaluation of effect of bent rod hanger  
File Number : S 96-0129  
Report Number : Attachment A  
Model Name : CR-5A  
Title : CR-5 W/ Rod Hangers, X CRW2 Y GRS Spectra  
Subtitle :

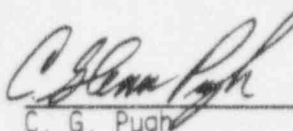
Prepared by :

  
D. L. Jopling

Date:

8/1/94

Checked by :

  
C. G. Pugh

Date:

8/1/96

## Options

Piping code = B31.1 (1967)  
Do not use liberal allowable stresses  
Exclude axial force in stress calculations  
Reference temperature = 70 (F)  
Number of thermal cycles = 7000  
Use modulus at reference temperature  
Include hanger stiffness  
Include Bourdon effect  
Do not use pressure correction for bends  
Pressure stress =  $PD / 4t$   
Peak pressure factor = 1.00  
Cut off frequency = 50 Hz  
Number of modes = 50  
Include missing mass correction  
Do not use friction in dynamic analysis  
Vertical direction = Y

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
1	1	From							Anchor
2	3	Bend		-12'6"		1	1	1	
3	6				11.854	1	1	1	User hanger
4	7				3.583	1	1	1	
5	14				8.333	1	1	1	Snubber
6	17	Bend			7.583	1	1	1	
7	20		7'6"			1	1	1	User hanger
8	23		16.333			1	1	1	User hanger
9	25		18.792			1	1	1	User hanger
10	27		3.333			1	1	1	Snubber
11	29		14'5"			1	1	1	User hanger
12	31	Bend	7'0"			1	1	1	
13	34				15'0"	1	1	1	User hanger
14	35				5'6"	1	1	1	Snubber
15	39	Bend			7'6"	1	1	1	
16	40			-6'0"		1	1	1	User hanger
17	41	Bend		-3'0"		1	1	1	
18	43		7'7-1/2"			1	1	1	Snubber
19	44		6.042			1	1	1	Snubber
20	47		3.646			1	1	1	User hanger
21	50		18.583			1	1	1	User hanger
22	52		4'0"			1	1	1	Snubber
23	55		12'9"			1	1	1	User hanger
24	57		6'9-3/4"			1	1	1	Snubber
25	58		1.458			1	1	1	Anchor
26	59		2'0"			1	1	1	Snubber
27	61		2.062			1	1	1	
28	62	Valve	1'11"			1	1	1	
29	64	Valve	3'11"			1	1	1	
30	65		0'9-3/4"			1	1	1	Rod hanger
31	67	Bend	9'8"			1	1	1	
32	70		0.218		-12'6"	1	1	1	Snubber
33	73		0.069		-4'0"	1	1	1	
34	102		0.032		-1.833	1	1	1	Rod hanger
35	103		0.091		-5.208	1	1	1	



#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
36	112		0.044		-2.500	1	1	1	
37	121		0.025		-1.458	1	1	1	Anchor
38	122		0.018		-1.042	1	1	1	
39	131		0.044		-2.500	1	1	1	
40	140		0.044		-2'6"	1	1	1	Rod hanger
41	144		0.218		-12.512	1	1	1	Anchor
42	7	From							
43	700	Bend	8.964			1	2	2	
44	710		0.320	0.320		1	2	2	
45	720	Bend	0.320	0.320		1	2	2	
46	730		0'3-3/4"			1	2	2	
47	740	Valve	0'9"			1	2	2	
48	750	Valve	0'9"			1	2	2	
49	760		1.542			1	2	2	User hanger
50	62	From							
51	63	Rigid	3'0"	2'5"		1	2	2	Conc mass
52	73	From							
53	74			1.416		1	2	2	
54	75	Reducer		0.450		1	2	2	
55	76	Valve		0.450		1	2	2	
56	77	Rigid		1.458		1	2	2	Conc mass
57	76	From							
58	78	Valve	-0.450			1	2	2	
59	79	Reducer	-0.450			1	2	2	
60	80	Bend	-7.600			1	2	2	
61	82			4.104		1	2	2	Snubber
62	840			2.042		1	2	2	User hanger
63	84	Bend		1'6"		1	2	2	
64	87				-1'0"	1	2	2	Snubber
65	89				-7'10-1/2"	1	2	2	Snubber
66	92				-3'3"	1	2	2	Snubber
67	94	Bend			-2'0"	1	2	2	
68	96		-1.833			1	2	2	User hanger
69	98		-20.083			1	2	2	Rod hanger
70	99		-7'0"			1	2	2	Snubber
71	101		-1'0"			1	2	2	
72	103	From							
73	104			1.224		1	2	2	
74	105			0'6-3/4"		1	2	2	Flange
75	106	Valve		1.177		1	2	2	
76	107	Rigid	0.083	0.984		1	2	2	Conc mass
77	106	From							
78	108	Valve	0.833			1	4	4	
79	109		0.698			1	4	4	Flange
80	110	Bend	0'8"			1	4	4	
81	111		1.002	1.002		1	4	4	Conc mass
82	112	From							
83	113			1.224		1	2	2	
84	114			0'6-3/4"		1	2	2	Flange
85	115	Valve		1.344		1	2	2	
86	116	Rigid	0.083	0.817		1	2	2	Conc mass
87	115	From							
88	117	Valve	0'10-1/2"			1	3	3	
89	118		0.833			1	3	3	Flange

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
90	119	Bend	0.833			1	3	3	
91	120		1.002	1.002		1	3	3	Conc mass
92	122	From							
93	123			1.224		1	2	2	
94	124			0'6-3/4"		1	2	2	Flange
95	125	Valve		1.344		1	2	2	
96	126	Rigid	0.083	0.817		1	2	2	Conc mass
97	125	From							
98	127	Valve	0'10-1/2"			1	3	3	Flange
99	128		0.833			1	3	3	
100	129	Bend	0.833			1	3	3	
101	130		1.002	1.002		1	3	3	Conc mass
102	131	From							
103	132			1.224		1	2	2	
104	133			0'6-3/4"		1	2	2	Flange
105	134	Valve		1.344		1	2	2	
106	135	Rigid	0.083	0.817		1	2	2	Conc mass
107	134	From							
108	136	Valve	0'10-1/2"			1	3	2	
109	137		0.833			1	3	3	Flange
110	138	Bend	0.833			1	3	3	
111	139		1.002	1.002		1	3	3	Conc mass
112	140	From							
113	141			1.198		1	2	2	
114	142	Valve		1.833		1	2	2	
115	143	Rigid	1'3"			1	2	2	Conc mass

Bends

Bend Node	Radius (inch)	Thickness (inch)	Int. Node	Angle (deg)	Int. Node	Angle (deg)
3	36.0	U				
17	72.0	U				
31	72.0	U				
39	72.0	U				
41	36.0	U				
67	72.0	U				
700	9.0	L				
720	6.0	S				
80	9.0	L				
84	9.0	L				
94	9.0	L				
110	8.0	S				
119	10.0	S				
129	10.0	S				
138	10.0	S				

Valves

From	To	Weight (lb)	Thick X	Insul Wgt X	Add Wght (lb)	DX (inch)	DY (inch)	DZ (inch)
61	62	0	3.00	1.75				

## Valves

From	To	Weight (lb)	Thick X	Insul wgt X	Add Wgt (lb)	DX (inch)	DY (inch)	DZ (inch)
62	64	0	3.00	1.75				
730	740	575	3.00	1.75				
740	750	575	3.00	1.75				
75	76	0	3.00	1.75				
76	78	0	3.00	1.75				
105	106	0	3.00	1.75				
106	108	0	3.00	1.75				
114	115	0	3.00	1.75				
115	117	0	3.00	1.75				
124	125	0	3.00	1.75				
125	127	0	3.00	1.75				
133	134	0	3.00	1.75				
134	136	0	3.00	1.75				
141	142	0	3.00	1.75				

## Reducers

From	To	OD1 (inch)	Thk1 (inch)	OD2 (inch)	Thk2 (inch)	Cone Angle (deg)	Knuc Delta kles (inch)
74	75	6.625	0.28	3.5	0.28	0.00	
78	79	3.5	0.28	6.625	0.28	0.00	

## Rigid Elements

From	To	Weight(lb)
62	63	0
76	77	0
106	107	0
115	116	0
125	126	0
134	135	0
142	143	0

## Anchors

Node	KX	(lb/inch) KY	KZ	KXX	(in-lb/deg) KYY	KZZ	Releases X Y Z XXYYZZ		
1	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			
58		7.5758E+5					Y	Y Y Y Y	
121	Rigid	Rigid				Rigid		Y Y Y	
144	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			

## Hangers

Node	Type	No. of	Load var(%)	Short Range	SpringRate (lb/inch)	HangerLoad (lb)	Load type
6	User hanger	1			1000	6670	Hot

## Hangers

Node	Type	No. of	Load var(%)	Short Range (lb/inch)	SpringRate (lb)	HangerLoad (lb)	Load type
20	User hanger	1			1200	6250	Hot
23	User hanger	1			1000	4265	Hot
25	User hanger	1			1000	4800	Hot
29	User hanger	1			500	5520	Hot
34	User hanger	1			435	1990	Hot
40	User hanger	1			1200	7130	Hot
47	User hanger	1			500	6465	Hot
50	User hanger	1			500	5250	Hot
55	User hanger	1			670	3340	Hot
65	Rod Hanger	1					
102	Rod Hanger	1					
140	Rod Hanger	1					
760	User hanger	1			100	675	Hot
840	User hanger	1			140	670	Hot
96	User hanger	1			74	500	Hot
98	Rod Hanger	1					

## Snubbers

Node	Stiffness (lb/inch)	Direction		
		X comp	Y comp	Z comp
14	Rigid			1.000
27	Rigid	1.000		
35	Rigid	1.125		-6.000
43	Rigid		1.000	
44	Rigid		-2.604	7.000
52	Rigid		-2.740	7.000
57	Rigid	1.000		
59	Rigid		-2.870	7.000
70	Rigid	7.000	-3.021	
82	Rigid	-4.357	0.687	0.891
87	Rigid		1.000	
89	Rigid	3.190	-2.206	4.577
92	Rigid			1.000
99	Rigid	-6.357		-3.570

## Flanges

Node	Weight(lb)	Type
105	164	Weld neck
109	273	Weld neck
114	164	Weld neck
118	454	Weld neck
124	164	Weld neck
127	454	Weld neck
133	164	Weld neck
137	454	Weld neck

## Concentrated Masses

Node	Weight (lb)	DX (inch)	DY (inch)	DZ (inch)
63	18400			
77	540			
107	1257			
111	44.50			
116	1257			
120	83			
126	1257			
130	83			
135	1257			
139	83			
143	1320			

## Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
1	0'0"	0'0"	0'0"
3A	0'0"	-9'6"	0'0"
3	0'0"	-12'6"	0'0"
3B	0'0"	-12'6"	3'0"
6	0'0"	-12'6"	11.854
7	0'0"	-12'6"	15.437
14	0'0"	-12'6"	23.770
17A	0'0"	-12'6"	25.354
17	0'0"	-12'6"	31.354
17B	6'0"	-12'6"	31.354
20	7'6"	-12'6"	31.354
23	23.833	-12'6"	31.354
25	42.625	-12'6"	31.354
27	45.958	-12'6"	31.354
29	60.374	-12'6"	31.354
31A	61.374	-12'6"	31.354
31	67.374	-12'6"	31.354
31B	67.374	-12'6"	37.354
34	67.374	-12'6"	46.354
35	67.374	-12'6"	51.854
39A	67.374	-12'6"	53.354
39	67.374	-12'6"	59.354
39B	67.374	-18'6"	59.354
40	67.374	-18'6"	59.354
41A	67.374	-18'6"	59.354
41	67.374	-21'6"	59.354
41B	70.374	-21'6"	59.354
43	74.999	-21'6"	59.354
44	81.041	-21'6"	59.354
47	84.687	-21'6"	59.354
50	103.271	-21'6"	59.354
52	107.271	-21'6"	59.354
55	120.021	-21'6"	59.354
57	126.833	-21'6"	59.354
58	128.291	-21'6"	59.354



## Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
59	130.291	-21'6"	59.354
61	132.353	-21'6"	59.354
62	134.270	-21'6"	59.354
64	138.186	-21'6"	59.354
65	138.999	-21'6"	59.354
67A	142.769	-21'6"	59.354
67	148.666	-21'6"	59.354
67B	148.769	-21'6"	53.458
70	148.884	-21'6"	46.854
73	148.953	-21'6"	42.854
102	148.985	-21'6"	41.021
103	149.076	-21'6"	35'9-3/4"
112	149.120	-21'6"	33.313
121	149.145	-21'6"	31.855
122	149.163	-21'6"	30.813
131	149.206	-21'6"	28.313
140	149'3"	-21'6"	25.813
144	149.469	-21'6"	13.301
700A	8.653	-12'6"	15.437
700	8.964	-12'6"	15.437
700B	9.183	-12.280	15.437
710	9.283	-12.180	15.437
720A	9.457	-12.006	15.437
720	9.603	-11.860	15.437
720B	9.811	-11.860	15.437
730	9.916	-11.860	15.437
740	10.666	-11.860	15.437
750	11.416	-11.860	15.437
760	12.958	-11.860	15.437
63	137.270	-19'1"	59.354
74	148.953	-20'1"	42.854
75	148.953	-19.634	42.854
76	148.953	-19.184	42.854
77	148.953	-17.726	42.854
78	148.503	-19.184	42.854
79	148.053	-19.184	42.854
80A	141.203	-19.184	42.854
80	140.453	-19.184	42.854
80B	140.453	-18.434	42.854
82	140.453	-15.080	42.854
840	140.453	-13.038	42.854
84A	140.453	-12.288	42.854
84	140.453	-11.538	42.854
84B	140.453	-11.538	42.104
87	140.453	-11.538	41.854
89	140.453	-11.538	33.979
92	140.453	-11.538	30.729
94A	140.453	-11.538	29.479
94	140.453	-11.538	28.729
94B	139.703	-11.538	28.729
96	138.620	-11.538	28.729
98	118.537	-11.538	28.729

Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
99	111.537	-11.538	28.729
101	110.537	-11.538	28.729
104	149.076	-20.276	35'9-3/4"
105	149.076	-19.713	35'9-3/4"
106	149.076	-18.536	35'9-3/4"
107	149.159	-17.552	35'9-3/4"
108	149.909	-18.536	35'9-3/4"
109	150.607	-18.536	35'9-3/4"
110A	150.997	-18.536	35'9-3/4"
110	151.273	-18.536	35'9-3/4"
110B	151.469	-18.341	35'9-3/4"
111	152.275	-17.534	35'9-3/4"
113	149.120	-20.276	33.313
114	149.120	-19.713	33.313
115	149.120	-18.369	33.313
116	149.203	-17.552	33.313
117	149.995	-18.369	33.313
118	150.828	-18.369	33.313
119A	151.316	-18.369	33.313
119	151.661	-18.369	33.313
119B	151.905	-18.125	33.313
120	152.663	-17.367	33.313
123	149.163	-20.276	30.813
124	149.163	-19.713	30.813
125	149.163	-18.369	30.813
126	149.246	-17.552	30.813
127	150.038	-18.369	30.813
128	150.871	-18.369	30.813
129A	151.359	-18.369	30.813
129	151.704	-18.369	30.813
129B	151.948	-18.125	30.813
130	152.706	-17.367	30.813
132	149.206	-20.276	28.313
133	149.206	-19.713	28.313
134	149.206	-18.369	28.313
135	149.289	-17.552	28.313
136	150.081	-18.369	28.313
137	150.914	-18.369	28.313
138A	151.402	-18.369	28.313
138	151.747	-18.369	28.313
138B	151.991	-18.125	28.313
139	152.749	-17.367	28.313
141	149'3"	-20.302	25.813
142	149'3"	-18.469	25.813
143	150'6"	-18.469	25.813

Pipe material 1: A106 Grade B

Density = 0.2800 (lb/in3), Nu = 0.300, Joint factor 1.00, Type = CS

Temp (F)	E (psi)	Alpha (in/in/F)	Allowable (psi)
-100	29.0E+6	5.65E-6	15000
70	27.9E+6	6.07E-6	15000
200	27.7E+6	6.38E-6	15000
300	27.4E+6	6.60E-6	15000
400	27.0E+6	6.82E-6	15000
500	26.4E+6	7.02E-6	15000
600	25.7E+6	7.23E-6	15000
650	25.3E+6	7.34E-6	15000
700	24.8E+6	7.44E-6	14350
750	24.8E+6	7.55E-6	12950
800	23.4E+6	7.65E-6	10800

Pipe Sections

Name	Nominal Dia.	Sch	O.D. (inch)	Thk (inch)	Cor. Al (inch)	M.Tol (%)	Ins.Dens (lb/ft3)	Ins.Th (inch)	Lin.Dens (lb/ft3)	Lin.Th (inch)
1	24"	60	24.0	0.968	0.0	0.0				
2	6"	STD	6.625	0.28	0.0	0.0				
3	10"	60	10.75	0.5	0.0	0.0				
4	8"	STD	8.625	0.322	0.0	0.0				

Loads

Acceleration load: X = 0.00, Y = 0.00, Z = 0.00 (g's)

Acceleration load combination = Algebraic sum

Wind velocity = 0 (mph)

Shape factor = 0.60

Wind direction: X comp = 0.000, Y comp = 0.000, Z comp = 0.000

X spectrum: CRW2

Factor = 2.0000 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.500	0.040
0.700	0.064
1.000	0.150
1.200	0.210
1.300	0.220
2.500	0.220
3.150	0.220
4.000	0.440
5.000	0.440
5.250	0.240
6.750	0.240
7.000	0.240

8.000	0.240
10.000	0.250
12.500	0.250
13.000	0.240
14.000	0.440
14.500	0.440
18.000	0.440
20.000	0.180
22.000	0.180
31.000	0.180
34.000	0.180
36.000	0.100
50.000	0.100

Y spectrum: GRS (fig 22)

Factor = 1.3300 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.700	0.065
1.000	0.150
1.300	0.190
1.500	0.190
2.000	0.187
3.800	0.187
5.500	0.175
10.000	0.118
15.000	0.080
20.000	0.072
25.000	0.070
31.000	0.059
40.000	0.052
50.000	0.050

Mode sum = Closely spaced

Direction sum = SRSS

Number of thermal loads = 1

#### Pipe Loads

Load Name	T1 (F)	P1 (psi)	T2 (F)	P2 (psi)	T3 (F)	P3 (psi)	Specific gravity	Add.Wgt (lb/ft)	Wind Load
1	600	1050						37.700	
2	600	1050						10.030	
3	600	1050						16.800	
4	600	1050						13.500	

#### B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
7	15082	1.01	41B	12840	0.57	78	23614	1.31

## B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
75	10275	0.69	38	12610	0.56	7	19178	1.07
78	10061	0.67	121	9075	0.40	75	16309	0.91
720B	9898	0.66	112	8632	0.38	112	15632	0.87
720A	9026	0.60	122	8343	0.37	131	15030	0.84
114	8585	0.57	103	7874	0.35	84A	13890	0.77
112	8585	0.57	1	7086	0.31	113	13637	0.76
113	8585	0.57	3A	6993	0.31	140	13446	0.75
133	8582	0.57	131	6589	0.29	122	13410	0.75
131	8581	0.57	102	6293	0.28	84B	13395	0.74
132	8581	0.57	41A	6107	0.27	132	13205	0.73
140	8542	0.57	39B	5995	0.27	114	12726	0.71
141	8542	0.57	39A	5850	0.26	133	12371	0.69
124	8051	0.54	73	5737	0.25	103	12241	0.68
122	8051	0.54	43	5446	0.24	141	11842	0.66
123	8051	0.54	44	4915	0.22	123	11831	0.66
74	7951	0.53	140	4834	0.21	124	11110	0.62
73	7951	0.53	47	4596	0.20	79	11071	0.62
41A	7880	0.53	70	4523	0.20	104	10806	0.60
79	7846	0.52	144	3950	0.18	720B	10662	0.59
700B	7834	0.52	35	3875	0.17	94B	10483	0.58
58	7820	0.52	17B	3579	0.16	80B	10420	0.58
57	7801	0.52	67B	3481	0.15	720A	10218	0.57
94B	7745	0.52	6	3176	0.14	105	10150	0.56
59	7734	0.52	75	3168	0.14	840	9506	0.53
61	7609	0.51	31A	3154	0.14	87	9482	0.53
17A	7566	0.50	78	3020	0.13	700B	9442	0.52
730	7540	0.50	50	2996	0.13	82	9296	0.52
750	7534	0.50	52	2660	0.12	74	9265	0.51
98	7512	0.50	20	2457	0.11	38	9248	0.51
105	7500	0.50	34	2342	0.10	700A	9135	0.51
103	7500	0.50	29	2197	0.10	80A	9093	0.51
104	7500	0.50	7	2178	0.10	89	9074	0.50
55	7474	0.50	17A	1913	0.09	41A	8962	0.50
31B	7452	0.50	55	1642	0.07	3A	8888	0.49
39B	7373	0.49	31B	1552	0.07	73	8857	0.49
108	7348	0.49	14	1226	0.05	98	8681	0.48
80B	7330	0.49	57	1182	0.05	96	8394	0.47
84A	7330	0.49	58	1102	0.05	17A	8390	0.47
14	7280	0.49	23	1035	0.05	1	8364	0.46
67B	7278	0.49	27	967	0.04	58	8276	0.46
110A	7268	0.48	59	906	0.04	31B	8209	0.46
96	7230	0.48	74	788	0.04	57	8188	0.45
3A	7203	0.48	79	715	0.03	59	8183	0.45
110B	7157	0.48	80B	709	0.03	47	8108	0.45
38	7152	0.48	84A	709	0.03	44	8096	0.45
109	7140	0.48	61	705	0.03	39B	8054	0.45
52	7122	0.47	25	694	0.03	61	7965	0.44
17B	7119	0.47	84B	668	0.03	25	7865	0.44
102	7105	0.47	720A	667	0.03	94A	7854	0.44
89	7103	0.47	700A	626	0.03	14	7851	0.44
20	7095	0.47	720B	599	0.03	39A	7830	0.44



B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
31A	7064	0.47	700B	549	0.02	730	7773	0.43
111	7031	0.47	67A	342	0.02	23	7724	0.43
710	7013	0.47	80A	319	0.01	17B	7712	0.43
29	6991	0.47	840	313	0.01	55	7675	0.43
47	6906	0.46	82	313	0.01	31A	7661	0.43
65	6889	0.46	87	291	0.01	27	7653	0.43
25	6832	0.46	710	236	0.01	52	7650	0.42
34	6826	0.46	730	195	0.01	750	7647	0.42
23	6806	0.45	64	137	0.01	67B	7634	0.42
1	6798	0.45	89	121	0.01	710	7601	0.42
700A	6791	0.45	94B	119	0.01	41B	7588	0.42
67A	6751	0.45	750	99	0.00	20	7516	0.42
50	6736	0.45	96	76	0.00	108	7501	0.42
840	6705	0.45	65	62	0.00	43	7493	0.42
82	6705	0.45	92	57	0.00	110A	7480	0.42
92	6684	0.45	94A	52	0.00	35	7457	0.41
64	6680	0.45	141	0	0.00	29	7438	0.41
41B	6676	0.45	104	0	0.00	65	7417	0.41
27	6660	0.44	132	0	0.00	34	7374	0.41
94A	6658	0.44	113	0	0.00	6	7334	0.41
44	6656	0.44	123	0	0.00	110B	7291	0.41
70	6632	0.44	105	0	0.00	64	7266	0.40
35	6627	0.44	133	0	0.00	109	7223	0.40
144	6618	0.44	114	0	0.00	102	7216	0.40
6	6610	0.44	124	0	0.00	50	7156	0.40
43	6606	0.44	98	0	0.00	67A	7039	0.39
39A	6585	0.44	110A	0	0.00	111	7031	0.39
121	6574	0.44	109	0	0.00	92	7026	0.39
80A	6565	0.44	136	0	0.00	70	6763	0.38
84B	6351	0.42	101	0	0.00	144	6702	0.37
87	6338	0.42	138A	0	0.00	121	6680	0.37
99	6231	0.42	99	0	0.00	99	6245	0.35
101	6211	0.41	127	0	0.00	760	6211	0.35
760	6211	0.41	137	0	0.00	101	6211	0.35
117	5921	0.39	129A	0	0.00	117	6091	0.34
136	5921	0.39	108	0	0.00	136	6078	0.34
119A	5809	0.39	119A	0	0.00	119A	5993	0.33
138A	5809	0.39	118	0	0.00	138A	5978	0.33
129A	5809	0.39	110B	0	0.00	129A	5957	0.33
127	5806	0.39	138B	0	0.00	127	5911	0.33
137	5738	0.38	117	0	0.00	118	5826	0.32
118	5738	0.38	128	0	0.00	119B	5823	0.32
128	5738	0.38	139	0	0.00	137	5819	0.32
138B	5720	0.38	129B	0	0.00	138B	5814	0.32
129B	5720	0.38	119B	0	0.00	128	5809	0.32
119B	5720	0.38	120	0	0.00	129B	5803	0.32
130	5644	0.38	130	0	0.00	120	5644	0.31
120	5644	0.38	111	0	0.00	139	5644	0.31
139	5644	0.38	760	0	0.00	130	5644	0.31

B31.1 (1967) Code Compliance										
Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---				--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
1	1050	6798	15000	0.45	7086	22500	0.31	8364	18000	0.46
3A	1250	6825	15000	0.45	6602	22500	0.29	7593	18000	0.42
3A	1050	7203	15000	0.48	6993	22500	0.31	8888	18000	0.49
3B	1250	7152	15000	0.48	12610	22500	0.56	9248	18000	0.51
3B	1050	6802	15000	0.45	5813	22500	0.26	7757	18000	0.43
6	1250	6610	15000	0.44	3176	22500	0.14	7334	18000	0.41
6	1050	6610	15000	0.44	3176	22500	0.14	7334	18000	0.41
7	1250	6970	15000	0.46	2178	22500	0.10	7702	18000	0.43
7	1050	6970	15000	0.46	2170	22500	0.10	7706	18000	0.43
14	1250	7280	15000	0.49	1226	22500	0.05	7851	18000	0.44
14	1050	7280	15000	0.49	1226	22500	0.05	7851	18000	0.44
17A	1250	7273	15000	0.48	1533	22500	0.07	7870	18000	0.44
17A	1050	7566	15000	0.50	1913	22500	0.09	8390	18000	0.47
17B	1250	7119	15000	0.47	3579	22500	0.16	7712	18000	0.43
17B	1050	6950	15000	0.46	2590	22500	0.12	7379	18000	0.41
20	1250	7095	15000	0.47	2457	22500	0.11	7516	18000	0.42
20	1050	7095	15000	0.47	2457	22500	0.11	7516	18000	0.42
23	1250	6806	15000	0.45	1035	22500	0.05	7724	18000	0.43
23	1050	6806	15000	0.45	1035	22500	0.05	7724	18000	0.43
25	1250	6832	15000	0.46	694	22500	0.03	7865	18000	0.44
25	1050	6832	15000	0.46	694	22500	0.03	7865	18000	0.44
27	1250	6660	15000	0.44	967	22500	0.04	7653	18000	0.43
27	1050	6660	15000	0.44	967	22500	0.04	7653	18000	0.43
29	1250	6991	15000	0.47	2197	22500	0.10	7438	18000	0.41
29	1050	6991	15000	0.47	2197	22500	0.10	7438	18000	0.41
31A	1250	6910	15000	0.46	2283	22500	0.10	7343	18000	0.41
31A	1050	7064	15000	0.47	3154	22500	0.14	7661	18000	0.43
31B	1250	7452	15000	0.50	1552	22500	0.07	8209	18000	0.46
31B	1050	7191	15000	0.48	1386	22500	0.06	7739	18000	0.43
34	1250	6826	15000	0.46	2342	22500	0.10	7374	18000	0.41
34	1050	6826	15000	0.46	2342	22500	0.10	7374	18000	0.41
35	1250	6627	15000	0.44	3875	22500	0.17	7457	18000	0.41
35	1050	6627	15000	0.44	3875	22500	0.17	7457	18000	0.41
39A	1250	6564	15000	0.44	4310	22500	0.19	7465	18000	0.41

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		SL/ SH	--- Expansion ---		SE/ SA	--- Occasional ---		
		SL (psi)	SH (psi)		SE (psi)	SA (psi)		SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
39A	1050	6585	15000	0.44	5850	22500	0.26	7830	18000	0.44
39B	1250	7373	15000	0.49	5995	22500	0.27	8054	18000	0.45
41A	1050	7880	15000	0.53	6107	22500	0.27	8962	18000	0.50
41B	1250	6676	15000	0.45	12840	22500	0.57	7588	18000	0.42
41B	1050	6585	15000	0.44	5853	22500	0.26	7000	18000	0.39
43	1250	6606	15000	0.44	5446	22500	0.24	7493	18000	0.42
43	1050	6606	15000	0.44	5446	22500	0.24	7493	18000	0.42
44	1250	6656	15000	0.44	4915	22500	0.22	8096	18000	0.45
44	1050	6656	15000	0.44	4915	22500	0.22	8096	18000	0.45
47	1250	6906	15000	0.46	4596	22500	0.20	8108	18000	0.45
47	1050	6906	15000	0.46	4596	22500	0.20	8108	18000	0.45
50	1250	6736	15000	0.45	2996	22500	0.13	7156	18000	0.40
50	1050	6736	15000	0.45	2996	22500	0.13	7156	18000	0.40
52	1250	7122	15000	0.47	2660	22500	0.12	7650	18000	0.42
52	1050	7122	15000	0.47	2660	22500	0.12	7650	18000	0.42
55	1250	7474	15000	0.50	1642	22500	0.07	7675	18000	0.43
55	1050	7474	15000	0.50	1642	22500	0.07	7675	18000	0.43
57	1250	7801	15000	0.52	1182	22500	0.05	8188	18000	0.45
57	1050	7801	15000	0.52	1182	22500	0.05	8188	18000	0.45
58	1250	7820	15000	0.52	1102	22500	0.05	8276	18000	0.46
58	1050	7820	15000	0.52	1102	22500	0.05	8276	18000	0.46
59	1250	7734	15000	0.52	906	22500	0.04	8183	18000	0.45
59	1050	7734	15000	0.52	906	22500	0.04	8183	18000	0.45
61	1250	7609	15000	0.51	705	22500	0.03	7965	18000	0.44
64	1050	6680	15000	0.45	137	22500	0.01	7266	18000	0.40
65	1250	6889	15000	0.46	62	22500	0.00	7417	18000	0.41
65	1050	6889	15000	0.46	62	22500	0.00	7417	18000	0.41
67A	1250	6684	15000	0.45	247	22500	0.01	6892	18000	0.38
67A	1050	6751	15000	0.45	342	22500	0.02	7039	18000	0.39
67B	1250	7278	15000	0.49	3481	22500	0.15	7634	18000	0.42
67B	1050	7065	15000	0.47	2519	22500	0.11	7323	18000	0.41
70	1250	6632	15000	0.44	4523	22500	0.20	6763	18000	0.38
70	1050	6632	15000	0.44	4523	22500	0.20	6763	18000	0.38
73	1250	6831	15000	0.46	5737	22500	0.25	6929	18000	0.38

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---		--- Occasional ---				
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
73	1050	6827	15000	0.46	5737	22500	0.25	6939	18000	0.39
102	1250	7105	15000	0.47	6293	22500	0.28	7216	18000	0.40
102	1050	7105	15000	0.47	6293	22500	0.28	7216	18000	0.40
103	1250	6524	15000	0.43	7874	22500	0.35	6610	18000	0.37
103	1050	6524	15000	0.43	7874	22500	0.35	6609	18000	0.37
112	1250	6550	15000	0.44	8632	22500	0.38	6627	18000	0.37
112	1050	6551	15000	0.44	8632	22500	0.38	6628	18000	0.37
121	1250	6572	15000	0.44	9075	22500	0.40	6677	18000	0.37
121	1050	6574	15000	0.44	9075	22500	0.40	6680	18000	0.37
122	1250	6556	15000	0.44	8343	22500	0.37	6629	18000	0.37
122	1050	6556	15000	0.44	8343	22500	0.37	6630	18000	0.37
131	1250	6588	15000	0.44	6589	22500	0.29	6667	18000	0.37
131	1050	6589	15000	0.44	6589	22500	0.29	6669	18000	0.37
140	1250	6621	15000	0.44	4834	22500	0.21	6723	18000	0.37
140	1050	6620	15000	0.44	4834	22500	0.21	6720	18000	0.37
144	1250	6618	15000	0.44	3950	22500	0.18	6702	18000	0.37
7	1050	15082	15000	1.01	831	22500	0.04	19178	18000	1.07
700A	1312	6467	15000	0.43	276	22500	0.01	7502	18000	0.42
700A	1050	6791	15000	0.45	626	22500	0.03	9135	18000	0.51
700B	1312	7834	15000	0.52	549	22500	0.02	9442	18000	0.52
700B	1050	6927	15000	0.46	242	22500	0.01	7637	18000	0.42
710	1312	7013	15000	0.47	236	22500	0.01	7601	18000	0.42
710	1050	7013	15000	0.47	236	22500	0.01	7601	18000	0.42
720A	1312	7159	15000	0.48	225	22500	0.01	7561	18000	0.42
720A	1050	9026	15000	0.60	667	22500	0.03	10218	18000	0.57
720B	1312	9898	15000	0.66	599	22500	0.03	10662	18000	0.59
720B	1050	7453	15000	0.50	202	22500	0.01	7710	18000	0.43
730	1312	7540	15000	0.50	195	22500	0.01	7773	18000	0.43
750	1050	7534	15000	0.50	99	22500	0.00	7647	18000	0.42
760	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35
73	1050	7951	15000	0.53	788	22500	0.04	8857	18000	0.49
74	1312	7951	15000	0.53	788	22500	0.04	9265	18000	0.51
74	1050	7951	15000	0.53	788	22500	0.04	9265	18000	0.51
75		10275	15000	0.69	3168	22500	0.14	16309	18000	0.91

B31.1 (1967) Code Compliance											
Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---		--- Occasional ---					
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO 1 (psi)	20SH (psi)	SL+SO/ 1 20SH	
78	1050	10061	15000	0.67	3020	22500	0.13	23614	18000	1.31	
79		7846	15000	0.52	715	22500	0.03	11071	18000	0.62	
79	1050	7846	15000	0.52	715	22500	0.03	11070	18000	0.62	
80A	1312	6367	15000	0.42	312	22500	0.01	7483	18000	0.42	
80A	1050	6565	15000	0.44	319	22500	0.01	9093	18000	0.51	
80B	1312	7330	15000	0.49	709	22500	0.03	10420	18000	0.58	
80B	1050	6705	15000	0.45	313	22500	0.01	8069	18000	0.45	
82	1312	6705	15000	0.45	313	22500	0.01	9066	18000	0.52	
82	1050	6705	15000	0.45	313	22500	0.01	9296	18000	0.52	
840	1312	6705	15000	0.45	313	22500	0.01	9506	18000	0.53	
840	1050	6705	15000	0.45	313	22500	0.01	9506	18000	0.53	
84A	1312	6705	15000	0.45	313	22500	0.01	9600	18000	0.53	
84A	1050	7330	15000	0.49	709	22500	0.03	13890	18000	0.77	
84B	1312	6351	15000	0.42	668	22500	0.03	13395	18000	0.74	
84B	1050	6273	15000	0.42	297	22500	0.01	9382	18000	0.52	
87	1312	6338	15000	0.42	291	22500	0.01	9482	18000	0.53	
87	1050	6338	15000	0.42	291	22500	0.01	9482	18000	0.53	
89	1312	7103	15000	0.47	121	22500	0.01	9074	18000	0.50	
89	1050	7103	15000	0.47	121	22500	0.01	9074	18000	0.50	
92	1312	6684	15000	0.45	57	22500	0.00	7026	18000	0.39	
92	1050	6684	15000	0.45	57	22500	0.00	7026	18000	0.39	
94A	1312	6408	15000	0.43	40	22500	0.00	6936	18000	0.39	
94A	1050	6658	15000	0.44	52	22500	0.00	7854	18000	0.44	
94B	1312	7745	15000	0.52	119	22500	0.01	10483	18000	0.58	
94B	1050	6888	15000	0.46	52	22500	0.00	8097	18000	0.45	
96	1312	7230	15000	0.48	76	22500	0.00	8394	18000	0.47	
96	1050	7230	15000	0.48	76	22500	0.00	8394	18000	0.47	
98	1312	7512	15000	0.50	0	22500	0.00	8681	18000	0.48	
98	1050	7512	15000	0.50	0	22500	0.00	8681	18000	0.48	
99	1312	6231	15000	0.42	0	22500	0.00	6245	18000	0.35	
99	1050	6231	15000	0.42	0	22500	0.00	6245	18000	0.35	
101	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35	
103	1050	7500	15000	0.50	0	22500	0.00	12241	18000	0.68	
104	1312	7500	15000	0.50	0	22500	0.00	10806	18000	0.60	



B31.1 (1967) Code Compliance										
Node	Press (psi)	--- Sustained ---		--- Expansion ---				--- Occasional ---		
	Allow	SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
104	1050	7500	15000	0.50	0	22500	0.00	10806	18000	0.60
105	1312	7500	15000	0.50	0	22500	0.00	10150	18000	0.56
108	1050	7348	15000	0.49	0	22500	0.00	7501	18000	0.42
109	1154	7140	15000	0.48	0	22500	0.00	7223	18000	0.40
109	1050	7140	15000	0.48	0	22500	0.00	7223	18000	0.40
110A	1154	7105	15000	0.47	0	22500	0.00	7172	18000	0.40
110A	1050	7268	15000	0.48	0	22500	0.00	7480	18000	0.42
110B	1154	7157	15000	0.48	0	22500	0.00	7291	18000	0.41
110B	1050	7071	15000	0.47	0	22500	0.00	7113	18000	0.40
111	1154	7031	15000	0.47	0	22500	0.00	7031	18000	0.39
112	1050	8585	15000	0.57	0	22500	0.00	15632	18000	0.87
113	1312	8585	15000	0.57	0	22500	0.00	13637	18000	0.76
113	1050	8585	15000	0.57	0	22500	0.00	13637	18000	0.76
114	1312	8585	15000	0.57	0	22500	0.00	12726	18000	0.71
117	1050	5921	15000	0.39	0	22500	0.00	6091	18000	0.34
118	1449	5738	15000	0.38	0	22500	0.00	5826	18000	0.32
118	1050	5738	15000	0.38	0	22500	0.00	5826	18000	0.32
119A	1449	5705	15000	0.38	0	22500	0.00	5772	18000	0.32
119A	1050	5809	15000	0.39	0	22500	0.00	5993	18000	0.33
119B	1449	5720	15000	0.38	0	22500	0.00	5823	18000	0.32
119B	1050	5672	15000	0.38	0	22500	0.00	5710	18000	0.32
120	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
122	1050	8051	15000	0.54	0	22500	0.00	13410	18000	0.75
123	1312	8051	15000	0.54	0	22500	0.00	11831	18000	0.66
123	1050	8051	15000	0.54	0	22500	0.00	11831	18000	0.66
124	1312	8051	15000	0.54	0	22500	0.00	11110	18000	0.62
127	1050	5806	15000	0.39	0	22500	0.00	5911	18000	0.33
128	1449	5738	15000	0.38	0	22500	0.00	5809	18000	0.32
128	1050	5738	15000	0.38	0	22500	0.00	5809	18000	0.32
129A	1449	5705	15000	0.38	0	22500	0.00	5759	18000	0.32
129A	1050	5809	15000	0.39	0	22500	0.00	5957	18000	0.33
129B	1449	5720	15000	0.38	0	22500	0.00	5803	18000	0.32
129B	1050	5672	15000	0.38	0	22500	0.00	5702	18000	0.32
130	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31

## B31.1 (1967) Code Compliance

Node	Press (psi)	--- Sustained ---			--- Expansion ---			--- Occasional ---		
	Allow	SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO 1 (psi)	20SH (psi)	SL+SO/ 1 20SH
131	1050	8581	15000	0.57	0	22500	0.00	15030	18000	0.84
132	1312	8581	15000	0.57	0	22500	0.00	13205	18000	0.73
132	1050	8581	15000	0.57	0	22500	0.00	13205	18000	0.73
133	1312	8582	15000	0.57	0	22500	0.00	12371	18000	0.69
136	1050	5921	15000	0.39	0	22500	0.00	6078	18000	0.34
137	1449	5738	15000	0.38	0	22500	0.00	5819	18000	0.32
137	1050	5738	15000	0.38	0	22500	0.00	5819	18000	0.32
138A	1449	5705	15000	0.38	0	22500	0.00	5767	18000	0.32
138A	1050	5809	15000	0.39	0	22500	0.00	5978	18000	0.33
138B	1449	5720	15000	0.38	0	22500	0.00	5814	18000	0.32
138B	1050	5672	15000	0.38	0	22500	0.00	5706	18000	0.32
139	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
140	1050	8542	15000	0.57	0	22500	0.00	13446	18000	0.75
141	1312	8542	15000	0.57	0	22500	0.00	11842	18000	0.66

## Loads on Anchors: Sustained (W+P)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	116	-4273	1	-6017	4371	-7173
58		1345				
121	-178	-5688				-4393
144	62	-1703	-1	3554	366	-867

## Loads on Hangers: Sustained (W+P)

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	-6235	1	-6235
20	User hanger	-6132	1	-6132
23	User hanger	-4179	1	-4179
25	User hanger	-4742	1	-4742
29	User hanger	-5473	1	-5473
34	User hanger	-2069	1	-2069
40	User hanger	-7325	1	-7325
47	User hanger	-6420	1	-6420
50	User hanger	-5214	1	-5214
55	User hanger	-3326	1	-3326
65	Rod Hanger	-23422	1	-23422
102	Rod Hanger	-9479	1	-9479
140	Rod Hanger	-5900	1	-5900
760	User hanger	-630	1	-630
840	User hanger	-718	1	-718
96	User hanger	-518	1	-518
98	Rod Hanger	-529	1	-529

## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	-0.005	-0.000	0.004	-0.0036	0.0034	-0.0047
3B	-0.008	0.007	0.009	-0.0171	0.0042	-0.0122
6	0.002	0.043	0.009	-0.0209	0.0061	-0.0185
7	0.007	0.059	0.009	-0.0228	0.0068	-0.0211
14	0.019	0.108	0.009	-0.0341	0.0079	-0.0227
17A	0.022	0.119	0.009	-0.0366	0.0080	-0.0230
17B	0.033	0.156	-0.003	-0.0633	0.0099	-0.0248
20	0.033	0.148	-0.006	-0.0654	0.0100	-0.0263
23	0.033	0.040	-0.042	-0.0883	0.0107	-0.0348
25	0.033	-0.101	-0.086	-0.1147	0.0116	-0.0372
27	0.033	-0.128	-0.094	-0.1194	0.0118	-0.0388
29	0.033	-0.250	-0.130	-0.1396	0.0125	-0.0438
31A	0.033	-0.259	-0.133	-0.1410	0.0125	-0.0447
31B	0.050	-0.126	-0.149	-0.1660	0.0135	-0.0469
34	0.075	0.198	-0.149	-0.1763	0.0133	-0.0496
35	0.090	0.403	-0.149	-0.1789	0.0128	-0.0513
39A	0.094	0.459	-0.149	-0.1791	0.0127	-0.0518
39B	0.039	0.679	0.063	-0.1573	0.0084	-0.0578
41A	0.039	0.679	0.063	-0.1572	0.0084	-0.0578
41B	0.001	0.640	0.147	-0.1360	0.0150	-0.0628
43	0.001	0.579	0.132	-0.1285	0.0143	-0.0624
44	0.001	0.501	0.115	-0.1186	0.0133	-0.0625
47	0.001	0.453	0.105	-0.1127	0.0128	-0.0644
50	0.001	0.206	0.061	-0.0824	0.0099	-0.0584
52	0.001	0.158	0.053	-0.0758	0.0092	-0.0549
55	0.001	0.040	0.031	-0.0550	0.0073	-0.0314
57	0.001	0.006	0.021	-0.0439	0.0062	-0.0152
58	0.001	0.002	0.019	-0.0416	0.0060	-0.0113
59	0.001	-0.002	0.017	-0.0383	0.0057	-0.0060
61	0.001	-0.003	0.015	-0.0349	0.0054	-0.0011
62	0.001	-0.003	0.012	-0.0341	0.0053	-0.0001
64	0.001	-0.001	0.008	-0.0325	0.0051	0.0029
65	0.001	0.000	0.007	-0.0311	0.0050	0.0027
67A	0.001	0.001	0.004	-0.0250	0.0044	0.0007
67B	-0.001	-0.011	-0.000	0.0001	0.0004	0.0040
70	-0.001	-0.006	-0.000	0.0052	-0.0002	0.0024
73	-0.001	-0.002	-0.000	0.0044	-0.0003	0.0013
102	-0.001	0.000	-0.000	0.0027	-0.0004	0.0010
103	-0.000	0.000	-0.000	-0.0003	-0.0004	0.0001
112	-0.000	-0.000	-0.000	-0.0002	-0.0003	-0.0001
121	0.000	0.000	0.000	-0.0002	-0.0002	0.0000
122	0.000	-0.000	0.000	-0.0003	-0.0002	-0.0003
131	0.000	-0.000	0.000	0.0001	-0.0001	-0.0008
140	0.000	0.000	0.000	0.0000	0.0000	-0.0010
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.007	-0.307	-0.004	-0.0228	0.0068	-0.2821
700B	0.019	-0.338	-0.005	-0.0228	0.0068	-0.2676
710	0.025	-0.343	-0.006	-0.0228	0.0068	-0.2668
720	0.034	-0.353	-0.007	-0.0228	0.0068	-0.2652
720B	0.042	-0.372	-0.008	-0.0228	0.0068	-0.2338
730	0.042	-0.377	-0.008	-0.0228	0.0068	-0.2328

## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
740	0.042	-0.413	-0.010	-0.0228	0.0068	-0.2306
750	0.042	-0.449	-0.011	-0.0228	0.0068	-0.2284
760	0.042	-0.521	-0.013	-0.0228	0.0068	-0.2208
63	0.001	-0.003	-0.008	-0.0341	0.0053	-0.0001
74	0.001	-0.002	0.001	0.0028	-0.0003	-0.0170
75	0.004	-0.002	0.001	0.0017	-0.0003	-0.0305
76	0.007	-0.002	0.001	0.0015	-0.0003	-0.0320
77	0.016	-0.002	0.002	0.0015	-0.0003	-0.0320
78	0.007	0.001	0.001	0.0014	-0.0003	-0.0334
79	0.007	0.005	0.001	-0.0002	-0.0003	-0.0464
80A	0.007	0.116	0.001	-0.0102	-0.0003	-0.0922
80B	0.019	0.130	-0.001	-0.0155	-0.0026	-0.0717
82	0.066	0.130	-0.014	-0.0192	-0.0026	-0.0600
840	0.090	0.130	-0.022	-0.0215	-0.0026	-0.0529
84A	0.098	0.130	-0.026	-0.0224	-0.0026	-0.0502
84B	0.104	0.126	-0.030	-0.0266	0.0044	-0.0340
87	0.104	0.124	-0.030	-0.0264	0.0044	-0.0329
89	0.097	0.109	-0.030	0.0158	0.0044	0.0029
92	0.094	0.126	-0.030	0.0332	0.0044	0.0177
94A	0.093	0.136	-0.030	0.0364	0.0044	0.0234
94B	0.092	0.136	-0.029	0.0320	0.0044	0.0422
96	0.092	0.126	-0.028	0.0320	0.0044	0.0490
98	0.092	0.000	-0.010	0.0320	0.0044	0.0181
99	0.092	-0.054	-0.003	0.0320	0.0044	0.0439
101	0.092	-0.063	-0.002	0.0320	0.0044	0.0439
104	0.001	-0.000	-0.000	-0.0003	-0.0004	-0.0116
105	0.003	-0.000	-0.000	-0.0003	-0.0004	-0.0170
106	0.007	-0.000	-0.000	-0.0003	-0.0004	-0.0199
107	0.012	-0.000	-0.000	-0.0003	-0.0004	-0.0199
108	0.007	-0.004	-0.000	-0.0003	-0.0004	-0.0205
109	0.007	-0.007	-0.000	-0.0003	-0.0004	-0.0213
110A	0.007	-0.009	-0.000	-0.0003	-0.0004	-0.0215
110B	0.008	-0.011	-0.000	-0.0003	-0.0004	-0.0233
111	0.012	-0.015	-0.000	-0.0003	-0.0004	-0.0234
113	0.003	-0.000	-0.000	-0.0002	-0.0003	-0.0217
114	0.006	-0.000	-0.000	-0.0002	-0.0003	-0.0316
115	0.016	-0.000	-0.000	-0.0002	-0.0003	-0.0377
116	0.022	-0.001	-0.000	-0.0002	-0.0003	-0.0377
117	0.016	-0.007	-0.000	-0.0002	-0.0003	-0.0381
118	0.016	-0.014	-0.000	-0.0002	-0.0003	-0.0388
119A	0.016	-0.018	-0.000	-0.0002	-0.0003	-0.0390
119B	0.018	-0.023	0.000	-0.0002	-0.0003	-0.0401
120	0.024	-0.029	0.000	-0.0002	-0.0003	-0.0401
123	0.002	-0.000	-0.000	-0.0003	-0.0002	-0.0171
124	0.005	-0.000	-0.000	-0.0003	-0.0002	-0.0248
125	0.012	-0.001	-0.000	-0.0003	-0.0002	-0.0295
126	0.017	-0.001	-0.000	-0.0003	-0.0002	-0.0295
127	0.012	-0.006	-0.000	-0.0003	-0.0002	-0.0297
128	0.012	-0.011	-0.000	-0.0003	-0.0002	-0.0302
129A	0.012	-0.014	-0.000	-0.0003	-0.0002	-0.0304
129B	0.014	-0.018	-0.000	-0.0003	-0.0002	-0.0315
130	0.019	-0.023	-0.000	-0.0003	-0.0002	-0.0316

## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
132	0.003	-0.000	0.000	0.0001	-0.0001	-0.0224
133	0.006	-0.001	0.000	0.0001	-0.0001	-0.0323
134	0.016	-0.001	0.000	0.0001	-0.0001	-0.0384
135	0.023	-0.001	0.000	0.0001	-0.0001	-0.0384
136	0.016	-0.008	0.000	0.0001	-0.0001	-0.0387
137	0.016	-0.015	0.000	0.0001	-0.0001	-0.0394
138A	0.016	-0.019	0.000	0.0001	-0.0001	-0.0396
138B	0.018	-0.024	0.000	0.0001	-0.0001	-0.0407
139	0.025	-0.030	0.000	0.0001	-0.0001	-0.0408
141	0.003	-0.000	0.000	0.0000	0.0000	-0.0217
142	0.013	-0.000	0.000	0.0000	0.0000	-0.0298
143	0.013	-0.008	0.000	0.0000	0.0000	-0.0298

## Loads on Anchors: Expansion (T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9759	1689	-2643	-12989	-209854	-90590
58		-2807				
121	32486	-90				588
144	-22727	-1	2643	5	-127611	0

## Loads on Hangers: Expansion (T1)

Node	Type	Load(lb)	No of	Total(lb)
6	User hanger	-435	1	-435
20	User hanger	-118	1	-118
23	User hanger	-86	1	-86
25	User hanger	-58	1	-58
29	User hanger	-47	1	-47
34	User hanger	79	1	79
40	User hanger	195	1	195
47	User hanger	-45	1	-45
50	User hanger	-36	1	-36
55	User hanger	-14	1	-14
65	Rod Hanger	1714	1	1714
102	Rod Hanger	21	1	21
140	Rod Hanger	21	1	21
760	User hanger	-45	1	-45
840	User hanger	48	1	48
96	User hanger	18	1	18
98	Rod Hanger	-3	1	-3

## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.039	-0.447	0.012	-0.0154	-0.1649	-0.0268
38	-0.244	-0.562	0.172	-0.0579	-0.3761	-0.1028
6	-1.024	-0.435	0.589	-0.0767	-0.4534	-0.0799



## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
7	-1.572	-0.375	0.757	-0.0821	-0.4709	-0.0706
14	-2.211	-0.223	1.149	-0.0908	-0.4807	-0.0493
17A	-2.371	-0.193	1.224	-0.0919	-0.4777	-0.0453
17B	-2.654	-0.096	2.035	-0.1092	-0.3777	-0.0071
20	-2.584	-0.098	2.152	-0.1095	-0.3702	-0.0049
23	-1.816	-0.086	3.307	-0.1126	-0.3134	0.0084
25	-0.933	-0.058	4.500	-0.1161	-0.3035	0.0018
27	-0.776	-0.058	4.713	-0.1167	-0.3079	-0.0017
29	-0.099	-0.094	5.695	-0.1194	-0.3486	-0.0245
31A	-0.052	-0.099	5.768	-0.1196	-0.3527	-0.0266
31B	-0.283	-0.018	6.536	-0.1066	-0.4261	-0.0738
34	-1.086	0.180	6.959	-0.1025	-0.4144	-0.1021
35	-1.548	0.296	7.218	-0.0977	-0.3824	-0.1194
39A	-1.667	0.327	7.288	-0.0960	-0.3705	-0.1241
39B	-2.151	0.163	7.688	-0.0958	-0.1578	-0.0793
41A	-2.151	0.163	7.688	-0.0958	-0.1575	-0.0793
41B	-2.055	-0.017	7.759	-0.0015	0.0564	-0.0433
43	-1.838	-0.052	7.678	-0.0014	0.1086	-0.0305
44	-1.554	-0.081	7.500	-0.0014	0.1712	-0.0162
47	-1.383	-0.091	7.355	-0.0013	0.2061	-0.0089
50	-0.509	-0.073	6.255	-0.0011	0.3489	0.0135
52	-0.321	-0.061	5.952	-0.0010	0.3721	0.0151
55	0.278	-0.020	4.877	-0.0009	0.4280	0.0128
57	0.598	-0.006	4.251	-0.0008	0.4467	0.0070
58	0.667	-0.004	4.114	-0.0007	0.4497	0.0053
59	0.761	-0.002	3.925	-0.0007	0.4532	0.0032
61	0.858	-0.001	3.729	-0.0007	0.4561	0.0014
62	0.946	-0.001	3.545	-0.0007	0.4567	0.0011
64	1.126	-0.000	3.170	-0.0007	0.4573	0.0008
65	1.164	0.000	3.092	-0.0007	0.4574	0.0007
67A	1.341	0.001	2.731	-0.0006	0.4567	0.0007
67B	1.122	0.001	1.910	-0.0004	0.3548	0.0006
70	0.665	0.000	1.591	-0.0003	0.3070	0.0006
73	0.426	0.000	1.399	-0.0002	0.2649	0.0005
102	0.330	0.000	1.311	-0.0001	0.2422	0.0004
103	0.108	-0.000	1.062	0.0000	0.1665	0.0002
112	0.033	-0.000	0.943	0.0000	0.1241	0.0001
121	0.000	0.000	0.874	0.0000	0.0976	0.0000
122	-0.018	0.000	0.824	0.0000	0.0789	0.0000
131	-0.045	0.000	0.706	0.0000	0.0406	0.0000
140	-0.054	0.000	0.588	0.0000	0.0113	0.0000
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.965	-0.465	1.610	-0.0821	-0.4709	-0.0349
700B	-0.938	-0.459	1.659	-0.0821	-0.4709	-0.0450
710	-0.933	-0.456	1.667	-0.0821	-0.4709	-0.0447
720A	-0.923	-0.449	1.681	-0.0821	-0.4709	-0.0443
720B	-0.905	-0.444	1.714	-0.0821	-0.4709	-0.0155
730	-0.900	-0.445	1.724	-0.0821	-0.4709	-0.0153
740	-0.866	-0.447	1.798	-0.0821	-0.4709	-0.0151
750	-0.831	-0.449	1.872	-0.0821	-0.4709	-0.0149
760	-0.759	-0.454	2.024	-0.0821	-0.4709	-0.0143
63	1.083	0.111	3.258	-0.0007	0.4567	0.0011



## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
74	0.425	0.067	1.399	-0.0035	0.2649	0.0082
75	0.424	0.088	1.398	-0.0059	0.2649	0.0138
76	0.423	0.108	1.398	-0.0061	0.2649	0.0144
77	0.418	0.175	1.396	-0.0061	0.2649	0.0144
78	0.402	0.107	1.422	-0.0065	0.2649	0.0150
79	0.381	0.105	1.447	-0.0096	0.2649	0.0202
80A	0.059	0.060	1.827	-0.0302	0.2649	0.0374
80B	0.014	0.087	1.863	-0.0410	0.2603	0.0718
82	-0.036	0.245	1.832	-0.0487	0.2603	0.0709
840	-0.066	0.341	1.810	-0.0535	0.2603	0.0703
84A	-0.077	0.376	1.801	-0.0552	0.2603	0.0701
84B	-0.129	0.405	1.758	-0.0378	0.2597	0.0689
87	-0.142	0.403	1.747	-0.0383	0.2597	0.0688
89	-0.571	0.328	1.376	-0.0502	0.2597	0.0661
92	-0.748	0.293	1.224	-0.0521	0.2597	0.0649
94A	-0.816	0.279	1.165	-0.0524	0.2597	0.0645
94B	-0.890	0.261	1.167	-0.0521	0.2247	0.0630
96	-0.941	0.247	1.218	-0.0521	0.2247	0.0625
98	-1.885	0.000	2.163	-0.0521	0.2247	0.0568
99	-2.214	-0.083	2.493	-0.0521	0.2247	0.0568
101	-2.261	-0.095	2.540	-0.0521	0.2247	0.0568
104	0.108	0.058	1.062	0.0000	0.1665	0.0002
105	0.108	0.084	1.062	0.0000	0.1665	0.0002
106	0.108	0.138	1.062	0.0000	0.1665	0.0002
107	0.112	0.183	1.059	0.0000	0.1665	0.0002
108	0.146	0.138	1.033	0.0000	0.1665	0.0002
109	0.179	0.138	1.009	0.0000	0.1665	0.0002
110A	0.198	0.138	0.995	0.0000	0.1665	0.0002
110B	0.220	0.146	0.979	0.0000	0.1665	-0.0252
111	0.263	0.180	0.950	0.0000	0.1665	-0.0252
113	0.033	0.058	0.943	0.0000	0.1241	0.0001
114	0.033	0.084	0.943	0.0000	0.1241	0.0001
115	0.033	0.146	0.943	0.0000	0.1241	0.0001
116	0.037	0.183	0.941	0.0000	0.1241	0.0001
117	0.073	0.146	0.920	0.0000	0.1241	0.0001
118	0.112	0.146	0.899	0.0000	0.1241	0.0001
119A	0.135	0.146	0.886	0.0000	0.1241	0.0001
119B	0.164	0.156	0.871	0.0000	0.1241	-0.0199
120	0.202	0.188	0.851	0.0000	0.1241	-0.0199
123	-0.018	0.058	0.824	0.0000	0.0789	0.0000
124	-0.018	0.084	0.824	0.0000	0.0789	0.0000
125	-0.018	0.146	0.824	0.0000	0.0789	0.0000
126	-0.014	0.183	0.823	0.0000	0.0789	0.0000
127	0.023	0.146	0.810	0.0000	0.0789	0.0000
128	0.062	0.146	0.796	0.0000	0.0789	0.0000
129A	0.085	0.146	0.788	0.0000	0.0789	0.0000
129B	0.113	0.156	0.778	0.0000	0.0789	-0.0200
130	0.152	0.188	0.766	0.0000	0.0789	-0.0200
132	-0.045	0.058	0.706	0.0000	0.0406	0.0000
133	-0.045	0.084	0.706	0.0000	0.0406	0.0000
134	-0.045	0.146	0.706	0.0000	0.0406	0.0000
135	-0.041	0.183	0.705	0.0000	0.0406	0.0000

Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
136	-0.004	0.146	0.699	0.0000	0.0406	0.0000
137	0.035	0.146	0.692	0.0000	0.0406	0.0000
138A	0.058	0.146	0.687	0.0000	0.0406	0.0000
138B	0.086	0.156	0.682	0.0000	0.0406	-0.0200
139	0.125	0.188	0.676	0.0000	0.0406	-0.0200
141	-0.054	0.056	0.588	0.0000	0.0113	0.0000
142	-0.054	0.141	0.588	0.0000	0.0113	0.0000
143	0.004	0.141	0.585	0.0000	0.0113	0.0000

Loads on Anchors: Operating (W+P1+T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9643	-2584	-2642	-19007	-205483	-97762
58		-1462				
121	32308	-5778				-3805
144	-22665	-1705	2642	3559	-127244	-867

Loads on Hangers: Operating (W+P1+T1)

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	-6670	1	-6670
20	User hanger	-6250	1	-6250
23	User hanger	-4265	1	-4265
25	User hanger	-4800	1	-4800
29	User hanger	-5520	1	-5520
34	User hanger	-1990	1	-1990
40	User hanger	-7130	1	-7130
47	User hanger	-6465	1	-6465
50	User hanger	-5250	1	-5250
55	User hanger	-3340	1	-3340
65	Rod Hanger	-21708	1	-21708
102	Rod Hanger	-9458	1	-9458
140	Rod Hanger	-5879	1	-5879
760	User hanger	-675	1	-675
840	User hanger	-670	1	-670
96	User hanger	-500	1	-500
98	Rod Hanger	-532	1	-532

Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.043	-0.447	0.016	-0.0191	-0.1614	-0.0314
38	-0.252	-0.555	0.181	-0.0750	-0.3719	-0.1151
6	-1.022	-0.392	0.597	-0.0976	-0.4473	-0.0984
7	-1.366	-0.316	0.766	-0.1049	-0.4641	-0.0917
14	-2.192	-0.116	1.158	-0.1250	-0.4728	-0.0721
17A	-2.349	-0.074	1.232	-0.1285	-0.4696	-0.0683
17B	-2.621	0.059	2.032	-0.1725	-0.3678	-0.0318

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
20	-2.551	0.050	2.146	-0.1749	-0.3603	-0.0312
23	-1.783	-0.046	3.266	-0.2009	-0.3027	-0.0264
25	-0.900	-0.159	4.415	-0.2308	-0.2919	-0.0354
27	-0.743	-0.186	4.620	-0.2361	-0.2961	-0.0404
29	-0.066	-0.344	5.564	-0.2590	-0.3361	-0.0683
31A	-0.019	-0.358	5.635	-0.2606	-0.3402	-0.0713
31B	-0.233	-0.144	6.386	-0.2726	-0.4126	-0.1207
34	-1.010	0.378	6.810	-0.2788	-0.4011	-0.1517
35	-1.458	0.699	7.069	-0.2766	-0.3696	-0.1707
39A	-1.572	0.786	7.139	-0.2751	-0.3578	-0.1758
39B	-2.112	0.842	7.751	-0.2530	-0.1493	-0.1371
41A	-2.112	0.842	7.751	-0.2530	-0.1491	-0.1371
41B	-2.054	0.624	7.905	-0.1375	0.0714	-0.1062
43	-1.837	0.527	7.810	-0.1299	0.1228	-0.0929
44	-1.553	0.420	7.615	-0.1200	0.1845	-0.0787
47	-1.382	0.362	7.460	-0.1140	0.2188	-0.0733
50	-0.508	0.133	6.316	-0.0834	0.3588	-0.0449
52	-0.320	0.097	6.005	-0.0768	0.3814	-0.0398
55	0.279	0.020	4.908	-0.0559	0.4353	-0.0185
57	0.599	0.000	4.273	-0.0447	0.4529	-0.0082
58	0.668	-0.002	4.134	-0.0423	0.4557	-0.0059
59	0.762	-0.004	3.942	-0.0390	0.4589	-0.0029
61	0.859	-0.004	3.743	-0.0356	0.4615	0.0003
62	0.947	-0.004	3.558	-0.0348	0.4619	0.0010
64	1.127	-0.001	3.178	-0.0331	0.4624	0.0036
65	1.165	0.000	3.100	-0.0318	0.4624	0.0034
67A	1.342	0.002	2.735	-0.0256	0.4611	0.0014
67B	1.121	-0.011	1.910	-0.0002	0.3552	0.0046
70	0.663	-0.006	1.591	0.0049	0.3069	0.0029
73	0.425	-0.002	1.399	0.0043	0.2645	0.0018
102	0.329	0.000	1.311	0.0026	0.2418	0.0014
103	0.108	0.000	1.062	-0.0003	0.1661	0.0003
112	0.033	-0.000	0.943	-0.0002	0.1238	0.0000
121	0.000	0.000	0.874	-0.0002	0.0973	0.0000
122	-0.018	-0.000	0.824	-0.0002	0.0787	-0.0003
131	-0.045	-0.000	0.706	0.0001	0.0405	-0.0008
140	-0.054	0.000	0.588	0.0000	0.0113	-0.0010
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.959	-0.772	1.607	-0.1049	-0.4641	-0.3170
700B	-0.919	-0.797	1.654	-0.1049	-0.4641	-0.3126
710	-0.908	-0.799	1.661	-0.1049	-0.4641	-0.3115
720A	-0.889	-0.802	1.674	-0.1049	-0.4641	-0.3095
720B	-0.863	-0.816	1.705	-0.1049	-0.4641	-0.2493
730	-0.858	-0.822	1.716	-0.1049	-0.4641	-0.2481
740	-0.824	-0.860	1.788	-0.1049	-0.4641	-0.2457
750	-0.789	-0.899	1.861	-0.1049	-0.4641	-0.2434
760	-0.717	-0.975	2.011	-0.1049	-0.4641	-0.2351
63	1.084	0.108	3.250	-0.0348	0.4619	0.0010
74	0.426	0.065	1.400	-0.0006	0.2645	-0.0088
75	0.428	0.086	1.399	-0.0042	0.2645	-0.0167
76	0.429	0.107	1.399	-0.0046	0.2645	-0.0175
77	0.435	0.174	1.398	-0.0046	0.2645	-0.0175

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
78	0.409	0.108	1.424	-0.0051	0.2645	-0.0184
79	0.388	0.110	1.449	-0.0098	0.2645	-0.0262
80A	0.066	0.176	1.828	-0.0405	0.2645	-0.0548
80B	0.034	0.217	1.862	-0.0565	0.2577	0.0000
82	0.030	0.375	1.818	-0.0680	0.2577	0.0109
840	0.024	0.471	1.788	-0.0750	0.2577	0.0175
84A	0.021	0.506	1.776	-0.0776	0.2577	0.0199
84B	-0.025	0.530	1.729	-0.0643	0.2641	0.0349
87	-0.038	0.527	1.717	-0.0647	0.2641	0.0359
89	-0.474	0.437	1.347	-0.0344	0.2641	0.0690
92	-0.654	0.420	1.194	-0.0189	0.2641	0.0826
94A	-0.723	0.415	1.135	-0.0160	0.2641	0.0879
94B	-0.798	0.398	1.138	-0.0201	0.2291	0.1052
96	-0.849	0.373	1.190	-0.0201	0.2291	0.1115
98	-1.793	0.000	2.153	-0.0201	0.2291	0.0749
99	-2.122	-0.137	2.489	-0.0201	0.2291	0.1007
101	-2.169	-0.158	2.537	-0.0201	0.2291	0.1008
104	0.109	0.057	1.062	-0.0003	0.1661	-0.0114
105	0.111	0.084	1.062	-0.0003	0.1661	-0.0168
106	0.115	0.138	1.062	-0.0003	0.1661	-0.0197
107	0.123	0.183	1.059	-0.0003	0.1661	-0.0197
108	0.154	0.134	1.033	-0.0003	0.1661	-0.0203
109	0.187	0.131	1.009	-0.0003	0.1661	-0.0211
110A	0.205	0.130	0.995	-0.0003	0.1661	-0.0213
110B	0.229	0.135	0.979	-0.0003	0.1661	-0.0485
111	0.275	0.165	0.950	-0.0003	0.1661	-0.0486
113	0.036	0.057	0.943	-0.0002	0.1238	-0.0216
114	0.039	0.084	0.943	-0.0002	0.1238	-0.0316
115	0.049	0.145	0.943	-0.0002	0.1238	-0.0376
116	0.059	0.182	0.941	-0.0002	0.1238	-0.0376
117	0.089	0.138	0.920	-0.0002	0.1238	-0.0380
118	0.128	0.132	0.899	-0.0002	0.1238	-0.0387
119A	0.151	0.128	0.886	-0.0002	0.1238	-0.0389
119B	0.181	0.133	0.871	-0.0002	0.1238	-0.0600
120	0.226	0.159	0.851	-0.0002	0.1238	-0.0600
123	-0.015	0.057	0.824	-0.0002	0.0787	-0.0171
124	-0.013	0.084	0.824	-0.0002	0.0787	-0.0248
125	-0.005	0.145	0.824	-0.0002	0.0787	-0.0295
126	0.004	0.182	0.823	-0.0002	0.0787	-0.0295
127	0.035	0.140	0.810	-0.0002	0.0787	-0.0297
128	0.074	0.135	0.796	-0.0002	0.0787	-0.0302
129A	0.097	0.131	0.788	-0.0002	0.0787	-0.0304
129B	0.127	0.138	0.778	-0.0002	0.0787	-0.0515
130	0.171	0.165	0.766	-0.0002	0.0787	-0.0515
132	-0.042	0.057	0.706	0.0001	0.0405	-0.0224
133	-0.038	0.083	0.706	0.0001	0.0405	-0.0323
134	-0.028	0.145	0.706	0.0001	0.0405	-0.0384
135	-0.018	0.182	0.706	0.0001	0.0405	-0.0384
136	0.012	0.138	0.699	0.0001	0.0405	-0.0387
137	0.051	0.131	0.692	0.0001	0.0405	-0.0394
138A	0.074	0.127	0.688	0.0001	0.0405	-0.0396
138B	0.104	0.132	0.683	0.0001	0.0405	-0.0607

Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
139	0.149	0.158	0.676	0.0001	0.0405	-0.0608
141	-0.051	0.056	0.588	0.0000	0.0113	-0.0217
142	-0.041	0.140	0.588	0.0000	0.0113	-0.0298
143	0.016	0.133	0.585	0.0000	0.0113	-0.0298

Loads on Anchors: Response spectrum

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	3713	2428	5323	29021	7105	41440
58		3890				
121	3303	949				12345
144	679	109	2772	107	2688	1461

Loads on Hangers: Response spectrum

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	130	1	130
20	User hanger	521	1	521
23	User hanger	542	1	542
25	User hanger	597	1	597
29	User hanger	283	1	283
34	User hanger	113	1	113
40	User hanger	56	1	56
47	User hanger	17	1	17
50	User hanger	19	1	19
55	User hanger	10	1	10
65	Rod Hanger	2149	1	2149
102	Rod Hanger	887	1	887
140	Rod Hanger	661	1	661
760	User hanger	57	1	57
840	User hanger	10	1	10
96	User hanger	88	1	88
98	Rod Hanger	79	1	79

Loads on Snubbers: Response spectrum

Node	Load (lb)	X comp	Y comp	Z comp
14	5752	0.000	0.000	1.000
27	5679	1.000	0.000	0.000
35	4135	1.125	0.000	-6.000
43	3038	0.000	1.000	0.000
44	6162	0.000	-2.604	7.000
52	2849	0.000	-2.740	7.000
57	8121	1.000	0.000	0.000
59	4782	0.000	-2.870	7.000
70	1789	7.000	-3.021	0.000
82	373	-4.357	0.687	0.891
87	374	0.000	1.000	0.000
89	878	3.190	-2.206	4.577



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Loads on Snubbers: Response spectrum  
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Node	Load (lb)	X comp	Y comp	Z comp
92	568	0.000	0.000	1.000
99	266	-6.357	0.000	-3.570

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Displacements: Response spectrum  
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Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	0.019	0.000	0.009	0.0023	0.0056	0.0151
3B	0.036	0.020	0.001	0.0526	0.0069	0.0239
6	0.043	0.130	0.000	0.0641	0.0033	0.0294
7	0.041	0.179	0.000	0.0657	0.0057	0.0320
14	0.025	0.293	0.000	0.0633	0.0132	0.0371
17A	0.021	0.314	0.000	0.0620	0.0140	0.0382
17B	0.001	0.424	0.022	0.0396	0.0199	0.0377
20	0.001	0.434	0.028	0.0369	0.0201	0.0376
23	0.000	0.542	0.087	0.0130	0.0134	0.0275
25	0.000	0.597	0.096	0.0330	0.0097	0.0111
27	0.000	0.597	0.089	0.0389	0.0130	0.0114
29	0.000	0.566	0.039	0.0650	0.0209	0.0215
31A	0.000	0.563	0.035	0.0668	0.0209	0.0220
31B	0.023	0.434	0.012	0.0909	0.0178	0.0315
34	0.053	0.260	0.012	0.0926	0.0146	0.0318
35	0.066	0.156	0.012	0.0881	0.0103	0.0325
39A	0.069	0.129	0.012	0.0862	0.0091	0.0328
39B	0.023	0.047	0.061	0.0426	0.0142	0.0378
41A	0.023	0.047	0.061	0.0426	0.0142	0.0378
41B	0.001	0.026	0.067	0.0272	0.0290	0.0284
43	0.001	0.000	0.039	0.0260	0.0278	0.0238
44	0.001	0.025	0.009	0.0246	0.0183	0.0151
47	0.001	0.034	0.007	0.0237	0.0107	0.0101
50	0.000	0.038	0.013	0.0208	0.0053	0.0072
52	0.000	0.034	0.013	0.0204	0.0036	0.0072
55	0.000	0.015	0.008	0.0202	0.0036	0.0077
57	0.000	0.006	0.003	0.0205	0.0034	0.0050
58	0.000	0.005	0.002	0.0206	0.0032	0.0039
59	0.000	0.004	0.002	0.0208	0.0030	0.0028
61	0.000	0.003	0.003	0.0210	0.0030	0.0023
62	0.000	0.002	0.004	0.0210	0.0028	0.0023
64	0.000	0.000	0.006	0.0199	0.0014	0.0025
65	0.000	0.000	0.006	0.0191	0.0006	0.0028
67A	0.000	0.003	0.005	0.0150	0.0022	0.0037
67B	0.002	0.002	0.001	0.0020	0.0011	0.0063
70	0.000	0.001	0.001	0.0009	0.0011	0.0045
73	0.001	0.000	0.001	0.0007	0.0006	0.0034
102	0.001	0.000	0.000	0.0004	0.0003	0.0029
103	0.001	0.000	0.000	0.0001	0.0006	0.0016
112	0.000	0.000	0.000	0.0001	0.0008	0.0008
121	0.000	0.000	0.000	0.0001	0.0009	0.0000
122	0.000	0.000	0.000	0.0001	0.0009	0.0006
131	0.001	0.000	0.000	0.0000	0.0006	0.0013
140	0.001	0.000	0.000	0.0000	0.0002	0.0015



## Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.042	0.395	0.031	0.0666	0.0279	0.1754
700B	0.041	0.415	0.035	0.0670	0.0312	0.1910
710	0.042	0.419	0.036	0.0670	0.0313	0.1914
720A	0.044	0.426	0.038	0.0670	0.0315	0.1921
720B	0.046	0.440	0.041	0.0672	0.0336	0.1989
730	0.046	0.444	0.042	0.0672	0.0336	0.1991
740	0.046	0.475	0.047	0.0672	0.0337	0.1991
750	0.046	0.506	0.052	0.0672	0.0337	0.1990
760	0.046	0.569	0.063	0.0672	0.0337	0.1984
63	0.001	0.001	0.016	0.0210	0.0028	0.0023
74	0.002	0.000	0.001	0.0076	0.0453	0.0094
75	0.003	0.000	0.002	0.0152	0.0786	0.0165
76	0.004	0.000	0.003	0.0161	0.0822	0.0174
77	0.010	0.000	0.008	0.0161	0.0822	0.0174
78	0.004	0.002	0.005	0.0174	0.0850	0.0183
79	0.004	0.004	0.014	0.0292	0.1091	0.0261
80A	0.004	0.066	0.258	0.1060	0.2139	0.0506
80B	0.011	0.073	0.275	0.1356	0.2302	0.0455
82	0.045	0.073	0.166	0.1805	0.2593	0.0614
840	0.075	0.073	0.081	0.2171	0.2770	0.0787
84A	0.088	0.073	0.046	0.2319	0.2835	0.0841
84B	0.058	0.021	0.000	0.3954	0.3027	0.1018
87	0.042	0.000	0.000	0.4009	0.3045	0.1038
89	0.521	0.753	0.000	0.4803	0.3857	0.1698
92	0.794	1.079	0.000	0.4760	0.4092	0.1971
94A	0.901	1.203	0.000	0.4752	0.4077	0.2076
94B	0.963	1.242	0.060	0.4618	0.3673	0.2371
96	0.963	1.187	0.143	0.4618	0.3606	0.2434
98	0.964	0.000	1.394	0.4618	0.2357	0.3063
99	0.964	0.453	1.717	0.4618	0.2163	0.3101
101	0.964	0.518	1.761	0.4618	0.2164	0.3101
104	0.006	0.000	0.000	0.0016	0.0012	0.0375
105	0.011	0.000	0.000	0.0022	0.0015	0.0500
106	0.024	0.000	0.001	0.0024	0.0017	0.0544
107	0.036	0.001	0.001	0.0024	0.0017	0.0544
108	0.024	0.010	0.001	0.0024	0.0017	0.0546
109	0.024	0.018	0.001	0.0024	0.0018	0.0551
110A	0.024	0.022	0.001	0.0024	0.0018	0.0553
110B	0.027	0.028	0.001	0.0024	0.0020	0.0570
111	0.036	0.037	0.002	0.0024	0.0020	0.0571
113	0.008	0.000	0.000	0.0020	0.0017	0.0556
114	0.016	0.000	0.001	0.0027	0.0021	0.0748
115	0.039	0.000	0.001	0.0029	0.0024	0.0827
116	0.053	0.002	0.002	0.0029	0.0024	0.0827
117	0.039	0.015	0.002	0.0029	0.0024	0.0829
118	0.039	0.030	0.002	0.0029	0.0024	0.0834
119A	0.039	0.038	0.002	0.0029	0.0025	0.0836
119B	0.043	0.049	0.003	0.0030	0.0025	0.0849
120	0.057	0.062	0.003	0.0030	0.0025	0.0850
123	0.006	0.000	0.000	0.0013	0.0016	0.0422
124	0.012	0.000	0.000	0.0018	0.0021	0.0565

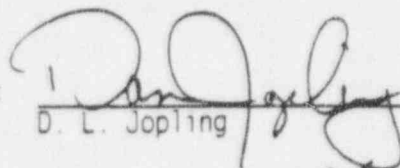
Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
125	0.029	0.000	0.001	0.0019	0.0024	0.0621
126	0.040	0.001	0.001	0.0019	0.0024	0.0621
127	0.029	0.011	0.001	0.0019	0.0024	0.0622
128	0.029	0.022	0.001	0.0019	0.0024	0.0626
129A	0.029	0.029	0.001	0.0019	0.0025	0.0627
129B	0.033	0.037	0.002	0.0019	0.0026	0.0638
130	0.043	0.047	0.002	0.0019	0.0026	0.0639
132	0.008	0.000	0.000	0.0021	0.0013	0.0512
133	0.015	0.000	0.001	0.0028	0.0017	0.0688
134	0.036	0.000	0.001	0.0030	0.0019	0.0760
135	0.049	0.001	0.002	0.0030	0.0019	0.0760
136	0.036	0.014	0.002	0.0030	0.0019	0.0762
137	0.036	0.027	0.002	0.0030	0.0020	0.0766
138A	0.036	0.035	0.002	0.0030	0.0020	0.0768
138B	0.040	0.045	0.003	0.0030	0.0020	0.0781
139	0.052	0.057	0.003	0.0030	0.0020	0.0781
141	0.006	0.000	0.001	0.0034	0.0021	0.0376
142	0.023	0.000	0.002	0.0039	0.0029	0.0448
143	0.023	0.012	0.003	0.0039	0.0029	0.0448

CAEPIPE  
Version 3.72

Client : F. P. C.  
Project : Evaluation of effect of bent rod hanger  
File Number : S 96-0129  
Report Number : Attachment B  
Model Name : CR-5B  
Title : CR-5 W/ Rod Hangers, Y GRS Z CRW2 Spectra  
Subtitle :

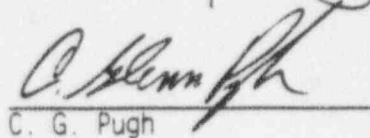
Prepared by :

  
D. L. Jopling

Date:

6/1/96

Checked by :

  
C. G. Pugh

Date:

8/1/96

## Options

Piping code = B31.1 (1967)  
Do not use liberal allowable stresses  
Exclude axial force in stress calculations  
Reference temperature = 70 (F)  
Number of thermal cycles = 7000  
Use modulus at reference temperature  
Include hanger stiffness  
Include Bourdon effect  
Do not use pressure correction for bends  
Pressure stress =  $PD / 4t$   
Peak pressure factor = 1.00  
Cut off frequency = 50 Hz  
Number of modes = 50  
Include missing mass correction  
Do not use friction in dynamic analysis  
Vertical direction = Y

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
1	1	From							Anchor
2	3	Bend		-12'6"		1	1	1	
3	6				11.854	1	1	1	User hanger
4	7				3.583	1	1	1	
5	14				8.333	1	1	1	Snubber
6	17	Bend			7.583	1	1	1	
7	20		7'6"			1	1	1	User hanger
8	23		16.333			1	1	1	User hanger
9	25		18.792			1	1	1	User hanger
10	27		3.333			1	1	1	Snubber
11	29		14'5"			1	1	1	User hanger
12	31	Bend	7'0"			1	1	1	
13	34				15'0"	1	1	1	User hanger
14	35				5'6"	1	1	1	Snubber
15	39	Bend			7'6"	1	1	1	
16	40			-6'0"		1	1	1	User hanger
17	41	Bend		-3'0"		1	1	1	
18	43		7'7-1/2"			1	1	1	Snubber
19	44		6.042			1	1	1	Snubber
20	47		3.646			1	1	1	User hanger
21	50		18.583			1	1	1	User hanger
22	52		4'0"			1	1	1	Snubber
23	55		12'9"			1	1	1	User hanger
24	57		6'9-3/4"			1	1	1	Snubber
25	58		1.458			1	1	1	Anchor
26	59		2'0"			1	1	1	Snubber
27	61		2.062			1	1	1	
28	62	Valve	1'11"			1	1	1	
29	64	Valve	3'11"			1	1	1	
30	65		0'9-3/4"			1	1	1	Rod hanger
31	67	Bend	9'8"			1	1	1	
32	70		0.218		-12'6"	1	1	1	Snubber
33	73		0.069		-4'0"	1	1	1	
34	102		0.032		-1.833	1	1	1	Rod hanger
35	103		0.091		-5.208	1	1	1	

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
36	112		0.044		-2.500	1	1	1	
37	121		0.025		-1.458	1	1	1	Anchor
38	122		0.018		-1.042	1	1	1	
39	131		0.044		-2.500	1	1	1	
40	140		0.044		-2'6"	1	1	1	Rod hanger
41	144		0.218		-12.512	1	1	1	Anchor
42	7	From							
43	700	Bend	8.964			1	2	2	
44	710		0.320	0.320		1	2	2	
45	720	Bend	0.320	0.320		1	2	2	
46	730		0'3-3/4"			1	2	2	
47	740	Valve	0'9"			1	2	2	
48	750	Valve	0'9"			1	2	2	
49	760		1.542			1	2	2	User hanger
50	62	From							
51	63	Rigid	3'0"	2'5"		1	2	2	Conc mass
52	73	From							
53	74			1.416		1	2	2	
54	75	Reducer		0.450		1	2	2	
55	76	Valve		0.450		1	2	2	
56	77	Rigid		1.458		1	2	2	Conc mass
57	76	From							
58	78	Valve	-0.450			1	2	2	
59	79	Reducer	-0.450			1	2	2	
60	80	Bend	-7.600			1	2	2	
61	82			4.104		1	2	2	Snubber
62	840			2.042		1	2	2	User hanger
63	84	Bend		1'6"		1	2	2	
64	87				-1'0"	1	2	2	Snubber
65	89				-7'10-1/2"	1	2	2	Snubber
66	92				-3'3"	1	2	2	Snubber
67	94	Bend			-2'0"	1	2	2	
68	96		-1.833			1	2	2	User hanger
69	98		-20.083			1	2	2	Rod hanger
70	99		-7'0"			1	2	2	Snubber
71	101		-1'0"			1	2	2	
72	103	From							
73	104			1.224		1	2	2	
74	105			0'6-3/4"		1	2	2	Flange
75	106	Valve		1.177		1	2	2	
76	107	Rigid	0.083	0.984		1	2	2	Conc mass
77	106	From							
78	108	Valve	0.833			1	4	4	
79	109		0.698			1	4	4	Flange
80	110	Bend	0'8"			1	4	4	
81	111		1.002	1.002		1	4	4	Conc mass
82	112	From							
83	113			1.224		1	2	2	
84	114			0'6-3/4"		1	2	2	Flange
85	115	Valve		1.344		1	2	2	
86	116	Rigid	0.083	0.817		1	2	2	Conc mass
87	115	From							
88	117	Valve	0'10-1/2"			1	3	3	
89	118		0.833			1	3	3	Flange

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
90	119	Bend	0.833			1	3	3	
91	120		1.002	1.002		1	3	3	Conc mass
92	122	From							
93	123			1.224		1	2	2	
94	124			0'6-3/4"		1	2	2	Flange
95	125	Valve		1.344		1	2	2	
96	126	Rigid	0.083	0.817		1	2	2	Conc mass
97	125	From							
98	127	Valve	0'10-1/2"			1	3	3	Flange
99	128		0.833			1	3	3	
100	129	Bend	0.833			1	3	3	
101	130		1.002	1.002		1	3	3	Conc mass
102	131	From							
103	132			1.224		1	2	2	
104	133			0'6-3/4"		1	2	2	Flange
105	134	Valve		1.344		1	2	2	
106	135	Rigid	0.083	0.817		1	2	2	Conc mass
107	134	From							
108	136	Valve	0'10-1/2"			1	3	2	
109	137		0.833			1	3	3	Flange
110	138	Bend	0.833			1	3	3	
111	139		1.002	1.002		1	3	3	Conc mass
112	140	From							
113	141			1.198		1	2	2	
114	142	Valve		1.833		1	2	2	
115	143	Rigid	1'3"			1	2	2	Conc mass

Bends

Bend Node	Radius (inch)	Thickness (inch)	Int. Node	Angle (deg)	Int. Node	Angle (deg)
3	36.0	U				
17	72.0	U				
31	72.0	U				
39	72.0	U				
41	36.0	U				
67	72.0	U				
700	9.0	L				
720	6.0	S				
80	9.0	L				
84	9.0	L				
94	9.0	L				
110	8.0	S				
119	10.0	S				
129	10.0	S				
138	10.0	S				

Valves

From	To	Weight (lb)	Thick X	Insul Wgt X	Add Wght (lb)	DX (inch)	DY (inch)	DZ (inch)
61	62	0	3.00	1.75				



## Valves

From	To	weight (lb)	Thick X	Insul wgt X	Add Wght (lb)	DX (inch)	DY (inch)	DZ (inch)
62	64	0	3.00	1.75				
730	740	575	3.00	1.75				
740	750	575	3.00	1.75				
75	76	0	3.00	1.75				
76	78	0	3.00	1.75				
105	106	0	3.00	1.75				
106	108	0	3.00	1.75				
114	115	0	3.00	1.75				
115	117	0	3.00	1.75				
124	125	0	3.00	1.75				
125	127	0	3.00	1.75				
133	134	0	3.00	1.75				
134	136	0	3.00	1.75				
141	142	0	3.00	1.75				

## Reducers

From	To	OD1 (inch)	Thk1 (inch)	OD2 (inch)	Thk2 (inch)	Cone Angle (deg)	Knuc Delta kles (inch)
74	75	6.625	0.28	3.5	0.28	0.00	
78	79	3.5	0.28	6.625	0.28	0.00	

## Rigid Elements

From	To	Weight(lb)
62	63	0
76	77	0
106	107	0
115	116	0
125	126	0
134	135	0
142	143	0

## Anchors

Node	KX	(lb/inch)		KXX	(in-lb/deg)		Releases		
		KY	KZ		KYY	KZZ	X	Y	Z
1	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			
58		7.5758E+5					Y	Y	Y
121	Rigid	Rigid				Rigid		Y	Y
144	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			

## Hangers

Node	Type	No. of	Load var(%)	Short Range	SpringRate (lb/inch)	HangerLoad (lb)	Load type
6	User hanger	1			1000	6670	Hot

## Hangers

Node	Type	No. of	Load var(%)	Short Range	SpringRate (lb/inch)	HangerLoad (lb)	Load type
20	User hanger	1			1200	6250	Hot
23	User hanger	1			1000	4265	Hot
25	User hanger	1			1000	4800	Hot
29	User hanger	1			500	5520	Hot
34	User hanger	1			435	1990	Hot
40	User hanger	1			1200	7130	Hot
47	User hanger	1			500	6465	Hot
50	User hanger	1			500	5250	Hot
55	User hanger	1			670	3340	Hot
65	Rod Hanger	1					
102	Rod Hanger	1					
140	Rod Hanger	1					
760	User hanger	1			100	675	Hot
840	User hanger	1			140	670	Hot
96	User hanger	1			74	500	Hot
98	Rod Hanger	1					

## Snubbers

Node	Stiffness (lb/inch)	Direction		
		X comp	Y comp	Z comp
14	Rigid			1.000
27	Rigid	1.000		
35	Rigid	1.125		-6.000
43	Rigid		1.000	
44	Rigid		-2.604	7.000
52	Rigid		-2.740	7.000
57	Rigid	1.000		
59	Rigid		-2.870	7.000
70	Rigid	7.000	-3.021	
82	Rigid	-4.357	0.687	0.891
87	Rigid		1.000	
89	Rigid	3.190	-2.206	4.577
92	Rigid			1.000
99	Rigid	-6.357		-3.570

## Flanges

Node	Weight(lb)	Type
105	164	Weld neck
109	273	Weld neck
114	164	Weld neck
118	454	Weld neck
124	164	Weld neck
127	454	Weld neck
133	164	Weld neck
137	454	Weld neck

## Concentrated Masses

Node	Weight (lb)	DX (inch)	DY (inch)	DZ (inch)
63	18400			
77	540			
107	1257			
111	44.50			
116	1257			
120	83			
126	1257			
130	83			
135	1257			
139	83			
143	1320			

## Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
1	0'0"	0'0"	0'0"
3A	0'0"	-9'6"	0'0"
3	0'0"	-12'6"	0'0"
3B	0'0"	-12'6"	3'0"
6	0'0"	-12'6"	11.854
7	0'0"	-12'6"	15.437
14	0'0"	-12'6"	23.770
17A	0'0"	-12'6"	25.354
17	0'0"	-12'6"	31.354
17B	6'0"	-12'6"	31.354
20	7'6"	-12'6"	31.354
23	23.833	-12'6"	31.354
25	42.625	-12'6"	31.354
27	45.958	-12'6"	31.354
29	60.374	-12'6"	31.354
31A	61.374	-12'6"	31.354
31	67.374	-12'6"	31.354
31B	67.374	-12'6"	37.354
34	67.374	-12'6"	46.354
35	67.374	-12'6"	51.854
39A	67.374	-12'6"	53.354
39	67.374	-12'6"	59.354
39B	67.374	-18'6"	59.354
40	67.374	-18'6"	59.354
41A	67.374	-18'6"	59.354
41	67.374	-21'6"	59.354
41B	70.374	-21'6"	59.354
43	74.999	-21'6"	59.354
44	81.041	-21'6"	59.354
47	84.687	-21'6"	59.354
50	103.271	-21'6"	59.354
52	107.271	-21'6"	59.354
55	120.021	-21'6"	59.354
57	126.833	-21'6"	59.354
58	128.291	-21'6"	59.354

-----  
Coordinates  
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Node	X (ft'in")	Y (ft'in")	Z (ft'in")
59	130.291	-21'6"	59.354
61	132.353	-21'6"	59.354
62	134.270	-21'6"	59.354
64	138.186	-21'6"	59.354
65	138.999	-21'6"	59.354
67A	142.769	-21'6"	59.354
67	148.666	-21'6"	59.354
67B	148.769	-21'6"	53.458
70	148.884	-21'6"	46.854
73	148.953	-21'6"	42.854
102	148.985	-21'6"	41.021
103	149.076	-21'6"	35'9-3/4"
112	149.120	-21'6"	33.313
121	149.145	-21'6"	31.855
122	149.163	-21'6"	30.813
131	149.206	-21'6"	28.313
140	149'3"	-21'6"	25.813
144	149.469	-21'6"	13.301
700A	8.653	-12'6"	15.437
700	8.964	-12'6"	15.437
700B	9.183	-12.280	15.437
710	9.283	-12.180	15.437
720A	9.457	-12.006	15.437
720	9.603	-11.860	15.437
720B	9.811	-11.860	15.437
730	9.916	-11.860	15.437
740	10.666	-11.860	15.437
750	11.416	-11.860	15.437
760	12.958	-11.860	15.437
63	137.270	-19'1"	59.354
74	148.953	-20'1"	42.854
75	148.953	-19.634	42.854
76	148.953	-19.184	42.854
77	148.953	-17.726	42.854
78	148.503	-19.184	42.854
79	148.053	-19.184	42.854
80A	141.203	-19.184	42.854
80	140.453	-19.184	42.854
80B	140.453	-18.434	42.854
82	140.453	-15.080	42.854
840	140.453	-13.038	42.854
84A	140.453	-12.288	42.854
84	140.453	-11.538	42.854
84B	140.453	-11.538	42.104
87	140.453	-11.538	41.854
89	140.453	-11.538	33.979
92	140.453	-11.538	30.729
94A	140.453	-11.538	29.479
94	140.453	-11.538	28.729
94B	139.703	-11.538	28.729
96	138.620	-11.538	28.729
98	118.537	-11.538	28.729

## Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
99	111.537	-11.538	28.729
101	110.537	-11.538	28.729
104	149.076	-20.276	35'9-3/4"
105	149.076	-19.713	35'9-3/4"
106	149.076	-18.536	35'9-3/4"
107	149.159	-17.552	35'9-3/4"
108	149.909	-18.536	35'9-3/4"
109	150.607	-18.536	35'9-3/4"
110A	150.997	-18.536	35'9-3/4"
110	151.273	-18.536	35'9-3/4"
110B	151.469	-18.341	35'9-3/4"
111	152.275	-17.534	35'9-3/4"
113	149.120	-20.276	33.313
114	149.120	-19.713	33.313
115	149.120	-18.369	33.313
116	149.203	-17.552	33.313
117	149.995	-18.369	33.313
118	150.828	-18.369	33.313
119A	151.316	-18.369	33.313
119	151.661	-18.369	33.313
119B	151.905	-18.125	33.313
120	152.663	-17.367	33.313
123	149.163	-20.276	30.813
124	149.163	-19.713	30.813
125	149.163	-18.369	30.813
126	149.246	-17.552	30.813
127	150.038	-18.369	30.813
128	150.871	-18.369	30.813
129A	151.359	-18.369	30.813
129	151.704	-18.369	30.813
129B	151.948	-18.125	30.813
130	152.706	-17.367	30.813
132	149.206	-20.276	28.313
133	149.206	-19.713	28.313
134	149.206	-18.369	28.313
135	149.289	-17.552	28.313
136	150.081	-18.369	28.313
137	150.915	-18.369	28.313
138A	151.403	-18.369	28.313
138	151.748	-18.369	28.313
138B	151.992	-18.125	28.313
139	152.750	-17.367	28.313
141	149'3"	-20.302	25.813
142	149'3"	-18.469	25.813
143	150'6"	-18.469	25.813

Pipe material 1: A106 Grade B

Density = 0.2800 (lb/in<sup>3</sup>), Nu = 0.300, Joint factor = 1.00, Type = CS

Temp (F)	E (psi)	Alpha (in/in/F)	Allowable (psi)
-100	29.0E+6	5.65E-6	15000
70	27.9E+6	6.07E-6	15000
200	27.7E+6	6.38E-6	15000
300	27.4E+6	6.60E-6	15000
400	27.0E+6	6.82E-6	15000
500	26.4E+6	7.02E-6	15000
600	25.7E+6	7.23E-6	15000
650	25.3E+6	7.34E-6	15000
700	24.8E+6	7.44E-6	14350
750	24.8E+6	7.55E-6	12950
800	23.4E+6	7.65E-6	10800

#### Pipe Sections

Name	Nominal Dia.	O.D. Sch (inch)	Thk (inch)	Cor. Al (inch)	M. Tol (%)	Ins. Dens (lb/ft <sup>3</sup> )	Ins. Th (inch)	Lin. Dens (lb/ft <sup>3</sup> )	Lin. Th (inch)
1	24"	60	24.0	0.968	0.0	0.0			
2	6"	STD	6.625	0.28	0.0	0.0			
3	10"	60	10.75	0.5	0.0	0.0			
4	8"	STD	8.625	0.322	0.0	0.0			

#### Loads

Acceleration load: X = 0.00, Y = 0.00, Z = 0.00 (g's)

Acceleration load combination = Algebraic sum

Wind velocity = 0 (mph)

Shape factor = 0.60

Wind direction: X comp = 0.000, Y comp = 0.000, Z comp = 0.000

Y spectrum: GRS (fig 22)

Factor = 1.3300 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.700	0.065
1.000	0.150
1.300	0.190
1.500	0.190
2.000	0.187
3.800	0.187
5.500	0.175
10.000	0.118
15.000	0.080
20.000	0.072
25.000	0.070
31.000	0.059



40.000 0.052  
50.000 0.050

Z spectrum: CRW2  
Factor = 2.0000 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.500	0.040
0.700	0.064
1.000	0.150
1.200	0.210
1.300	0.220
2.500	0.220
3.150	0.220
4.000	0.440
5.000	0.440
5.250	0.240
6.750	0.240
7.000	0.240
8.000	0.240
10.000	0.250
12.500	0.250
13.000	0.240
14.000	0.440
14.500	0.440
18.000	0.440
20.000	0.180
22.000	0.180
31.000	0.180
34.000	0.180
36.000	0.100
50.000	0.100

Mode sum = Closely spaced  
Direction sum = SRSS

Number of thermal loads = 1

# Pipe Loads

Load Name	T1 (F)	P1 (psi)	T2 (F)	P2 (psi)	T3 (F)	P3 (psi)	Specific gravity	Add. Wgt (lb/ft)	Wind Load
1	600	1050						37.700	
2	600	1050						10.030	
3	600	1050						16.800	
4	600	1050						13.500	

# B31.1 (1967) Code Compliance (sorted stresses)

Sustained			Expansion			Occasional		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/1.20SH
7	15082	1.01	41B	12840	0.57	7	24996	1.39

## B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
75	10275	0.69	38	12610	0.56	78	22532	1.25
78	10061	0.67	121	9075	0.40	112	17827	0.99
720B	9898	0.66	112	8632	0.38	75	16204	0.90
720A	9026	0.60	122	8343	0.37	131	14935	0.83
114	8586	0.57	103	7874	0.35	113	14745	0.82
112	8585	0.57	1	7086	0.31	122	13949	0.77
113	8585	0.57	3A	6993	0.31	140	13764	0.76
133	8582	0.57	131	6589	0.29	103	13441	0.75
131	8582	0.57	102	6293	0.28	114	13332	0.74
132	8582	0.57	41A	6107	0.27	84A	13321	0.74
140	8542	0.57	39B	5995	0.27	132	12820	0.71
141	8542	0.57	39A	5850	0.26	84B	12800	0.71
124	8051	0.54	73	5737	0.25	720B	12230	0.68
122	8051	0.54	43	5446	0.24	123	11990	0.67
123	8051	0.54	44	4915	0.22	133	11851	0.66
74	7951	0.53	140	4834	0.21	141	11729	0.65
73	7951	0.53	47	4596	0.20	720A	11669	0.65
41A	7880	0.53	70	4523	0.20	104	11528	0.64
79	7846	0.52	144	3950	0.18	124	11093	0.62
700B	7833	0.52	35	3875	0.17	700A	11084	0.62
58	7820	0.52	17B	3579	0.16	79	10812	0.60
57	7801	0.52	67B	3481	0.15	700B	10724	0.60
94B	7745	0.52	6	3176	0.14	105	10653	0.59
59	7734	0.52	75	3168	0.14	94B	10215	0.57
61	7609	0.51	31A	3154	0.14	80B	10177	0.57
17A	7566	0.50	78	3020	0.13	73	9396	0.52
730	7539	0.50	50	2996	0.13	74	9336	0.52
750	7534	0.50	52	2660	0.12	17A	9307	0.52
98	7512	0.50	20	2457	0.11	38	9275	0.52
105	7500	0.50	34	2342	0.10	840	9262	0.51
103	7500	0.50	29	2197	0.10	89	9232	0.51
104	7500	0.50	7	2178	0.10	87	9217	0.51
55	7474	0.50	17A	1913	0.09	41A	9182	0.51
31B	7452	0.50	55	1642	0.07	82	9087	0.50
39B	7373	0.49	31B	1552	0.07	25	9062	0.50
108	7348	0.49	14	1226	0.05	31B	9044	0.50
80B	7330	0.49	57	1182	0.05	3A	8919	0.50
84A	7330	0.49	58	1102	0.05	23	8902	0.49
14	7280	0.49	23	1035	0.05	80A	8891	0.49
67B	7278	0.49	27	967	0.04	27	8669	0.48
110A	7268	0.48	59	906	0.04	98	8637	0.48
96	7230	0.48	74	788	0.04	58	8540	0.47
3A	7203	0.48	79	715	0.03	59	8518	0.47
110B	7157	0.48	80B	709	0.03	14	8474	0.47
38	7152	0.48	84A	709	0.03	57	8440	0.47
109	7140	0.48	61	705	0.03	96	8300	0.46
52	7122	0.47	25	694	0.03	1	8291	0.46
17B	7119	0.47	84B	668	0.03	61	8266	0.46
102	7105	0.47	720A	667	0.03	730	8239	0.46
89	7103	0.47	700A	626	0.03	47	8223	0.46
20	7095	0.47	720B	599	0.03	65	8209	0.46

## B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
31A	7064	0.47	700B	548	0.02	39B	8192	0.46
111	7031	0.47	67A	342	0.02	44	8189	0.45
710	7013	0.47	80A	319	0.01	64	8150	0.45
29	6991	0.47	840	313	0.01	710	8144	0.45
47	6906	0.46	82	313	0.01	67B	8097	0.45
65	6889	0.46	87	291	0.01	41B	8095	0.45
25	6832	0.46	710	236	0.01	39A	7935	0.44
34	6826	0.46	730	195	0.01	31A	7909	0.44
23	6806	0.45	64	137	0.01	17B	7820	0.43
1	6798	0.45	89	121	0.01	55	7816	0.43
700A	6791	0.45	94B	119	0.01	52	7724	0.43
67A	6751	0.45	750	99	0.00	94A	7724	0.43
50	6736	0.45	96	76	0.00	34	7709	0.43
840	6705	0.45	65	62	0.00	750	7652	0.43
82	6705	0.45	92	57	0.00	29	7575	0.42
92	6684	0.45	94A	52	0.00	35	7574	0.42
64	6680	0.45	141	0	0.00	108	7553	0.42
41B	6676	0.45	104	0	0.00	43	7527	0.42
27	6660	0.44	123	0	0.00	110A	7488	0.42
94A	6658	0.44	105	0	0.00	67A	7475	0.42
44	6656	0.44	124	0	0.00	20	7461	0.41
70	6632	0.44	132	0	0.00	6	7399	0.41
35	6627	0.44	133	0	0.00	110B	7315	0.41
144	6618	0.44	113	0	0.00	50	7303	0.41
6	6610	0.44	114	0	0.00	102	7295	0.41
43	6606	0.44	98	0	0.00	109	7232	0.40
39A	6585	0.44	110A	0	0.00	92	7189	0.40
121	6574	0.44	108	0	0.00	111	7031	0.39
80A	6565	0.44	109	0	0.00	70	6927	0.38
84B	6351	0.42	136	0	0.00	121	6701	0.37
87	6338	0.42	117	0	0.00	144	6683	0.37
99	6231	0.42	118	0	0.00	99	6242	0.35
101	6211	0.41	119A	0	0.00	760	6211	0.35
760	6211	0.41	129B	0	0.00	101	6211	0.35
136	5921	0.39	137	0	0.00	117	6205	0.34
117	5921	0.39	110B	0	0.00	136	6117	0.34
119A	5809	0.39	129A	0	0.00	119A	6018	0.33
138A	5809	0.39	127	0	0.00	138A	5954	0.33
129A	5809	0.39	138A	0	0.00	129A	5939	0.33
127	5806	0.39	99	0	0.00	127	5924	0.33
137	5738	0.38	128	0	0.00	119B	5862	0.33
128	5738	0.38	119B	0	0.00	118	5853	0.33
118	5738	0.38	111	0	0.00	138B	5818	0.32
138B	5720	0.38	138B	0	0.00	137	5817	0.32
129B	5720	0.38	101	0	0.00	128	5809	0.32
119B	5720	0.38	120	0	0.00	129B	5808	0.32
130	5644	0.38	130	0	0.00	130	5644	0.31
120	5644	0.38	760	0	0.00	120	5644	0.31
139	5644	0.38	139	0	0.00	139	5644	0.31

B31.1 (1967) Code Compliance										
Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---				--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
1	1050	6798	15000	0.45	7086	22500	0.31	8291	18000	0.46
3A	1250	6825	15000	0.45	6602	22500	0.29	7607	18000	0.42
3A	1050	7203	15000	0.48	6993	22500	0.31	8919	18000	0.50
3B	1250	7152	15000	0.48	12610	22500	0.56	9275	18000	0.52
3B	1050	6802	15000	0.45	5813	22500	0.26	7770	18000	0.43
6	1250	6610	15000	0.44	3176	22500	0.14	7399	18000	0.41
6	1050	6610	15000	0.44	3176	22500	0.14	7399	18000	0.41
7	1250	6970	15000	0.46	2178	22500	0.10	7898	18000	0.44
7	1050	6970	15000	0.46	2170	22500	0.10	7895	18000	0.44
14	1250	7280	15000	0.49	1226	22500	0.05	8474	18000	0.47
14	1050	7280	15000	0.49	1226	22500	0.05	8474	18000	0.47
17A	1250	7273	15000	0.48	1533	22500	0.07	8534	18000	0.47
17A	1050	7566	15000	0.50	1913	22500	0.09	9307	18000	0.52
17B	1250	7119	15000	0.47	3579	22500	0.16	7820	18000	0.43
17B	1050	6950	15000	0.46	2590	22500	0.12	7458	18000	0.41
20	1250	7095	15000	0.47	2457	22500	0.11	7461	18000	0.41
20	1050	7095	15000	0.47	2457	22500	0.11	7461	18000	0.41
23	1250	6806	15000	0.45	1035	22500	0.05	8902	18000	0.49
23	1050	6806	15000	0.45	1035	22500	0.05	8902	18000	0.49
25	1250	6802	15000	0.46	694	22500	0.03	9062	18000	0.50
25	1050	6832	15000	0.46	694	22500	0.03	9062	18000	0.50
27	1250	6660	15000	0.44	967	22500	0.04	8669	18000	0.48
27	1050	6660	15000	0.44	967	22500	0.04	8669	18000	0.48
29	1250	6991	15000	0.47	2197	22500	0.10	7575	18000	0.42
29	1050	6991	15000	0.47	2197	22500	0.10	7575	18000	0.42
31A	1250	6910	15000	0.46	2283	22500	0.10	7522	18000	0.42
31A	1050	7064	15000	0.47	3154	22500	0.14	7909	18000	0.44
31B	1250	7452	15000	0.50	1552	22500	0.07	9044	18000	0.50
31B	1050	7191	15000	0.48	1386	22500	0.06	8343	18000	0.46
34	1250	6826	15000	0.46	2342	22500	0.10	7709	18000	0.43
34	1050	6826	15000	0.46	2342	22500	0.10	7709	18000	0.43
35	1250	6627	15000	0.44	3875	22500	0.17	7574	18000	0.42
35	1050	6627	15000	0.44	3875	22500	0.17	7574	18000	0.42
39A	1250	6564	15000	0.44	4310	22500	0.19	7541	18000	0.42

B31.1 (1967) Code Compliance										
Node	Press (psi) Allow	Sustained			Expansion			Occasional		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
73	1050	6827	15000	0.46	5737	22500	0.25	7045	18000	0.39
102	1250	7105	15000	0.47	6293	22500	0.28	7295	18000	0.41
102	1050	7105	15000	0.47	6293	22500	0.28	7295	18000	0.41
103	1250	6524	15000	0.43	7874	22500	0.35	6659	18000	0.37
103	1050	6524	15000	0.43	7874	22500	0.35	6653	18000	0.37
112	1250	6550	15000	0.44	8632	22500	0.38	6692	18000	0.37
112	1050	6551	15000	0.44	8632	22500	0.38	6678	18000	0.37
121	1250	6572	15000	0.44	9075	22500	0.40	6698	18000	0.37
121	1050	6574	15000	0.44	9075	22500	0.40	6701	18000	0.37
122	1250	6556	15000	0.44	8343	22500	0.37	6672	18000	0.37
122	1050	6556	15000	0.44	8343	22500	0.37	6706	18000	0.37
131	1250	6588	15000	0.44	6589	22500	0.29	6699	18000	0.37
131	1050	6589	15000	0.44	6589	22500	0.29	6728	18000	0.37
140	1250	6621	15000	0.44	4834	22500	0.21	6718	18000	0.37
140	1050	6620	15000	0.44	4834	22500	0.21	6711	18000	0.37
144	1250	6618	15000	0.44	3950	22500	0.18	6683	18000	0.37
7	1050	15082	15000	1.01	831	22500	0.04	24996	18000	1.39
700A	1312	6467	15000	0.43	276	22500	0.01	8362	18000	0.46
700A	1050	6791	15000	0.45	626	22500	0.03	11084	18000	0.62
700B	1312	7833	15000	0.52	548	22500	0.02	10724	18000	0.60
700B	1050	6927	15000	0.46	242	22500	0.01	8203	18000	0.46
710	1312	7013	15000	0.47	236	22500	0.01	8144	18000	0.45
710	1050	7013	15000	0.47	236	22500	0.01	8144	18000	0.45
720A	1312	7159	15000	0.48	225	22500	0.01	8050	18000	0.45
720A	1050	9026	15000	0.60	667	22500	0.03	11669	18000	0.65
720B	1312	9898	15000	0.66	599	22500	0.03	12230	18000	0.68
720B	1050	7453	15000	0.50	202	22500	0.01	8238	18000	0.46
730	1312	7539	15000	0.50	195	22500	0.01	8239	18000	0.46
750	1050	7534	15000	0.50	99	22500	0.00	7652	18000	0.43
760	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35
73	1050	7951	15000	0.53	788	22500	0.04	9396	18000	0.52
74	1312	7951	15000	0.53	788	22500	0.04	9335	18000	0.52
74	1050	7951	15000	0.53	788	22500	0.04	9336	18000	0.52
75		10275	15000	0.69	3168	22500	0.14	16204	18000	0.90



B31.1 (1967) Code Compliance										
Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---				--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO 1.20SH (psi)	SL+SO/ 1.20SH	
78	1050	10061	15000	0.67	3020	22500	0.13	22532	18000	1.25
79		7846	15000	0.52	715	22500	0.03	10812	18000	0.60
79	1050	7846	15000	0.52	715	22500	0.03	10811	18000	0.60
80A	1312	6367	15000	0.42	312	22500	0.01	7394	18000	0.41
80A	1050	6565	15000	0.44	319	22500	0.01	8891	18000	0.49
80B	1312	7330	15000	0.49	709	22500	0.03	10177	18000	0.57
80B	1050	6705	15000	0.45	313	22500	0.01	7962	18000	0.44
82	1312	6705	15000	0.45	313	22500	0.01	9087	18000	0.50
82	1050	6705	15000	0.45	313	22500	0.01	9087	18000	0.50
840	1312	6705	15000	0.45	313	22500	0.01	9262	18000	0.51
840	1050	6705	15000	0.45	313	22500	0.01	9262	18000	0.51
84A	1312	6705	15000	0.45	313	22500	0.01	9349	18000	0.52
84A	1050	7330	15000	0.49	709	22500	0.03	13321	18000	0.74
84B	1312	6351	15000	0.42	668	22500	0.03	12800	18000	0.71
84B	1050	6273	15000	0.42	297	22500	0.01	9119	18000	0.51
87	1312	6338	15000	0.42	291	22500	0.01	9217	18000	0.51
87	1050	6338	15000	0.42	291	22500	0.01	9217	18000	0.51
89	1312	7103	15000	0.47	121	22500	0.01	9232	18000	0.51
89	1050	7103	15000	0.47	121	22500	0.01	9232	18000	0.51
92	1312	6684	15000	0.45	57	22500	0.00	7189	18000	0.40
92	1050	6684	15000	0.45	57	22500	0.00	7189	18000	0.40
94A	1312	6408	15000	0.43	40	22500	0.00	6879	18000	0.38
94A	1050	6658	15000	0.44	52	22500	0.00	7724	18000	0.43
94B	1312	7745	15000	0.52	119	22500	0.01	10215	18000	0.57
94B	1050	6888	15000	0.46	52	22500	0.00	7978	18000	0.44
96	1312	7230	15000	0.48	76	22500	0.00	8300	18000	0.46
96	1050	7230	15000	0.48	76	22500	0.00	8300	18000	0.46
98	1312	7512	15000	0.50	0	22500	0.00	8637	18000	0.48
98	1050	7512	15000	0.50	0	22500	0.00	8637	18000	0.48
99	1312	6231	15000	0.42	0	22500	0.00	6242	18000	0.35
99	1050	6231	15000	0.42	0	22500	0.00	6242	18000	0.35
101	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35
103	1050	7500	15000	0.50	0	22500	0.00	13441	18000	0.75
104	1312	7500	15000	0.50	0	22500	0.00	11528	18000	0.64



## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---			--- Expansion ---			--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
104	1050	7500	15000	0.50	0	22500	0.00	11528	18000	0.64
105	1312	7500	15000	0.50	0	22500	0.00	10653	18000	0.59
108	1050	7348	15000	0.49	0	22500	0.00	7553	18000	0.42
109	1154	7140	15000	0.48	0	22500	0.00	7232	18000	0.40
109	1050	7140	15000	0.48	0	22500	0.00	7232	18000	0.40
110A	1154	7105	15000	0.47	0	22500	0.00	7174	18000	0.40
110A	1050	7268	15000	0.48	0	22500	0.00	7488	18000	0.42
110B	1154	7157	15000	0.48	0	22500	0.00	7315	18000	0.41
110B	1050	7071	15000	0.47	0	22500	0.00	7120	18000	0.40
111	1154	7031	15000	0.47	0	22500	0.00	7031	18000	0.39
112	1050	8585	15000	0.57	0	22500	0.00	17827	18000	0.99
113	1312	8585	15000	0.57	0	22500	0.00	14745	18000	0.82
113	1050	8585	15000	0.57	0	22500	0.00	14745	18000	0.82
114	1312	8586	15000	0.57	0	22500	0.00	13332	18000	0.74
117	1050	5921	15000	0.39	0	22500	0.00	6205	18000	0.34
118	1449	5738	15000	0.38	0	22500	0.00	5853	18000	0.33
118	1050	5738	15000	0.38	0	22500	0.00	5853	18000	0.33
119A	1449	5705	15000	0.38	0	22500	0.00	5781	18000	0.32
119A	1050	5809	15000	0.39	0	22500	0.00	6018	18000	0.33
119B	1449	5720	15000	0.38	0	22500	0.00	5862	18000	0.33
119B	1050	5672	15000	0.38	0	22500	0.00	5724	18000	0.32
120	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
122	1050	8051	15000	0.54	0	22500	0.00	13949	18000	0.77
123	1312	8051	15000	0.54	0	22500	0.00	11990	18000	0.67
123	1050	8051	15000	0.54	0	22500	0.00	11990	18000	0.67
124	1312	8051	15000	0.54	0	22500	0.00	11093	18000	0.62
127	1050	5806	15000	0.39	0	22500	0.00	5924	18000	0.33
128	1449	5738	15000	0.38	0	22500	0.00	5809	18000	0.32
128	1050	5738	15000	0.38	0	22500	0.00	5809	18000	0.32
129A	1449	5705	15000	0.38	0	22500	0.00	5752	18000	0.32
129A	1050	5809	15000	0.39	0	22500	0.00	5939	18000	0.33
129B	1449	5720	15000	0.38	0	22500	0.00	5808	18000	0.32
129B	1050	5672	15000	0.38	0	22500	0.00	5704	18000	0.32
130	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---				--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
131	1050	8582	15000	0.57	0	22500	0.00	14935	18000	0.83
132	1312	8582	15000	0.57	0	22500	0.00	12820	18000	0.71
132	1050	8582	15000	0.57	0	22500	0.00	12820	18000	0.71
133	1312	8582	15000	0.57	0	22500	0.00	11851	18000	0.66
136	1050	5921	15000	0.39	0	22500	0.00	6117	18000	0.34
137	1449	5738	15000	0.38	0	22500	0.00	5817	18000	0.32
137	1050	5738	15000	0.38	0	22500	0.00	5817	18000	0.32
138A	1449	5705	15000	0.38	0	22500	0.00	5758	18000	0.32
138A	1050	5809	15000	0.39	0	22500	0.00	5954	18000	0.33
138B	1449	5720	15000	0.38	0	22500	0.00	5818	18000	0.32
138B	1050	5672	15000	0.38	0	22500	0.00	5708	18000	0.32
139	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
140	1050	8542	15000	0.57	0	22500	0.00	13764	18000	0.76
141	1312	8542	15000	0.57	0	22500	0.00	11729	18000	0.65

## Loads on Anchors: Sustained (W+P)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	116	-4273	1	-6018	4371	-7173
58		1345				
121	-178	-5688				-4393
144	62	-1703	-1	3554	366	-867

## Loads on Hangers: Sustained (W+P)

Node	Type	Load(lb)	No.of	Total(lb)
6	User hanger	-6235	1	-6235
20	User hanger	-6132	1	-6132
23	User hanger	-4179	1	-4179
25	User hanger	-4742	1	-4742
29	User hanger	-5473	1	-5473
34	User hanger	-2069	1	-2069
40	User hanger	-7325	1	-7325
47	User hanger	-6420	1	-6420
50	User hanger	-5214	1	-5214
55	User hanger	-3326	1	-3326
65	Rod Hanger	-23422	1	-23422
102	Rod Hanger	-9479	1	-9479
140	Rod Hanger	-5900	1	-5900
760	User hanger	-630	1	-630
840	User hanger	-718	1	-718
96	User hanger	-518	1	-518
98	Rod Hanger	-529	1	-529

## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	-0.005	-0.000	0.004	-0.0036	0.0034	-0.0047
3B	-0.008	0.007	0.009	-0.0171	0.0042	-0.0122
6	0.002	0.043	0.009	-0.0209	0.0061	-0.0185
7	0.007	0.059	0.009	-0.0228	0.0068	-0.0211
14	0.019	0.108	0.009	-0.0341	0.0079	-0.0227
17A	0.022	0.119	0.009	-0.0366	0.0080	-0.0230
17B	0.033	0.156	-0.003	-0.0633	0.0099	-0.0248
20	0.033	0.148	-0.006	-0.0654	0.0100	-0.0263
23	0.033	0.040	-0.042	-0.0883	0.0107	-0.0348
25	0.033	-0.101	-0.086	-0.1147	0.0116	-0.0372
27	0.033	-0.128	-0.094	-0.1194	0.0118	-0.0388
29	0.033	-0.250	-0.130	-0.1396	0.0125	-0.0438
31A	0.033	-0.259	-0.133	-0.1410	0.0125	-0.0447
31B	0.050	-0.126	-0.149	-0.1660	0.0135	-0.0469
34	0.075	0.198	-0.149	-0.1763	0.0133	-0.0496
35	0.090	0.403	-0.149	-0.1789	0.0128	-0.0513
39A	0.094	0.459	-0.149	-0.1791	0.0127	-0.0518
39B	0.039	0.679	0.063	-0.1573	0.0084	-0.0578
41A	0.039	0.679	0.063	-0.1572	0.0084	-0.0578
41B	0.001	0.640	0.147	-0.1360	0.0150	-0.0628
43	0.001	0.579	0.132	-0.1285	0.0143	-0.0624
44	0.001	0.501	0.115	-0.1186	0.0133	-0.0625
47	0.001	0.453	0.105	-0.1127	0.0128	-0.0644
50	0.001	0.206	0.061	-0.0824	0.0099	-0.0584
52	0.001	0.158	0.053	-0.0758	0.0092	-0.0549
55	0.001	0.040	0.031	-0.0550	0.0073	-0.0314
57	0.001	0.006	0.021	-0.0439	0.0062	-0.0152
58	0.001	0.002	0.019	-0.0416	0.0060	-0.0113
59	0.001	-0.002	0.017	-0.0383	0.0057	-0.0060
61	0.001	-0.003	0.015	-0.0349	0.0054	-0.0011
62	0.001	-0.003	0.012	-0.0341	0.0053	-0.0001
64	0.001	-0.001	0.008	-0.0325	0.0051	0.0029
65	0.001	0.000	0.007	-0.0311	0.0050	0.0027
67A	0.001	0.001	0.004	-0.0250	0.0044	0.0007
67B	-0.001	-0.011	-0.000	0.0001	0.0004	0.0040
70	-0.001	-0.006	-0.000	0.0052	-0.0002	0.0024
73	-0.001	-0.002	-0.000	0.0044	-0.0003	0.0013
102	-0.001	0.000	-0.000	0.0027	-0.0004	0.0010
103	-0.000	0.000	-0.000	-0.0003	-0.0004	0.0001
112	-0.000	-0.000	-0.000	-0.0002	-0.0003	-0.0001
121	0.000	0.000	0.000	-0.0002	-0.0002	0.0000
122	0.000	-0.000	0.000	-0.0003	-0.0002	-0.0003
131	0.000	-0.000	0.000	0.0001	-0.0001	-0.0008
140	0.000	0.000	0.000	0.0000	0.0000	-0.0010
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.007	-0.307	-0.004	-0.0228	0.0068	-0.2821
700B	0.019	-0.338	-0.005	-0.0228	0.0068	-0.2676
710	0.025	-0.343	-0.006	-0.0228	0.0068	-0.2668
720A	0.034	-0.353	-0.007	-0.0228	0.0068	-0.2652
720B	0.042	-0.372	-0.008	-0.0228	0.0068	-0.2338
730	0.042	-0.377	-0.008	-0.0228	0.0068	-0.2328

Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
740	0.042	-0.413	-0.010	-0.0228	0.0068	-0.2306
750	0.042	-0.449	-0.011	-0.0228	0.0068	-0.2285
760	0.042	-0.521	-0.013	-0.0228	0.0068	-0.2208
63	0.001	-0.003	-0.008	-0.0341	0.0053	-0.0001
74	0.001	-0.002	0.001	0.0028	-0.0003	-0.0170
75	0.004	-0.002	0.001	0.0017	-0.0003	-0.0305
76	0.007	-0.002	0.001	0.0015	-0.0003	-0.0320
77	0.016	-0.002	0.002	0.0015	-0.0003	-0.0320
78	0.007	0.001	0.001	0.0014	-0.0003	-0.0334
79	0.007	0.005	0.001	-0.0002	-0.0003	-0.0464
80A	0.007	0.116	0.001	-0.0102	-0.0003	-0.0922
80B	0.019	0.130	-0.001	-0.0155	-0.0026	-0.0717
82	0.066	0.130	-0.014	-0.0192	-0.0026	-0.0600
840	0.090	0.130	-0.022	-0.0215	-0.0026	-0.0529
84A	0.098	0.130	-0.026	-0.0224	-0.0026	-0.0502
84B	0.104	0.126	-0.030	-0.0266	0.0044	-0.0340
87	0.104	0.124	-0.030	-0.0264	0.0044	-0.0329
89	0.097	0.109	-0.030	0.0158	0.0044	0.0029
92	0.094	0.126	-0.030	0.0332	0.0044	0.0177
94A	0.093	0.136	-0.030	0.0364	0.0044	0.0234
94B	0.092	0.136	-0.029	0.0320	0.0044	0.0422
96	0.092	0.126	-0.028	0.0320	0.0044	0.0490
98	0.092	0.000	-0.010	0.0320	0.0044	0.0181
99	0.092	-0.054	-0.003	0.0320	0.0044	0.0439
101	0.092	-0.063	-0.002	0.0320	0.0044	0.0439
104	0.001	-0.000	-0.000	-0.0003	-0.0004	-0.0116
105	0.003	-0.000	-0.000	-0.0003	-0.0004	-0.0170
106	0.007	-0.000	-0.000	-0.0003	-0.0004	-0.0199
107	0.012	-0.000	-0.000	-0.0003	-0.0004	-0.0199
108	0.007	-0.004	-0.000	-0.0003	-0.0004	-0.0205
109	0.007	-0.007	-0.000	-0.0003	-0.0004	-0.0213
110A	0.007	-0.009	-0.000	-0.0003	-0.0004	-0.0215
110B	0.008	-0.011	-0.000	-0.0003	-0.0004	-0.0233
111	0.012	-0.015	-0.000	-0.0003	-0.0004	-0.0234
113	0.003	-0.000	-0.000	-0.0002	-0.0003	-0.0217
114	0.006	-0.000	-0.000	-0.0002	-0.0003	-0.0316
115	0.016	-0.000	-0.000	-0.0002	-0.0003	-0.0377
116	0.022	-0.001	-0.000	-0.0002	-0.0003	-0.0377
117	0.016	-0.007	-0.000	-0.0002	-0.0003	-0.0381
118	0.016	-0.014	-0.000	-0.0002	-0.0003	-0.0388
119A	0.016	-0.018	-0.000	-0.0002	-0.0003	-0.0390
119B	0.018	-0.023	0.000	-0.0002	-0.0003	-0.0401
120	0.024	-0.029	0.000	-0.0002	-0.0003	-0.0401
123	0.002	-0.000	-0.000	-0.0003	-0.0002	-0.0171
124	0.005	-0.000	-0.000	-0.0003	-0.0002	-0.0248
125	0.012	-0.001	-0.000	-0.0003	-0.0002	-0.0295
126	0.017	-0.001	-0.000	-0.0003	-0.0002	-0.0295
127	0.012	-0.006	-0.000	-0.0003	-0.0002	-0.0297
128	0.012	-0.011	-0.000	-0.0003	-0.0002	-0.0302
129A	0.012	-0.014	-0.000	-0.0003	-0.0002	-0.0304
129B	0.014	-0.018	-0.000	-0.0003	-0.0002	-0.0315
130	0.019	-0.023	-0.000	-0.0003	-0.0002	-0.0316

## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
132	0.003	-0.000	0.000	0.0001	-0.0001	-0.0224
133	0.006	-0.001	0.000	0.0001	-0.0001	-0.0323
134	0.016	-0.001	0.000	0.0001	-0.0001	-0.0384
135	0.023	-0.001	0.000	0.0001	-0.0001	-0.0384
136	0.016	-0.008	0.000	0.0001	-0.0001	-0.0388
137	0.016	-0.015	0.000	0.0001	-0.0001	-0.0395
138A	0.016	-0.019	0.000	0.0001	-0.0001	-0.0396
138B	0.018	-0.024	0.000	0.0001	-0.0001	-0.0407
139	0.025	-0.030	0.000	0.0001	-0.0001	-0.0408
141	0.003	-0.000	0.000	0.0000	0.0000	-0.0217
142	0.013	-0.000	0.000	0.0000	0.0000	-0.0298
143	0.013	-0.008	0.000	0.0000	0.0000	-0.0298

## Loads on Anchors: Expansion (T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9759	1689	-2643	-12989	-209854	-90590
58		-2807				
121	32486	-90				588
144	-22727	-1	2643	5	-127611	0

## Loads on Hangers: Expansion (T1)

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	-435	1	-435
20	User hanger	-118	1	-118
23	User hanger	-86	1	-86
25	User hanger	-58	1	-58
29	User hanger	-47	1	-47
34	User hanger	79	1	79
40	User hanger	195	1	195
47	User hanger	-45	1	-45
50	User hanger	-36	1	-36
55	User hanger	-14	1	-14
65	Rod Hanger	1714	1	1714
102	Rod Hanger	21	1	21
140	Rod Hanger	21	1	21
760	User hanger	-45	1	-45
840	User hanger	48	1	48
96	User hanger	18	1	18
98	Rod Hanger	-3	1	-3

## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.039	-0.447	0.012	-0.0154	-0.1649	-0.0268
3B	-0.244	-0.562	0.172	-0.0579	-0.3761	-0.1028
6	-1.024	-0.435	0.589	-0.0767	-0.4534	-0.0799



Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
7	-1.372	-0.375	0.757	-0.0821	-0.4709	-0.0706
14	-2.211	-0.223	1.149	-0.0908	-0.4807	-0.0493
17A	-2.371	-0.193	1.224	-0.0919	-0.4777	-0.0453
17B	-2.654	-0.096	2.035	-0.1092	-0.3777	-0.0071
20	-2.584	-0.098	2.152	-0.1095	-0.3702	-0.0049
23	-1.816	-0.086	3.307	-0.1126	-0.3134	0.0084
25	-0.933	-0.058	4.500	-0.1161	-0.3035	0.0018
27	-0.776	-0.058	4.713	-0.1167	-0.3079	-0.0017
29	-0.099	-0.094	5.695	-0.1194	-0.3486	-0.0245
31A	-0.052	-0.099	5.768	-0.1196	-0.3527	-0.0266
31B	-0.283	-0.018	6.536	-0.1066	-0.4261	-0.0738
34	-1.086	0.180	6.959	-0.1025	-0.4144	-0.1021
35	-1.548	0.296	7.218	-0.0977	-0.3824	-0.1194
39A	-1.667	0.327	7.288	-0.0960	-0.3705	-0.1241
39B	-2.151	0.163	7.688	-0.0958	-0.1578	-0.0793
41A	-2.151	0.163	7.688	-0.0958	-0.1575	-0.0793
41B	-2.055	-0.017	7.759	-0.0015	0.0564	-0.0433
43	-1.838	-0.052	7.678	-0.0014	0.1086	-0.0305
44	-1.554	-0.081	7.500	-0.0014	0.1712	-0.0162
47	-1.383	-0.091	7.355	-0.0013	0.2061	-0.0089
50	-0.509	-0.073	6.255	-0.0011	0.3489	0.0135
52	-0.321	-0.061	5.952	-0.0010	0.3721	0.0151
55	0.278	-0.020	4.877	-0.0009	0.4280	0.0128
57	0.598	-0.006	4.251	-0.0008	0.4467	0.0070
58	0.667	-0.004	4.114	-0.0007	0.4497	0.0053
59	0.761	-0.002	3.925	-0.0007	0.4532	0.0032
61	0.858	-0.001	3.729	-0.0007	0.4561	0.0014
62	0.946	-0.001	3.545	-0.0007	0.4567	0.0011
64	1.126	-0.000	3.170	-0.0007	0.4573	0.0008
65	1.164	0.000	3.092	-0.0007	0.4574	0.0007
67A	1.341	0.001	2.731	-0.0006	0.4567	0.0007
67B	1.122	0.001	1.910	-0.0004	0.3548	0.0006
70	0.665	0.000	1.591	-0.0003	0.3070	0.0006
73	0.426	0.000	1.399	-0.0002	0.2649	0.0005
102	0.330	0.000	1.311	-0.0001	0.2422	0.0004
103	0.108	-0.000	1.062	0.0000	0.1665	0.0002
112	0.033	-0.000	0.943	0.0000	0.1241	0.0001
121	0.000	0.000	0.874	0.0000	0.0976	0.0000
122	-0.018	0.000	0.824	0.0000	0.0789	0.0000
131	-0.045	0.000	0.706	0.0000	0.0406	0.0000
140	-0.054	0.000	0.588	0.0000	0.0113	0.0000
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.965	-0.465	1.610	-0.0821	-0.4709	-0.0349
700B	-0.938	-0.459	1.659	-0.0821	-0.4709	-0.0450
710	-0.933	-0.456	1.667	-0.0821	-0.4709	-0.0447
720A	-0.923	-0.449	1.681	-0.0821	-0.4709	-0.0443
720B	-0.905	-0.444	1.714	-0.0821	-0.4709	-0.0155
730	-0.900	-0.445	1.724	-0.0821	-0.4709	-0.0153
740	-0.866	-0.447	1.798	-0.0821	-0.4709	-0.0151
750	-0.831	-0.449	1.872	-0.0821	-0.4709	-0.0149
760	-0.759	-0.454	2.024	-0.0821	-0.4709	-0.0144
63	1.083	0.111	3.258	-0.0007	0.4567	0.0011



## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
74	0.425	0.067	1.399	-0.0035	0.2649	0.0082
75	0.424	0.088	1.398	-0.0059	0.2649	0.0138
76	0.423	0.108	1.398	-0.0061	0.2649	0.0144
77	0.418	0.175	1.396	-0.0061	0.2649	0.0144
78	0.402	0.107	1.422	-0.0065	0.2649	0.0150
79	0.381	0.105	1.447	-0.0096	0.2649	0.0202
80A	0.059	0.060	1.827	-0.0302	0.2649	0.0374
80B	0.014	0.087	1.863	-0.0410	0.2603	0.0718
82	-0.036	0.245	1.832	-0.0487	0.2603	0.0709
840	-0.066	0.341	1.810	-0.0535	0.2603	0.0703
84A	-0.077	0.376	1.801	-0.0552	0.2603	0.0701
84B	-0.129	0.405	1.758	-0.0378	0.2597	0.0689
87	-0.142	0.403	1.747	-0.0383	0.2597	0.0688
89	-0.571	0.328	1.376	-0.0502	0.2597	0.0661
92	-0.748	0.293	1.224	-0.0521	0.2597	0.0649
94A	-0.816	0.279	1.165	-0.0524	0.2597	0.0645
94B	-0.890	0.261	1.167	-0.0521	0.2247	0.0630
96	-0.941	0.247	1.218	-0.0521	0.2247	0.0625
98	-1.885	0.000	2.163	-0.0521	0.2247	0.0568
99	-2.214	-0.083	2.493	-0.0521	0.2247	0.0568
101	-2.261	-0.095	2.540	-0.0521	0.2247	0.0568
104	0.108	0.058	1.062	0.0000	0.1665	0.0002
105	0.108	0.084	1.062	0.0000	0.1665	0.0002
106	0.108	0.138	1.062	0.0000	0.1665	0.0002
107	0.112	0.183	1.059	0.0000	0.1665	0.0002
108	0.146	0.138	1.033	0.0000	0.1665	0.0002
109	0.179	0.138	1.009	0.0000	0.1665	0.0002
110A	0.198	0.138	0.995	0.0000	0.1665	0.0002
110B	0.220	0.146	0.979	0.0000	0.1665	-0.0252
111	0.263	0.180	0.950	0.0000	0.1665	-0.0252
113	0.033	0.058	0.943	0.0000	0.1241	0.0001
114	0.033	0.084	0.943	0.0000	0.1241	0.0001
115	0.033	0.146	0.943	0.0000	0.1241	0.0001
116	0.037	0.183	0.941	0.0000	0.1241	0.0001
117	0.073	0.146	0.920	0.0000	0.1241	0.0001
118	0.112	0.146	0.899	0.0000	0.1241	0.0001
119A	0.135	0.146	0.886	0.0000	0.1241	0.0001
119B	0.164	0.156	0.871	0.0000	0.1241	-0.0199
120	0.202	0.188	0.851	0.0000	0.1241	-0.0199
123	-0.018	0.058	0.824	0.0000	0.0789	0.0000
124	-0.018	0.084	0.824	0.0000	0.0789	0.0000
125	-0.018	0.146	0.824	0.0000	0.0789	0.0000
126	-0.014	0.183	0.823	0.0000	0.0789	0.0000
127	0.023	0.146	0.810	0.0000	0.0789	0.0000
128	0.062	0.146	0.796	0.0000	0.0789	0.0000
129A	0.085	0.146	0.788	0.0000	0.0789	0.0000
129B	0.113	0.156	0.778	0.0000	0.0789	-0.0200
130	0.152	0.188	0.766	0.0000	0.0789	-0.0200
132	-0.045	0.058	0.706	0.0000	0.0406	0.0000
133	-0.045	0.084	0.706	0.0000	0.0406	0.0000
134	-0.045	0.146	0.706	0.0000	0.0406	0.0000
135	-0.041	0.183	0.705	0.0000	0.0406	0.0000

## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
136	-0.004	0.146	0.699	0.0000	0.0406	0.0000
137	0.035	0.146	0.692	0.0000	0.0406	0.0000
138A	0.058	0.146	0.687	0.0000	0.0406	0.0000
138B	0.086	0.156	0.682	0.0000	0.0406	-0.0200
139	0.125	0.188	0.676	0.0000	0.0406	-0.0200
141	-0.054	0.056	0.588	0.0000	0.0113	0.0000
142	-0.054	0.141	0.588	0.0000	0.0113	0.0000
143	0.004	0.141	0.585	0.0000	0.0113	0.0000

## Loads on Anchors: Operating (W+P1+T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9643	-2584	-2642	-19007	-205483	-97762
58		-1462				
121	32308	-5778				-3805
144	-22665	-1705	2642	3559	-127244	-867

## Loads on Hangers: Operating (W+P1+T1)

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	-6670	1	-6670
20	User hanger	-6250	1	-6250
23	User hanger	-4265	1	-4265
25	User hanger	-4800	1	-4800
29	User hanger	-5520	1	-5520
34	User hanger	-1990	1	-1990
40	User hanger	-7130	1	-7130
47	User hanger	-6465	1	-6465
50	User hanger	-5250	1	-5250
55	User hanger	-3340	1	-3340
65	Rod Hanger	-21708	1	-21708
102	Rod Hanger	-9458	1	-9458
140	Rod Hanger	-5879	1	-5879
760	User hanger	-675	1	-675
840	User hanger	-670	1	-670
96	User hanger	-500	1	-500
98	Rod Hanger	-532	1	-532

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.043	-0.447	0.016	-0.0191	-0.1614	-0.0314
3B	-0.252	-0.555	0.181	-0.0750	-0.3719	-0.1151
6	-1.022	-0.392	0.597	-0.0976	-0.4473	-0.0984
7	-1.366	-0.316	0.766	-0.1049	-0.4641	-0.0917
14	-2.192	-0.116	1.158	-0.1250	-0.4728	-0.0721
17A	-2.349	-0.074	1.232	-0.1285	-0.4696	-0.0683
17B	-2.621	0.059	2.032	-0.1725	-0.3678	-0.0318

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
20	-2.551	0.050	2.146	-0.1749	-0.3603	-0.0312
23	-1.783	-0.046	3.266	-0.2009	-0.3027	-0.0264
25	-0.900	-0.159	4.415	-0.2308	-0.2919	-0.0354
27	-0.743	-0.186	4.620	-0.2361	-0.2961	-0.0404
29	-0.066	-0.344	5.564	-0.2590	-0.3361	-0.0683
31A	-0.019	-0.358	5.635	-0.2606	-0.3402	-0.0713
31B	-0.233	-0.144	6.386	-0.2726	-0.4126	-0.1207
34	-1.010	0.378	6.810	-0.2788	-0.4011	-0.1517
35	-1.458	0.699	7.069	-0.2766	-0.3696	-0.1707
39A	-1.572	0.786	7.139	-0.2751	-0.3578	-0.1758
39B	-2.112	0.842	7.751	-0.2530	-0.1493	-0.1371
41A	-2.112	0.842	7.751	-0.2530	-0.1491	-0.1371
41B	-2.054	0.624	7.905	-0.1375	0.0714	-0.1062
43	-1.837	0.527	7.810	-0.1299	0.1228	-0.0929
44	-1.553	0.420	7.615	-0.1200	0.1845	-0.0787
47	-1.382	0.362	7.460	-0.1140	0.2188	-0.0733
50	-0.508	0.133	6.316	-0.0834	0.3588	-0.0449
52	-0.320	0.097	6.005	-0.0768	0.3814	-0.0398
55	0.279	0.020	4.908	-0.0559	0.4353	-0.0185
57	0.599	0.000	4.273	-0.0447	0.4529	-0.0082
58	0.668	-0.002	4.134	-0.0423	0.4557	-0.0059
59	0.762	-0.004	3.942	-0.0390	0.4589	-0.0029
61	0.859	-0.004	3.743	-0.0356	0.4615	0.0003
62	0.947	-0.004	3.558	-0.0348	0.4619	0.0010
64	1.127	-0.001	3.178	-0.0331	0.4624	0.0036
65	1.165	0.000	3.100	-0.0318	0.4624	0.0034
67A	1.342	0.002	2.735	-0.0256	0.4611	0.0014
67B	1.121	-0.011	1.910	-0.0002	0.3552	0.0046
70	0.663	-0.006	1.591	0.0049	0.3069	0.0029
73	0.425	-0.002	1.399	0.0043	0.2645	0.0018
102	0.329	0.000	1.311	0.0026	0.2418	0.0014
103	0.108	0.000	1.062	-0.0003	0.1661	0.0003
112	0.033	-0.000	0.943	-0.0002	0.1238	0.0000
121	0.000	0.000	0.874	-0.0002	0.0973	0.0000
122	-0.018	-0.000	0.824	-0.0002	0.0787	-0.0003
131	-0.045	-0.000	0.706	0.0001	0.0405	-0.0008
140	-0.054	0.000	0.588	0.0000	0.0113	-0.0010
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.959	-0.772	1.607	-0.1049	-0.4641	-0.3170
700B	-0.919	-0.797	1.654	-0.1049	-0.4641	-0.3126
710	-0.908	-0.799	1.661	-0.1049	-0.4641	-0.3116
720A	-0.889	-0.802	1.674	-0.1049	-0.4641	-0.3095
720B	-0.863	-0.816	1.705	-0.1049	-0.4641	-0.2493
730	-0.858	-0.822	1.716	-0.1049	-0.4641	-0.2482
740	-0.824	-0.860	1.788	-0.1049	-0.4641	-0.2457
750	-0.789	-0.899	1.861	-0.1049	-0.4641	-0.2434
760	-0.717	-0.975	2.011	-0.1049	-0.4641	-0.2351
63	1.084	0.108	3.250	-0.0348	0.4619	0.0010
74	0.426	0.065	1.400	-0.0006	0.2645	-0.0088
75	0.428	0.086	1.399	-0.0042	0.2645	-0.0167
76	0.429	0.107	1.399	-0.0046	0.2645	-0.0175
77	0.435	0.174	1.398	-0.0046	0.2645	-0.0175

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
78	0.409	0.108	1.424	-0.0051	0.2645	-0.0184
79	0.388	0.110	1.449	-0.0098	0.2645	-0.0262
80A	0.066	0.176	1.828	-0.0405	0.2645	-0.0548
80B	0.034	0.217	1.862	-0.0565	0.2577	0.0000
82	0.030	0.375	1.818	-0.0680	0.2577	0.0109
840	0.024	0.471	1.788	-0.0750	0.2577	0.0175
84A	0.021	0.506	1.776	-0.0776	0.2577	0.0199
84B	-0.025	0.530	1.729	-0.0643	0.2641	0.0349
87	-0.038	0.527	1.717	-0.0647	0.2641	0.0359
89	-0.474	0.437	1.347	-0.0344	0.2641	0.0690
92	-0.654	0.420	1.194	-0.0189	0.2641	0.0826
94A	-0.723	0.415	1.135	-0.0160	0.2641	0.0879
94B	-0.798	0.398	1.138	-0.0201	0.2291	0.1052
96	-0.849	0.373	1.190	-0.0201	0.2291	0.1115
98	-1.793	0.000	2.153	-0.0201	0.2291	0.0749
99	-2.122	-0.137	2.489	-0.0201	0.2291	0.1007
101	-2.169	-0.158	2.537	-0.0201	0.2291	0.1008
104	0.109	0.057	1.062	-0.0003	0.1661	-0.0114
105	0.111	0.084	1.062	-0.0003	0.1661	-0.0168
106	0.115	0.138	1.062	-0.0003	0.1661	-0.0197
107	0.123	0.183	1.059	-0.0003	0.1661	-0.0197
108	0.154	0.134	1.033	-0.0003	0.1661	-0.0203
109	0.187	0.131	1.009	-0.0003	0.1661	-0.0211
110A	0.205	0.130	0.995	-0.0003	0.1661	-0.0213
110B	0.229	0.135	0.979	-0.0003	0.1661	-0.0485
111	0.275	0.165	0.950	-0.0003	0.1661	-0.0486
113	0.036	0.057	0.943	-0.0002	0.1238	-0.0216
114	0.039	0.084	0.943	-0.0002	0.1238	-0.0316
115	0.049	0.145	0.943	-0.0002	0.1238	-0.0376
116	0.059	0.182	0.941	-0.0002	0.1238	-0.0376
117	0.089	0.138	0.920	-0.0002	0.1238	-0.0380
118	0.128	0.132	0.899	-0.0002	0.1238	-0.0387
119A	0.151	0.128	0.886	-0.0002	0.1238	-0.0389
119B	0.181	0.133	0.871	-0.0002	0.1238	-0.0600
120	0.226	0.159	0.851	-0.0002	0.1238	-0.0600
123	-0.015	0.057	0.824	-0.0002	0.0787	-0.0171
124	-0.013	0.084	0.824	-0.0002	0.0787	-0.0248
125	-0.005	0.145	0.824	-0.0002	0.0787	-0.0295
126	0.004	0.182	0.823	-0.0002	0.0787	-0.0295
127	0.035	0.140	0.810	-0.0002	0.0787	-0.0297
128	0.074	0.135	0.796	-0.0002	0.0787	-0.0302
129A	0.097	0.131	0.788	-0.0002	0.0787	-0.0304
129B	0.127	0.138	0.778	-0.0002	0.0787	-0.0515
130	0.171	0.165	0.766	-0.0002	0.0787	-0.0515
132	-0.042	0.057	0.706	0.0001	0.0405	-0.0224
133	-0.038	0.083	0.706	0.0001	0.0405	-0.0323
134	-0.028	0.145	0.706	0.0001	0.0405	-0.0384
135	-0.018	0.182	0.706	0.0001	0.0405	-0.0384
136	0.012	0.138	0.699	0.0001	0.0405	-0.0388
137	0.051	0.131	0.692	0.0001	0.0405	-0.0395
138A	0.074	0.127	0.688	0.0001	0.0405	-0.0396
138B	0.104	0.132	0.683	0.0001	0.0405	-0.0607

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
139	0.149	0.158	0.676	0.0001	0.0405	-0.0608
141	-0.051	0.056	0.588	0.0000	0.0113	-0.0217
142	-0.041	0.140	0.588	0.0000	0.0113	-0.0298
143	0.016	0.133	0.585	0.0000	0.0113	-0.0298

## Loads on Anchors: Response spectrum

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	3430	2660	5448	29625	10694	38085
58		5632				
121	1083	1537				7635
144	409	199	8543	642	1979	392

## Loads on Hangers: Response spectrum

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	133	1	133
20	User hanger	524	1	524
23	User hanger	542	1	542
25	User hanger	597	1	597
29	User hanger	284	1	284
34	User hanger	114	1	114
40	User hanger	70	1	70
47	User hanger	23	1	23
50	User hanger	29	1	29
55	User hanger	14	1	14
65	Rod Hanger	2842	1	2842
102	Rod Hanger	1552	1	1552
140	Rod Hanger	1547	1	1547
760	User hanger	58	1	58
840	User hanger	9	1	9
96	User hanger	80	1	80
98	Rod Hanger	60	1	60

## Loads on Snubbers: Response spectrum

Node	Load (lb)	X comp	Y comp	Z comp
14	7581	0.000	0.000	1.000
27	3697	1.000	0.000	0.000
35	5977	1.125	0.000	-6.000
43	2748	0.000	1.000	0.000
44	6896	0.000	-2.604	7.000
52	3267	0.000	-2.740	7.000
57	4589	1.000	0.000	0.000
59	10415	0.000	-2.870	7.000
70	3764	7.000	-3.021	0.000
82	365	-4.357	0.587	0.891
87	343	0.000	1.000	0.000
89	892	3.190	-2.206	4.577



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Loads on Snubbers: Response spectrum  
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Node	Load (lb)	X comp	Y comp	Z comp
92	630	0.000	0.000	1.000
99	270	-6.357	0.000	-3.570

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Displacements: Response spectrum  
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Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	0.018	0.000	0.009	0.0023	0.0084	0.0140
3B	0.036	0.020	0.001	0.0535	0.0141	0.0240
6	0.057	0.133	0.000	0.0651	0.0096	0.0298
7	0.061	0.182	0.000	0.0665	0.0064	0.0326
14	0.054	0.297	0.000	0.0641	0.0137	0.0382
17A	0.049	0.318	0.000	0.0628	0.0168	0.0394
17B	0.001	0.426	0.070	0.0409	0.0706	0.0406
20	0.001	0.437	0.092	0.0384	0.0715	0.0405
23	0.000	0.542	0.309	0.0177	0.0429	0.0293
25	0.000	0.597	0.330	0.0364	0.0336	0.0163
27	0.000	0.597	0.302	0.0420	0.0468	0.0170
29	0.000	0.568	0.108	0.0677	0.0720	0.0277
31A	0.000	0.565	0.093	0.0696	0.0716	0.0284
31B	0.058	0.438	0.020	0.0930	0.0276	0.0417
34	0.094	0.261	0.020	0.0944	0.0155	0.0466
35	0.104	0.158	0.020	0.0898	0.0103	0.0506
39A	0.106	0.132	0.020	0.0878	0.0092	0.0518
39B	0.032	0.059	0.067	0.0446	0.0157	0.0560
41A	0.032	0.059	0.067	0.0446	0.0158	0.0560
41B	0.001	0.032	0.072	0.0312	0.0319	0.0348
43	0.001	0.000	0.041	0.0309	0.0310	0.0295
44	0.001	0.032	0.012	0.0308	0.0210	0.0205
47	0.001	0.045	0.015	0.0308	0.0127	0.0150
50	0.001	0.058	0.021	0.0348	0.0064	0.0078
52	0.000	0.051	0.020	0.0363	0.0053	0.0098
55	0.000	0.021	0.012	0.0418	0.0049	0.0118
57	0.000	0.009	0.004	0.0451	0.0062	0.0071
58	0.000	0.007	0.002	0.0458	0.0067	0.0055
59	0.000	0.007	0.003	0.0468	0.0077	0.0038
61	0.000	0.005	0.006	0.0479	0.0079	0.0034
62	0.000	0.004	0.010	0.0481	0.0074	0.0036
64	0.000	0.001	0.014	0.0456	0.0037	0.0045
65	0.000	0.000	0.014	0.0436	0.0016	0.0052
67A	0.000	0.005	0.011	0.0343	0.0052	0.0075
67B	0.005	0.002	0.002	0.0040	0.0026	0.0142
70	0.001	0.001	0.002	0.0009	0.0027	0.0099
73	0.002	0.000	0.001	0.0008	0.0008	0.0072
102	0.002	0.000	0.001	0.0006	0.0003	0.0060
103	0.001	0.000	0.001	0.0003	0.0010	0.0025
112	0.000	0.000	0.001	0.0007	0.0011	0.0009
121	0.000	0.000	0.001	0.0005	0.0009	0.0000
122	0.000	0.000	0.001	0.0005	0.0008	0.0001
131	0.000	0.000	0.001	0.0003	0.0005	0.0002
140	0.001	0.000	0.001	0.0003	0.0002	0.0004



## Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.062	0.402	0.386	0.0814	0.3433	0.1818
700B	0.061	0.422	0.429	0.0907	0.3822	0.1979
710	0.061	0.426	0.438	0.0908	0.3836	0.1984
720A	0.062	0.433	0.455	0.0909	0.3858	0.1991
720B	0.064	0.448	0.486	0.0966	0.4076	0.2063
730	0.064	0.453	0.495	0.0966	0.4082	0.2064
740	0.064	0.484	0.559	0.0966	0.4088	0.2065
750	0.064	0.516	0.624	0.0966	0.4090	0.2064
760	0.064	0.581	0.756	0.0966	0.4091	0.2058
63	0.002	0.002	0.039	0.0482	0.0074	0.0036
74	0.004	0.000	0.003	0.0125	0.0417	0.0111
75	0.005	0.000	0.004	0.0207	0.0723	0.0163
76	0.006	0.000	0.006	0.0216	0.0756	0.0170
77	0.011	0.000	0.012	0.0216	0.0756	0.0170
78	0.006	0.002	0.006	0.0223	0.0781	0.0176
79	0.006	0.004	0.014	0.0303	0.1003	0.0241
80A	0.006	0.060	0.237	0.0977	0.1959	0.0462
80B	0.011	0.067	0.252	0.1252	0.2103	0.0420
82	0.041	0.067	0.151	0.1658	0.2366	0.0564
840	0.069	0.067	0.074	0.1987	0.2527	0.0722
84A	0.081	0.067	0.042	0.2120	0.2586	0.0771
84B	0.053	0.019	0.000	0.3599	0.2760	0.0932
87	0.040	0.000	0.000	0.3649	0.2777	0.0950
89	0.475	0.686	0.000	0.4381	0.3511	0.1546
92	0.723	0.983	0.000	0.4349	0.3735	0.1794
94A	0.820	1.097	0.000	0.4344	0.3723	0.1889
94B	0.877	1.132	0.055	0.4222	0.3358	0.2157
96	0.877	1.083	0.131	0.4222	0.3296	0.2214
98	0.877	0.000	1.270	0.4222	0.2150	0.2807
99	0.877	0.415	1.562	0.4222	0.1987	0.2845
101	0.877	0.475	1.603	0.4222	0.1987	0.2845
104	0.004	0.000	0.006	0.0378	0.0085	0.0254
105	0.008	0.000	0.011	0.0501	0.0122	0.0340
106	0.016	0.000	0.024	0.0541	0.0142	0.0371
107	0.024	0.001	0.036	0.0541	0.0142	0.0371
108	0.016	0.006	0.027	0.0541	0.0145	0.0372
109	0.016	0.012	0.029	0.0543	0.0150	0.0376
110A	0.016	0.015	0.030	0.0544	0.0151	0.0377
110B	0.018	0.019	0.034	0.0551	0.0165	0.0389
111	0.025	0.025	0.046	0.0552	0.0166	0.0390
113	0.001	0.000	0.011	0.0704	0.0275	0.0058
114	0.002	0.000	0.021	0.0931	0.0399	0.0079
115	0.004	0.000	0.049	0.1009	0.0474	0.0088
116	0.005	0.000	0.067	0.1009	0.0474	0.0088
117	0.004	0.002	0.057	0.1010	0.0478	0.0088
118	0.004	0.003	0.066	0.1013	0.0486	0.0089
119A	0.004	0.004	0.071	0.1014	0.0488	0.0089
119B	0.004	0.005	0.082	0.1021	0.0503	0.0091
120	0.006	0.007	0.106	0.1022	0.0504	0.0091
123	0.001	0.000	0.007	0.0450	0.0137	0.0044
124	0.001	0.000	0.013	0.0595	0.0198	0.0059

Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
125	0.003	0.000	0.031	0.0646	0.0236	0.0065
126	0.004	0.000	0.043	0.0646	0.0236	0.0065
127	0.003	0.001	0.036	0.0646	0.0237	0.0065
128	0.003	0.002	0.040	0.0648	0.0241	0.0065
129A	0.003	0.003	0.042	0.0649	0.0242	0.0065
129B	0.003	0.004	0.048	0.0653	0.0252	0.0066
130	0.004	0.005	0.063	0.0654	0.0252	0.0067
132	0.001	0.000	0.007	0.0481	0.0187	0.0063
133	0.002	0.000	0.014	0.0636	0.0272	0.0085
134	0.004	0.000	0.033	0.0690	0.0324	0.0094
135	0.006	0.000	0.046	0.0690	0.0324	0.0094
136	0.004	0.002	0.039	0.0691	0.0327	0.0094
137	0.004	0.003	0.045	0.0692	0.0332	0.0094
138A	0.004	0.004	0.048	0.0693	0.0333	0.0095
138B	0.005	0.006	0.056	0.0698	0.0344	0.0096
139	0.006	0.007	0.073	0.0699	0.0345	0.0096
141	0.002	0.000	0.006	0.0359	0.0237	0.0121
142	0.007	0.000	0.021	0.0411	0.0330	0.0144
143	0.007	0.004	0.030	0.0411	0.0330	0.0144

Center of Gravity (ft/in")

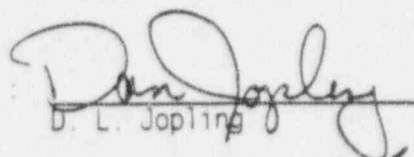
X = 92.855      Y = -17.003      Z = 41.503

Total weight = 102630.55 (lb)

CAEPIPE  
Version 3.72

Client : F. P. C.  
Project : Evaluation of effect of bent rod hanger  
File Number : S 96-0129  
Report Number : Attachment C  
Model Name : CR-5C  
Title : CR-5 W/ Bent MSH-27B, X CRW2 Y GRS Spectra  
Subtitle :

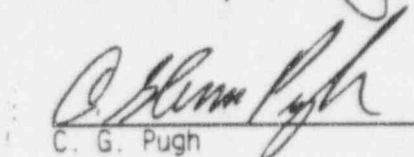
Prepared by

  
D. L. Jopling

Date:

8/1/96

Checked by

  
C. G. Pugh

Date:

8/1/96

## Options

Piping code = B31.1 (1967)  
Do not use liberal allowable stresses  
Exclude axial force in stress calculations  
Reference temperature = 70 (F)  
Number of thermal cycles = 7000  
Use modulus at reference temperature  
Include hanger stiffness  
Include Bourdon effect  
Do not use pressure correction for bends  
Pressure stress =  $PD / 4t$   
Peak pressure factor = 1.00  
Cut off frequency = 50 Hz  
Number of modes = 50  
Include missing mass correction  
Do not use friction in dynamic analysis  
Vertical direction = Y

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
1	1	From							Anchor
2	3	Bend		-12'6"		1	1	1	
3	6				11.854	1	1	1	User hanger
4	7				3.583	1	1	1	
5	14				8.333	1	1	1	Snubber
6	17	Bend			7.583	1	1	1	
7	20		7'6"			1	1	1	User hanger
8	23		16.333			1	1	1	User hanger
9	25		18.792			1	1	1	User hanger
10	27		3.333			1	1	1	Snubber
11	29		14'5"			1	1	1	User hanger
12	31	Bend	7'0"			1	1	1	
13	34				15'0"	1	1	1	User hanger
14	35				5'6"	1	1	1	Snubber
15	39	Bend			7'6"	1	1	1	
16	40			-6'0"		1	1	1	User hanger
17	41	Bend		-3'0"		1	1	1	
18	43		7'7-1/2"			1	1	1	Snubber
19	44		6.042			1	1	1	Snubber
20	47		3.646			1	1	1	User hanger
21	50		18.583			1	1	1	User hanger
22	52		4'0"			1	1	1	Snubber
23	55		12'9"			1	1	1	User hanger
24	57		6'9-3/4"			1	1	1	Snubber
25	58		1.458			1	1	1	Anchor
26	59		2'0"			1	1	1	Snubber
27	61		2.062			1	1	1	
28	62	Valve	1'11"			1	1	1	
29	64	Valve	3'11"			1	1	1	
30	65		0'9-3/4"			1	1	1	Rod hanger
31	67	Bend	9'8"			1	1	1	
32	70		0.218		-12'6"	1	1	1	Snubber
33	73		0.069		-4'0"	1	1	1	
34	102		0.032		-1.833	1	1	1	Rod hanger
35	103		0.091		-5.208	1	1	1	

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
36	112		0.044		-2.500	1	1	1	
37	121		0.025		-1.458	1	1	1	Anchor
38	122		0.018		-1.042	1	1	1	
39	131		0.044		-2.500	1	1	1	
40	140		0.044		-2'6"	1	1	1	Rod hanger
41	144		0.218		-12.512	1	1	1	Anchor
42	7	From							
43	700	Bend	8.964			1	2	2	
44	710		0.320	0.320		1	2	2	
45	720	Bend	0.320	0.320		1	2	2	
46	730		0'3-3/4"			1	2	2	
47	740	Valve	0'9"			1	2	2	
48	750	Valve	0'9"			1	2	2	
49	760		1.542			1	2	2	User hanger
50	62	From							
51	63	Rigid	3'0"	2'5"		1	2	2	Conc mass
52	73	From							
53	74			1.416		1	2	2	
54	75	Reducer		0.450		1	2	2	
55	76	Valve		0.450		1	2	2	
56	77	Rigid		1.458		1	2	2	Conc mass
57	76	From							
58	78	Valve	-0.450			1	2	2	
59	79	Reducer	-0.450			1	2	2	
60	80	Bend	-7.600			1	2	2	
61	82			4.104		1	2	2	Snubber
62	840			2.042		1	2	2	User hanger
63	84	Bend		1'6"		1	2	2	
64	87				-1'0"	1	2	2	Snubber
65	89				-7'10-1/2"	1	2	2	Snubber
66	92				-3'3"	1	2	2	Snubber
67	94	Bend			-2'0"	1	2	2	
68	96		-1.833			1	2	2	User hanger
69	98		-20.083			1	2	2	Rod hanger
70	99		-7'0"			1	2	2	Snubber
71	101		-1'0"			1	2	2	
72	103	From							
73	104			1.224		1	2	2	
74	105			0'6-3/4"		1	2	2	Flange
75	106	Valve		1.177		1	2	2	
76	107	Rigid	0.083	0.984		1	2	2	Conc mass
77	106	From							
78	108	Valve	0.833			1	4	4	
79	109		0.698			1	4	4	Flange
80	110	Bend	0'8"			1	4	4	
81	111		1.002	1.002		1	4	4	Conc mass
82	112	From							
83	113			1.224		1	2	2	
84	114			0'6-3/4"		1	2	2	Flange
85	115	Valve		1.344		1	2	2	
86	116	Rigid	0.083	0.817		1	2	2	Conc mass
87	115	From							
88	117	Valve	0'10-1/2"			1	3	3	
89	118		0.833			1	3	3	Flange

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
90	119	Bend	0.833			1	3	3	
91	120		1.002	1.002		1	3	3	Conc mass
92	122	From							
93	123			1.224		1	2	2	
94	124			0'6-3/4"		1	2	2	Flange
95	125	Valve		1.344		1	2	2	
96	126	Rigid	0.083	0.817		1	2	2	Conc mass
97	125	From							
98	127	Valve	0'10-1/2"			1	3	3	Flange
99	128		0.833			1	3	3	
100	129	Bend	0.833			1	3	3	
101	130		1.002	1.002		1	3	3	Conc mass
102	131	From							
103	132			1.224		1	2	2	
104	133			0'6-3/4"		1	2	2	Flange
105	134	Valve		1.344		1	2	2	
106	135	Rigid	0.083	0.817		1	2	2	Conc mass
107	134	From							
108	136	Valve	0'10-1/2"			1	3	2	
109	137		0.833			1	3	3	Flange
110	138	Bend	0.833			1	3	3	
111	139		1.002	1.002		1	3	3	Conc mass
112	140	From							
113	141			1.198		1	2	2	
114	142	Valve		1.833		1	2	2	
115	143	Rigid	1'3"			1	2	2	Conc mass

## Bends

Bend Node	Radius (inch)	Thickness (inch)	Int. Node	Angle (deg)	Int. Node	Angle (deg)
3	36.0	U				
17	72.0	U				
31	72.0	U				
39	72.0	U				
41	36.0	U				
67	72.0	U				
700	9.0	L				
720	6.0	S				
80	9.0	L				
84	9.0	L				
94	9.0	L				
110	8.0	S				
119	10.0	S				
129	10.0	S				
138	10.0	S				

## Valves

From	To	Weight (lb)	Thick X	Insul Wgt X	Add Wght (lb)	DX (inch)	DY (inch)	DZ (inch)
61	62	0	3.00	1.75				



## Valves

From	To	Weight (lb)	Thick X	Insul Wgt X	Add Wght (lb)	DX (inch)	DY (inch)	DZ (inch)
62	64	0	3.00	1.75				
730	740	575	3.00	1.75				
740	750	575	3.00	1.75				
75	76	0	3.00	1.75				
76	78	0	3.00	1.75				
105	106	0	3.00	1.75				
106	108	0	3.00	1.75				
114	115	0	3.00	1.75				
115	117	0	3.00	1.75				
124	125	0	3.00	1.75				
125	127	0	3.00	1.75				
133	134	0	3.00	1.75				
134	136	0	3.00	1.75				
141	142	0	3.00	1.75				

## Reducers

From	To	OD1 (inch)	Thk1 (inch)	OD2 (inch)	Thk2 (inch)	Cone Angle (deg)	Knuc Delta kles (inch)
74	75	6.625	0.28	3.5	0.28	0.00	
78	79	3.5	0.28	6.625	0.28	0.00	

## Rigid Elements

From	To	Weight(lb)
62	63	0
76	77	0
106	107	0
115	116	0
125	126	0
134	135	0
142	143	0

## Anchors

Node	KX	(lb/inch)		KXX	(in-lb/deg)		Releases		
		KY	KZ		KYY	KZZ	X	Y	Z
1	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			
58		1.1980E+5					Y	Y	Y
121	Rigid	Rigid				Rigid		Y	Y
144	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			

## Hangers

Node	Type	No. of	Load var(%)	Short Range	SpringRate (lb/inch)	HangerLoad (lb)	Load type
6	User hanger	1			1000	6670	Hot

### Hangers

Node	Type	No. of	Load var(%)	Short Range (lb/inch)	SpringRate (lb)	HangerLoad (lb)	Load type
20	User hanger	1			1200	6250	Hot
23	User hanger	1			1000	4265	Hot
25	User hanger	1			1000	4800	Hot
29	User hanger	1			500	5520	Hot
34	User hanger	1			435	1990	Hot
40	User hanger	1			1200	7130	Hot
47	User hanger	1			500	6465	Hot
50	User hanger	1			500	5250	Hot
55	User hanger	1			670	3340	Hot
65	Rod Hanger	1					
102	Rod Hanger	1					
140	Rod Hanger	1					
760	User hanger	1			100	675	Hot
840	User hanger	1			140	670	Hot
96	User hanger	1			74	500	Hot
98	Rod Hanger	1					

### Snubbers

Node	Stiffness (lb/inch)	Direction		
		X comp	Y comp	Z comp
14	Rigid			1.000
27	Rigid	1.000		
35	Rigid	1.125		-6.000
43	Rigid		1.000	
44	Rigid		-2.604	7.000
52	Rigid		-2.740	7.000
57	Rigid	1.000		
59	Rigid		-2.870	7.000
70	Rigid	7.000	-3.021	
82	Rigid	-4.357	0.687	0.891
87	Rigid		1.000	
89	Rigid	3.190	-2.206	4.577
92	Rigid			1.000
99	Rigid	-6.357		-3.570

### Flanges

Node	Weight(lb)	Type
105	164	Weld neck
109	273	Weld neck
114	164	Weld neck
118	454	Weld neck
124	164	Weld neck
127	454	Weld neck
133	164	Weld neck
137	454	Weld neck

## Concentrated Masses

Node	Weight (lb)	DX (inch)	DY (inch)	DZ (inch)
63	18400			
77	540			
107	1257			
111	44.50			
116	1257			
120	83			
126	1257			
130	83			
135	1257			
139	83			
143	1320			

## Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
1	0'0"	0'0"	0'0"
3A	0'0"	-9'6"	0'0"
3	0'0"	-12'6"	0'0"
3B	0'0"	-12'6"	3'0"
6	0'0"	-12'6"	11.854
7	0'0"	-12'6"	15.437
14	0'0"	-12'6"	23.770
17A	0'0"	-12'6"	25.354
17	0'0"	-12'6"	31.354
17B	6'0"	-12'6"	31.354
20	7'6"	-12'6"	31.354
23	23.833	-12'6"	31.354
25	42'7-1/2"	-12'6"	31.354
27	45.958	-12'6"	31.354
29	60.375	-12'6"	31.354
31A	61.375	-12'6"	31.354
31	67.375	-12'6"	31.354
31B	67.375	-12'6"	37.354
34	67.375	-12'6"	46.354
35	67.375	-12'6"	51.854
39A	67.375	-12'6"	53.354
39	67.375	-12'6"	59.354
39B	67.375	-18'6"	59.354
40	67.375	-18'6"	59.354
41A	67.375	-18'6"	59.354
41	67.375	-21'6"	59.354
41B	70.375	-21'6"	59.354
43	75.000	-21'6"	59.354
44	81'0-1/2"	-21'6"	59.354
47	84.688	-21'6"	59.354
50	103.271	-21'6"	59.354
52	107.271	-21'6"	59.354
55	120.021	-21'6"	59.354
57	126.833	-21'6"	59.354
58	128.291	-21'6"	59.354

Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
59	130.291	-21'6"	59.354
61	132.353	-21'6"	59.354
62	134.270	-21'6"	59.354
64	138.187	-21'6"	59.354
65	138.999	-21'6"	59.354
67A	142.769	-21'6"	59.354
67	148.666	-21'6"	59.354
67B	148.768	-21'6"	53.458
70	148.884	-21'6"	46.854
73	148.953	-21'6"	42.854
102	148.985	-21'6"	41.021
103	149.076	-21'6"	35'9-3/4"
112	149.120	-21'6"	33.313
121	149.145	-21'6"	31.855
122	149.163	-21'6"	30.813
131	149.207	-21'6"	28.313
140	149'3"	-21'6"	25.813
144	149.469	-21'6"	13.301
700A	8.653	-12'6"	15.437
700	8.964	-12'6"	15.437
700B	9.184	-12.280	15.437
710	9.284	-12.180	15.437
720A	9.458	-12.006	15.437
720	9.604	-11.860	15.437
720B	9.811	-11.860	15.437
730	9.916	-11.860	15.437
740	10.666	-11.860	15.437
750	11.416	-11.860	15.437
760	12.958	-11.860	15.437
63	137.270	-19'1"	59.354
74	148.953	-20'1"	42.854
75	148.953	-19.634	42.854
76	148.953	-19.184	42.854
77	148.953	-17.726	42.854
78	148.503	-19.184	42.854
79	148.053	-19.184	42.854
80A	141.203	-19.184	42.854
80	140.453	-19.184	42.854
80B	140.453	-18.434	42.854
82	140.453	-15.080	42.854
840	140.453	-13.038	42.854
84A	140.453	-12.288	42.854
84	140.453	-11.538	42.854
84B	140.453	-11.538	42.104
87	140.453	-11.538	41.854
89	140.453	-11.538	33.979
92	140.453	-11.538	30.729
94A	140.453	-11.538	29.479
94	140.453	-11.538	28.729
94B	139.703	-11.538	28.729
96	138.620	-11.538	28.729
98	118.537	-11.538	28.729

Coordinates

Node	X (ft'in")	Y (ft'in")	Z (ft'in")
99	111.537	-11.538	28.729
101	110.537	-11.538	28.729
104	149.076	-20.276	35'9-3/4"
105	149.076	-19.713	35'9-3/4"
106	149.076	-18.536	35'9-3/4"
107	149.159	-17.552	35'9-3/4"
108	149.909	-18.536	35'9-3/4"
109	150.607	-18.536	35'9-3/4"
110A	150.997	-18.536	35'9-3/4"
110	151.273	-18.536	35'9-3/4"
110B	151.469	-18.341	35'9-3/4"
111	152.275	-17.534	35'9-3/4"
113	149.120	-20.276	33.313
114	149.120	-19.713	33.313
115	149.120	-18.369	33.313
116	149.203	-17.552	33.313
117	149.995	-18.369	33.313
118	150.828	-18.369	33.313
119A	151.316	-18.369	33.313
119	151.661	-18.369	33.313
119B	151.905	-18.125	33.313
120	152.663	-17.367	33.313
123	149.163	-20.276	30.813
124	149.163	-19.713	30.813
125	149.163	-18.369	30.813
126	149.246	-17.552	30.813
127	150.038	-18.369	30.813
128	150.871	-18.369	30.813
129A	151.359	-18.369	30.813
129	151.704	-18.369	30.813
129B	151.948	-18.125	30.813
130	152.706	-17.367	30.813
132	149.207	-20.276	28.313
133	149.207	-19.713	28.313
134	149.207	-18.369	28.313
135	149.290	-17.552	28.313
136	150.082	-18.369	28.313
137	150.915	-18.369	28.313
138A	151.402	-18.369	28.313
138	151.748	-18.369	28.313
138B	151.992	-18.125	28.313
139	152.750	-17.367	28.313
141	149'3"	-20.302	25.813
142	149'3"	-18.469	25.813
143	150'6"	-18.469	25.813

Pipe material 1: A106 Grade B

Density = 0.2800 (lb/in3), Nu = 0.300, Joint factor = 1.00, Type = CS

Temp (F)	E (psi)	Alpha (in/in/F)	Allowable (psi)
-100	29.0E+6	5.65E-6	15000
70	27.9E+6	6.07E-6	15000
200	27.7E+6	6.38E-6	15000
300	27.4E+6	6.60E-6	15000
400	27.0E+6	6.82E-6	15000
500	26.4E+6	7.02E-6	15000
600	25.7E+6	7.23E-6	15000
650	25.3E+6	7.34E-6	15000
700	24.8E+6	7.44E-6	14350
750	24.8E+6	7.55E-6	12950
800	23.4E+6	7.65E-6	10800

#### Pipe Sections

Name	Nominal Dia.	Sch	O.D. (inch)	Thk (inch)	Cor. Al (inch)	M. Tol (%)	Ins. Dens (lb/ft3)	Ins. Th (inch)	Lin. Dens (lb/ft3)	Lin. Th (inch)
1	24"	60	24.0	0.968	0.0	0.0				
2	6"	STD	6.625	0.28	0.0	0.0				
3	10"	60	10.75	0.5	0.0	0.0				
4	8"	STD	8.625	0.322	0.0	0.0				

#### Loads

Acceleration load: X = 0.00, Y = 0.00, Z = 0.00 (g's)

Acceleration load combination = Algebraic sum

Wind velocity = 0 (mph)

Shape factor = 0.60

Wind direction: X comp = 0.000, Y comp = 0.000, Z comp = 0.000

X spectrum: CRW2

Factor = 2.0000 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.500	0.040
0.700	0.064
1.000	0.150
1.200	0.210
1.300	0.220
2.500	0.220
3.150	0.220
4.000	0.440
5.000	0.440
5.250	0.240
6.750	0.240
7.000	0.240



8.000	0.240
10.000	0.250
12.500	0.250
13.000	0.240
14.000	0.440
14.500	0.440
18.000	0.440
20.000	0.180
22.000	0.180
31.000	0.180
34.000	0.180
36.000	0.100
50.000	0.100

Y spectrum: GRS (fig 22)

Factor = 1.3300 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.700	0.065
1.000	0.150
1.300	0.190
1.500	0.190
2.000	0.187
3.800	0.187
5.500	0.175
10.000	0.118
15.000	0.080
20.000	0.072
25.000	0.070
31.000	0.059
40.000	0.052
50.000	0.050

Mode sum = Closely spaced

Direction sum = SRSS

Number of thermal loads = 1

#### Pipe Loads

Load Name	T1 (F)	P1 (psi)	T2 (F)	P2 (psi)	T3 (F)	P3 (psi)	Specific gravity	Add.Wgt (lb/ft)	Wind Load
1	600	1050						37.700	
2	600	1050						10.030	
3	600	1050						16.800	
4	600	1050						13.500	

#### B31.1 (1967) Code Compliance (sorted stresses)

Sustained			Expansion			Occasional		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+S0 (psi)	SL+S0/ 1.20SH
7	15084	1.01	41B	12839	0.57	78	23621	1.31

## B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
75	10260	0.68	38	12604	0.56	7	19132	1.06
78	10045	0.67	121	9071	0.40	75	16340	0.91
720B	9897	0.66	112	8629	0.38	112	15784	0.88
720A	9025	0.60	122	8340	0.37	131	15044	0.84
114	8586	0.57	103	7871	0.35	84A	13897	0.77
112	8585	0.57	1	7084	0.31	140	13877	0.77
113	8585	0.57	3A	6990	0.31	113	13748	0.76
133	8582	0.57	131	6586	0.29	122	13426	0.75
131	8581	0.57	102	6292	0.28	84B	13393	0.74
132	8581	0.57	41A	6102	0.27	132	13215	0.73
140	8542	0.57	39B	5992	0.27	114	12817	0.71
141	8542	0.57	39A	5847	0.26	133	12380	0.69
124	8051	0.54	73	5736	0.25	103	12274	0.68
122	8051	0.54	43	5446	0.24	141	12130	0.67
123	8051	0.54	44	4918	0.22	123	11842	0.66
74	7947	0.53	140	4832	0.21	124	11118	0.62
73	7947	0.53	47	4599	0.20	79	11072	0.62
41A	7883	0.53	70	4522	0.20	104	10829	0.60
79	7842	0.52	144	3948	0.18	720B	10552	0.59
700B	7833	0.52	35	3873	0.17	94B	10490	0.58
94B	7747	0.52	17B	3576	0.16	80B	10427	0.58
58	7728	0.52	67B	3480	0.15	105	10168	0.56
57	7712	0.51	6	3173	0.14	720A	10132	0.56
59	7667	0.51	31A	3154	0.14	840	9508	0.53
61	7570	0.50	75	3135	0.14	87	9481	0.53
17A	7567	0.50	50	3001	0.13	700B	9357	0.52
730	7539	0.50	78	2988	0.13	82	9302	0.52
750	7534	0.50	52	2664	0.12	74	9282	0.52
98	7512	0.50	20	2455	0.11	38	9218	0.51
105	7500	0.50	34	2341	0.10	39	9108	0.51
103	7500	0.50	29	2197	0.10	80A	9098	0.51
104	7500	0.50	7	2175	0.10	700A	9027	0.50
31B	7457	0.50	17A	1909	0.08	41A	8985	0.50
55	7402	0.49	55	1626	0.07	73	8941	0.50
39B	7374	0.49	31B	1551	0.07	3A	8864	0.49
108	7348	0.49	14	1222	0.05	98	8687	0.48
80B	7333	0.49	57	1134	0.05	96	8403	0.47
84A	7333	0.49	58	1043	0.05	17A	8365	0.46
14	7281	0.49	23	1034	0.05	1	8306	0.46
110A	7268	0.48	27	970	0.04	59	8269	0.46
67B	7260	0.48	59	868	0.04	58	8235	0.46
96	7231	0.48	74	780	0.03	31B	8182	0.45
3A	7198	0.48	79	707	0.03	57	8170	0.45
110B	7157	0.48	80B	701	0.03	61	8145	0.45
102	7154	0.48	84A	701	0.03	47	8109	0.45
109	7140	0.48	25	698	0.03	44	8085	0.45
38	7133	0.48	61	688	0.03	39B	8068	0.45
17B	7121	0.47	720A	668	0.03	94A	7863	0.44
89	7102	0.47	84B	660	0.03	14	7829	0.43
20	7096	0.47	700A	627	0.03	25	7798	0.43
52	7076	0.47	720B	600	0.03	67B	7774	0.43

## B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----	
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi) 1.20SH
31A	7047	0.47	700B	549	0.02	39A	7769 0.43
111	7031	0.47	67A	363	0.02	730	7734 0.43
710	7012	0.47	80A	313	0.01	55	7706 0.43
29	6979	0.47	82	309	0.01	17B	7686 0.43
47	6914	0.46	840	309	0.01	65	7661 0.43
65	6844	0.46	87	288	0.01	23	7659 0.43
34	6828	0.46	710	236	0.01	52	7656 0.43
25	6820	0.45	730	195	0.01	750	7645 0.42
23	6800	0.45	64	192	0.01	31A	7639 0.42
1	6796	0.45	65	133	0.01	64	7632 0.42
700A	6790	0.45	94B	125	0.01	27	7582 0.42
64	6712	0.45	89	121	0.01	710	7568 0.42
67A	6709	0.45	750	99	0.00	41B	7535 0.42
840	6706	0.45	96	79	0.00	108	7506 0.42
82	6706	0.45	92	58	0.00	20	7491 0.42
50	6700	0.45	94A	54	0.00	110A	7484 0.42
92	6684	0.45	123	0	0.00	43	7444 0.41
41B	6674	0.44	124	0	0.00	29	7430 0.41
44	6660	0.44	104	0	0.00	35	7405 0.41
94A	6658	0.44	113	0	0.00	102	7356 0.41
27	6648	0.44	105	0	0.00	34	7316 0.41
35	6626	0.44	141	0	0.00	6	7303 0.41
144	6618	0.44	114	0	0.00	110B	7295 0.41
43	6607	0.44	132	0	0.00	109	7224 0.40
6	6607	0.44	133	0	0.00	50	7220 0.40
70	6601	0.44	98	0	0.00	67A	7160 0.40
39A	6583	0.44	110A	0	0.00	92	7059 0.39
80A	6567	0.44	108	0	0.00	111	7031 0.39
121	6563	0.44	99	0	0.00	70	6818 0.38
84B	6346	0.42	110B	0	0.00	144	6709 0.37
87	6336	0.42	138A	0	0.00	121	6679 0.37
99	6231	0.42	129A	0	0.00	99	6246 0.35
101	6211	0.41	109	0	0.00	760	6211 0.35
760	6211	0.41	127	0	0.00	101	6211 0.35
117	5921	0.39	101	0	0.00	117	6121 0.34
136	5921	0.39	129B	0	0.00	136	6082 0.34
119A	5809	0.39	119B	0	0.00	119A	6016 0.33
138A	5809	0.39	137	0	0.00	138A	5982 0.33
129A	5809	0.39	128	0	0.00	129A	5957 0.33
127	5806	0.39	117	0	0.00	127	5910 0.33
137	5738	0.38	119A	0	0.00	119B	5840 0.32
118	5738	0.38	138B	0	0.00	118	5840 0.32
128	5738	0.38	136	0	0.00	137	5821 0.32
138B	5720	0.38	118	0	0.00	138B	5817 0.32
129B	5720	0.38	139	0	0.00	128	5809 0.32
119B	5720	0.38	111	0	0.00	129B	5802 0.32
130	5644	0.38	760	0	0.00	139	5644 0.31
120	5644	0.38	120	0	0.00	130	5644 0.31
139	5644	0.38	130	0	0.00	120	5644 0.31

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---			--- Occasional ---			
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
1	1050	6796	15000	0.45	7084	22500	0.31	8306	18000	0.46
3A	1250	6823	15000	0.45	6599	22500	0.29	7582	18000	0.42
3A	1050	7198	15000	0.48	6990	22500	0.31	8864	18000	0.49
3B	1250	7133	15000	0.48	12604	22500	0.56	9218	18000	0.51
3B	1050	6793	15000	0.45	5809	22500	0.26	7744	18000	0.43
6	1250	6607	15000	0.44	3173	22500	0.14	7303	18000	0.41
6	1050	6607	15000	0.44	3173	22500	0.14	7303	18000	0.41
7	1250	6967	15000	0.46	2175	22500	0.10	7663	18000	0.43
7	1050	6967	15000	0.46	2167	22500	0.10	7666	18000	0.43
14	1250	7281	15000	0.49	1222	22500	0.05	7829	18000	0.43
14	1050	7281	15000	0.49	1222	22500	0.05	7829	18000	0.43
17A	1250	7275	15000	0.48	1529	22500	0.07	7852	18000	0.44
17A	1050	7567	15000	0.50	1909	22500	0.08	8365	18000	0.46
17B	1250	7121	15000	0.47	3576	22500	0.16	7686	18000	0.43
17B	1050	6952	15000	0.46	2588	22500	0.12	7360	18000	0.41
20	1250	7096	15000	0.47	2455	22500	0.11	7491	18000	0.42
20	1050	7096	15000	0.47	2455	22500	0.11	7491	18000	0.42
23	1250	6800	15000	0.45	1034	22500	0.05	7659	18000	0.43
23	1050	6800	15000	0.45	1034	22500	0.05	7659	18000	0.43
25	1250	6820	15000	0.45	698	22500	0.03	7798	18000	0.43
25	1050	6820	15000	0.45	698	22500	0.03	7798	18000	0.43
27	1250	6648	15000	0.44	970	22500	0.04	7582	18000	0.42
27	1050	6648	15000	0.44	970	22500	0.04	7582	18000	0.42
29	1250	6979	15000	0.47	2197	22500	0.10	7430	18000	0.41
29	1050	6979	15000	0.47	2197	22500	0.10	7430	18000	0.41
31A	1250	6898	15000	0.46	2283	22500	0.10	7327	18000	0.41
31A	1050	7047	15000	0.47	3154	22500	0.14	7639	18000	0.42
31B	1250	7457	15000	0.50	1551	22500	0.07	8182	18000	0.45
31B	1050	7194	15000	0.48	1386	22500	0.06	7719	18000	0.43
34	1250	6828	15000	0.46	2341	22500	0.10	7316	18000	0.41
34	1050	6828	15000	0.46	2341	22500	0.10	7316	18000	0.41
35	1250	6626	15000	0.44	3873	22500	0.17	7405	18000	0.41
35	1050	6626	15000	0.44	3873	22500	0.17	7405	18000	0.41
39A	1250	6563	15000	0.44	4308	22500	0.19	7421	18000	0.41

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---				--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
39A	1050	6583	15000	0.44	5817	22500	0.26	7769	18000	0.43
39B	1250	7374	15000	0.49	5992	22500	0.27	8068	18000	0.45
41A	1050	7883	15000	0.53	6102	22500	0.27	8985	18000	0.50
41B	1250	6674	15000	0.44	12839	22500	0.57	7535	18000	0.42
41B	1050	6584	15000	0.44	5852	22500	0.26	6976	18000	0.39
43	1250	6607	15000	0.44	5446	22500	0.24	7444	18000	0.41
43	1050	6607	15000	0.44	5446	22500	0.24	7444	18000	0.41
44	1250	6660	15000	0.44	4918	22500	0.22	8085	18000	0.45
44	1050	6660	15000	0.44	4918	22500	0.22	8085	18000	0.45
47	1250	6914	15000	0.46	4599	22500	0.20	8109	18000	0.45
47	1050	6914	15000	0.46	4599	22500	0.20	8109	18000	0.45
50	1250	6700	15000	0.45	3001	22500	0.13	7220	18000	0.40
50	1050	6700	15000	0.45	3001	22500	0.13	7220	18000	0.40
52	1250	7076	15000	0.47	2664	22500	0.12	7656	18000	0.43
52	1050	7076	15000	0.47	2664	22500	0.12	7656	18000	0.43
55	1250	7402	15000	0.49	1626	22500	0.07	7706	18000	0.43
55	1050	7402	15000	0.49	1626	22500	0.07	7706	18000	0.43
57	1250	7712	15000	0.51	1134	22500	0.05	8170	18000	0.45
57	1050	7712	15000	0.51	1134	22500	0.05	8170	18000	0.45
58	1250	7728	15000	0.52	1043	22500	0.05	8235	18000	0.46
58	1050	7728	15000	0.52	1043	22500	0.05	8235	18000	0.46
59	1250	7667	15000	0.51	868	22500	0.04	8269	18000	0.46
59	1050	7667	15000	0.51	868	22500	0.04	8269	18000	0.46
61	1250	7570	15000	0.50	688	22500	0.03	8145	18000	0.45
64	1050	6712	15000	0.45	192	22500	0.01	7632	18000	0.42
65	1250	6844	15000	0.46	133	22500	0.01	7661	18000	0.43
65	1050	6844	15000	0.46	133	22500	0.01	7661	18000	0.43
67A	1250	6653	15000	0.44	262	22500	0.01	6980	18000	0.39
67A	1050	6709	15000	0.45	363	22500	0.02	7160	18000	0.40
67B	1250	7260	15000	0.48	3480	22500	0.15	7774	18000	0.43
67B	1050	7052	15000	0.47	2518	22500	0.11	7424	18000	0.41
70	1250	6601	15000	0.44	4522	22500	0.20	6818	18000	0.38
70	1050	6601	15000	0.44	4522	22500	0.20	6818	18000	0.38
73	1250	6876	15000	0.46	5736	22500	0.25	7066	18000	0.39



B31.1 (1967) Code Compliance										
Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---				--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
73	1050	6871	15000	0.46	5736	22500	0.25	7071	18000	0.39
102	1250	7154	15000	0.48	6292	22500	0.28	7356	18000	0.41
102	1050	7154	15000	0.48	6292	22500	0.28	7356	18000	0.41
103	1250	6537	15000	0.44	7871	22500	0.35	6642	18000	0.37
103	1050	6537	15000	0.44	7871	22500	0.35	6640	18000	0.37
112	1250	6551	15000	0.44	8629	22500	0.38	6633	18000	0.37
112	1050	6552	15000	0.44	8629	22500	0.38	6633	18000	0.37
121	1250	6561	15000	0.44	9071	22500	0.40	6677	18000	0.37
121	1050	6563	15000	0.44	9071	22500	0.40	6679	18000	0.37
122	1250	6563	15000	0.44	8340	22500	0.37	6645	18000	0.37
122	1050	6564	15000	0.44	8340	22500	0.37	6648	18000	0.37
131	1250	6592	15000	0.44	6586	22500	0.29	6676	18000	0.37
131	1050	6593	15000	0.44	6586	22500	0.29	6679	18000	0.37
140	1250	6622	15000	0.44	4832	22500	0.21	6733	18000	0.37
140	1050	6621	15000	0.44	4832	22500	0.21	6731	18000	0.37
144	1250	6618	15000	0.44	3948	22500	0.18	6709	18000	0.37
7	1050	15084	15000	1.01	832	22500	0.04	19132	18000	1.06
700A	1312	6467	15000	0.43	277	22500	0.01	7454	18000	0.41
700A	1050	6790	15000	0.45	627	22500	0.03	9027	18000	0.50
700B	1312	7833	15000	0.52	549	22500	0.02	9357	18000	0.52
700B	1050	6927	15000	0.46	242	22500	0.01	7600	18000	0.42
710	1312	7012	15000	0.47	236	22500	0.01	7568	18000	0.42
710	1050	7012	15000	0.47	236	22500	0.01	7568	18000	0.42
720A	1312	7159	15000	0.48	225	22500	0.01	7532	18000	0.42
720A	1050	9025	15000	0.60	668	22500	0.03	10132	18000	0.56
720B	1312	9897	15000	0.66	600	22500	0.03	10552	18000	0.59
720B	1050	7453	15000	0.50	202	22500	0.01	7673	18000	0.43
730	1312	7539	15000	0.50	195	22500	0.01	7734	18000	0.43
750	1050	7534	15000	0.50	99	22500	0.00	7645	18000	0.42
760	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35
73	1050	7947	15000	0.53	780	22500	0.03	8941	18000	0.50
74	1312	7947	15000	0.53	780	22500	0.03	9281	18000	0.52
74	1050	7947	15000	0.53	780	22500	0.03	9282	18000	0.52
75		10260	15000	0.68	3135	22500	0.14	16340	18000	0.91



B31.1 (1967) Code Compliance										
Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---			--- Occasional ---			
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO 1.20SH (psi)	SL+SO/ 1.20SH	
78	1050	10045	15000	0.67	2988	22500	0.13	23621	18000	1.31
79		7842	15000	0.52	707	22500	0.03	11072	18000	0.62
79	1050	7842	15000	0.52	707	22500	0.03	11072	18000	0.62
80A	1312	6368	15000	0.42	308	22500	0.01	7485	18000	0.42
80A	1050	6567	15000	0.44	313	22500	0.01	9098	18000	0.51
80B	1312	7333	15000	0.49	701	22500	0.03	10427	18000	0.58
80B	1050	6706	15000	0.45	309	22500	0.01	8072	18000	0.45
82	1312	6706	15000	0.45	309	22500	0.01	9302	18000	0.52
82	1050	6706	15000	0.45	309	22500	0.01	9302	18000	0.52
840	1312	6706	15000	0.45	309	22500	0.01	9508	18000	0.53
840	1050	6706	15000	0.45	309	22500	0.01	9508	18000	0.53
84A	1312	6706	15000	0.45	309	22500	0.01	9603	18000	0.53
84A	1050	7333	15000	0.49	701	22500	0.03	13897	18000	0.77
84B	1312	6346	15000	0.42	660	22500	0.03	13393	18000	0.74
84B	1050	6271	15000	0.42	293	22500	0.01	9381	18000	0.52
87	1312	6336	15000	0.42	288	22500	0.01	9481	18000	0.53
87	1050	6336	15000	0.42	288	22500	0.01	9481	18000	0.53
89	1312	7102	15000	0.47	121	22500	0.01	9108	18000	0.51
89	1050	7102	15000	0.47	121	22500	0.01	9108	18000	0.51
92	1312	6684	15000	0.45	58	22500	0.00	7059	18000	0.39
92	1050	6684	15000	0.45	58	22500	0.00	7059	18000	0.39
94A	1312	6408	15000	0.43	42	22500	0.00	6940	18000	0.39
94A	1050	6658	15000	0.44	54	22500	0.00	7863	18000	0.44
94B	1312	7747	15000	0.52	125	22500	0.01	10490	18000	0.58
94B	1050	6889	15000	0.46	55	22500	0.00	8100	18000	0.45
96	1312	7231	15000	0.48	79	22500	0.00	8403	18000	0.47
96	1050	7231	15000	0.48	79	22500	0.00	8403	18000	0.47
98	1312	7512	15000	0.50	0	22500	0.00	8687	18000	0.48
98	1050	7512	15000	0.50	0	22500	0.00	8687	18000	0.48
99	1312	6231	15000	0.42	0	22500	0.00	6246	18000	0.35
99	1050	6231	15000	0.42	0	22500	0.00	6246	18000	0.35
101	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35
103	1050	7500	15000	0.50	0	22500	0.00	12274	18000	0.68
104	1312	7500	15000	0.50	0	22500	0.00	10829	18000	0.60

B31.1 (1967) Code Compliance										
Node	Press	--- Sustained ---		--- Expansion ---				--- Occasional ---		
	(psi) Allow	SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO 1 (psi)	20SH (psi)	SL+SO/ 1.20SH
104	1050	7500	15000	0.50	0	22500	0.00	10829	18000	0.60
105	1312	7500	15000	0.50	0	22500	0.00	10168	18000	0.56
108	1050	7348	15000	0.49	0	22500	0.00	7506	18000	0.42
109	1154	7140	15000	0.48	0	22500	0.00	7224	18000	0.40
109	1050	7140	15000	0.48	0	22500	0.00	7224	18000	0.40
110A	1154	7105	15000	0.47	0	22500	0.00	7173	18000	0.40
110A	1050	7268	15000	0.48	0	22500	0.00	7484	18000	0.42
110B	1154	7157	15000	0.48	0	22500	0.00	7295	18000	0.41
110B	1050	7071	15000	0.47	0	22500	0.00	7114	18000	0.40
111	1154	7031	15000	0.47	0	22500	0.00	7031	18000	0.39
112	1050	8585	15000	0.57	0	22500	0.00	15784	18000	0.88
113	1312	8585	15000	0.57	0	22500	0.00	13748	18000	0.76
113	1050	8585	15000	0.57	0	22500	0.00	13748	18000	0.76
114	1312	8586	15000	0.57	0	22500	0.00	12817	18000	0.71
117	1050	5921	15000	0.39	0	22500	0.00	6121	18000	0.34
118	1449	5738	15000	0.38	0	22500	0.00	5840	18000	0.32
118	1050	5738	15000	0.38	0	22500	0.00	5840	18000	0.32
119A	1449	5705	15000	0.38	0	22500	0.00	5781	18000	0.32
119A	1050	5809	15000	0.39	0	22500	0.00	6016	18000	0.33
119B	1449	5720	15000	0.38	0	22500	0.00	5840	18000	0.32
119B	1050	5672	15000	0.38	0	22500	0.00	5716	18000	0.32
120	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
122	1050	8051	15000	0.54	0	22500	0.00	13426	18000	0.75
123	1312	8051	15000	0.54	0	22500	0.00	11842	18000	0.66
123	1050	8051	15000	0.54	0	22500	0.00	11842	18000	0.66
124	1312	8051	15000	0.54	0	22500	0.00	11118	18000	0.62
127	1050	5806	15000	0.39	0	22500	0.00	5910	18000	0.33
128	1449	5738	15000	0.38	0	22500	0.00	5809	18000	0.32
128	1050	5738	15000	0.38	0	22500	0.00	5809	18000	0.32
129A	1449	5705	15000	0.38	0	22500	0.00	5759	18000	0.32
129A	1050	5809	15000	0.39	0	22500	0.00	5957	18000	0.33
129B	1449	5720	15000	0.38	0	22500	0.00	5802	18000	0.32
129B	1050	5672	15000	0.38	0	22500	0.00	5702	18000	0.32
130	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31

B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---			--- Expansion ---			--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
131	1050	8581	15000	0.57	0	22500	0.00	15044	18000	0.84
132	1312	8581	15000	0.57	0	22500	0.00	13215	18000	0.73
132	1050	8581	15000	0.57	0	22500	0.00	13215	18000	0.73
133	1312	8582	15000	0.57	0	22500	0.00	12380	18000	0.69
136	1050	5921	15000	0.39	0	22500	0.00	6082	18000	0.34
137	1449	5738	15000	0.38	0	22500	0.00	5821	18000	0.32
137	1050	5738	15000	0.38	0	22500	0.00	5821	18000	0.32
138A	1449	5705	15000	0.38	0	22500	0.00	5768	18000	0.32
138A	1050	5809	15000	0.39	0	22500	0.00	5982	18000	0.33
138B	1449	5720	15000	0.38	0	22500	0.00	5817	18000	0.32
138B	1050	5672	15000	0.38	0	22500	0.00	5707	18000	0.32
139	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
140	1050	8542	15000	0.57	0	22500	0.00	13877	18000	0.77
141	1312	8542	15000	0.57	0	22500	0.00	12130	18000	0.67

Loads on Anchors: Sustained (W+P)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	114	-4288	0	-5669	4317	-7349
58		850				
121	-170	-5411				-4957
144	56	-1699	-0	3538	331	-867

Loads on Hangers: Sustained (W+P)

Node	Type	Load(lb)	No.of	Total(lb)
6	User hanger	-6235	1	-6235
20	User hanger	-6131	1	-6131
23	User hanger	-4175	1	-4175
25	User hanger	-4734	1	-4734
29	User hanger	-5466	1	-5466
34	User hanger	-2060	1	-2060
40	User hanger	-7300	1	-7300
47	User hanger	-6407	1	-6407
50	User hanger	-5200	1	-5200
55	User hanger	-3313	1	-3313
65	Rod Hanger	-22912	1	-22912
102	Rod Hanger	-9787	1	-9787
140	Rod Hanger	-5968	1	-5968
760	User hanger	-630	1	-630
840	User hanger	-718	1	-718
96	User hanger	-518	1	-518
98	Rod Hanger	-529	1	-529

## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	-0.005	-0.000	0.003	-0.0034	0.0034	-0.0048
3B	-0.008	0.007	0.008	-0.0163	0.0040	-0.0125
6	0.001	0.041	0.008	-0.0200	0.0059	-0.0190
7	0.006	0.056	0.008	-0.0218	0.0066	-0.0215
14	0.018	0.103	0.008	-0.0331	0.0077	-0.0233
17A	0.021	0.115	0.008	-0.0356	0.0078	-0.0236
17B	0.032	0.149	-0.003	-0.0624	0.0097	-0.0254
20	0.032	0.141	-0.006	-0.0645	0.0098	-0.0270
23	0.032	0.031	-0.041	-0.0876	0.0106	-0.0354
25	0.032	-0.112	-0.084	-0.1142	0.0114	-0.0375
27	0.032	-0.139	-0.092	-0.1189	0.0116	-0.0389
29	0.032	-0.261	-0.129	-0.1393	0.0123	-0.0436
31A	0.032	-0.270	-0.131	-0.1407	0.0123	-0.0445
31B	0.048	-0.137	-0.147	-0.1659	0.0133	-0.0462
34	0.073	0.187	-0.147	-0.1762	0.0130	-0.0486
35	0.088	0.392	-0.147	-0.1789	0.0126	-0.0501
39A	0.092	0.448	-0.147	-0.1791	0.0124	-0.0505
39B	0.038	0.668	0.065	-0.1571	0.0084	-0.0561
41A	0.038	0.668	0.065	-0.1570	0.0084	-0.0561
41B	0.001	0.631	0.148	-0.1356	0.0151	-0.0605
43	0.001	0.572	0.134	-0.1281	0.0143	-0.0600
44	0.001	0.496	0.116	-0.1181	0.0134	-0.0601
47	0.001	0.450	0.106	-0.1122	0.0128	-0.0620
50	0.002	0.211	0.062	-0.0817	0.0100	-0.0570
52	0.002	0.164	0.054	-0.0751	0.0094	-0.0539
55	0.002	0.047	0.032	-0.0542	0.0074	-0.0318
57	0.002	0.012	0.022	-0.0430	0.0063	-0.0167
58	0.002	0.007	0.020	-0.0406	0.0061	-0.0131
59	0.002	0.003	0.017	-0.0373	0.0058	-0.0082
61	0.002	0.000	0.015	-0.0340	0.0055	-0.0035
62	0.002	-0.001	0.013	-0.0331	0.0054	-0.0025
64	0.002	-0.001	0.008	-0.0315	0.0053	0.0005
65	0.002	0.000	0.008	-0.0301	0.0051	0.0003
67A	0.002	-0.001	0.004	-0.0240	0.0045	-0.0013
67B	-0.001	-0.013	-0.000	0.0013	0.0005	0.0030
70	-0.001	-0.007	-0.000	0.0060	-0.0001	0.0017
73	-0.001	-0.002	-0.000	0.0049	-0.0003	0.0008
102	-0.001	0.000	-0.000	0.0030	-0.0003	0.0006
103	-0.000	0.000	-0.000	-0.0003	-0.0003	-0.0001
112	-0.000	-0.000	-0.000	-0.0003	-0.0003	-0.0002
121	0.000	0.000	0.000	-0.0003	-0.0002	0.0000
122	0.000	-0.000	0.000	-0.0003	-0.0002	-0.0003
131	0.000	-0.000	0.000	0.0001	-0.0001	-0.0008
140	0.000	0.000	0.000	0.0000	0.0000	-0.0010
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.006	-0.311	-0.004	-0.0218	0.0066	-0.2826
700B	0.018	-0.342	-0.005	-0.0218	0.0066	-0.2682
710	0.024	-0.347	-0.006	-0.0218	0.0066	-0.2674
720A	0.034	-0.357	-0.007	-0.0218	0.0066	-0.2658
720B	0.042	-0.375	-0.008	-0.0218	0.0066	-0.2344
730	0.042	-0.381	-0.008	-0.0218	0.0066	-0.2334

## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
740	0.042	-0.417	-0.009	-0.0218	0.0066	-0.2312
750	0.042	-0.453	-0.010	-0.0218	0.0066	-0.2290
760	0.042	-0.525	-0.013	-0.0218	0.0066	-0.2213
63	0.003	-0.002	-0.007	-0.0331	0.0054	-0.0025
74	0.002	-0.002	0.001	0.0033	-0.0003	-0.0174
75	0.004	-0.002	0.001	0.0021	-0.0003	-0.0309
76	0.007	-0.002	0.002	0.0020	-0.0003	-0.0324
77	0.017	-0.002	0.002	0.0020	-0.0003	-0.0324
78	0.007	0.001	0.002	0.0018	-0.0003	-0.0338
79	0.007	0.005	0.002	0.0002	-0.0003	-0.0468
80A	0.007	0.116	0.001	-0.0100	-0.0003	-0.0924
80B	0.020	0.130	-0.001	-0.0153	-0.0026	-0.0719
82	0.066	0.130	-0.013	-0.0191	-0.0026	-0.0602
840	0.090	0.130	-0.022	-0.0215	-0.0026	-0.0531
84A	0.098	0.130	-0.025	-0.0223	-0.0026	-0.0504
84B	0.105	0.126	-0.029	-0.0266	0.0044	-0.0342
87	0.105	0.125	-0.029	-0.0265	0.0044	-0.0330
89	0.097	0.109	-0.029	0.0156	0.0044	0.0028
92	0.094	0.126	-0.029	0.0330	0.0044	0.0176
94A	0.093	0.136	-0.029	0.0362	0.0044	0.0233
94B	0.092	0.136	-0.028	0.0318	0.0044	0.0421
96	0.092	0.126	-0.027	0.0318	0.0044	0.0489
98	0.092	0.000	-0.009	0.0318	0.0044	0.0181
99	0.092	-0.054	-0.003	0.0318	0.0044	0.0439
101	0.092	-0.063	-0.002	0.0318	0.0044	0.0439
104	0.001	0.000	-0.000	-0.0003	-0.0003	-0.0118
105	0.003	-0.000	-0.000	-0.0003	-0.0003	-0.0172
106	0.008	-0.000	-0.000	-0.0003	-0.0003	-0.0201
107	0.012	-0.000	-0.000	-0.0003	-0.0003	-0.0201
108	0.008	-0.004	-0.000	-0.0003	-0.0003	-0.0206
109	0.008	-0.007	-0.000	-0.0003	-0.0003	-0.0215
110A	0.008	-0.009	-0.000	-0.0003	-0.0003	-0.0217
110B	0.009	-0.011	-0.000	-0.0003	-0.0003	-0.0235
111	0.013	-0.015	-0.000	-0.0003	-0.0003	-0.0236
113	0.003	-0.000	-0.000	-0.0003	-0.0003	-0.0218
114	0.006	-0.000	-0.000	-0.0003	-0.0003	-0.0317
115	0.016	-0.000	-0.000	-0.0003	-0.0003	-0.0378
116	0.022	-0.001	-0.000	-0.0003	-0.0003	-0.0378
117	0.016	-0.007	-0.000	-0.0003	-0.0003	-0.0382
118	0.016	-0.014	-0.000	-0.0003	-0.0003	-0.0389
119A	0.016	-0.018	-0.000	-0.0003	-0.0003	-0.0390
119B	0.018	-0.023	-0.000	-0.0003	-0.0003	-0.0401
120	0.024	-0.029	-0.000	-0.0003	-0.0003	-0.0402
123	0.002	-0.000	-0.000	-0.0003	-0.0002	-0.0171
124	0.005	-0.000	-0.000	-0.0003	-0.0002	-0.0248
125	0.012	-0.001	-0.000	-0.0003	-0.0002	-0.0295
126	0.017	-0.001	-0.000	-0.0003	-0.0002	-0.0295
127	0.012	-0.006	-0.000	-0.0003	-0.0002	-0.0297
128	0.012	-0.011	-0.000	-0.0003	-0.0002	-0.0302
129A	0.012	-0.014	-0.000	-0.0003	-0.0002	-0.0304
129B	0.014	-0.018	-0.000	-0.0003	-0.0002	-0.0315
130	0.019	-0.023	-0.000	-0.0003	-0.0002	-0.0316



## Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
132	0.003	-0.000	0.000	0.0001	-0.0001	-0.0224
133	0.006	-0.001	0.000	0.0001	-0.0001	-0.0323
134	0.016	-0.001	0.000	0.0001	-0.0001	-0.0384
135	0.023	-0.001	0.000	0.0001	-0.0001	-0.0384
136	0.016	-0.008	0.000	0.0001	-0.0001	-0.0387
137	0.016	-0.015	0.000	0.0001	-0.0001	-0.0394
138A	0.016	-0.019	0.000	0.0001	-0.0001	-0.0396
138B	0.018	-0.024	0.000	0.0001	-0.0001	-0.0407
139	0.025	-0.030	0.000	0.0001	-0.0001	-0.0408
141	0.003	-0.000	0.000	0.0000	0.0000	-0.0217
142	0.013	-0.000	0.000	0.0000	0.0000	-0.0298
143	0.013	-0.008	0.000	0.0000	0.0000	-0.0298

## Loads on Anchors: Expansion (T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9755	1694	-2642	-13020	-209758	-90690
58		-2015				
121	32472	-759				1919
144	-22717	-11	2642	43	-127554	-0

## Loads on Hangers: Expansion (T1)

Node	Type	Load(lb)	No of	Total(lb)
6	User hanger	-435	1	-435
20	User hanger	-119	1	-119
23	User hanger	-90	1	-90
25	User hanger	-66	1	-66
29	User hanger	-54	1	-54
34	User hanger	70	1	70
40	User hanger	170	1	170
47	User hanger	-58	1	-58
50	User hanger	-50	1	-50
55	User hanger	-27	1	-27
65	Rod Hanger	778	1	778
102	Rod Hanger	769	1	769
140	Rod Hanger	186	1	186
760	User hanger	-45	1	-45
840	User hanger	48	1	48
96	User hanger	18	1	18
98	Rod Hanger	-3	1	-3

## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.039	-0.447	0.012	-0.0154	-0.1648	-0.0268
3B	-0.244	-0.562	0.172	-0.0579	-0.3760	-0.1030
6	-1.023	-0.435	0.589	-0.0767	-0.4533	-0.0802



## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
7	-1.372	-0.375	0.757	-0.0821	-0.4707	-0.0709
14	-2.211	-0.223	1.149	-0.0908	-0.4805	-0.0498
17A	-2.370	-0.193	1.224	-0.0919	-0.4775	-0.0458
17B	-2.653	-0.097	2.035	-0.1090	-0.3775	-0.0078
20	-2.583	-0.099	2.152	-0.1092	-0.3701	-0.0056
23	-1.815	-0.090	3.307	-0.1121	-0.3133	0.0075
25	-0.932	-0.066	4.499	-0.1154	-0.3033	0.0006
27	-0.776	-0.067	4.712	-0.1160	-0.3078	-0.0030
29	-0.098	-0.107	5.693	-0.1185	-0.3484	-0.0260
31A	-0.051	-0.113	5.766	-0.1187	-0.3526	-0.0280
31B	-0.282	-0.034	6.534	-0.1056	-0.4258	-0.0753
34	-1.084	0.162	6.957	-0.1015	-0.4141	-0.1036
35	-1.546	0.276	7.216	-0.0967	-0.3822	-0.1209
39A	-1.665	0.307	7.286	-0.0951	-0.3703	-0.1256
39B	-2.151	0.142	7.686	-0.0955	-0.1576	-0.0808
41A	-2.151	0.142	7.686	-0.0955	-0.1573	-0.0808
41B	-2.056	-0.039	7.756	-0.0017	0.0564	-0.0448
43	-1.839	-0.075	7.675	-0.0018	0.1085	-0.0319
44	-1.555	-0.106	7.497	-0.0019	0.1711	-0.0174
47	-1.383	-0.116	7.353	-0.0020	0.2059	-0.0099
50	-0.510	-0.100	6.253	-0.0023	0.3488	0.0141
52	-0.322	-0.087	5.951	-0.0024	0.3719	0.0163
55	0.277	-0.041	4.876	-0.0026	0.4278	0.0162
57	0.597	-0.020	4.251	-0.0028	0.4465	0.0119
58	0.666	-0.017	4.114	-0.0028	0.4495	0.0106
59	0.760	-0.013	3.924	-0.0028	0.4530	0.0088
61	0.857	-0.009	3.728	-0.0029	0.4559	0.0073
62	0.945	-0.007	3.545	-0.0029	0.4565	0.0070
64	1.125	-0.001	3.170	-0.0029	0.4571	0.0066
65	1.163	0.000	3.092	-0.0029	0.4572	0.0063
67A	1.340	0.005	2.731	-0.0030	0.4565	0.0055
67B	1.122	0.006	1.910	-0.0031	0.3546	0.0029
70	0.664	0.002	1.592	-0.0022	0.3069	0.0022
73	0.426	0.000	1.399	-0.0014	0.2648	0.0017
102	0.330	0.000	1.311	-0.0009	0.2421	0.0014
103	0.108	-0.000	1.062	0.0001	0.1664	0.0006
112	0.033	-0.000	0.943	0.0002	0.1240	0.0002
121	0.000	0.000	0.874	0.0001	0.0975	0.0000
122	-0.018	0.000	0.824	0.0001	0.0789	0.0000
131	-0.045	0.000	0.706	0.0000	0.0406	0.0000
140	-0.054	0.000	0.588	0.0000	0.0113	0.0000
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.965	-0.466	1.610	-0.0821	-0.4707	-0.0352
700B	-0.938	-0.460	1.659	-0.0821	-0.4707	-0.0453
710	-0.932	-0.456	1.667	-0.0821	-0.4707	-0.0450
720A	-0.923	-0.450	1.681	-0.0821	-0.4707	-0.0446
720B	-0.905	-0.445	1.713	-0.0821	-0.4707	-0.0158
730	-0.900	-0.445	1.724	-0.0821	-0.4707	-0.0156
740	-0.866	-0.448	1.798	-0.0821	-0.4707	-0.0154
750	-0.831	-0.450	1.872	-0.0821	-0.4707	-0.0152
760	-0.759	-0.455	2.024	-0.0821	-0.4707	-0.0146
63	1.079	0.109	3.256	-0.0029	0.4565	0.0070

## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
74	0.425	0.067	1.398	-0.0046	0.2648	0.0093
75	0.423	0.088	1.398	-0.0070	0.2648	0.0149
76	0.422	0.109	1.397	-0.0073	0.2648	0.0155
77	0.417	0.176	1.395	-0.0073	0.2648	0.0155
78	0.401	0.107	1.422	-0.0076	0.2648	0.0161
79	0.380	0.105	1.447	-0.0107	0.2648	0.0212
80A	0.058	0.059	1.827	-0.0310	0.2648	0.0381
80B	0.013	0.086	1.862	-0.0417	0.2602	0.0723
82	-0.037	0.244	1.830	-0.0493	0.2602	0.0713
840	-0.067	0.340	1.808	-0.0540	0.2602	0.0707
84A	-0.078	0.375	1.800	-0.0557	0.2602	0.0705
84B	-0.130	0.403	1.757	-0.0381	0.2596	0.0692
87	-0.144	0.401	1.745	-0.0386	0.2596	0.0691
89	-0.572	0.327	1.375	-0.0503	0.2596	0.0661
92	-0.749	0.292	1.222	-0.0522	0.2596	0.0649
94A	-0.817	0.278	1.163	-0.0525	0.2596	0.0644
94B	-0.891	0.260	1.165	-0.0521	0.2246	0.0628
96	-0.942	0.245	1.216	-0.0521	0.2246	0.0623
98	-1.886	0.000	2.161	-0.0521	0.2246	0.0564
99	-2.215	-0.083	2.490	-0.0521	0.2246	0.0564
101	-2.262	-0.095	2.537	-0.0521	0.2246	0.0564
104	0.108	0.057	1.062	0.0001	0.1664	0.0006
105	0.108	0.084	1.062	0.0001	0.1664	0.0006
106	0.108	0.138	1.062	0.0001	0.1664	0.0006
107	0.111	0.183	1.059	0.0001	0.1664	0.0006
108	0.146	0.138	1.033	0.0001	0.1664	0.0006
109	0.179	0.138	1.009	0.0001	0.1664	0.0006
110A	0.197	0.138	0.995	0.0001	0.1664	0.0006
110B	0.220	0.146	0.979	0.0001	0.1664	-0.0248
111	0.262	0.180	0.951	0.0001	0.1664	-0.0248
113	0.033	0.057	0.943	0.0002	0.1240	0.0002
114	0.033	0.084	0.943	0.0002	0.1240	0.0002
115	0.033	0.146	0.943	0.0002	0.1240	0.0002
116	0.037	0.183	0.941	0.0002	0.1240	0.0002
117	0.073	0.146	0.920	0.0002	0.1240	0.0002
118	0.112	0.146	0.899	0.0002	0.1240	0.0002
119A	0.135	0.146	0.886	0.0002	0.1240	0.0002
119B	0.163	0.156	0.871	0.0002	0.1240	-0.0197
120	0.202	0.189	0.851	0.0002	0.1240	-0.0197
123	-0.018	0.058	0.824	0.0001	0.0789	0.0000
124	-0.018	0.084	0.824	0.0001	0.0789	0.0000
125	-0.018	0.146	0.824	0.0001	0.0789	0.0000
126	-0.014	0.183	0.823	0.0001	0.0789	0.0000
127	0.023	0.146	0.810	0.0001	0.0789	0.0000
128	0.062	0.146	0.796	0.0001	0.0789	0.0000
129A	0.085	0.146	0.788	0.0001	0.0789	0.0000
129B	0.113	0.156	0.778	0.0001	0.0789	-0.0200
130	0.152	0.188	0.766	0.0001	0.0789	-0.0200
132	-0.045	0.058	0.706	0.0000	0.0406	0.0000
133	-0.045	0.084	0.706	0.0000	0.0406	0.0000
134	-0.045	0.146	0.706	0.0000	0.0406	0.0000
135	-0.041	0.183	0.705	0.0000	0.0406	0.0000

## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
136	-0.004	0.146	0.699	0.0000	0.0406	0.0000
137	0.035	0.146	0.692	0.0000	0.0406	0.0000
138A	0.058	0.146	0.687	0.0000	0.0406	0.0000
138B	0.086	0.156	0.682	0.0000	0.0406	-0.0200
139	0.125	0.188	0.676	0.0000	0.0406	-0.0200
141	-0.054	0.056	0.588	0.0000	0.0113	0.0000
142	-0.054	0.141	0.588	0.0000	0.0113	0.0000
143	0.004	0.141	0.585	0.0000	0.0113	0.0000

## Loads on Anchors: Operating (W+P1+T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9642	-2594	-2642	-18690	-205441	-98039
58		-1164				
121	32302	-6170				-3037
144	-22661	-1711	2642	3581	-127223	-857

## Loads on Hangers: Operating (W+P1+T1)

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	-6670	1	-6670
20	User hanger	-6250	1	-6250
23	User hanger	-4265	1	-4265
25	User hanger	-4800	1	-4800
29	User hanger	-5520	1	-5520
34	User hanger	-1990	1	-1990
40	User hanger	-7130	1	-7130
47	User hanger	-6465	1	-6465
50	User hanger	-5250	1	-5250
55	User hanger	-3340	1	-3340
65	Rod Hanger	-22134	1	-22134
102	Rod Hanger	-9018	1	-9018
140	Rod Hanger	-5783	1	-5783
760	User hanger	-675	1	-675
840	User hanger	-670	1	-670
96	User hanger	-500	1	-500
98	Rod Hanger	-532	1	-532

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.044	-0.447	0.015	-0.0189	-0.1614	-0.0316
3B	-0.253	-0.555	0.180	-0.0742	-0.3720	-0.1156
6	-1.022	-0.394	0.597	-0.0967	-0.4473	-0.0991
7	-1.366	-0.319	0.765	-0.1040	-0.4641	-0.0925
14	-2.192	-0.120	1.157	-0.1240	-0.4728	-0.0731
17A	-2.349	-0.078	1.232	-0.1275	-0.4697	-0.0694
17B	-2.622	0.052	2.031	-0.1713	-0.3678	-0.0332

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
20	-2.551	0.042	2.146	-0.1737	-0.3603	-0.0326
23	-1.784	-0.059	3.266	-0.1997	-0.3027	-0.0280
25	-0.900	-0.179	4.415	-0.2296	-0.2919	-0.0369
27	-0.744	-0.206	4.620	-0.2349	-0.2962	-0.0419
29	-0.066	-0.368	5.564	-0.2578	-0.3361	-0.0696
31A	-0.019	-0.383	5.635	-0.2594	-0.3402	-0.0725
31B	-0.234	-0.172	6.396	-0.2715	-0.4125	-0.1215
34	-1.011	0.348	6.810	-0.2778	-0.4011	-0.1522
35	-1.458	0.668	7.068	-0.2756	-0.3696	-0.1710
39A	-1.573	0.754	7.139	-0.2742	-0.3578	-0.1761
39B	-2.113	0.810	7.751	-0.2526	-0.1492	-0.1369
41A	-2.113	0.810	7.751	-0.525	-0.1489	-0.1369
41B	-2.055	0.592	7.904	-0.1373	0.0714	-0.1053
43	-1.837	0.497	7.809	-0.1298	0.1228	-0.0919
44	-1.553	0.390	7.614	-0.1200	0.1845	-0.0775
47	-1.382	0.334	7.459	-0.1141	0.2188	-0.0719
50	-0.508	0.111	6.315	-0.0840	0.3587	-0.0429
52	-0.320	0.077	6.005	-0.0775	0.3813	-0.0376
55	0.279	0.006	4.907	-0.0568	0.4352	-0.0156
57	0.599	-0.009	4.272	-0.0458	0.4528	-0.0049
58	0.667	-0.010	4.134	-0.0434	0.4556	-0.0025
59	0.761	-0.010	3.942	-0.0402	0.4588	0.0006
61	0.858	-0.009	3.743	-0.0368	0.4614	0.0038
62	0.946	-0.007	3.558	-0.0360	0.4619	0.0045
64	1.126	-0.002	3.178	-0.0344	0.4623	0.0070
65	1.165	0.000	3.100	-0.0331	0.4623	0.0067
67A	1.342	0.004	2.735	-0.0269	0.4610	0.0042
67B	1.121	-0.008	1.910	-0.0018	0.3551	0.0059
70	0.663	-0.005	1.591	0.0038	0.3068	0.0038
73	0.425	-0.001	1.399	0.0036	0.2645	0.0025
102	0.329	0.000	1.311	0.0022	0.2418	0.0020
103	0.108	0.000	1.062	-0.0003	0.1660	0.0006
112	0.033	-0.000	0.943	-0.0001	0.1238	0.0001
121	0.000	0.000	0.874	-0.0002	0.0973	0.0000
122	-0.018	-0.000	0.824	-0.0002	0.0787	-0.0003
131	-0.045	-0.000	0.706	0.0001	0.0405	-0.0008
140	-0.054	0.000	0.588	0.0000	0.0113	-0.0010
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.959	-0.776	1.607	-0.1040	-0.4641	-0.3178
700B	-0.920	-0.801	1.653	-0.1040	-0.4641	-0.3134
710	-0.908	-0.803	1.661	-0.1040	-0.4641	-0.3124
720A	-0.889	-0.806	1.674	-0.1040	-0.4641	-0.3103
720B	-0.863	-0.820	1.705	-0.1040	-0.4641	-0.2501
730	-0.858	-0.826	1.715	-0.1040	-0.4641	-0.2490
740	-0.824	-0.865	1.788	-0.1040	-0.4641	-0.2465
750	-0.789	-0.903	1.861	-0.1040	-0.4641	-0.2442
760	-0.717	-0.980	2.011	-0.1040	-0.4641	-0.2359
63	1.082	0.106	3.249	-0.0360	0.4619	0.0045
74	0.426	0.065	1.399	-0.0013	0.2645	-0.0081
75	0.427	0.086	1.399	-0.0049	0.2645	-0.0160
76	0.429	0.107	1.399	-0.0053	0.2645	-0.0169
77	0.434	0.174	1.397	-0.0053	0.2645	-0.0169

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
78	0.408	0.108	1.424	-0.0058	0.2645	-0.0178
79	0.387	0.110	1.448	-0.0105	0.2645	-0.0256
80A	0.065	0.175	1.828	-0.0410	0.2645	-0.0543
80B	0.033	0.216	1.861	-0.0570	0.2577	0.0004
82	0.029	0.374	1.817	-0.0685	0.2577	0.0111
840	0.023	0.470	1.787	-0.0755	0.2577	0.0177
84A	0.020	0.505	1.775	-0.0780	0.2577	0.0201
84B	-0.025	0.529	1.728	-0.0647	0.2640	0.0350
87	-0.039	0.526	1.716	-0.0651	0.2640	0.0361
89	-0.475	0.436	1.346	-0.0347	0.2640	0.0689
92	-0.654	0.418	1.193	-0.0192	0.2640	0.0825
94A	-0.724	0.414	1.134	-0.0163	0.2640	0.0877
94B	-0.798	0.396	1.137	-0.0203	0.2290	0.1050
96	-0.849	0.372	1.189	-0.0203	0.2290	0.1112
98	-1.793	0.000	2.152	-0.0203	0.2290	0.0745
99	-2.122	-0.137	2.488	-0.0203	0.2290	0.1003
101	-2.169	-0.158	2.536	-0.0203	0.2290	0.1003
104	0.109	0.057	1.062	-0.0003	0.1660	-0.0112
105	0.111	0.084	1.062	-0.0003	0.1660	-0.0166
106	0.115	0.138	1.062	-0.0003	0.1660	-0.0194
107	0.123	0.183	1.059	-0.0003	0.1660	-0.0194
108	0.154	0.134	1.033	-0.0003	0.1660	-0.0200
109	0.186	0.131	1.009	-0.0003	0.1660	-0.0209
110A	0.205	0.130	0.995	-0.0003	0.1660	-0.0211
110B	0.229	0.135	0.979	-0.0003	0.1660	-0.0483
111	0.275	0.165	0.950	-0.0003	0.1660	-0.0484
113	0.036	0.057	0.943	-0.0001	0.1238	-0.0215
114	0.039	0.084	0.943	-0.0001	0.1238	-0.0315
115	0.049	0.145	0.943	-0.0001	0.1238	-0.0375
116	0.059	0.182	0.941	-0.0001	0.1238	-0.0375
117	0.089	0.138	0.920	-0.0001	0.1238	-0.0379
118	0.128	0.132	0.899	-0.0001	0.1238	-0.0386
119A	0.151	0.128	0.886	-0.0001	0.1238	-0.0388
119B	0.181	0.133	0.871	-0.0001	0.1238	-0.0599
120	0.226	0.159	0.851	-0.0001	0.1238	-0.0599
123	-0.015	0.057	0.824	-0.0002	0.0787	-0.0171
124	-0.013	0.084	0.824	-0.0002	0.0787	-0.0248
125	-0.005	0.145	0.824	-0.0002	0.0787	-0.0295
126	0.004	0.182	0.823	-0.0002	0.0787	-0.0295
127	0.035	0.140	0.810	-0.0002	0.0787	-0.0297
128	0.074	0.135	0.796	-0.0002	0.0787	-0.0302
129A	0.097	0.131	0.788	-0.0002	0.0787	-0.0304
129B	0.127	0.138	0.778	-0.0002	0.0787	-0.0515
130	0.171	0.165	0.766	-0.0002	0.0787	-0.0515
132	-0.042	0.057	0.706	0.0001	0.0405	-0.0224
133	-0.038	0.083	0.706	0.0001	0.0405	-0.0323
134	-0.028	0.145	0.706	0.0001	0.0405	-0.0384
135	-0.018	0.182	0.706	0.0001	0.0405	-0.0384
136	0.012	0.138	0.699	0.0001	0.0405	-0.0387
137	0.051	0.131	0.692	0.0001	0.0405	-0.0394
138A	0.074	0.127	0.688	0.0001	0.0405	-0.0396
138B	0.104	0.132	0.683	0.0001	0.0405	-0.0607



## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
139	0.149	0.158	0.676	0.0001	0.0405	-0.0608
141	-0.051	0.056	0.588	0.0000	0.0113	-0.0217
142	-0.041	0.140	0.588	0.0000	0.0113	-0.0298
143	0.016	0.133	0.585	0.0000	0.0113	-0.0298

## Loads on Anchors: Response spectrum

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	3521	2350	5289	28837	6892	39369
58		2235				
121	3341	1382				13774
144	720	112	4327	141	2931	1534

## Loads on Hangers: Response spectrum

Node	Type	Load(lb)	No.of	Total(lb)
6	User hanger	130	1	130
20	User hanger	520	1	520
23	User hanger	540	1	540
25	User hanger	595	1	595
29	User hanger	281	1	281
34	User hanger	113	1	113
40	User hanger	60	1	60
47	User hanger	21	1	21
50	User hanger	29	1	29
55	User hanger	22	1	22
65	Rod Hanger	1667	1	1667
102	Rod Hanger	1249	1	1249
140	Rod Hanger	775	1	775
760	User hanger	57	1	57
840	User hanger	10	1	10
96	User hanger	88	1	88
98	Rod Hanger	80	1	80

## Loads on Snubbers: Response spectrum

Node	Load (lb)	X comp	Y comp	Z comp
14	5669	0.000	0.000	1.000
27	5482	1.000	0.000	0.000
35	4079	1.125	0.000	-6.000
43	2691	0.000	1.000	0.000
44	6208	0.000	-2.604	7.000
52	2843	0.000	-2.740	7.000
57	7803	1.000	0.000	0.000
59	5943	0.000	-2.870	7.000
70	2535	7.000	-3.021	0.000
82	377	-4.357	0.687	0.891
87	376	0.000	1.000	0.000
89	880	3.190	-2.206	4.577



## Loads on Snubbers: Response spectrum

Node	Load (lb)	X comp	Y comp	Z comp
92	571	0.000	0.000	1.000
99	266	-6.357	0.000	-3.570

## Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	0.018	0.000	0.009	0.0023	0.0054	0.0144
3B	0.034	0.020	0.001	0.0523	0.0068	0.0232
6	0.041	0.130	0.000	0.0639	0.0031	0.0286
7	0.040	0.179	0.000	0.0655	0.0053	0.0312
14	0.025	0.292	0.000	0.0632	0.0127	0.0361
17A	0.021	0.313	0.000	0.0619	0.0135	0.0371
17B	0.001	0.423	0.022	0.0395	0.0201	0.0364
20	0.001	0.434	0.028	0.0368	0.0203	0.0363
23	0.000	0.540	0.088	0.0120	0.0134	0.0267
25	0.000	0.595	0.097	0.0319	0.0099	0.0096
27	0.000	0.594	0.090	0.0378	0.0130	0.0097
29	0.000	0.563	0.040	0.0638	0.0209	0.0197
31A	0.000	0.559	0.036	0.0657	0.0209	0.0202
31B	0.024	0.431	0.012	0.0899	0.0176	0.0311
34	0.052	0.259	0.012	0.0916	0.0144	0.0316
35	0.066	0.156	0.012	0.0872	0.0104	0.0322
39A	0.069	0.130	0.012	0.0853	0.0092	0.0325
39B	0.023	0.050	0.060	0.0414	0.0138	0.0380
41A	0.023	0.050	0.060	0.0414	0.0138	0.0380
41B	0.001	0.028	0.066	0.0260	0.0285	0.0306
43	0.001	0.000	0.038	0.0252	0.0273	0.0266
44	0.001	0.029	0.011	0.0244	0.0179	0.0192
47	0.001	0.042	0.010	0.0240	0.0104	0.0144
50	0.000	0.058	0.020	0.0241	0.0054	0.0069
52	0.000	0.054	0.021	0.0245	0.0035	0.0085
55	0.000	0.032	0.014	0.0268	0.0047	0.0106
57	0.000	0.021	0.008	0.0284	0.0052	0.0090
58	0.000	0.019	0.007	0.0288	0.0052	0.0084
59	0.000	0.016	0.006	0.0294	0.0051	0.0080
61	0.000	0.012	0.007	0.0300	0.0046	0.0084
62	0.000	0.009	0.009	0.0301	0.0042	0.0086
64	0.000	0.002	0.010	0.0286	0.0023	0.0089
65	0.000	0.000	0.010	0.0274	0.0016	0.0090
67A	0.000	0.007	0.008	0.0220	0.0041	0.0094
67B	0.004	0.007	0.001	0.0052	0.0015	0.0105
70	0.001	0.002	0.001	0.0028	0.0017	0.0074
73	0.001	0.001	0.001	0.0017	0.0008	0.0055
102	0.001	0.000	0.001	0.0011	0.0005	0.0046
103	0.001	0.000	0.001	0.0001	0.0007	0.0023
112	0.000	0.000	0.001	0.0003	0.0009	0.0010
121	0.000	0.000	0.000	0.0002	0.0010	0.0000
122	0.000	0.000	0.000	0.0001	0.0009	0.0006
131	0.001	0.000	0.000	0.0000	0.0007	0.0014
140	0.001	0.000	0.000	0.0001	0.0002	0.0016

## Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.041	0.393	0.030	0.0664	0.0267	0.1738
700B	0.040	0.413	0.034	0.0667	0.0298	0.1890
710	0.040	0.417	0.035	0.0667	0.0299	0.1894
720A	0.042	0.424	0.037	0.0667	0.0301	0.1901
720B	0.044	0.438	0.040	0.0669	0.0319	0.1967
730	0.044	0.442	0.041	0.0669	0.0320	0.1968
740	0.044	0.473	0.045	0.0669	0.0320	0.1969
750	0.044	0.503	0.050	0.0669	0.0320	0.1967
760	0.044	0.565	0.061	0.0669	0.0321	0.1961
63	0.004	0.003	0.026	0.0301	0.0043	0.0086
74	0.003	0.001	0.002	0.0085	0.0453	0.0106
75	0.004	0.001	0.003	0.0161	0.0786	0.0172
76	0.005	0.001	0.004	0.0170	0.0823	0.0181
77	0.010	0.001	0.009	0.0170	0.0823	0.0181
78	0.005	0.002	0.005	0.0182	0.0850	0.0188
79	0.005	0.004	0.014	0.0296	0.1092	0.0263
80A	0.005	0.066	0.258	0.1061	0.2140	0.0506
80B	0.011	0.073	0.275	0.1357	0.2303	0.0457
82	0.045	0.073	0.166	0.1806	0.2593	0.0615
840	0.075	0.073	0.081	0.2172	0.2770	0.0788
84A	0.088	0.073	0.046	0.2319	0.2835	0.0842
84B	0.058	0.021	0.000	0.3954	0.3027	0.1018
87	0.043	0.000	0.000	0.4009	0.3045	0.1039
89	0.521	0.753	0.000	0.4803	0.3857	0.1698
92	0.794	1.079	0.000	0.4761	0.4093	0.1971
94A	0.901	1.203	0.000	0.4753	0.4078	0.2076
94B	0.963	1.242	0.060	0.4619	0.3674	0.2371
96	0.963	1.187	0.143	0.4619	0.3606	0.2434
98	0.964	0.000	1.394	0.4619	0.2357	0.3063
99	0.964	0.453	1.717	0.4619	0.2164	0.3101
101	0.964	0.518	1.761	0.4619	0.2164	0.3101
104	0.006	0.000	0.000	0.0037	0.0019	0.0377
105	0.011	0.000	0.001	0.0049	0.0025	0.0501
106	0.024	0.000	0.002	0.0053	0.0029	0.0546
107	0.036	0.001	0.003	0.0053	0.0029	0.0546
108	0.024	0.010	0.002	0.0053	0.0030	0.0548
109	0.024	0.018	0.002	0.0053	0.0031	0.0553
110A	0.024	0.022	0.003	0.0053	0.0031	0.0554
110B	0.027	0.028	0.003	0.0054	0.0035	0.0572
111	0.036	0.037	0.004	0.0054	0.0035	0.0573
113	0.008	0.000	0.001	0.0038	0.0085	0.0566
114	0.017	0.000	0.001	0.0051	0.0123	0.0762
115	0.039	0.000	0.003	0.0057	0.0146	0.0843
116	0.054	0.002	0.003	0.0057	0.0146	0.0843
117	0.039	0.016	0.001	0.0057	0.0147	0.0845
118	0.039	0.030	0.003	0.0056	0.0150	0.0850
119A	0.039	0.039	0.005	0.0056	0.0151	0.0851
119B	0.044	0.050	0.007	0.0053	0.0158	0.0865
120	0.058	0.063	0.009	0.0053	0.0158	0.0866
123	0.006	0.000	0.000	0.0030	0.0018	0.0422
124	0.012	0.000	0.001	0.0039	0.0022	0.0565

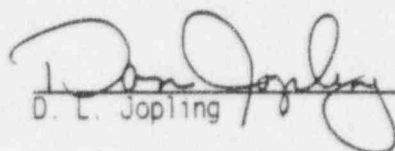
Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
125	0.029	0.000	0.002	0.0043	0.0025	0.0622
126	0.040	0.001	0.003	0.0043	0.0025	0.0622
127	0.029	0.011	0.002	0.0043	0.0025	0.0623
128	0.029	0.022	0.003	0.0043	0.0026	0.0626
129A	0.029	0.029	0.003	0.0043	0.0026	0.0628
129B	0.033	0.037	0.003	0.0043	0.0026	0.0638
130	0.043	0.047	0.004	0.0043	0.0026	0.0639
132	0.008	0.000	0.000	0.0026	0.0034	0.0513
133	0.015	0.000	0.001	0.0035	0.0048	0.0689
134	0.036	0.000	0.002	0.0038	0.0057	0.0761
135	0.049	0.001	0.002	0.0038	0.0057	0.0761
136	0.036	0.014	0.002	0.0038	0.0057	0.0763
137	0.036	0.027	0.002	0.0038	0.0058	0.0768
138A	0.036	0.035	0.003	0.0038	0.0059	0.0769
138B	0.040	0.045	0.004	0.0037	0.0061	0.0782
139	0.052	0.057	0.005	0.0037	0.0061	0.0783
141	0.007	0.000	0.001	0.0043	0.0027	0.0408
142	0.025	0.000	0.003	0.0050	0.0038	0.0486
143	0.025	0.013	0.004	0.0050	0.0038	0.0486

CAEPIPE  
Version 3.72

Client : F. P. C.  
Project : Evaluation of effect of bent rod hanger  
File Number : S 96-0129  
Report Number : Attachment D  
Model Name : CR-5D  
Title : CR-5 W/ Bent MSH-27B, Z CRW2 Y GRS Spectra  
Subtitle :

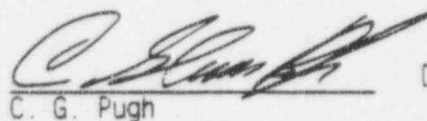
Prepared by :

  
D. L. Jopling

Date:

8/1/96

Checked by :

  
C. G. Pugh

Date:

8/1/96

## Options

Piping code = 831.1 (1967)  
Do not use liberal allowable stresses  
Exclude axial force in stress calculations  
Reference temperature = 70 (F)  
Number of thermal cycles = 7000  
Use modulus at reference temperature  
Include hanger stiffness  
Include Bourdon effect  
Do not use pressure correction for bends  
Pressure stress =  $PD / 4t$   
Peak pressure factor = 1.00  
Cut off frequency = 50 Hz  
Number of modes = 50  
Include missing mass correction  
Do not use friction in dynamic analysis  
Vertical direction = Y

#	Node	Type	DX(ft.in")	DY(ft.in")	DZ(ft.in")	Mat	Sec	Load	Data
1	1	From							Anchor
2	3	Bend		-12'6"		1	1	1	
3	6				11.854	1	1	1	User hanger
4	7				3.583	1	1	1	
5	14				8.333	1	1	1	Snubber
6	17	Bend			7.583	1	1	1	
7	20		7'6"			1	1	1	User hanger
8	23		16.333			1	1	1	User hanger
9	25		18.792			1	1	1	User hanger
10	27		3.333			1	1	1	Snubber
11	29		14'5"			1	1	1	User hanger
12	31	Bend	7'0"			1	1	1	
13	34				15'0"	1	1	1	User hanger
14	35				5'6"	1	1	1	Snubber
15	39	Bend			7'6"	1	1	1	
16	40			-6'0"		1	1	1	User hanger
17	41	Bend		-3'0"		1	1	1	
18	43		7'7-1/2"			1	1	1	Snubber
19	44		6.042			1	1	1	Snubber
20	47		3.646			1	1	1	User hanger
21	50		18.583			1	1	1	User hanger
22	52		4'0"			1	1	1	Snubber
23	55		12'9"			1	1	1	User hanger
24	57		6'9-3/4"			1	1	1	Snubber
25	58		1.458			1	1	1	Anchor
26	59		2'0"			1	1	1	Snubber
27	61		2.062			1	1	1	
28	62	Valve	1'11"			1	1	1	
29	64	Valve	3'11"			1	1	1	
30	65		0'9-3/4"			1	1	1	Rod hanger
31	67	Bend	9'8"			1	1	1	
32	70		0.218		-12'6"	1	1	1	Snubber
33	73		0.069		-4'0"	1	1	1	
34	102		0.032		-1.833	1	1	1	Rod hanger
35	103		0.091		-5.208	1	1	1	

#	Node	Type	DX(ft'in")	DY(ft'in")	DZ(ft'in")	Mat	Sec	Load	Data
36	112		0.044		-2.500	1	1	1	
37	121		0.025		-1.458	1	1	1	Anchor
38	122		0.018		-1.042	1	1	1	
39	131		0.044		-2.500	1	1	1	
40	140		0.044		-2'6"	1	1	1	Rod hanger
41	144		0.218		-12.512	1	1	1	Anchor
42	7	From							
43	700	Bend	8.964			1	2	2	
44	710		0.320	0.320		1	2	2	
45	720	Bend	0.320	0.320		1	2	2	
46	730		0'3-3/4"			1	2	2	
47	740	Valve	0'9"			1	2	2	
48	750	Valve	0'9"			1	2	2	
49	760		1.542			1	2	2	User hanger
50	62	From							
51	63	Rigid	3'0"	2'5"		1	2	2	Conc mass
52	73	From							
53	74			1.416		1	2	2	
54	75	Reducer		0.450		1	2	2	
55	76	Valve		0.450		1	2	2	
56	77	Rigid		1.458		1	2	2	Conc mass
57	76	From							
58	78	Valve	-0.450			1	2	2	
59	79	Reducer	-0.450			1	2	2	
60	80	Bend	-7.600			1	2	2	
61	82			4.104		1	2	2	Snubber
62	840			2.042		1	2	2	User hanger
63	84	Bend		1'6"		1	2	2	
64	87				-1'0"	1	2	2	Snubber
65	89				-7'10-1/2"	1	2	2	Snubber
66	92				-3'3"	1	2	2	Snubber
67	94	Bend			-2'0"	1	2	2	
68	96		-1.833			1	2	2	User hanger
69	98		-20.083			1	2	2	Rod hanger
70	99		-7'0"			1	2	2	Snubber
71	101		-1'0"			1	2	2	
72	103	From							
73	104			1.224		1	2	2	
74	105			0'6-3/4"		1	2	2	Flange
75	106	Valve		1.177		1	2	2	
76	107	Rigid	0.083	0.984		1	2	2	Conc mass
77	106	From							
78	108	Valve	0.833			1	4	4	
79	109		0.698			1	4	4	Flange
80	110	Bend	0'8"			1	4	4	
81	111		1.002	1.002		1	4	4	Conc mass
82	112	From							
83	113			1.224		1	2	2	
84	114			0'6-3/4"		1	2	2	Flange
85	115	Valve		1.344		1	2	2	
86	116	Rigid	0.083	0.817		1	2	2	Conc mass
87	115	From							
88	117	Valve	0'10-1/2"			1	3	3	
89	118		0.833			1	3	3	Flange



## Valves

From	To	Weight (lb)	Thick X	Insul Wgt X	Add Wght (lb)	DX (inch)	DY (inch)	DZ (inch)
62	64	0	3.00	1.75				
730	740	575	3.00	1.75				
740	750	575	3.00	1.75				
75	76	0	3.00	1.75				
76	78	0	3.00	1.75				
105	106	0	3.00	1.75				
106	109	0	3.00	1.75				
114	115	0	3.00	1.75				
115	117	0	3.00	1.75				
124	125	0	3.00	1.75				
125	127	0	3.00	1.75				
133	134	0	3.00	1.75				
134	136	0	3.00	1.75				
141	142	0	3.00	1.75				

## Reducers

From	To	OD1 (inch)	Thk1 (inch)	OD2 (inch)	Thk2 (inch)	Cone Angle (deg)	Knuc Delta kles (inch)
74	75	6.625	0.28	3.5	0.28	0.00	
78	79	3.5	0.28	6.625	0.28	0.00	

## Rigid Elements

From	To	Weight(lb)
62	63	0
76	77	0
106	107	0
115	116	0
125	126	0
134	135	0
142	143	0

## Anchors

Node	KX	(lb/inch) KY	KZ	KXX	(in-lb/deg) KYY	KZZ	Releases X Y Z XXYYZZ		
1	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			
58		1.1980E+5					Y	Y Y Y Y	
121	Rigid	Rigid				Rigid		Y Y Y	
144	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid			

## Hangers

Node	Type	No. of	Load var(%)	Short Spring Range (lb/inch)	Rate Hanger (lb)	Load type
6	User hanger	1		1000	6670	Hot

## Hangers

Node	Type	No. of	Load var(%)	Short SpringRate Range (lb/inch)	HangerLoad (lb)	Load type
20	User hanger	1		1200	6250	Hot
23	User hanger	1		1000	4265	Hot
25	User hanger	1		1000	4800	Hot
29	User hanger	1		500	5520	Hot
34	User hanger	1		435	1990	Hot
40	User hanger	1		1200	7130	Hot
47	User hanger	1		500	6465	Hot
50	User hanger	1		500	5250	Hot
55	User hanger	1		670	3340	Hot
65	Rod Hanger	1				
102	Rod Hanger	1				
140	Rod Hanger	1				
760	User hanger	1		100	675	Hot
840	User hanger	1		140	670	Hot
96	User hanger	1		74	500	Hot
98	Rod Hanger	1				

## Snubbers

Node	Stiffness (lb/inch)	Direction		
		X comp	Y comp	Z comp
14	Rigid			1.000
27	Rigid	1.000		
35	Rigid	1.125		-6.000
43	Rigid		1.000	
44	Rigid		-2.604	7.000
52	Rigid		-2.740	7.000
57	Rigid	1.000		
59	Rigid		-2.870	7.000
70	Rigid	7.000	-3.021	
82	Rigid	-4.357	0.687	0.891
87	Rigid		1.000	
89	Rigid	3.190	-2.206	4.577
92	Rigid			1.000
99	Rigid	-6.357		-3.570

## Flanges

Node	Weight(lb)	Type
105	164	Weld neck
109	273	Weld neck
114	164	Weld neck
118	454	Weld neck
124	164	Weld neck
127	454	Weld neck
133	164	Weld neck
137	454	Weld neck

## Concentrated Masses

Node	Weight (lb)	DX (inch)	DY (inch)	DZ (inch)
63	18400			
77	540			
107	1257			
111	44.50			
116	1257			
120	83			
126	1257			
130	83			
135	1257			
139	83			
143	1320			

Pipe material 1: A106 Grade B

Density = 0.2800 (lb/in3), Nu = 0.300, Joint factor = 1.00, Type = CS

Temp (F)	E (psi)	Alpha (in/in/F)	Allowable (psi)
-100	29.0E+6	5.65E-6	15000
70	27.9E+6	6.07E-6	15000
200	27.7E+6	6.38E-6	15000
300	27.4E+6	6.60E-6	15000
400	27.0E+6	6.82E-6	15000
500	26.4E+6	7.02E-6	15000
600	25.7E+6	7.23E-6	15000
650	25.3E+6	7.34E-6	15000
700	24.8E+6	7.44E-6	14350
750	24.8E+6	7.55E-6	12950
800	23.4E+6	7.65E-6	10800

## Pipe Sections

Name	Nominal Dia.	O.D. Sch (inch)	Thk (inch)	Cor.Al (inch)	M.Tol (%)	Ins.Dens (lb/ft3)	Ins.Th (inch)	Lin.Dens (lb/ft3)	Lin.Th (inch)
1	24"	60	24.0	0.968	0.0	0.0			
2	6"	STD	6.625	0.28	0.0	0.0			
3	10"	60	10.75	0.5	0.0	0.0			
4	8"	STD	8.625	0.322	0.0	0.0			

-----  
Loads  
-----

Acceleration load: X = 0.00, Y = 0.00, Z = 0.00 (g's)  
Acceleration load combination = Algebraic sum

Wind velocity = 0 (mph)  
Shape factor = 0.60  
Wind direction: X comp = 0.000, Y comp = 0.000, Z comp = 0.000

Y spectrum: GRS (fig 22)  
Factor = 1.3300 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.700	0.065
1.000	0.150
1.300	0.190
1.500	0.190
2.000	0.187
3.800	0.187
5.500	0.175
10.000	0.118
15.000	0.080
20.000	0.072
25.000	0.070
31.000	0.059
40.000	0.052
50.000	0.050

Z spectrum: CRW2  
Factor = 2.0000 Interpolation: 1:Linear 1:Linear

Frequency (Hz)	Acceleration (g's)
0.500	0.040
0.700	0.064
1.000	0.150
1.200	0.210
1.300	0.220
2.500	0.220
3.150	0.220
4.000	0.440
5.000	0.440
5.250	0.240
6.750	0.240
7.000	0.240
8.000	0.240
10.000	0.250
12.500	0.250
13.000	0.240
14.000	0.440
14.500	0.440
18.000	0.440
20.000	0.180
22.000	0.180

31.000 0.180  
34.000 0.180  
36.000 0.100  
50.000 0.100

Mode sum = Closely spaced  
Direction sum = SRSS

Number of thermal loads = 1

Pipe Loads

Load Name	T1 (F)	P1 (psi)	T2 (F)	P2 (psi)	T3 (F)	P3 (psi)	Specific gravity	Add.Wgt (lb/ft)	Wind Load
1	600	1050						37.700	
2	600	1050						10.030	
3	600	1050						16.800	
4	600	1050						13.500	

B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/1.20SH
7	15083	1.01	418	12838	0.57	7	24957	1.39
75	10260	0.68	38	12604	0.56	78	22477	1.25
78	10045	0.67	121	9071	0.40	112	17940	1.00
720B	9897	0.66	112	8629	0.38	75	16115	0.90
720A	9025	0.60	122	8340	0.37	131	15111	0.84
114	8586	0.57	103	7871	0.35	113	14822	0.82
112	8586	0.57	1	7084	0.31	122	14325	0.80
113	8586	0.57	3A	6990	0.31	140	13657	0.76
133	8582	0.57	131	6586	0.29	114	13394	0.74
131	8582	0.57	102	6292	0.28	84A	13326	0.74
132	8582	0.57	41A	6102	0.27	132	12937	0.72
140	8542	0.57	39B	5992	0.27	103	12823	0.71
141	8542	0.57	39A	5847	0.26	84B	12797	0.71
124	8051	0.54	73	5736	0.25	123	12241	0.68
122	8051	0.54	43	5446	0.24	720B	12220	0.68
123	8051	0.54	44	4918	0.22	133	11941	0.66
74	7947	0.53	140	4832	0.21	720A	11658	0.65
73	7947	0.53	47	4599	0.20	141	11638	0.65
41A	7883	0.53	70	4522	0.20	124	11287	0.63
79	7842	0.52	144	3948	0.18	700A	11148	0.62
700B	7833	0.52	35	3873	0.17	104	11072	0.62
94B	7747	0.52	17B	3576	0.16	79	10799	0.60
58	7728	0.52	67B	3480	0.15	700B	10759	0.60
57	7712	0.51	6	3173	0.14	105	10270	0.57
59	7667	0.51	31A	3154	0.14	94B	10219	0.57
61	7570	0.50	75	3135	0.14	80B	10182	0.57
17A	7567	0.50	50	3001	0.13	74	9297	0.52
730	7539	0.50	78	2988	0.13	840	9264	0.51
750	7533	0.50	52	2663	0.12	73	9256	0.51
98	7512	0.50	20	2454	0.11	17A	9253	0.51

## B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
105	7500	0.50	34	2341	0.10	89	9245	0.51
103	7500	0.50	29	2197	0.10	38	9244	0.51
104	7500	0.50	7	2175	0.10	87	9215	0.51
31B	7457	0.50	17A	1909	0.08	41A	9109	0.51
55	7402	0.49	55	1626	0.07	82	9093	0.51
39B	7374	0.49	31B	1551	0.07	31B	8977	0.50
108	7348	0.49	14	1222	0.05	25	8974	0.50
80B	7333	0.49	57	1134	0.05	3A	8895	0.49
84A	7333	0.49	58	1043	0.05	80A	8893	0.49
14	7281	0.49	23	1034	0.05	23	8778	0.49
110A	7268	0.48	27	970	0.04	98	8644	0.48
67B	7260	0.48	59	868	0.04	27	8585	0.48
96	7231	0.48	74	780	0.03	1	8457	0.47
3A	7198	0.48	79	707	0.03	14	8437	0.47
110B	7157	0.48	84A	701	0.03	58	8398	0.47
102	7154	0.48	80B	701	0.03	59	8391	0.47
109	7140	0.48	25	698	0.03	96	8305	0.46
3R	7133	0.48	61	688	0.03	57	8280	0.46
17B	7121	0.47	720A	668	0.03	47	8264	0.46
89	7102	0.47	84B	660	0.03	730	8236	0.46
20	7096	0.47	700A	626	0.03	61	8233	0.46
52	7076	0.47	720B	600	0.03	44	8193	0.46
31A	7047	0.47	700B	549	0.02	710	8150	0.45
111	7031	0.47	67A	363	0.02	39B	8147	0.45
710	7012	0.47	80A	313	0.01	41B	8046	0.45
29	6979	0.47	840	309	0.01	52	8019	0.45
47	6914	0.46	82	309	0.01	17B	7897	0.44
65	6844	0.46	87	288	0.01	39A	7889	0.44
34	6828	0.46	710	236	0.01	31A	7872	0.44
25	6820	0.45	730	195	0.01	67B	7787	0.43
23	6800	0.45	64	192	0.01	55	7744	0.43
1	6796	0.45	65	133	0.01	94A	7734	0.43
700A	6790	0.45	94B	125	0.01	65	7690	0.43
64	6712	0.45	89	121	0.01	50	7672	0.43
67A	6709	0.45	750	99	0.00	64	7660	0.43
840	6706	0.45	96	79	0.00	750	7651	0.43
82	6706	0.45	92	58	0.00	34	7651	0.43
50	6700	0.45	94A	54	0.00	43	7550	0.42
92	6684	0.45	104	0	0.00	29	7549	0.42
41B	6674	0.44	123	0	0.00	108	7540	0.42
44	6660	0.44	141	0	0.00	20	7534	0.42
94A	6658	0.44	105	0	0.00	35	7533	0.42
27	6648	0.44	124	0	0.00	102	7473	0.42
35	6626	0.44	132	0	0.00	110A	7453	0.41
144	6618	0.44	133	0	0.00	6	7447	0.41
43	6607	0.44	113	0	0.00	110B	7299	0.41
6	6607	0.44	114	0	0.00	109	7220	0.40
70	6601	0.44	117	0	0.00	67A	7220	0.40
39A	6583	0.44	109	0	0.00	92	7198	0.40
80A	6567	0.44	98	0	0.00	111	7031	0.39
121	6563	0.44	108	0	0.00	70	6881	0.38



## B31.1 (1967) Code Compliance (sorted stresses)

----- Sustained -----			----- Expansion -----			----- Occasional -----		
Node	SL (psi)	SL/SH	Node	SE (psi)	SE/SA	Node	SL+SO (psi)	SL+SO/ 1.20SH
84B	6346	0.42	119B	0	0.00	121	6698	0.37
87	6336	0.42	127	0	0.00	144	6670	0.37
99	6231	0.42	118	0	0.00	99	6242	0.35
101	6211	0.41	110A	0	0.00	117	6230	0.35
760	6211	0.41	101	0	0.00	760	6211	0.35
117	5921	0.39	760	0	0.00	101	6211	0.35
136	5921	0.39	129A	0	0.00	136	6125	0.34
119A	5809	0.39	129B	0	0.00	119A	6043	0.34
138A	5809	0.39	110B	0	0.00	138A	5961	0.33
129A	5809	0.39	136	0	0.00	129A	5946	0.33
127	5806	0.39	137	0	0.00	127	5931	0.33
118	5738	0.38	128	0	0.00	119B	5878	0.33
128	5738	0.38	138A	0	0.00	118	5866	0.33
137	5738	0.38	111	0	0.00	138B	5822	0.32
138B	5720	0.38	99	0	0.00	137	5821	0.32
129B	5720	0.38	119A	0	0.00	128	5813	0.32
119B	5720	0.38	120	0	0.00	129B	5813	0.32
130	5644	0.38	130	0	0.00	139	5644	0.31
120	5644	0.38	138B	0	0.00	130	5644	0.31
139	5644	0.38	139	0	0.00	120	5644	0.31

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---			--- Expansion ---			--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
1	1050	6796	15000	0.45	7084	22500	0.31	8457	18000	0.47
3A	1250	6823	15000	0.45	6599	22500	0.29	7596	18000	0.42
3A	1050	7198	15000	0.48	6990	22500	0.31	8895	18000	0.49
38	1250	7133	15000	0.48	12604	22500	0.56	9744	18000	0.51
38	1050	6793	15000	0.45	5809	22500	0.26	7755	18000	0.43
6	1250	6607	15000	0.44	3173	22500	0.14	7447	18000	0.41
6	1050	6607	15000	0.44	3173	22500	0.14	7447	18000	0.41
7	1250	6967	15000	0.46	2175	22500	0.10	7933	18000	0.44
7	1050	6967	15000	0.46	2167	22500	0.10	7932	18000	0.44
14	1250	7281	15000	0.49	1222	22500	0.05	8437	18000	0.47
14	1050	7281	15000	0.49	1222	22500	0.05	8437	18000	0.47
17A	1250	7275	15000	0.48	1529	22500	0.07	8494	18000	0.47
17A	1050	7567	15000	0.50	1909	22500	0.08	9253	18000	0.51
17B	1250	7121	15000	0.47	3576	22500	0.16	7897	18000	0.44
17B	1050	6952	15000	0.46	2588	22500	0.12	7513	18000	0.42
20	1250	7096	15000	0.47	2454	22500	0.11	7534	18000	0.42

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---			--- Occasional ---		
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO 1.20SH (psi)	SL+SO/ 1.20SH
20	1050	7096	15000	0.47	2454	22500	0.11	7534	18000 0.42
23	1250	6800	15000	0.45	1034	22500	0.05	8778	18000 0.49
23	1050	6800	15000	0.45	1034	22500	0.05	8778	18000 0.49
25	1250	6820	15000	0.45	698	22500	0.03	8974	18000 0.50
25	1050	6820	15000	0.45	698	22500	0.03	8974	18000 0.50
27	1250	6648	15000	0.44	970	22500	0.04	8585	18000 0.48
27	1050	6648	15000	0.44	970	22500	0.04	8585	18000 0.48
29	1250	6979	15000	0.47	2197	22500	0.10	7549	18000 0.42
29	1050	6979	15000	0.47	2197	22500	0.10	7549	18000 0.42
31A	1250	6898	15000	0.46	2283	22500	0.10	7495	18000 0.42
31A	1050	7047	15000	0.47	3154	22500	0.14	7872	18000 0.44
31B	1250	7457	15000	0.50	1551	22500	0.07	8977	18000 0.50
31B	1050	7194	15000	0.48	1386	22500	0.06	8295	18000 0.46
34	1250	6828	15000	0.46	2341	22500	0.10	7651	18000 0.43
34	1050	6828	15000	0.46	2341	22500	0.10	7651	18000 0.43
35	1250	6626	15000	0.44	3873	22500	0.17	7533	18000 0.42
35	1050	6626	15000	0.44	3873	22500	0.17	7533	18000 0.42
39A	1250	6563	15000	0.44	4308	22500	0.19	7507	18000 0.42
39A	1050	6583	15000	0.44	5847	22500	0.26	7889	18000 0.44
39B	1250	7374	15000	0.49	5992	22500	0.27	8147	18000 0.45
41A	1050	7883	15000	0.53	6102	22500	0.27	9109	18000 0.51
41B	1250	6674	15000	0.44	12838	22500	0.57	8046	18000 0.45
41B	1050	6584	15000	0.44	5852	22500	0.26	7209	18000 0.40
43	1250	6607	15000	0.44	5446	22500	0.24	7550	18000 0.42
43	1050	6607	15000	0.44	5446	22500	0.24	7550	18000 0.42
44	1250	6660	15000	0.44	4918	22500	0.22	8193	18000 0.46
44	1050	6660	15000	0.44	4918	22500	0.22	8193	18000 0.46
47	1250	6914	15000	0.46	4599	22500	0.20	8264	18000 0.46
47	1050	6914	15000	0.46	4599	22500	0.20	8264	18000 0.46
50	1250	6700	15000	0.45	3001	22500	0.13	7672	18000 0.43
50	1050	6700	15000	0.45	3001	22500	0.13	7672	18000 0.43
52	1250	7076	15000	0.47	2663	22500	0.12	8019	18000 0.45
52	1050	7076	15000	0.47	2663	22500	0.12	8019	18000 0.45
55	1250	7402	15000	0.49	1626	22500	0.07	7744	18000 0.43

B31.1 (1967) Code Compliance										
Node	Press (psi)	--- Sustained ---		--- Expansion ---				--- Occasional ---		
	Allow	SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO 1 (psi)	20SH (psi)	SL+SO/ 1 20SH
55	1050	7402	15000	0.49	1626	22500	0.07	7744	18000	0.43
57	1250	7712	15000	0.51	1134	22500	0.05	8280	18000	0.46
57	1050	7712	15000	0.51	1134	22500	0.05	8280	18000	0.46
58	1250	7728	15000	0.52	1043	22500	0.05	8398	18000	0.47
58	1050	7728	15000	0.52	1043	22500	0.05	8398	18000	0.47
59	1250	7667	15000	0.51	868	22500	0.04	8391	18000	0.47
59	1050	7667	15000	0.51	868	22500	0.04	8391	18000	0.47
61	1250	7570	15000	0.50	688	22500	0.03	8233	18000	0.46
64	1050	6712	15000	0.45	192	22500	0.01	7660	18000	0.43
65	1250	6844	15000	0.46	133	22500	0.01	7690	18000	0.43
65	1050	6844	15000	0.46	133	22500	0.01	7690	18000	0.43
67A	1250	6653	15000	0.44	262	22500	0.01	7023	18000	0.39
67A	1050	6709	15000	0.45	363	22500	0.02	7220	18000	0.40
67B	1250	7260	15000	0.48	3480	22500	0.15	7787	18000	0.43
67B	1050	7052	15000	0.47	2518	22500	0.11	7434	18000	0.41
70	1250	6601	15000	0.44	4522	22500	0.20	6881	18000	0.38
70	1050	6601	15000	0.44	4522	22500	0.20	6881	18000	0.38
73	1250	6876	15000	0.46	5736	22500	0.25	7171	18000	0.40
73	1050	6871	15000	0.46	5736	22500	0.25	7173	18000	0.40
102	1250	7154	15000	0.48	6292	22500	0.28	7473	18000	0.42
102	1050	7154	15000	0.48	6292	22500	0.28	7473	18000	0.42
103	1250	6537	15000	0.44	7871	22500	0.35	6704	18000	0.37
103	1050	6537	15000	0.44	7871	22500	0.35	6694	18000	0.37
112	1250	6551	15000	0.44	8629	22500	0.38	6695	18000	0.37
112	1050	6552	15000	0.44	8629	22500	0.38	6680	18000	0.37
121	1250	6561	15000	0.44	9071	22500	0.40	6697	18000	0.37
121	1050	6563	15000	0.44	9071	22500	0.40	6698	18000	0.37
122	1250	6563	15000	0.44	8340	22500	0.37	6683	18000	0.37
122	1050	6564	15000	0.44	8340	22500	0.37	6721	18000	0.37
131	1250	6592	15000	0.44	6586	22500	0.29	6700	18000	0.37
131	1050	6593	15000	0.44	6586	22500	0.29	6731	18000	0.37
140	1250	6622	15000	0.44	4832	22500	0.21	6709	18000	0.37
140	1050	6621	15000	0.44	4832	22500	0.21	6700	18000	0.37
144	1250	6618	15000	0.44	3948	22500	0.18	6670	18000	0.37

## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---			--- Occasional ---			
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
7	1050	15083	15000	1.01	832	22500	0.04	24957	18000	1.39
700A	1312	6467	15000	0.43	277	22500	0.01	8390	18000	0.47
700A	1050	6790	15000	0.45	626	22500	0.03	11148	18000	0.62
700B	1312	7833	15000	0.52	549	22500	0.02	10759	18000	0.60
700B	1050	6927	15000	0.46	242	22500	0.01	8218	18000	0.46
710	1312	7012	15000	0.47	236	22500	0.01	8150	18000	0.45
710	1050	7012	15000	0.47	236	22500	0.01	8150	18000	0.45
720A	1312	7159	15000	0.48	225	22500	0.01	8046	18000	0.45
720A	1050	9025	15000	0.60	668	22500	0.03	11658	18000	0.65
720B	1312	9897	15000	0.66	600	22500	0.03	12220	18000	0.68
720B	1050	7452	15000	0.50	202	22500	0.01	8235	18000	0.46
730	1312	7539	15000	0.50	195	22500	0.01	8236	18000	0.46
750	1050	7533	15000	0.50	99	22500	0.00	7651	18000	0.43
760	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35
73	1050	7947	15000	0.53	780	22500	0.03	9256	18000	0.51
74	1312	7947	15000	0.53	780	22500	0.03	9297	18000	0.52
74	1050	7947	15000	0.53	780	22500	0.03	9297	18000	0.52
75		10260	15000	0.68	3135	22500	0.14	16115	18000	0.90
78	1050	10045	15000	0.67	2988	22500	0.13	22477	18000	1.25
79		7842	15000	0.52	707	22500	0.03	10799	18000	0.60
79	1050	7842	15000	0.52	707	22500	0.03	10798	18000	0.60
80A	1312	6368	15000	0.42	308	22500	0.01	7395	18000	0.41
80A	1050	6567	15000	0.44	313	22500	0.01	8893	18000	0.49
80B	1312	7333	15000	0.49	701	22500	0.03	10182	18000	0.57
80B	1050	6706	15000	0.45	309	22500	0.01	7964	18000	0.44
82	1312	6706	15000	0.45	309	22500	0.01	9093	18000	0.51
82	1050	6706	15000	0.45	309	22500	0.01	9093	18000	0.51
840	1312	6706	15000	0.45	309	22500	0.01	9264	18000	0.51
840	1050	6706	15000	0.45	309	22500	0.01	9264	18000	0.51
84A	1312	6706	15000	0.45	309	22500	0.01	9351	18000	0.52
84A	1050	7333	15000	0.49	701	22500	0.03	13326	18000	0.74
84B	1312	6346	15000	0.42	660	22500	0.03	12797	18000	0.71
84B	1050	6271	15000	0.42	293	22500	0.01	9118	18000	0.51
87	1312	6336	15000	0.42	288	22500	0.01	9215	18000	0.51

B31.1 (1967) Code Compliance										
Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---			--- Occasional ---			
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
87	1050	6336	15000	0.42	288	22500	0.01	9215	18000	0.51
89	1312	7102	15000	0.47	121	22500	0.01	9245	18000	0.51
89	1050	7102	15000	0.47	121	22500	0.01	9245	18000	0.51
92	1312	6684	15000	0.45	58	22500	0.00	7198	18000	0.40
92	1050	6684	15000	0.45	58	22500	0.00	7198	18000	0.40
94A	1312	6408	15000	0.43	42	22500	0.00	6883	18000	0.38
94A	1050	6658	15000	0.44	54	22500	0.00	7734	18000	0.43
94B	1312	7747	15000	0.52	125	22500	0.01	10219	18000	0.57
94B	1050	6889	15000	0.46	55	22500	0.00	7980	18000	0.44
96	1312	7231	15000	0.48	79	22500	0.00	8305	18000	0.46
96	1050	7231	15000	0.48	79	22500	0.00	8305	18000	0.46
98	1312	7512	15000	0.50	0	22500	0.00	8644	18000	0.48
98	1050	7512	15000	0.50	0	22500	0.00	8644	18000	0.48
99	1312	6231	15000	0.42	0	22500	0.00	6242	18000	0.35
99	1050	6231	15000	0.42	0	22500	0.00	6242	18000	0.35
101	1312	6211	15000	0.41	0	22500	0.00	6211	18000	0.35
103	1050	7500	15000	0.50	0	22500	0.00	12823	18000	0.71
104	1312	7500	15000	0.50	0	22500	0.00	11072	18000	0.62
104	1050	7500	15000	0.50	0	22500	0.00	11072	18000	0.62
105	1312	7500	15000	0.50	0	22500	0.00	10270	18000	0.57
108	1050	7348	15000	0.49	0	22500	0.00	7540	18000	0.42
109	1154	7140	15000	0.48	0	22500	0.00	7220	18000	0.40
109	1050	7140	15000	0.48	0	22500	0.00	7220	18000	0.40
110A	1154	7105	15000	0.47	0	22500	0.00	7163	18000	0.40
110A	1050	7268	15000	0.48	0	22500	0.00	7453	18000	0.41
110B	1154	7157	15000	0.48	0	22500	0.00	7299	18000	0.41
110B	1050	7071	15000	0.47	0	22500	0.00	7115	18000	0.40
111	1154	7031	15000	0.47	0	22500	0.00	7031	18000	0.39
112	1050	8586	15000	0.57	0	22500	0.00	17940	18000	1.00
113	1312	8586	15000	0.57	0	22500	0.00	14822	18000	0.82
113	1050	8586	15000	0.57	0	22500	0.00	14822	18000	0.82
114	1312	8586	15000	0.57	0	22500	0.00	13394	18000	0.74
117	1050	5921	15000	0.39	0	22500	0.00	6230	18000	0.35
118	1449	5738	15000	0.38	0	22500	0.00	5866	18000	0.33



## B31.1 (1967) Code Compliance

Node	Press (psi) Allow	--- Sustained ---		--- Expansion ---			--- Occasional ---			
		SL (psi)	SH (psi)	SL/ SH	SE (psi)	SA (psi)	SE/ SA	SL+SO (psi)	1.20SH (psi)	SL+SO/ 1.20SH
118	1050	5738	15000	0.38	0	22500	0.00	5866	18000	0.33
119A	1449	5705	15000	0.38	0	22500	0.00	5790	18000	0.32
119A	1050	5809	15000	0.39	0	22500	0.00	6043	18000	0.34
119B	1449	5720	15000	0.38	0	22500	0.00	5878	18000	0.33
119B	1050	5672	15000	0.38	0	22500	0.00	5730	18000	0.32
120	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
122	1050	8051	15000	0.54	0	22500	0.00	14325	18000	0.80
123	1312	8051	15000	0.54	0	22500	0.00	12241	18000	0.68
123	1050	8051	15000	0.54	0	22500	0.00	12241	18000	0.68
124	1312	8051	15000	0.54	0	22500	0.00	11287	18000	0.63
127	1050	5806	15000	0.39	0	22500	0.00	5931	18000	0.33
128	1449	5738	15000	0.38	0	22500	0.00	5813	18000	0.32
128	1050	5738	15000	0.38	0	22500	0.00	5813	18000	0.32
129A	1449	5705	15000	0.38	0	22500	0.00	5755	18000	0.32
129A	1050	5809	15000	0.39	0	22500	0.00	5946	18000	0.33
129B	1449	5720	15000	0.38	0	22500	0.00	5813	18000	0.32
129B	1050	5672	15000	0.38	0	22500	0.00	5706	18000	0.32
130	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
131	1050	8582	15000	0.57	0	22500	0.00	15111	18000	0.84
132	1312	8582	15000	0.57	0	22500	0.00	12937	18000	0.72
132	1050	8582	15000	0.57	0	22500	0.00	12937	18000	0.72
133	1312	8582	15000	0.57	0	22500	0.00	11941	18000	0.66
136	1050	5921	15000	0.39	0	22500	0.00	6125	18000	0.34
137	1449	5738	15000	0.38	0	22500	0.00	5821	18000	0.32
137	1050	5738	15000	0.38	0	22500	0.00	5821	18000	0.32
138A	1449	5705	15000	0.38	0	22500	0.00	5760	18000	0.32
138A	1050	5809	15000	0.39	0	22500	0.00	5961	18000	0.33
138B	1449	5720	15000	0.38	0	22500	0.00	5822	18000	0.32
138B	1050	5672	15000	0.38	0	22500	0.00	5709	18000	0.32
139	1449	5644	15000	0.38	0	22500	0.00	5644	18000	0.31
140	1050	8542	15000	0.57	0	22500	0.00	13657	18000	0.76
141	1312	8542	15000	0.57	0	22500	0.00	11638	18000	0.65



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Loads on Anchors: Sustained (W+P)  
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Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	114	-4288	0	-5671	4317	-7348
58		850				
121	-170	-5411				-4957
144	56	-1699	-0	3539	331	-867

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Loads on Hangers: Sustained (W+P)  
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Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	-6235	1	-6235
20	User hanger	-6131	1	-6131
23	User hanger	-4175	1	-4175
25	User hanger	-4734	1	-4734
29	User hanger	-5466	1	-5466
34	User hanger	-2060	1	-2060
40	User hanger	-7300	1	-7300
47	User hanger	-6407	1	-6407
50	User hanger	-5200	1	-5200
55	User hanger	-3313	1	-3313
65	Rod Hanger	-22912	1	-22912
102	Rod Hanger	-9787	1	-9787
140	Rod Hanger	-5968	1	-5968
760	User hanger	-630	1	-630
840	User hanger	-718	1	-718
96	User hanger	-518	1	-518
98	Rod Hanger	-529	1	-529

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Displacements: Sustained (W+P)  
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Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	-0.005	-0.000	0.003	-0.0034	0.0034	-0.0048
3B	-0.008	0.007	0.008	-0.0163	0.0040	-0.0125
6	0.001	0.041	0.008	-0.0200	0.0059	-0.0190
7	0.006	0.056	0.008	-0.0218	0.0066	-0.0215
14	0.018	0.103	0.008	-0.0331	0.0077	-0.0233
17A	0.021	0.115	0.008	-0.0356	0.0078	-0.0236
17B	0.032	0.149	-0.003	-0.0624	0.0097	-0.0254
20	0.032	0.141	-0.006	-0.0645	0.0098	-0.0270
23	0.032	0.031	-0.041	-0.0876	0.0106	-0.0354
25	0.032	-0.112	-0.084	-0.1142	0.0114	-0.0375
27	0.032	-0.139	-0.092	-0.1189	0.0116	-0.0389
29	0.032	-0.261	-0.129	-0.1393	0.0123	-0.0436
31A	0.032	-0.270	-0.131	-0.1407	0.0123	-0.0445
31B	0.048	-0.137	-0.147	-0.1659	0.0133	-0.0462
34	0.073	0.187	-0.147	-0.1762	0.0130	-0.0486
35	0.088	0.392	-0.147	-0.1789	0.0126	-0.0501
39A	0.092	0.448	-0.147	-0.1791	0.0124	-0.0505
39B	0.038	0.668	0.065	-0.1571	0.0084	-0.0561
41A	0.038	0.668	0.065	-0.1570	0.0084	-0.0561
41B	0.001	0.631	0.148	-0.1356	0.0151	-0.0605

Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
43	0.001	0.572	0.134	-0.1281	0.0143	-0.0600
44	0.001	0.496	0.116	-0.1181	0.0134	-0.0601
47	0.001	0.450	0.106	-0.1122	0.0128	-0.0620
50	0.002	0.211	0.062	-0.0817	0.0100	-0.0570
52	0.002	0.164	0.054	-0.0751	0.0094	-0.0539
55	0.002	0.047	0.032	-0.0542	0.0074	-0.0318
57	0.002	0.012	0.022	-0.0430	0.0063	-0.0167
58	0.002	0.007	0.020	-0.0406	0.0061	-0.0131
59	0.002	0.003	0.017	-0.0373	0.0058	-0.0082
61	0.002	0.000	0.015	-0.0340	0.0055	-0.0035
62	0.002	-0.001	0.013	-0.0331	0.0054	-0.0025
64	0.002	-0.001	0.008	-0.0315	0.0053	0.0005
65	0.002	0.000	0.008	-0.0301	0.0051	0.0003
67A	0.002	-0.001	0.004	-0.0240	0.0045	-0.0013
67B	-0.001	-0.013	-0.000	0.0013	0.0005	0.0030
70	-0.001	-0.007	-0.000	0.0060	-0.0001	0.0017
73	-0.001	-0.002	-0.000	0.0049	-0.0003	0.0008
102	-0.001	0.000	-0.000	0.0030	-0.0003	0.0006
103	-0.000	0.000	-0.000	-0.0003	-0.0003	-0.0001
112	-0.000	-0.000	-0.000	-0.0003	-0.0003	-0.0002
121	0.000	0.000	0.000	-0.0003	-0.0002	0.0000
122	0.000	-0.000	0.000	-0.0003	-0.0002	-0.0003
131	0.000	-0.000	0.000	0.0001	-0.0001	-0.0008
140	0.000	0.000	0.000	0.0000	0.0000	-0.0010
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.006	-0.311	-0.004	-0.0218	0.0066	-0.2826
700B	0.018	-0.341	-0.005	-0.0218	0.0066	-0.2681
710	0.024	-0.347	-0.006	-0.0218	0.0066	-0.2673
720A	0.034	-0.357	-0.007	-0.0218	0.0066	-0.2658
720B	0.042	-0.375	-0.008	-0.0218	0.0066	-0.2344
730	0.042	-0.381	-0.008	-0.0218	0.0066	-0.2333
740	0.042	-0.417	-0.009	-0.0218	0.0066	-0.2312
750	0.042	-0.453	-0.010	-0.0218	0.0066	-0.2290
760	0.042	-0.525	-0.013	-0.0218	0.0066	-0.2213
63	0.003	-0.002	-0.007	-0.0331	0.0054	-0.0025
74	0.002	-0.002	0.001	0.0033	-0.0003	-0.0174
75	0.004	-0.002	0.001	0.0021	-0.0003	-0.0309
76	0.007	-0.002	0.002	0.0020	-0.0003	-0.0324
77	0.017	-0.002	0.002	0.0020	-0.0003	-0.0324
78	0.007	0.001	0.002	0.0018	-0.0003	-0.0338
79	0.007	0.005	0.002	0.0002	-0.0003	-0.0468
80A	0.007	0.116	0.001	-0.0100	-0.0003	-0.0924
80B	0.020	0.130	-0.001	-0.0153	-0.0026	-0.0719
82	0.066	0.130	-0.013	-0.0191	-0.0026	-0.0602
840	0.090	0.130	-0.022	-0.0215	-0.0026	-0.0531
84A	0.098	0.130	-0.025	-0.0223	-0.0026	-0.0504
84B	0.105	0.126	-0.029	-0.0266	0.0044	-0.0342
87	0.105	0.125	-0.029	-0.0265	0.0044	-0.0330
89	0.097	0.109	-0.029	0.0156	0.0044	0.0028
92	0.094	0.126	-0.029	0.0330	0.0044	0.0176
94A	0.093	0.136	-0.029	0.0362	0.0044	0.0233
94B	0.092	0.136	-0.028	0.0318	0.0044	0.0421

Displacements: Sustained (W+P)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
96	0.092	0.126	-0.027	0.0318	0.0044	0.0489
98	0.092	0.000	-0.009	0.0318	0.0044	0.0181
99	0.092	-0.054	-0.003	0.0318	0.0044	0.0439
101	0.092	-0.063	-0.002	0.0318	0.0044	0.0439
104	0.001	0.000	-0.000	-0.0003	-0.0003	-0.0118
105	0.003	-0.000	-0.000	-0.0003	-0.0003	-0.0172
106	0.008	-0.000	-0.000	-0.0003	-0.0003	-0.0201
107	0.012	-0.000	-0.000	-0.0003	-0.0003	-0.0201
108	0.008	-0.004	-0.000	-0.0003	-0.0003	-0.0206
109	0.008	-0.007	-0.000	-0.0003	-0.0003	-0.0215
110A	0.008	-0.009	-0.000	-0.0003	-0.0003	-0.0217
110B	0.009	-0.011	-0.000	-0.0003	-0.0003	-0.0235
111	0.013	-0.015	-0.000	-0.0003	-0.0003	-0.0236
113	0.003	-0.000	-0.000	-0.0003	-0.0003	-0.0218
114	0.006	-0.000	-0.000	-0.0003	-0.0003	-0.0317
115	0.016	-0.000	-0.000	-0.0003	-0.0003	-0.0378
116	0.022	-0.001	-0.000	-0.0003	-0.0003	-0.0378
117	0.016	-0.007	-0.000	-0.0003	-0.0003	-0.0382
118	0.016	-0.014	-0.000	-0.0003	-0.0003	-0.0389
119A	0.016	-0.018	-0.000	-0.0003	-0.0003	-0.0390
119B	0.018	-0.023	-0.000	-0.0003	-0.0003	-0.0401
120	0.024	-0.029	-0.000	-0.0003	-0.0003	-0.0402
123	0.002	-0.000	-0.000	-0.0003	-0.0002	-0.0171
124	0.005	-0.000	-0.000	-0.0003	-0.0002	-0.0248
125	0.012	-0.001	-0.000	-0.0003	-0.0002	-0.0295
126	0.017	-0.001	-0.000	-0.0003	-0.0002	-0.0295
127	0.012	-0.006	-0.000	-0.0003	-0.0002	-0.0297
128	0.012	-0.011	-0.000	-0.0003	-0.0002	-0.0302
129A	0.012	-0.014	-0.000	-0.0003	-0.0002	-0.0304
129B	0.014	-0.018	-0.000	-0.0003	-0.0002	-0.0315
130	0.019	-0.023	-0.000	-0.0003	-0.0002	-0.0316
132	0.003	-0.000	0.000	0.0001	-0.0001	-0.0224
133	0.006	-0.001	0.000	0.0001	-0.0001	-0.0323
134	0.016	-0.001	0.000	0.0001	-0.0001	-0.0384
135	0.023	-0.001	0.000	0.0001	-0.0001	-0.0384
136	0.016	-0.008	0.000	0.0001	-0.0001	-0.0387
137	0.016	-0.015	0.000	0.0001	-0.0001	-0.0395
138A	0.016	-0.019	0.000	0.0001	-0.0001	-0.0396
138B	0.018	-0.024	0.000	0.0001	-0.0001	-0.0407
139	0.025	-0.030	0.000	0.0001	-0.0001	-0.0408
141	0.003	-0.000	0.000	0.0000	0.0000	-0.0217
142	0.013	-0.000	0.000	0.0000	0.0000	-0.0298
143	0.013	-0.008	0.000	0.0000	0.0000	-0.0298

Loads on Anchors: Expansion (T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9755	1694	-2642	-13020	-209758	-90690
58		-2015				
121	32472	-759				1919
144	-22717	-11	2642	43	-127553	-0

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Loads on Hangers: Expansion (T1)  
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Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	-435	1	-435
20	User hanger	-119	1	-119
23	User hanger	-90	1	-90
25	User hanger	-66	1	-66
29	User hanger	-54	1	-54
34	User hanger	70	1	70
40	User hanger	170	1	170
47	User hanger	-58	1	-58
50	User hanger	-50	1	-50
55	User hanger	-27	1	-27
65	Rod Hanger	778	1	778
102	Rod Hanger	769	1	769
140	Rod Hanger	186	1	186
760	User hanger	-45	1	-45
840	User hanger	48	1	48
96	User hanger	18	1	18
98	Rod Hanger	-3	1	-3

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Displacements: Expansion (T1)  
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Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.039	-0.447	0.012	-0.0154	-0.1648	-0.0268
3B	-0.244	-0.562	0.172	-0.0579	-0.3760	-0.1030
6	-1.023	-0.435	0.589	-0.0767	-0.4533	-0.0802
7	-1.372	-0.375	0.757	-0.0821	-0.4707	-0.0709
14	-2.211	-0.223	1.149	-0.0908	-0.4805	-0.0498
17A	-2.370	-0.193	1.224	-0.0919	-0.4775	-0.0458
17B	-2.653	-0.097	2.035	-0.1090	-0.3775	-0.0078
20	-2.583	-0.099	2.152	-0.1092	-0.3701	-0.0056
23	-1.815	-0.090	3.307	-0.1121	-0.3133	0.0075
25	-0.932	-0.066	4.499	-0.1154	-0.3033	0.0006
27	-0.776	-0.067	4.712	-0.1160	-0.3078	-0.0030
29	-0.098	-0.107	5.693	-0.1185	-0.3484	-0.0260
31A	-0.051	-0.113	5.766	-0.1187	-0.3526	-0.0280
31B	-0.282	-0.034	6.534	-0.1056	-0.4258	-0.0753
34	-1.084	0.162	6.957	-0.1015	-0.4141	-0.1036
35	-1.546	0.276	7.216	-0.0967	-0.3822	-0.1209
39A	-1.665	0.307	7.286	-0.0951	-0.3703	-0.1256
39B	-2.151	0.142	7.686	-0.0955	-0.1576	-0.0808
41A	-2.151	0.142	7.686	-0.0955	-0.1573	-0.0808
41B	-2.056	-0.039	7.756	-0.0017	0.0564	-0.0448
43	-1.839	-0.075	7.675	-0.0018	0.1085	-0.0319
44	-1.555	-0.106	7.497	-0.0019	0.1711	-0.0174
47	-1.383	-0.116	7.353	-0.0020	0.2059	-0.0099
50	-0.510	-0.100	6.253	-0.0023	0.3488	0.0141
52	-0.322	-0.087	5.951	-0.0024	0.3719	0.0163
55	0.277	-0.041	4.876	-0.0026	0.4278	0.0162
57	0.597	-0.020	4.251	-0.0028	0.4465	0.0119
58	0.666	-0.017	4.114	-0.0028	0.4495	0.0106
59	0.760	-0.013	3.924	-0.0028	0.4530	0.0088

## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
61	0.857	-0.009	3.728	-0.0029	0.4559	0.0073
62	0.945	-0.007	3.545	-0.0029	0.4565	0.0070
64	1.125	-0.001	3.170	-0.0029	0.4571	0.0066
65	1.163	0.000	3.092	-0.0029	0.4572	0.0063
67A	1.340	0.005	2.731	-0.0030	0.4565	0.0055
67B	1.122	0.006	1.910	-0.0031	0.3546	0.0029
70	0.664	0.002	1.591	-0.0022	0.3069	0.0022
73	0.426	0.000	1.399	-0.0014	0.2648	0.0017
102	0.330	0.000	1.311	-0.0009	0.2421	0.0014
103	0.108	-0.000	1.062	0.0001	0.1664	0.0006
112	0.033	-0.000	0.943	0.0002	0.1240	0.0002
121	0.000	0.000	0.874	0.0001	0.0975	0.0000
122	-0.018	0.000	0.824	0.0001	0.0789	0.0000
131	-0.045	0.000	0.706	0.0000	0.0406	0.0000
140	-0.054	0.000	0.588	0.0000	0.0113	0.0000
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.965	-0.466	1.610	-0.0821	-0.4707	-0.0352
700B	-0.938	-0.460	1.659	-0.0821	-0.4707	-0.0453
710	-0.933	-0.456	1.667	-0.0821	-0.4707	-0.0450
720A	-0.923	-0.450	1.681	-0.0821	-0.4707	-0.0446
720B	-0.905	-0.445	1.713	-0.0821	-0.4707	-0.0158
730	-0.900	-0.445	1.724	-0.0821	-0.4707	-0.0156
740	-0.866	-0.448	1.798	-0.0821	-0.4707	-0.0154
750	-0.831	-0.450	1.872	-0.0821	-0.4707	-0.0152
760	-0.759	-0.455	2.024	-0.0821	-0.4707	-0.0146
63	1.079	0.109	3.256	-0.0029	0.4565	0.0070
74	0.425	0.067	1.398	-0.0046	0.2648	0.0093
75	0.423	0.088	1.398	-0.0070	0.2648	0.0149
76	0.422	0.109	1.397	-0.0073	0.2648	0.0155
77	0.417	0.176	1.395	-0.0073	0.2648	0.0155
78	0.401	0.107	1.422	-0.0076	0.2648	0.0161
79	0.380	0.105	1.447	-0.0107	0.2648	0.0212
80A	0.058	0.059	1.827	-0.0310	0.2648	0.0381
80B	0.013	0.086	1.862	-0.0417	0.2602	0.0723
82	-0.037	0.244	1.830	-0.0493	0.2602	0.0713
840	-0.067	0.340	1.808	-0.0540	0.2602	0.0707
84A	-0.078	0.375	1.800	-0.0557	0.2602	0.0705
84B	-0.130	0.403	1.757	-0.0381	0.2596	0.0692
87	-0.144	0.401	1.745	-0.0386	0.2596	0.0691
89	-0.572	0.327	1.375	-0.0503	0.2596	0.0661
92	-0.749	0.292	1.222	-0.0522	0.2596	0.0649
94A	-0.817	0.278	1.163	-0.0525	0.2596	0.0644
94B	-0.891	0.260	1.165	-0.0521	0.2246	0.0628
96	-0.942	0.245	1.216	-0.0521	0.2246	0.0623
98	-1.886	0.000	2.161	-0.0521	0.2246	0.0564
99	-2.215	-0.083	2.490	-0.0521	0.2246	0.0564
101	-2.262	-0.095	2.537	-0.0521	0.2246	0.0564
104	0.108	0.057	1.062	0.0001	0.1664	0.0006
105	0.108	0.084	1.062	0.0001	0.1664	0.0006
106	0.108	0.138	1.062	0.0001	0.1664	0.0006
107	0.111	0.183	1.059	0.0001	0.1664	0.0006
108	0.146	0.138	1.033	0.0001	0.1664	0.0006



## Displacements: Expansion (T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
109	0.179	0.138	1.009	0.0001	0.1664	0.0006
110A	0.197	0.138	0.995	0.0001	0.1664	0.0006
110B	0.220	0.146	0.979	0.0001	0.1664	-0.0248
111	0.262	0.180	0.951	0.0001	0.1664	-0.0248
113	0.033	0.057	0.943	0.0002	0.1240	0.0002
114	0.033	0.084	0.943	0.0002	0.1240	0.0002
115	0.033	0.146	0.943	0.0002	0.1240	0.0002
116	0.037	0.183	0.941	0.0002	0.1240	0.0002
117	0.073	0.146	0.920	0.0002	0.1240	0.0002
118	0.112	0.146	0.899	0.0002	0.1240	0.0002
119A	0.135	0.146	0.886	0.0002	0.1240	0.0002
119B	0.164	0.156	0.871	0.0002	0.1240	-0.0197
120	0.202	0.189	0.851	0.0002	0.1240	-0.0197
123	-0.018	0.058	0.824	0.0001	0.0789	0.0000
124	-0.018	0.084	0.824	0.0001	0.0789	0.0000
125	-0.018	0.146	0.824	0.0001	0.0789	0.0000
126	-0.014	0.183	0.823	0.0001	0.0789	0.0000
127	0.023	0.146	0.810	0.0001	0.0789	0.0000
128	0.062	0.146	0.796	0.0001	0.0789	0.0000
129A	0.085	0.146	0.788	0.0001	0.0789	0.0000
129B	0.113	0.156	0.778	0.0001	0.0789	-0.0200
130	0.152	0.188	0.766	0.0001	0.0789	-0.0200
132	-0.045	0.058	0.706	0.0000	0.0406	0.0000
133	-0.045	0.084	0.706	0.0000	0.0406	0.0000
134	-0.045	0.146	0.706	0.0000	0.0406	0.0000
135	-0.041	0.183	0.705	0.0000	0.0406	0.0000
136	-0.004	0.146	0.699	0.0000	0.0406	0.0000
137	0.035	0.146	0.692	0.0000	0.0406	0.0000
138A	0.058	0.146	0.687	0.0000	0.0406	0.0000
138B	0.086	0.156	0.682	0.0000	0.0406	-0.0200
139	0.125	0.188	0.676	0.0000	0.0406	-0.0200
141	-0.054	0.056	0.588	0.0000	0.0113	0.0000
142	-0.054	0.141	0.588	0.0000	0.0113	0.0000
143	0.004	0.141	0.585	0.0000	0.0113	0.0000

## Loads on Anchors: Operating (W+P1+T1)

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	-9641	-2594	-2642	-18691	-205441	-98038
58		-1165				
121	32302	-6171				-3038
144	-22661	-1711	2642	3581	-127221	-867

## Loads on Hangers: Operating (W+P1+T1)

Node	Type	Load(lb)	No.of	Total(lb)
6	User hanger	-6670	1	-6670
20	User hanger	-6250	1	-6250
23	User hanger	-4265	1	-4265
25	User hanger	-4800	1	-4800



## Loads on Hangers: Operating (W+P1+T1)

Node	Type	Load(lb)	No. of	Total(lb)
29	User hanger	-5520	1	-5520
34	User hanger	-1990	1	-1990
40	User hanger	-7130	1	-7130
47	User hanger	-6465	1	-6465
50	User hanger	-5250	1	-5250
55	User hanger	-3340	1	-3340
65	Rod Hanger	-22134	1	-22134
102	Rod Hanger	-9018	1	-9018
140	Rod Hanger	-5782	1	-5782
760	User hanger	-675	1	-675
840	User hanger	-670	1	-670
96	User hanger	-500	1	-500
98	Rod Hanger	-532	1	-532

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	-0.0001	-0.0001
3A	-0.044	-0.447	0.015	-0.0189	-0.1614	-0.0316
3B	-0.253	-0.555	0.180	-0.0742	-0.3720	-0.1156
6	-1.022	-0.394	0.597	-0.0967	-0.4473	-0.0991
7	-1.366	-0.319	0.765	-0.1040	-0.4641	-0.0925
14	-2.192	-0.120	1.157	-0.1240	-0.4728	-0.0731
17A	-2.349	-0.078	1.232	-0.1275	-0.4697	-0.0694
17B	-2.622	0.052	2.031	-0.1713	-0.3678	-0.0332
20	-2.551	0.042	2.146	-0.1737	-0.3603	-0.0326
23	-1.784	-0.059	3.266	-0.1997	-0.3027	-0.0280
25	-0.901	-0.179	4.415	-0.2296	-0.2919	-0.0369
27	-0.744	-0.206	4.620	-0.2349	-0.2962	-0.0419
29	-0.066	-0.368	5.564	-0.2578	-0.3361	-0.0696
31A	-0.019	-0.383	5.635	-0.2594	-0.3402	-0.0725
31B	-0.234	-0.172	6.386	-0.2715	-0.4125	-0.1215
34	-1.011	0.348	6.810	-0.2778	-0.4011	-0.1522
35	-1.458	0.668	7.068	-0.2756	-0.3696	-0.1710
39A	-1.573	0.755	7.139	-0.2742	-0.3578	-0.1761
39B	-2.113	0.810	7.751	-0.2526	-0.1492	-0.1369
41A	-2.113	0.810	7.751	-0.2525	-0.1489	-0.1369
41B	-2.055	0.592	7.904	-0.1373	0.0714	-0.1053
43	-1.837	0.497	7.809	-0.1298	0.1228	-0.0919
44	-1.553	0.390	7.614	-0.1200	0.1845	-0.0775
47	-1.382	0.334	7.459	-0.1141	0.2188	-0.0719
50	-0.508	0.111	6.315	-0.0840	0.3587	-0.0429
52	-0.320	0.077	6.005	-0.0775	0.3813	-0.0376
55	0.279	0.006	4.907	-0.0568	0.4352	-0.0156
57	0.599	-0.009	4.272	-0.0458	0.4528	-0.0049
58	0.667	-0.010	4.134	-0.0434	0.4556	-0.0025
59	0.761	-0.010	3.942	-0.0402	0.4588	0.0006
61	0.858	-0.009	3.743	-0.0368	0.4614	0.0038
62	0.946	-0.007	3.558	-0.0360	0.4619	0.0045
64	1.126	-0.002	3.178	-0.0344	0.4623	0.0070
65	1.165	0.000	3.100	-0.0331	0.4623	0.0067

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
67A	1.342	0.004	2.735	-0.0269	0.4610	0.0042
67B	1.121	-0.008	1.910	-0.0018	0.3551	0.0059
70	0.663	-0.005	1.591	0.0038	0.3068	0.0038
73	0.425	-0.001	1.399	0.0036	0.2645	0.0025
102	0.329	0.000	1.311	0.0022	0.2418	0.0020
103	0.108	0.000	1.062	-0.0003	0.1660	0.0006
112	0.033	-0.000	0.943	-0.0001	0.1238	0.0001
121	0.000	0.000	0.874	-0.0002	0.0973	0.0000
122	-0.018	-0.000	0.824	-0.0002	0.0787	-0.0003
131	-0.045	-0.000	0.706	0.0001	0.0405	-0.0008
140	-0.054	0.000	0.588	0.0000	0.0113	-0.0010
144	0.000	0.000	0.000	0.0000	-0.0001	0.0000
700A	-0.959	-0.776	1.606	-0.1040	-0.4641	-0.3178
700B	-0.920	-0.801	1.653	-0.1040	-0.4641	-0.3134
710	-0.908	-0.803	1.661	-0.1040	-0.4641	-0.3124
720A	-0.889	-0.806	1.674	-0.1040	-0.4641	-0.3103
720B	-0.863	-0.820	1.705	-0.1040	-0.4641	-0.2501
730	-0.858	-0.826	1.715	-0.1040	-0.4641	-0.2490
740	-0.824	-0.865	1.788	-0.1040	-0.4641	-0.2465
750	-0.790	-0.903	1.861	-0.1040	-0.4641	-0.2442
760	-0.717	-0.980	2.011	-0.1040	-0.4641	-0.2359
63	1.082	0.106	3.249	-0.0360	0.4619	0.0045
74	0.426	0.065	1.399	-0.0013	0.2645	-0.0081
75	0.427	0.086	1.399	-0.0049	0.2645	-0.0160
76	0.429	0.107	1.399	-0.0053	0.2645	-0.0169
77	0.434	0.174	1.397	-0.0053	0.2645	-0.0169
78	0.408	0.108	1.424	-0.0058	0.2645	-0.0178
79	0.387	0.110	1.448	-0.0105	0.2645	-0.0256
80A	0.065	0.175	1.828	-0.0410	0.2645	-0.0543
80B	0.033	0.216	1.861	-0.0570	0.2577	0.0004
82	0.029	0.374	1.817	-0.0685	0.2577	0.0111
840	0.023	0.470	1.787	-0.0755	0.2577	0.0177
84A	0.020	0.505	1.775	-0.0780	0.2577	0.0201
84B	-0.025	0.529	1.728	-0.0647	0.2640	0.0350
87	-0.039	0.526	1.716	-0.0651	0.2640	0.0361
89	-0.475	0.436	1.346	-0.0347	0.2640	0.0689
92	-0.654	0.418	1.193	-0.0192	0.2640	0.0825
94A	-0.724	0.414	1.134	-0.0163	0.2640	0.0877
94B	-0.798	0.396	1.137	-0.0203	0.2290	0.1050
96	-0.849	0.372	1.189	-0.0203	0.2290	0.1112
98	-1.793	0.000	2.152	-0.0203	0.2290	0.0745
99	-2.122	-0.137	2.488	-0.0203	0.2290	0.1003
101	-2.169	-0.158	2.536	-0.0203	0.2290	0.1003
104	0.109	0.057	1.062	-0.0003	0.1660	-0.0112
105	0.111	0.084	1.062	-0.0003	0.1660	-0.0166
106	0.115	0.138	1.062	-0.0003	0.1660	-0.0194
107	0.123	0.183	1.059	-0.0003	0.1660	-0.0194
108	0.154	0.134	1.033	-0.0003	0.1660	-0.0200
109	0.186	0.131	1.009	-0.0003	0.1660	-0.0209
110A	0.205	0.130	0.995	-0.0003	0.1660	-0.0211
110B	0.229	0.135	0.979	-0.0003	0.1660	-0.0483
111	0.275	0.165	0.950	-0.0003	0.1660	-0.0484

## Displacements: Operating (W+P1+T1)

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
113	0.036	0.057	0.943	-0.0001	0.1238	-0.0215
114	0.039	0.084	0.943	-0.0001	0.1238	-0.0315
115	0.049	0.145	0.943	-0.0001	0.1238	-0.0375
116	0.059	0.182	0.941	-0.0001	0.1238	-0.0375
117	0.089	0.138	0.920	-0.0001	0.1238	-0.0379
118	0.128	0.132	0.899	-0.0001	0.1238	-0.0386
119A	0.151	0.128	0.886	-0.0001	0.1238	-0.0388
119B	0.181	0.133	0.871	-0.0001	0.1238	-0.0599
120	0.226	0.159	0.851	-0.0001	0.1238	-0.0599
123	-0.015	0.057	0.824	-0.0002	0.0787	-0.0171
124	-0.013	0.084	0.824	-0.0002	0.0787	-0.0248
125	-0.005	0.145	0.824	-0.0002	0.0787	-0.0295
126	0.004	0.182	0.823	-0.0002	0.0787	-0.0295
127	0.035	0.140	0.810	-0.0002	0.0787	-0.0297
128	0.074	0.135	0.796	-0.0002	0.0787	-0.0302
129A	0.097	0.131	0.788	-0.0002	0.0787	-0.0304
129B	0.127	0.138	0.778	-0.0002	0.0787	-0.0515
130	0.171	0.165	0.766	-0.0002	0.0787	-0.0515
132	-0.042	0.057	0.706	0.0001	0.0405	-0.0224
133	-0.038	0.083	0.706	0.0001	0.0405	-0.0323
134	-0.028	0.145	0.706	0.0001	0.0405	-0.0384
135	-0.018	0.182	0.706	0.0001	0.0405	-0.0384
136	0.012	0.138	0.699	0.0001	0.0405	-0.0388
137	0.051	0.131	0.692	0.0001	0.0405	-0.0395
138A	0.074	0.127	0.688	0.0001	0.0405	-0.0396
138B	0.104	0.132	0.683	0.0001	0.0405	-0.0607
139	0.149	0.158	0.676	0.0001	0.0405	-0.0608
141	-0.051	0.056	0.588	0.0000	0.0113	-0.0217
142	-0.041	0.140	0.588	0.0000	0.0113	-0.0298
143	0.016	0.133	0.585	0.0000	0.0113	-0.0298

## Loads on Anchors: Response spectrum

Node	X (lb)	Y (lb)	Z (lb)	XX(ft-lb)	YY(ft-lb)	ZZ(ft-lb)
1	4017	2441	5366	29188	10860	45067
58		4135				
121	710	2374				6510
144	290	205	6977	661	1551	218

## Loads on Hangers: Response spectrum

Node	Type	Load(lb)	No. of	Total(lb)
6	User hanger	131	1	131
20	User hanger	523	1	523
23	User hanger	540	1	540
25	User hanger	594	1	594
29	User hanger	282	1	282
34	User hanger	113	1	113
40	User hanger	89	1	89
47	User hanger	34	1	34

## Loads on Hangers: Response spectrum

Node	Type	Load(lb)	No. of	Total(lb)
50	User hanger	58	1	58
55	User hanger	45	1	45
65	Rod Hanger	1453	1	1453
102	Rod Hanger	2223	1	2223
140	Rod Hanger	1665	1	1665
760	User hanger	58	1	58
840	User hanger	9	1	9
96	User hanger	80	1	80
98	Rod Hanger	60	1	60

## Loads on Snubbers: Response spectrum

Node	Load (lb)	X comp	Y comp	Z comp
14	7448	0.000	0.000	1.000
27	4186	1.000	0.000	0.000
35	5841	1.125	0.000	-6.000
43	2967	0.000	1.000	0.000
44	6626	0.000	-2.604	7.000
52	3205	0.000	-2.740	7.000
57	3726	1.000	0.000	0.000
59	6306	0.000	-2.870	7.000
70	2385	7.000	-3.021	0.000
82	371	-4.357	0.687	0.891
87	314	0.000	1.000	0.000
89	895	3.190	-2.206	4.577
92	635	0.000	0.000	1.000
99	271	-6.357	0.000	-3.570

## Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
1	0.000	0.000	0.000	0.0000	0.0000	0.0000
3A	0.021	0.000	0.009	0.0023	0.0085	0.0163
3B	0.041	0.020	0.001	0.0529	0.0141	0.0258
6	0.061	0.131	0.000	0.0645	0.0094	0.0301
7	0.065	0.181	0.000	0.0661	0.0070	0.0324
14	0.054	0.295	0.000	0.0638	0.0156	0.0369
17A	0.049	0.316	0.000	0.0625	0.0184	0.0379
17B	0.001	0.425	0.068	0.0405	0.0687	0.0373
20	0.001	0.436	0.090	0.0380	0.0696	0.0372
23	0.000	0.540	0.301	0.0172	0.0421	0.0280
25	0.000	0.594	0.322	0.0364	0.0327	0.0133
27	0.000	0.594	0.295	0.0420	0.0454	0.0135
29	0.000	0.565	0.107	0.0678	0.0702	0.0240
31A	0.000	0.562	0.093	0.0697	0.0698	0.0247
31B	0.058	0.434	0.021	0.0928	0.0287	0.0410
34	0.096	0.260	0.021	0.0942	0.0174	0.0478
35	0.109	0.161	0.020	0.0894	0.0124	0.0526
39A	0.112	0.136	0.020	0.0873	0.0114	0.0540
39B	0.037	0.074	0.065	0.0420	0.0159	0.0612

## Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
41A	0.037	0.074	0.065	0.0420	0.0159	0.0612
41B	0.001	0.042	0.069	0.0269	0.0319	0.0447
43	0.001	0.000	0.039	0.0260	0.0310	0.0401
44	0.001	0.046	0.017	0.0251	0.0218	0.0323
47	0.001	0.069	0.024	0.0247	0.0146	0.0269
50	0.001	0.115	0.044	0.0246	0.0058	0.0072
52	0.000	0.110	0.043	0.0251	0.0050	0.0111
55	0.000	0.068	0.027	0.0273	0.0083	0.0206
57	0.000	0.040	0.015	0.0290	0.0078	0.0188
58	0.000	0.035	0.013	0.0294	0.0074	0.0176
59	0.000	0.028	0.011	0.0300	0.0067	0.0162
61	0.000	0.021	0.011	0.0306	0.0057	0.0153
62	0.000	0.015	0.011	0.0308	0.0053	0.0152
64	0.000	0.003	0.011	0.0293	0.0037	0.0150
65	0.000	0.000	0.011	0.0281	0.0032	0.0148
67A	0.000	0.011	0.008	0.0228	0.0046	0.0139
67B	0.004	0.013	0.001	0.0077	0.0016	0.0117
70	0.002	0.004	0.001	0.0049	0.0017	0.0081
73	0.002	0.001	0.001	0.0030	0.0009	0.0060
102	0.001	0.000	0.001	0.0020	0.0007	0.0049
103	0.001	0.001	0.001	0.0004	0.0008	0.0021
112	0.000	0.000	0.001	0.0008	0.0008	0.0008
121	0.000	0.000	0.001	0.0006	0.0007	0.0000
122	0.000	0.000	0.001	0.0006	0.0006	0.0001
131	0.000	0.000	0.001	0.0003	0.0004	0.0002
140	0.001	0.000	0.001	0.0003	0.0002	0.0002
144	0.000	0.000	0.000	0.0000	0.0000	0.0000
700A	0.065	0.400	0.385	0.0809	0.3425	0.1796
700B	0.065	0.420	0.428	0.0902	0.3812	0.1954
710	0.065	0.424	0.437	0.0903	0.3826	0.1959
720A	0.066	0.431	0.453	0.0904	0.3848	0.1965
720B	0.067	0.446	0.485	0.0960	0.4066	0.2036
730	0.067	0.450	0.494	0.0960	0.4072	0.2037
740	0.067	0.481	0.558	0.0960	0.4078	0.2037
750	0.067	0.513	0.622	0.0960	0.4080	0.2036
760	0.067	0.577	0.754	0.0960	0.4081	0.2030
63	0.008	0.005	0.027	0.0308	0.0053	0.0152
74	0.002	0.001	0.003	0.0123	0.0417	0.0095
75	0.003	0.001	0.004	0.0201	0.0723	0.0151
76	0.004	0.001	0.006	0.0210	0.0757	0.0159
77	0.009	0.001	0.012	0.0210	0.0757	0.0159
78	0.004	0.002	0.006	0.0217	0.0782	0.0167
79	0.004	0.004	0.014	0.0301	0.1004	0.0238
80A	0.004	0.060	0.237	0.0978	0.1960	0.0460
80B	0.010	0.067	0.252	0.1252	0.2103	0.0418
82	0.041	0.067	0.151	0.1658	0.2366	0.0561
840	0.069	0.067	0.074	0.1987	0.2527	0.0720
84A	0.080	0.067	0.042	0.2120	0.2586	0.0770
84B	0.053	0.019	0.000	0.3599	0.2760	0.0931
87	0.040	0.000	0.000	0.3649	0.2777	0.0950
89	0.475	0.686	0.000	0.4381	0.3511	0.1546
92	0.723	0.983	0.000	0.4350	0.3735	0.1794



## Displacements: Response spectrum

Node	X (inch)	Y (inch)	Z (inch)	XX(deg)	YY(deg)	ZZ(deg)
94A	0.820	1.097	0.000	0.4344	0.3724	0.1889
94B	0.877	1.132	0.055	0.4223	0.3358	0.2157
96	0.877	1.083	0.131	0.4223	0.3296	0.2214
98	0.877	0.000	1.270	0.4223	0.2150	0.2807
99	0.877	0.415	1.562	0.4223	0.1988	0.2846
101	0.877	0.475	1.602	0.4223	0.1988	0.2846
104	0.002	0.001	0.006	0.0393	0.0087	0.0101
105	0.003	0.001	0.012	0.0521	0.0126	0.0137
106	0.006	0.001	0.025	0.0563	0.0147	0.0150
107	0.010	0.001	0.037	0.0563	0.0147	0.0150
108	0.006	0.003	0.028	0.0563	0.0150	0.0151
109	0.006	0.005	0.030	0.0565	0.0156	0.0152
110A	0.006	0.006	0.031	0.0566	0.0157	0.0153
110B	0.007	0.007	0.035	0.0573	0.0172	0.0158
111	0.010	0.010	0.048	0.0574	0.0173	0.0158
113	0.001	0.000	0.011	0.0711	0.0292	0.0064
114	0.002	0.000	0.021	0.0941	0.0425	0.0087
115	0.004	0.000	0.049	0.1021	0.0506	0.0097
116	0.006	0.000	0.067	0.1021	0.0506	0.0097
117	0.004	0.002	0.058	0.1021	0.0510	0.0097
118	0.004	0.004	0.066	0.1024	0.0518	0.0098
119A	0.004	0.005	0.072	0.1025	0.0520	0.0098
119B	0.005	0.006	0.083	0.1032	0.0538	0.0099
120	0.006	0.007	0.108	0.1033	0.0539	0.0100
123	0.001	0.000	0.007	0.0479	0.0145	0.0043
124	0.001	0.000	0.014	0.0634	0.0210	0.0057
125	0.003	0.000	0.033	0.0688	0.0249	0.0063
126	0.004	0.000	0.045	0.0688	0.0249	0.0063
127	0.003	0.001	0.038	0.0688	0.0251	0.0063
128	0.003	0.002	0.042	0.0690	0.0255	0.0063
129A	0.003	0.003	0.045	0.0691	0.0256	0.0064
129B	0.003	0.004	0.052	0.0696	0.0266	0.0065
130	0.004	0.005	0.067	0.0696	0.0267	0.0065
132	0.001	0.000	0.008	0.0494	0.0195	0.0062
133	0.002	0.000	0.015	0.0654	0.0283	0.0083
134	0.004	0.000	0.034	0.0710	0.0337	0.0092
135	0.006	0.000	0.047	0.0710	0.0337	0.0092
136	0.004	0.002	0.040	0.0710	0.0340	0.0092
137	0.004	0.003	0.046	0.0712	0.0346	0.0093
138A	0.004	0.004	0.050	0.0713	0.0347	0.0093
138B	0.005	0.006	0.058	0.0718	0.0358	0.0095
139	0.006	0.007	0.075	0.0719	0.0359	0.0095
141	0.001	0.000	0.006	0.0365	0.0242	0.0058
142	0.004	0.000	0.021	0.0418	0.0336	0.0069
143	0.004	0.002	0.030	0.0418	0.0336	0.0069



```

*****
*                                     *
*      S T A A D - III               *
*      Revision 20.0                 *
*      Proprietary Program of        *
*      RESEARCH ENGINEERS, Inc.      *
*      Date= JUL 20, 1996             *
*      Time= 12: 4:25                 *
*                                     *
*      USER ID:                       *
*****

```

1. STAAD PLANE FIND STRAIGHT ROD STIFFNESS
2. INPUT WIDTH 72
3. UNIT INCHES KIP
4. JOINT COORDINATES
5. 1 0. 0. 0.; 2 60. 0. 0.; 3 120. 0. 0.
6. MEMBER INCIDENCES
7. 1 1 2; 2 2 3
8. MEMBER PROPERTY AMERICAN
9. 1 2 PRI YD 2.
10. CONSTANTS
11. E STEEL ALL
12. POISSON STEEL ALL
13. SUPPORTS
14. 1 PINNED
15. LOAD 1 UNIT LOAD FOR STIFFNESS EVALUATION
16. JOINT LOAD
17. 3 FX 1.0
18. PERFORM ANALYSIS PRINT ALL

# PROBLEM STATISTICS

```

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 3/ 2/ 1
ORIGINAL/FINAL BAND-WIDTH = 1/ 1
TOTAL PRIMARY LOAD CASES = 1. TOTAL DEGREES OF FREEDOM = 7
SIZE OF STIFFNESS MATRIX = 42 DOUBLE PREC. WORDS
RECORD/AVAIL. DISK SPACE = 12.00/ 295.0 MB. EXMEM = 1.02 MB

```

ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # E

REV 0 SHEET 1 OF 6

## LOADING 1 UNIT LOAD FOR STIFFNESS EVALUATION

JOINT LOAD - UNIT KIP INCH

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
3	1.00	0.00	0.00	0.00	0.00	0.00

\*\*\*TOTAL APPLIED LOAD ( KIP INCH ) SUMMARY (LOADING 1)

SUMMATION FORCE-X = 1.00  
 SUMMATION FORCE-Y = 0.00  
 SUMMATION FORCE-Z = 0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-

MX= 0.00 MY= 0.00 MZ= 0.00

++ PROCESSING ELEMENT STIFFNESS MATRIX. 12: 4:29  
 ++ PROCESSING GLOBAL STIFFNESS MATRIX. 12: 4:29  
 ++ PROCESSING TRIANGULAR FACTORIZATION. 12: 4:29

\*\*\*WARNING - IMPROPER LOAD WILL CAUSE INSTABILITY AT JOINT 3

DIRECTION = MZ PROBABLE CAUSE MODELING PROBLEM -0.455E-12

++ CALCULATING JOINT DISPLACEMENTS. 12: 4:29  
 ++ CALCULATING MEMBER FORCES. 12: 4:30

\*\*\*TOTAL REACTION ( KIP INCH ) SUMMARY

LOADING 1

SUM-X= -1.00 SUM-Y= 0.00 SUM-Z= 0.00

SUMMATION OF MOMENTS AROUND ORIGIN-

MX= 0.00 MY= 0.00 MZ= 0.00

ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # E

REV 0 SHEET 2 OF 6

EXTERNAL AND INTERNAL JOINT LOAD SUMMARY-

JT	EXT FX/ INT FX	EXT FY/ INT FY	EXT FZ/ INT FZ	EXT MX/ INT MX	EXT MY/ INT MY	EXT MZ/ INT MZ
1	0.00	0.00	0.00	0.00	0.00	0.00
	1.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
3	1.00	0.00	0.00	0.00	0.00	0.00
	-1.00	0.00	0.00	0.00	0.00	0.00

\*\*\*\*\* END OF DATA FROM INTERNAL STORAGE \*\*\*\*\*

19. LOAD LIST ALL

ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # E

REV 0 SHEET 3 OF 6

FIND STRAIGHT ROD STIFFNESS

-- PAGE NO. 3  
ID:

20. PRINT SUPPORT REACTIONS

ANALYSIS/CALCULATION

DOC ID # 596-029 ATT # E

REV 0 SHEET 4 OF 6

SUPPORT REACTIONS -UNIT KIP INCH STRUCTURE TYPE = PLANE  
-----

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	-1.00	0.00	0.00	0.00	0.00	0.00

\*\*\*\*\* END OF LATEST ANALYSIS RESULT \*\*\*\*\*

21. PRINT JOINT DISPLACEMENTS ALL

ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # EREV 0 SHEET 5 OF 6



JOINT DISPLACEMENT (INCH RADIANS)      STRUCTURE TYPE = PLANE  
-----

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
1	1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
2	1	0.00066	0.00000	0.00000	0.00000	0.00000	0.00000
3	1	0.00132	0.00000	0.00000	0.00000	0.00000	0.00000

\*\*\*\*\* END OF LATEST ANALYSIS RESULT \*\*\*\*\*

22. FINISH

\*\*\*\*\* END OF STAAD-III \*\*\*\*\*

\*\*\*\* DATE= JUL 20,1996    TIME= 12: 4:30 \*\*\*\*

\*\*\*\*\*  
\*        For questions on STAAD-III/ISDS, contact:        \*  
\*        RESEARCH ENGINEERS, Inc at                        \*  
\*        Ph: (714) 974-2500    Fax: (714) 921-2543        \*  
\*\*\*\*\*

ANALYSIS/CALCULATION

DOC ID # 596-0129    ATT # E  
REV 0    SHEET 6    OF 6

```

*****
*                                     *
*      S T A A D - III               *
*      Revision 20.0                 *
*      Proprietary Program of        *
*      RESEARCH ENGINEERS, Inc.      *
*      Date= JUL 20, 1996             *
*      Time= 12: 7.25                *
*                                     *
*      USER ID:                      *
*****

```

1. STAAD PLANE FIND BENT ROD STIFFNESS
2. INPUT WIDTH 72
3. UNIT INCHES KIP
4. JOINT COORDINATES
5. 1 0. 0. 0. : 2 60. 2. 0. : 3 120. 0. 0.
6. MEMBER INCIDENCES
7. 1 1 2: 2 2 3
8. MEMBER PROPERTY AMERICAN
9. 1 2 PRI YD 2.
10. CONSTANTS
11. E STEEL ALL
12. POISSON STEEL ALL
13. SUPPORTS
14. 1 PINNED
15. LOAD 1 UNIT LOAD FOR STIFFNESS EVALUATION
16. JOINT LOAD
17. 3 FX 1.0
18. PERFORM ANALYSIS PRINT ALL

# PROBLEM STATISTICS -----

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 3/ 2/ 1  
 ORIGINAL/FINAL BAND-WIDTH = 1/ 1  
 TOTAL PRIMARY LOAD CASES = 1. TOTAL DEGREES OF FREEDOM = 7  
 SIZE OF STIFFNESS MATRIX = 42 DOUBLE PREC. WORDS  
 REQRD/AVAIL. DISK SPACE = 12.00/ 295.0 MB, EXMEM = 1.02 MB

## ANALYSIS/CALCULATION

DOC ID # S96-0129 ATT # F  
 REV 0 SHEET 1 OF 6

## LOADING 1 UNIT LOAD FOR STIFFNESS EVALUATION

JOINT LOAD - UNIT KIP INCH

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
3	1.00	0.00	0.00	0.00	0.00	0.00

\*\*\*TOTAL APPLIED LOAD ( KIP INCH ) SUMMARY (LOADING 1 )

SUMMATION FORCE-X = 1.00

SUMMATION FORCE-Y = 0.00

SUMMATION FORCE-Z = 0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-

MX= 0.00 MY= 0.00 MZ= 0.00

++ PROCESSING ELEMENT STIFFNESS MATRIX. 12: 7:26

++ PROCESSING GLOBAL STIFFNESS MATRIX. 12: 7:26

++ PROCESSING TRIANGULAR FACTORIZATION. 12: 7:26

\*\*\*WARNING - IMPROPER LOAD WILL CAUSE INSTABILITY AT JOINT 3

DIRECTION = MZ PROBABLE CAUSE MODELING PROBLEM 0.364E-11

++ CALCULATING JOINT DISPLACEMENTS. 12: 7:26

+ CALCULATING MEMBER FORCES. 12: 7:26

\*\*\*TOTAL REACTION ( KIP INCH ) SUMMARY

LOADING 1

SUM-X= -1.00 SUM-Y= 0.00 SUM-Z= 0.00

SUMMATION OF MOMENTS AROUND ORIGIN-

MX= 0.00 MY= 0.00 MZ= 0.00

EXTERNAL AND INTERNAL JOINT LOAD SUMMARY-

JT	EXT FX/ INT FX	EXT FY/ INT FY	EXT FZ/ INT FZ	EXT MX/ INT MX	EXT MY/ INT MY	EXT MZ/ INT MZ
1	0.00	0.00	0.00	0.00	0.00	0.00
	1.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
3	1.00	0.00	0.00	0.00	0.00	0.00
	-1.00	0.00	0.00	0.00	0.00	0.00

## ANALYSIS/CALCULATION

DOC ID #596-0129 ATT # F

REV 0 SHEET 2 OF 6

19. LOAD LIST ALL

ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # F  
REV 0 SHEET 3 OF 6

FIND BENT ROD STIFFNESS

-- PAGE NO. 3  
ID:

20. PRINT SUPPORT REACTIONS

ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # F  
REV 0 SHEET 4 OF 6

SUPPORT REACTIONS -UNIT KIP INCH STRUCTURE TYPE = PLANE  
-----

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	-1.00	0.00	0.00	0.00	0.00	0.00

\*\*\*\*\* END OF LATEST ANALYSIS RESULT \*\*\*\*\*

21. PRINT JOINT DISPLACEMENTS ALL

ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # FREV. 0 SHEET 5 OF 6



JOINT DISPLACEMENT (INCH RADIANS)      STRUCTURE TYPE = PLANE  
-----

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
1	1	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00527
2	1	0.00945	-0.26361	0.00000	0.00000	0.00000	-0.00264
3	1	0.00835	-0.31629	0.00000	0.00000	0.00000	0.00000

\*\*\*\*\* END OF LATEST ANALYSIS RESULT \*\*\*\*\*

22. FINISH

\*\*\*\*\* END OF STAAD-III \*\*\*\*\*

\*\*\*\* DATE= JUL 20,1996    TIME= 12: 7:26 \*\*\*\*

\*\*\*\*\*  
\*        For questions on STAAD-III/ISDS, contact:        \*  
\*        RESEARCH ENGINEERS, Inc at                        \*  
\*        Ph: (714) 974-2500    Fax: (714) 921-2543        \*  
\*\*\*\*\*

## ANALYSIS/CALCULATION

DOC ID # 596-0129 ATT # FREV 0 SHEET 6 OF 6

## Attachment G

Calc. S 96-0129

## Comparison of Original CR5 Analysis and Attachment A B C D Analyses

		Deadweight			Thermal			Seismic XY			Seismic ZY		
NODE/SUPT #		CR-5	A&B	C&D	CR-5	A&B	C&D	CR-5	A	C	CR-5	B	D
121/MSH-220	Fx	-20	-178	-170	32375	32486	32472	7276	3303	3341	1874	1083	710
	Fy	-4630	-5688	-5411	36	-90	-759	822	949	1382	1892	1537	2374
	Mz	-4534	-4393	-4957	80	588	1919	26282	12345	13774	5670	7635	6510
144/MSA-18	Fx	14	62	56	-22796	-22727	-22717	668	679	720	816	409	290
	Fy	-1743	-1703	-1699	1	-1	-11	24	109	112	304	199	205
	Fz	-2	-1	0	2660	2643	2642	3402	2772	4327	10898	8543	6977
	Mx	3667	3554	3539	-2	5	43	94	107	141	1154	642	661
	My	84	366	331	-136755	-127611	-127554	3958	2688	2931	4824	1979	1551
	Mz	-647	-867	-867	0	0	0	2524	1461	1534	336	392	218
<b>Rigid Hangers</b>													
58/MSH-27B	Fy	-6070	1345	850	-2597	-2807	-2015	5154	3890	2235	9892	5632	4135
102/MSH-28	Fy	-8000	-9479	-9787	-55	21	769	1632	887	1249	3060	1552	2223
65/MSH-216	Fy	-18616	-23422	-22912	1589	1714	778	4358	2149	1667	5240	2842	1453
140/MSH-244	Fy	-5856	-5900	-5968	-8	21	186	244	661	775	2574	1552	1665
<b>Springs</b>													
6/MSH-17	Fy	-6646	-6235	-6235	0	-435	-435	64	130	130	86	133	131
20/MSH-18	Fy	-5960	-6132	-6131	0	-118	-119	244	521	520	290	524	523
23/MSH-19	Fy	-4294	-4179	-4175	0	-86	-90	310	542	540	340	542	540
25/MSH-20	Fy	-4906	-4742	-4734	0	-58	-66	436	597	595	470	597	594
28/MSH-21	Fy	-5192	-5473	-5466	0	-47	-54	264	283	281	286	284	282

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Comparison of Original CR5 Analysis and Attachment A B C D Analyses

		Deadweight			Thermal			Seismic XY			Seismic ZY			
NODE/SUPT #		CR-5	A&B	C&D	CR-5	A&B	C&D	CR-5	A	C	CR-5	B	D	
34/MSH-22	Fy	-5529	-2069	-2060	0	79	70	110	113	113	120	114	113	
40/MSH-23	Fy	-4057	-7325	-7300	0	195	170	22	56	60	52	70	89	
47/MSH-24	ry	-5641	-6420	-6407	0	-45	-58	28	17	21	68	23	34	
50/MSH-25	Fy	-5009	-5214	-5200	0	-36	-50	36	19	29	80	29	58	
55/MSH-26	Fy	-3149	-3326	-3313	0	-14	-27	14	10	22	28	14	45	
<b>Snubbers</b>														
14/MSH-228	Fz													
27/MSH-229	Fx													
35/MSH-230	Fr													
43/MSH-231	Fy													
44/MSH-117	Fr													
52/MSH-119	Fr													
57/MSH-232	Fx													
59/MSH-121	Fr													
70/MSH-124	Fr													
								3358	5752	5669	7816	7581	7448	
								6004	5679	5482	4896	3697	4186	
								3266	4135	4079	9806	5977	5841	
								2370	3038	2691	3606	2748	2967	
								4010	6162	6208	5471	6896	6626	
								3393	2849	2843	4448	3267	3205	
								9668	8121	7803	6420	4589	3726	
								2151	4782	5943	5730	10415	6306	
								569	1789	2535	1283	3764	2385	

Attachment G  
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Comparison of Original CR5 Analysis and Attachment A B C D Analyses

		CR-5 X Y		A		C		CR-5 Y Z		B		D	
		Total Combined Loads -											
NODE/SUPT #		(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)
121/MSH-220	Fx	39631	25079	35611	29005	35643	28961	34229	30481	33391	31225	33012	31592
	Fy	-3772	-5416	-4829	-6727	-4788	-7552	-2702	-6486	-4241	-7315	-3796	-8544
	Mz	21828	-30736	8540	-16150	10736	-16812	1216	-10124	3830	-11440	3472	-9548
144/MSA-18	Fx	-22114	-23450	-21986	-23344	-21941	-23381	-21966	-23598	-22256	-23074	-22371	-22951
	Fy	-1718	-1766	-1595	-1813	-1598	-1822	-1438	-2046	-1505	-1903	-1505	-1915
	Fz	6060	-744	5414	-130	6969	-1685	13556	-8240	11185	-5901	9619	-4335
	Mx	3759	3571	3666	3452	3723	3441	4819	2511	4201	2917	4243	2921
	My	-132713	-140629	-124557	-129933	-124292	-130154	-131847	-141495	-125266	-129224	-125672	-128774
	Mz	1877	-3171	594	-2328	667	-2401	-311	-983	-475	-1259	-649	-1085
Rigid Hangers													
58/MSH-27B	Fy	-3513	-13821	2428	-5352	1070	-3400	1225	-18559	4170	-7094	2970	-5300
102/MSH-28	Fy	-6423	-9687	-8571	-10345	-7769	-10267	-4995	-11115	-7906	-11010	-6795	-11241
65/MSH-216	Fy	-12669	-21385	-19559	-23857	-20467	-23801	-11787	-22267	-18866	-24550	-20681	-23587
140/MSH-244	Fy	-5620	-6108	-5218	-6540	-5007	-6557	-3290	-8438	-4327	-7431	-4117	-7447
Springs													
6/MSH-17	Fy	-6582	-6710	-6540	-6800	-6540	-6800	-6560	-6732	-6537	-6803	-6539	-6801
20/MSH-18	Fy	-5716	-6204	-5729	-6771	-5730	-6770	-5670	-6250	-5726	-6774	-5727	-6773
23/MSH-19	Fy	-3984	-4604	-3723	-4807	-3725	-4805	-3954	-4634	-3723	-4807	-3725	-4805
25/MSH-20	Fy	-4470	-5342	-4203	-5397	-4205	-5395	-4436	-5376	-4203	-5397	-4206	-5394
29/MSH-21	Fy	-4928	-5456	-5237	-5803	-5239	-5801	-4906	-5478	-5236	-5804	-5238	-5802



Attachment G  
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Comparison of Original CR5 Analysis and Attachment A B C D Analyses

		CR-5 X Y		A		C			CR-5 Y Z		B		D	
		Total Combined Loads												
NODE/SUPT #		(+)	(-)	(+)	(-)	(+)	(-)		(+)	(-)	(+)	(-)	(+)	(-)
34/MSH-22	Fy	-5419	-5639	-1877	-2103	-1877	-2103		-5409	-5649	-1876	-2104	-1877	-2103
40/MSH-23	Fy	-4035	-4079	-7074	-7186	-7070	-7190		-4005	-4109	-7060	-7200	-7041	-7219
47/MSH-24	Fy	-5613	-5669	-6448	-6482	-6444	-6486		-5573	-5709	-6442	-6488	-6431	-6499
50/MSH-25	Fy	-4973	-5045	-5231	-5269	-5221	-5279		-4929	-5089	-5221	-5279	-5192	-5308
55/MSH-26	Fy	-3135	-3163	-3330	-3350	-3318	-3362		-3121	-3177	-3326	-3354	-3295	-3385
Snubbers														
14/MSH-228	Fz	3358	-3358	5752	-5752	5669	-5669		7816	-7816	7581	-7581	7448	-7448
27/MSH-229	Fx	6004	-6004	5679	-5679	5482	-5482		4896	-4896	3697	-3697	4186	-4186
35/MSH-230	Fr	3266	-3266	4135	-4135	4079	-4079		9806	-9806	5977	-5977	5841	-5841
43/MSH-231	Fy	2370	-2370	3038	-3038	2691	-2691		3606	-3606	2748	-2748	2967	-2967
44/MSH-117	Fr	4010	-4010	6162	-6162	6208	-6208		5471	-5471	6896	-6896	6626	-6626
52/MSH-119	Fr	3393	-3393	2849	-2849	2843	-2843		4448	-4448	3267	-3267	3205	-3205
57/MSH-232	Fx	9668	-9668	8121	-8121	7803	-7803		6420	-6420	4589	-4589	3726	-3726
59/MSH-121	Fr	2151	-2151	4782	-4782	5943	-5943		5730	-5730	10415	-10415	6306	-6306
70/MSH-124	Fr	569	-569	1789	-1789	2535	-2535		1283	-1283	3764	-3764	2385	-2385

### CR-3 Piping Systems Which Contain Some Rod Hanger Type Supports

The following Seismic Class I piping systems may contain rod type pipe hangers:

Reactor Building Spray (BS)

Makeup (MU)

Main Steam (MS)

Main Feedwater (FW)

Decay Heat Removal (DH)

Nuclear Services Closed Cycle Cooling (SW)

Emergency Feedwater (EF)

Decay Heat Closed Cycle Cooling (DC)

Chilled Water (CH)

Waste Disposal (WD)

Spent Fuel Cooling (SF)

Core Flooding (CF)

Circulating Water (CW)

Condensate (CD)

The B&W-analyzed Class I RCS piping does not contain rod hangers. Almost all non-safety related piping will contain some rod hangers. Other non-Parsons Power analyzed piping also may contain rod hanger supported sections of pipe. FPC has not performed a system walkdown for this information request to specifically look for rod hangers. The piping code of record did not prevent the use of these type of pipe support.