

ME-884

REVISED 3/12/82

REVISED 8/30/82

SEISMIC - STRESS ANALYSIS

OF

HORIZONTAL PUMPS

SIZE & TYPE: 8 X 10 X 14 CAP

CUSTOMER: CINCINNATI GAS & ELECTRIC COMPANY
PLANT: WM. H. ZIMMER NUCLEAR POWER STATION -
UNIT 1

CUSTOMER P. O. NO.: 2212

ITEM NOS.: 1WRO1PA, B, C, D

SERVICE: RX BUILDING CLOSED COOLING WATER PUMPS

SPECIFICATION NO.: H-2185

S.O. NO.: 14210325/8

MANUFACTURED BY

BINGHAM - WILLAMETTE CO.

PORTLAND, OREGON

Analysis By

MCDONALD ENGINEERING ANALYSIS COMPANY, INC.

BIRMINGHAM, ALABAMA

B210260493 B21021
PDR ADDCK 05000358
E PDR

CERTIFICATION STATEMENT

These Bingham-Willamette 8 x 10 x 14 CAP 1-stage RX Building Closed Cooling Water pumps have been analyzed in accordance with Sargent & Lundy Specification No. H-2185 including Supplement No. 3; the ASME B&PV Code, 1971 Edition through Summer 1973 Addendum, Section III, Class 3; and good practice in design analysis. AISC Code, 7th Edition is used for bolting.

The pump is adequate provided that the pump hold down bolts, upper tail bracket bolts, and frame to cover bolts are replaced by bolts of A-325 material, or equivalent and the lower tail bracket bolts are replaced by 1/2" diameter bolts of A-325 material.

C. K. McDonald

C. K. McDonald, Ph.D., P. E.

Alabama Registration No. 9586

August 21, 1981

Revised 5/1/82 - Revised nozzle loads, re-ran seismic analysis.

Revised 8/30/82 - Revised per S & L comments.



TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	SUMMARY OF RESULTS	3
3.	FREQUENCY ANALYSIS	4
3.1	Dynamic Model	4
3.2	Computer Analysis	7
3.3	Frequency Output	7
4.	LOADING CRITERIA	15
4.1	Dynamic Loading	15
4.2	Nozzle Loads	15
4.3	Internal Pressure Loading	15
4.4	Shaft Torsional Loading	15
4.5	Other Pump Normal Loads	15
4.6	Casting Factor	15
5.	STRUCTURAL INTEGRITY ANALYSIS	17
5.1	Motor Hold Down Bolts	17
5.2	Pump Hold Down Bolts	20
5.3	Anchor Bolt Loads	20
5.4	Shaft Stress	21
5.5	Stresses in Support Frame	22
5.6	Thrust Bearing Retainer Bolts	22
5.7	Tail Bracket Bolt Stress	23
5.8	Stuffing Box Cover Analysis	24
5.9	Nozzle Analysis	24
5.10	Suction and Discharge Flanges	26

Continued.....

TABLE OF CONTENTS (Cont.)

5.11	Bearing Housing to Stuffing Box Bolt Analysis	27
5.12	Pump Pedestal Stress	27
5.13	Pump Pedestal Weld Stress	28
5.14	Pump Foot Stress	28
5.15	Motor Support Stress	29
6.	FUNCTIONAL CAPABILITY ANALYSIS	30
6.1	Flexible Coupling Analysis	30
6.2	Impeller Key Analysis	31
6.3	Impeller Clearance	31
6.4	Shaft Mechanical Seal	32
6.5	Bearing Loads	33
7.	MOTOR SEISMIC LOADS	35

Appendix A - Computer Output for Forces and Displacements

Appendix B - Nomenclature and Formulas

Appendix C - Frequencies and Mode Shapes

Appendix D - New Departure Bearing Allowable Loads

Appendix E - Accelerations

Appendix F - Member Properties

Appendix G - Masses

Appendix H - Nozzle Loads

Appendix I - Response Spectra Curves

Appendix J - Flange Analysis

1. INTRODUCTION

This report covers the seismic, stress, and deflection analysis of Bingham-Willamette 8 x 10 x 14 CAP 1-stage RX Building Closed Cooling Water pumps. The analysis is directed toward proving both the structural integrity and functional capability of the pumps.

A dynamic model is developed and a computer frequency analysis is made to obtain the frequencies of the assembly, as required by the spec. The pump assembly has frequencies below 67 Hertz, thus a dynamic analysis is made.

The nozzle loads are also imposed on the computer model of the assembly and the resulting loads and deflections are calculated. The total stresses/loads are calculated and then compared to the allowables given in the specification, or ASME Code. The deflections are compared to operating clearances or other limiting criteria.

The nozzles are analyzed for the maximum nozzle loads. The equivalent pressure caused by the nozzle bending moments are calculated in accordance with the ASME Code and imposed on the flanges.

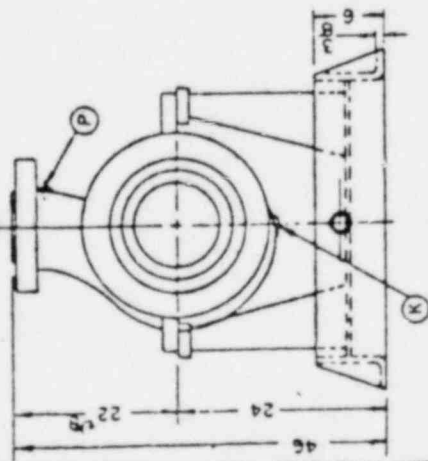
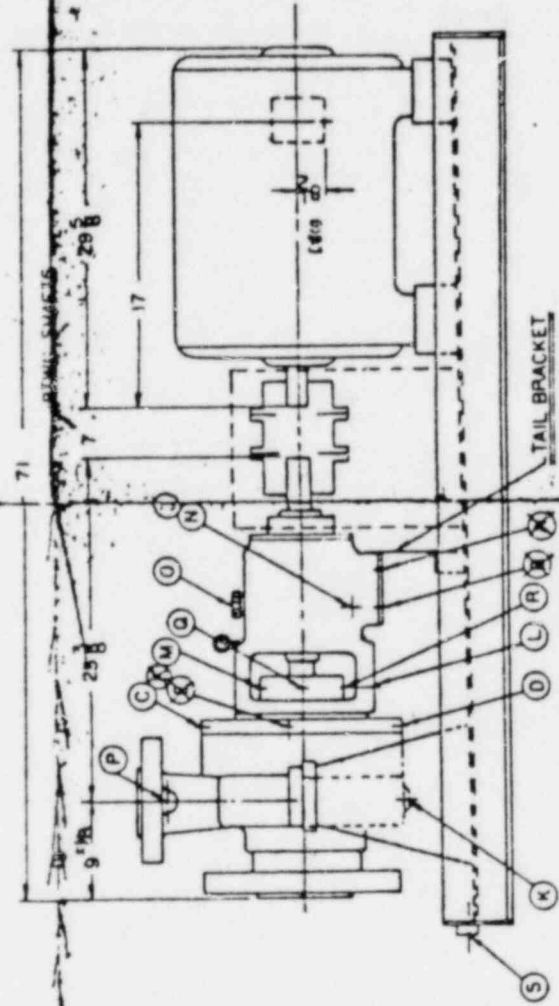
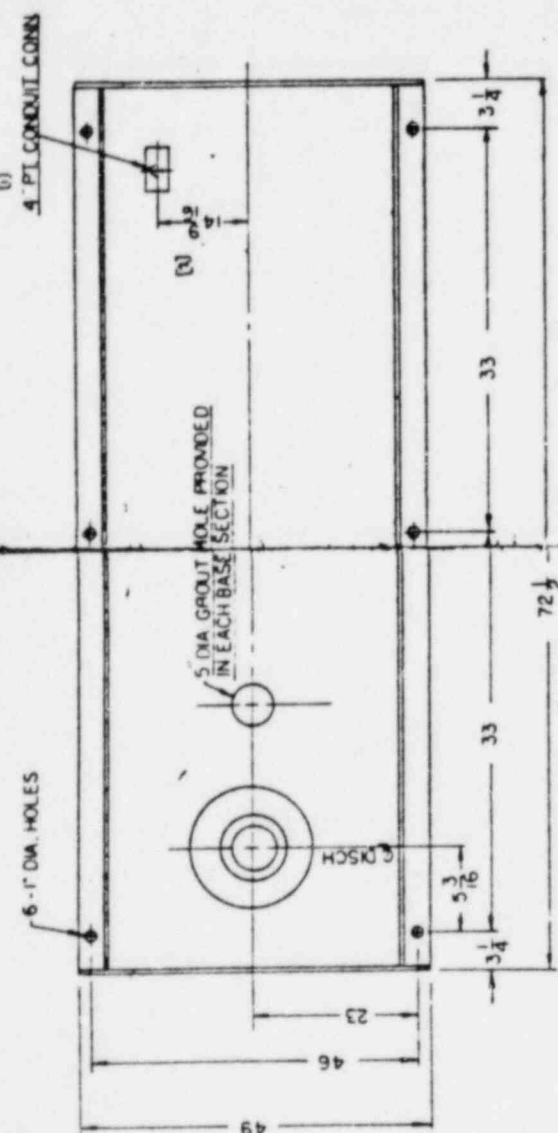
This pump casing is of complex geometry and has been well verified for normal operation by service experience and hydrostatic tests. The seismic and nozzle loads impose negligible stress in the casing except at nozzle penetrations and the Stuffing Box flange, which have been analyzed.

Only the worst case component is analyzed in detail in this report. The worst case is selected by either enveloping the loads for all components and applying these loads to the component selected or doing a case by case study of the stresses in each component. In either case, only the worst case calculations are included in the report.

ITEM	DESCRIPTION	QTY	UNIT
A	BASE PLATE	1	PC
B	BEARING HOUSING COUPLING PART	1	PC
C	BEARING HOUSING COUPLING G. DRIVE	1	PC
D	STUTTING BOX COUPLING PART	1	PC
E	SEALING HOUSING PART	1	PC
F	SEALING HOUSING PART	1	PC
G	GRADE CONNECTION	1	PC
H	PLASTIC COUPLING PART	1	PC
I	PLASTIC COUPLING DRIVE	1	PC
J	OM DRAIN (FAR SIDE)	1	PC
K	PUMP DRIVE	1	PC
L	BEARING BRACKET DRIVE	1	PC
M	FLUSHING INLET	1	PC
N	CONSTANT LEVEL ORER	1	PC
O	OM INSPECTION HOLE COVER	1	PC
P	PUMP VENT	1	PC
Q	OVERFLOW IN AND OUT	1	PC
R	GLAND DRAIN	1	PC
S	BASE DRAIN	1	PC

LIQUID SEAL FLUSHING LIQUID PIPING SUPPLIED BY BINGHAM PER MPL PLAN II W/ STAINLESS STEEL PIPE AND FITTINGS

SEE NOTE



UNIT DATA	
REF and TYPE	BX10X4 CAP
NO. STATOR	1/50
ROTATION	CW
DRUM NO.	8-300 (PART I)
SECTION NUMBER	300 (PART II)
ARCH. MAIL	10/11/50
TYPE	10
PACKING	5000
NO. W/GE	10
ASSEMBLY	

TYPE 10
DRUM NO. 8-300
SECTION NUMBER 300
ARCH. MAIL 10/11/50
TYPE 10
PACKING 5000
NO. W/GE 10
ASSEMBLY

BUYER SPECIFICATIONS	
ADDRESS	WESTINGHOUSE
CITY	PITTSBURGH
STATE	PENNSYLVANIA
PHONE	404-15
NO.	100
VOL.	1
DATE	APR 25 1950
BY	W. A. BIRCH

WEIGHT	
PUMP	250 LBS
BASE	250 LBS
STATOR	310 LBS
TOTAL	2740 LBS

CUSTOMER DATA	
PURCHASER	CINCINNATI GAS
ELECTRIC CO	77 DUMBUS 1
SOUTHERN OHIO ELECTRIC CO	
DIVISION	POWER LIGHT CO
INSTALLATION SITE	WM H
7 INCHER MAX CLEAR POWER	
STATION	UNIT
PLANT	BASE
ORDER NO.	2212
SPECIFICATION NO.	H 2185
PROPERTY	BUILDING CLOSED
COOLING	WATER PUMPS
PUMP SIZE	BX10X4 CAP
and TYPE	

FD-14210325/B
D-16094 X

PUMP ITEM NO'S: IWROIPA, B, C, D

CAUTION: Carefully Check Alignment Before Starting Unit. All Units in this Unit should be Subjected to Proper Pumping Practice.

CERTIFIED FOR CONSTRUCTION

Bingham-Willamette Company
Bingham-Willamette Ltd.

DATE: 11/11/50
BY: W. A. BIRCH

FORN USE OR EXPORT: IL
REWORK: 10

2. SUMMARY OF RESULTS

A summary of the actual stresses, loads, and deflections is given herein.

The actual Emergency values are compared to the Normal allowables.

<u>Components</u>	<u>Actual</u>	<u>Allowable</u>
Motor Hold Down Bolt Stress, PSI - Tensile	4,708	12,221
- Shear	9,487	10,000
Pump Hold Down Bolt Stress, PSI - Tensile	20,607	40,000
- Shear	22,742	33,000
Anchor Bolt Loads, Lbs. - Tensile	8,854	By Others
- Shear Y	15,205	By Others
- Shear Z	884	By Others
Shaft Stress, PSI	10,484	17,500
Support Frame Stress, PSI	18,206	24,000
Thrust Bearing Retainer Bolt Stress, PSI	1,271	20,000
Upper Tail Bracket Bolt Stress, PSI - Tensile	18,911	38,985
- Shear	6,884	15,000
Lower Tail Bracket Bolt Stress, PSI - Tensile	37,505	40,000
- Shear	2,694	15,000
Stuffing Box Cover Flange Stress, PSI	18,144	21,000
Bolt Stress, PSI	17,214	25,000
Maximum Nozzle Stress, PSI - Suction	15,562	21,000
- Discharge	8,755	21,000
Discharge Flange Stress, PSI	14,347	21,000
Suction Flange Stress, PSI	16,172	21,000
Frame/Cover Bolt Stress, PSI	18,127	40,000
Pump Pedestal Stress, PSI	12,936	24,000
Pump Pedestal Weld Stress, PSI	19,733	21,000
Pump Foot Stress, PSI	11,933	21,000
Motor Support Stress, PSI	8,935	24,000

Continued.....

2. SUMMARY OF RESULTS (cont.)

<u>Components</u>	<u>Actual</u>	<u>Allowable</u>
Flexible Coupling Misalignment, Radians	.019	.025
Impeller Key Stress, PSI	2,531	9,000
Impeller Clearance, Inches	.007	.009
Bearing Loads, Lbs. - Thrust	2,559	57,500
- Radial	1,941	28,480
Motor Accelerations, G's - X	1.80	-
- Y	.84	-
- Z	.86	-

3. FREQUENCY ANALYSIS

A dynamic model is prepared and a computer frequency analysis is made to determine the assembly frequencies as required by the specification. A detailed discussion of the dynamic model and computer analysis is given below.

3.1 Dynamic Model

The dynamic model which was developed for the frequency analysis is shown in Figure 2, page 5. The joint numbers (enclosed in circles) and member numbers are included to facilitate the computer input. Several assumptions were made in developing the model. These assumptions were made such that the model would be more flexible than the actual assembly. Thus, the frequencies predicted by the model will be lower than the actual frequencies. Some of these assumptions are:

1. The bedplate is assumed to be supported only at the foundation bolts. This is true for upward forces but for downward forces the bedplate channel flanges are continuously supported.
2. The effects of grouting have been completely neglected. The neglect of this grouting reduces the calculated frequencies and increases the calculated stresses, thus it can be seen from the response spectra curve that this approach is conservative.

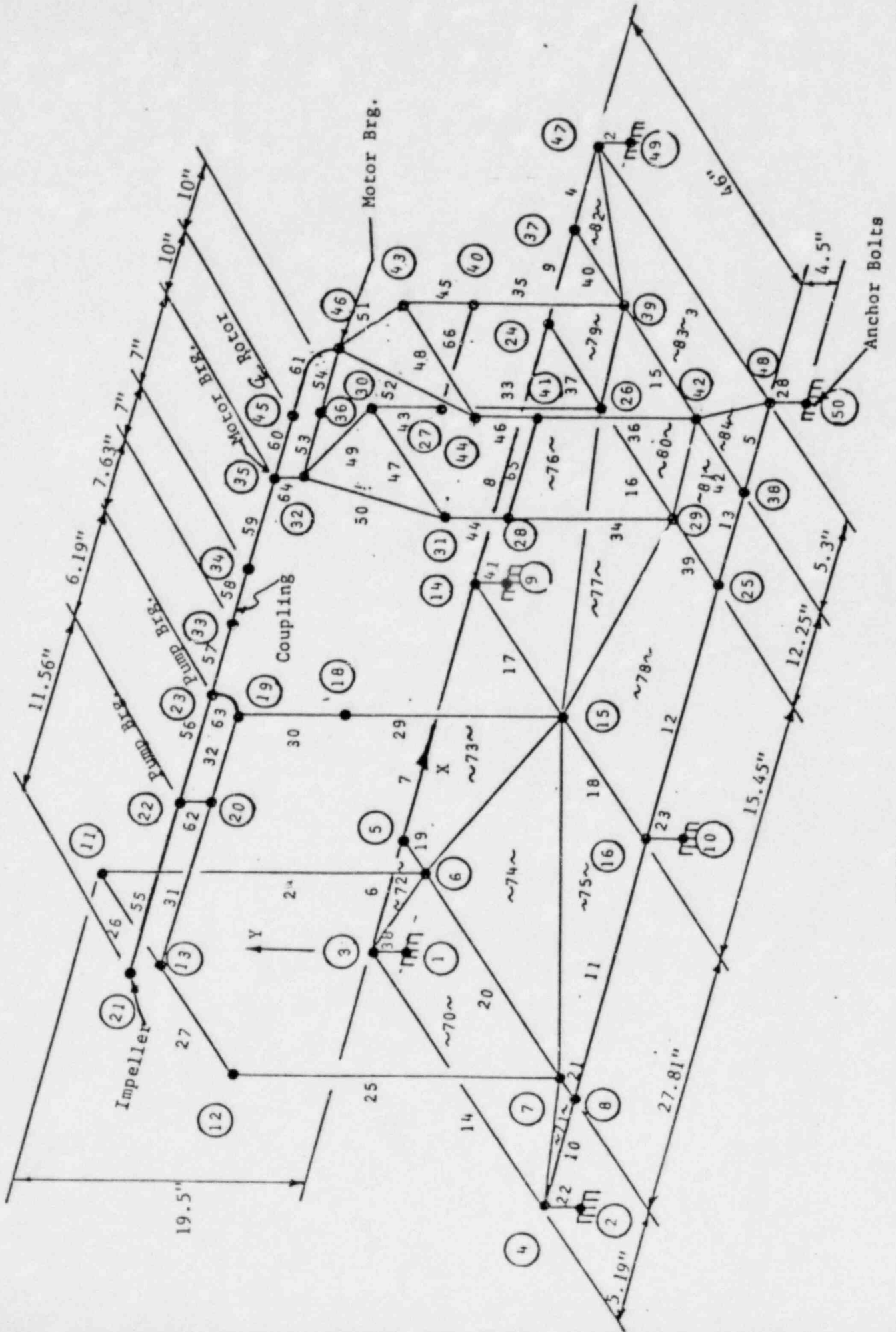


FIGURE 2 -

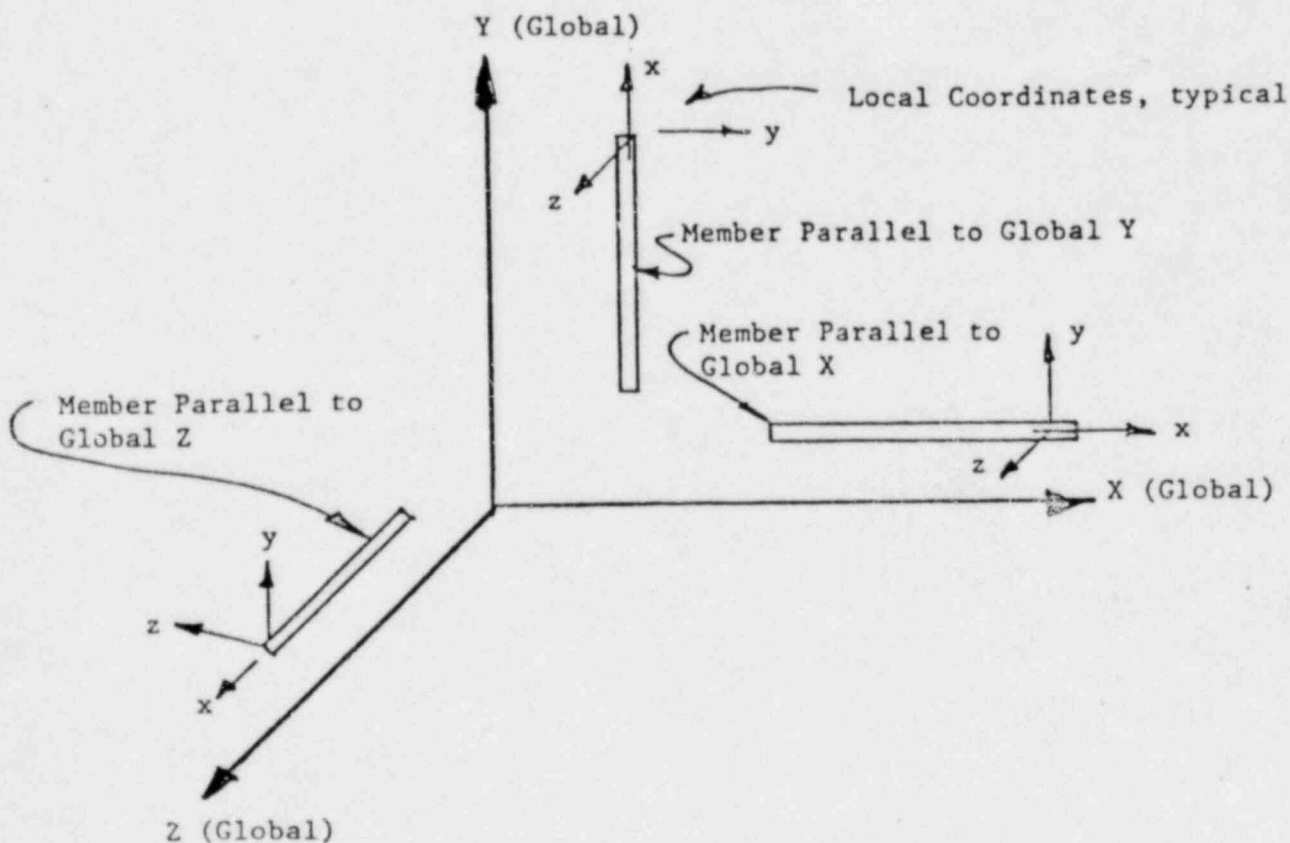
3. The bearing stiffness is difficult to determine precisely. Thus, the shaft is assumed to be pinned at the radial pump bearing (joint 22) and at both motor bearings (joints 35 and 46).

Masses are lumped at joints in accordance with good practice in seismic analysis. Most of the mass of the pump is lumped at joints 13 and 19. Joint 13 is the intersection point of the centerlines of the nozzles.

The pump and motor bearings are modeled by equivalent hollow beam sections. Members 33 thru 36, 43 thru 54, 65, and 66 represent the motor support and casings. Members 24 thru 27, 29, and 30 represent the pump pedestal.

The calculation of the member properties is given in detail in App. F. Members 15 thru 21, 37, 39, 40, and 42 represent the cross members under the bedplate which are welded integrally to the bedplate.

The relationship between the STRUDL local and global coordinate systems is shown below:



NOTE: DISPLACEMENTS ARE PRINTED OUT IN GLOBAL COORDINATES, FORCES AND STRESSES ARE PRINTED OUT IN LOCAL COORDINATES. REACTIONS ARE PRINTED OUT IN GLOBAL COORDINATES.

3.2 Computer Analysis

The computer analysis for the frequencies is performed by use of the computer code ICES-STRUOL operating on an IBM 370/158 computer. This code was developed at the Massachusetts Institute of Technology, Civil Engineering Department. Users manuals may be obtained from M.I.T. The code has been well verified for frequency calculations. These verification checks are contained in a set of course notes for a class in Dynamic Seismic Analysis* which was taught at the University of Alabama in Birmingham. These verification checks may be inspected at the offices of McDonald Engineering Analysis Company.

The detailed input data sheets are given on pages 9 through 14 and are believed to be self explanatory. The motor and pump shaft vary in cross section and are input accordingly.

The analysis is made for the three orthogonal directions simultaneously. Thus, the model is assigned 15 degrees of freedom (three per mass).

3.3 Frequency Output

The computer output for the frequencies is given in Appendix C. The lowest modes and their directions are:

<u>Direction</u>	<u>Lowest Mode</u>
Y	24.5 Hertz
X	30.5 Hertz
Z	40.7 Hertz

Note that the X mode is close to the operating speed of the pump. However, as noted previously, the neglect of grouting and assuming support only at the anchor bolts causes the calculated frequencies to be low.

The X mode is a combined bending of the pump pedestals and flexing of the pump baseplate. Grouting will have no effect upon the bending of the pedestals but it will have a significant effect upon the flexing of the baseplate because the cross channels are integrally welded to the baseplate and then grouted, thus forming a very rigid base. The same applies to the lowest Z mode.

The lowest Y mode will be significantly affected by the grouting because it is almost totally due to the flexing of the base plate.

The coupling used on this pump assembly is a Double Flex type that is designed to prevent transfer of moments, other than torque, between pump and motor. Thus, the end releases on members 58 and 59 (coupling) are included to correctly model the coupling.

STRUOL *ME-884* *BINGHAM 8 X 10 X 14 CAP*

ICES STRUOL-II
THE STRUCTURAL DESIGN LANGUAGE

IUG VERSION V340, JUNE 1976
SIZE OF POOL 8K BYTES
17:59:03 3/07/82

UNITS INCHES POUNDS SECONDS

JOINT COORDINATES

1	0.	-4.5	0.	SUPPORT
2	0.	-4.5	46.	SUPPORT
3	0.	0.	0.	
4	0.	0.	46.	
5	5.19	0.	0.	
6	5.19	0.	5.	
7	5.19	0.	39.	
8	5.19	0.	46.	
9	33.0	-4.5	0.	SUPPORT
10	33.0	-4.5	46.	SUPPORT
11	5.19	19.5	5.	
12	5.19	19.5	39.	
13	5.19	19.5	23.	
14	33.0	0.0	0.0	
15	22.94	0.	23.	
16	33.0	0.	46.	
* JOINT 17 IS OMITTED				
18	22.94	14.81	23.	
19	22.94	19.5	23.	
20	16.75	19.5	23.	
21	5.19	19.51	23.	
22	16.75	19.51	23.	
23	22.94	19.51	23.	
24	48.45	0.	0.	
25	48.45	0.	46.	
26	48.45	0.	15.	
27	48.45	9.5	15.	
28	48.45	9.5	31.	
29	48.45	0.	31.	
30	48.45	9.51	15.	
31	48.45	9.51	31.	
32	44.57	19.5	23.	

NOTE: This version of ICES-STRUOL is maintained
by the Georgia Institute of Technology.

24 6 11
 25 7 12
 26 11 13
 27 12 13
 28 48 50
 29 15 18
 30 18 19
 31 13 20
 32 20 19
 33 26 27
 34 29 28
 35 39 40
 36 42 41
 37 24 26
 38 3 1
 39 25 29
 40 37 39
 41 14 9
 42 38 42
 43 27 30
 44 28 31
 45 40 43
 46 41 44
 47 30 31
 48 43 44
 49 30 32
 50 31 32
 51 43 46
 52 44 46
 53 32 36
 54 36 46
 55 21 22
 56 22 23
 57 23 33
 58 33 34
 59 34 35
 60 35 45
 61 46 45
 62 20 22
 63 19 23
 64 32 35
 65 28 41
 66 27 40
 MEMBER DEFENSE

58 END FORCE X
62 64 END MOM X Y Z
62 END FORCE Y
43 TO 46 START MOM X Y Z
58 START MOM Y Z
59 START MOM Y Z
57 START MOM X
61 START MOM Y Z
29 END MOM X Y Z
24 25 END MOM X Y

CONSTANTS
E 2900000.0 ALL
POISSON .3 ALL
TYPE SHALLOW SHELL
ELEMENT INCIDENCES

70 4 7 6 3
71 4 8 7
72 3 6 5
73 6 15 14 5
74 7 15 6
75 7 8 16 15
76 14 15 26 24
77 15 29 26
78 15 16 25 29
79 24 26 39 37
80 26 29 42 39
81 29 25 38 42
82 37 39 47
83 39 42 48 47
84 42 38 48

ELEMENT PROPERTIES
70 73 75 76 78 TO 81 83 TYPE 'SSHQ2' THICKNESS .375
71 72 74 77 82 84 TYPE 'ANG15' THICKNESS .375
MEMBER PROPERTIES
2 22 28 38 PRIS AX 2.86 IX 1. IY .615 IZ 3888.
23 41 PRIS AX 2.25 IX 1. IY .026 IZ 3788.
3 14 PRIS AX 1.5 IX 1. IY .0078 IZ 4.5
4 TO 13 PRIS AX 3.42 IX 1. IY 3.34 IZ 12.9
15 TO 18 37 39 40 42 PPIS AX 1.47 IX .05 IY .247 IZ 5.16
19 20 21 PRIS AX 2.94 IX 28. IY .494 IZ 10.32
24 25 VARIABLE
SEG 1 AX 9.74 IX 1. IY 41. IZ 278. L 6.5
SEG 2 AX 7.29 IX 1. IY 14.9 IZ 127.5 L 6.5
SEG 3 AX 4.83 IX 1. IY 3.0 IZ 43. L 6.5

26 VARIABLE

SEG 1 AX 12.25 IX 1. IY 50. IZ 3.13 L 2.

SEG 2 AX 37. IX 2300. IY 1150. IZ 1150. L 16.

27 VARIABLE

SEG 1 AX 12.25 IX 1. IY 50. IZ 3.13 L 4.

SEG 2 AX 37. IX 2300. IY 1150. IZ 1150. L 12.

29 PRIS AX 2.13 IX 1. IY 4.59 IZ .432

30 32 PRIS AX 11.7 IX 166. IY 83. IZ 83.

31 VARIABLE

SEG 1 AX 37. IX 2300. IY 1150. IZ 1150. L 7.56

SEG 2 AX 8.8 IX 2. IY 130. IZ 46. L 4.

33 TO 36 PRIS AX 2.22 IX 6.03 IY 3.02 IZ 3.02

43 TO 46 PRIS AX .226 IX .015 IY .0075 IZ .0075

47 TO 54 PRIS AX 15.5 IX 1500. IY 750. IZ 750.

55 VARIABLE

SEG 1 AX 2.76 IX 1.21 IY .60 IZ .60 L 4.5

SEG 2 AX 4.19 IX 2.80 IY 1.40 IZ 1.40 L 7.06

56 PRIS AX 5.14 IX 4.22 IY 2.11 IZ 2.11

57 PRIS AX 3.54 IX 2.0 IY 1.0 IZ 1.0

58 TO 61 PRIS AX 3.54 IX 2. IY 1.0 IZ 1.0

62 63 64 PRIS AX 1. IX 1. IY 1. IZ 1.

65 66 PRIS AX 5. IX 1. IY 6.66 IZ .65

DYNAMIC DEGREES OF FREEDOM

JOINTS 13 15 19 21 33 36 DISP X Y Z

INERTIA OF JOINT 13 LINEAR ALL 2.16

INERTIA OF JOINT 15 LINEAR ALL 1.71

INERTIA OF JOINT 19 LINEAR ALL 1.08

INERTIA OF JOINT 21 LINEAR ALL .17

INERTIA OF JOINT 33 LINEAR ALL .13

INERTIA OF JOINT 36 LINEAR ALL 2.15

UNITS CYCLES

DAMPING .01 15

STORE RESPONSE SPECTRA ACCELERATION VS FREQUENCY 'LAT'

DAMPING .01 FACTOR 386.

1.5 20. 1.5 24.5 1.5 30.5 1.5 40.7 1.5 42. .9 69. .7 80. .55 86.4
.55 90.7 .55 104.5 .55 500.

STORE RESPONSE SPECTRA ACCELERATION VS FREQUENCY 'VERT'

DAMPING .01 FACTOR 386.

4.7 20. 4. 24.5 2.7 30.5 1.4 40.7 1.4 42. .9 69. .8 80. .75 86.4
.75 90.7 .75 104.5 .75 500.

DYNAMIC LOADING 1 'LATERAL X'

SUPPORT ACCELERATION

DISP X FILE 'LAT'

DYNAMIC LOADING 2 'LATERAL Z'

SUPPORT ACCELERATION

DISP Z FILE 'LAT'

DYNAMIC LOADING 5 'VERTICAL SEISMIC'

SUPPORT ACCELERATION

DISP Y FILE 'VERT'

DYNAMIC ANALYSIS MODAL

4. LOADING CRITERIA

4.1 Dynamic Loading

The dynamic loadings applied are those given in the specification and are shown on page 14.

The lateral dynamic loadings are applied in both lateral directions. The two lateral cases are then combined by the SRSS method, with the vertical seismic. Normal Operating plus Max. Nozzle loads are added directly to the dynamic loads. See Loadings 1, 2, and 5 on page 14 for detailed input.

4.2 Nozzle Loads

The nozzle loads are given in Appendix H. See page 16 for detailed computer input.

4.3 Internal Pressure Loading

The internal pressure design conditions are 150 psig at 150° F.

4.4 Shaft Torsional Loading

The motor horsepower is 100 at 1775 R.P.M. Thus, the torque is:

$$T = \frac{63000(100)}{1775} = 3,550 \text{ in-lbs.}$$

4.5 Other Pump Normal Loads

The pump is subjected to a 600 lb. axial and a 300 lb. radial load on the impeller during Normal Operation. This load is included in Load Case 4, page 16. The deadweight loads are given in Loading 3, page 16.

4.6 Casting Factor

A casting factor of .8 is used for pressure components.

LOADING 3 *IG IN VERTICAL DIRECTION*

JOINT LOADS

- 13 FORCE Y 833.
- 15 FORCE Y 660.
- 19 FORCE Y 417.
- 21 FORCE Y 65.
- 33 FORCE Y 50.
- 36 FORCE Y 830.

LOADING 4 *NOZZLE + IMPELLER LOADS*

JOINT LOADS

- 13 FORCE X 6693. Y 4165. Z 2509.
- 13 MOMENT X 94175. Y 147941. Z -111685.
- 21 FORCE X 600. Z 300.

LOADING LIST ALL

STIFFNESS ANALYSIS

OUTPUT DECIMAL 5

LIST FORCES

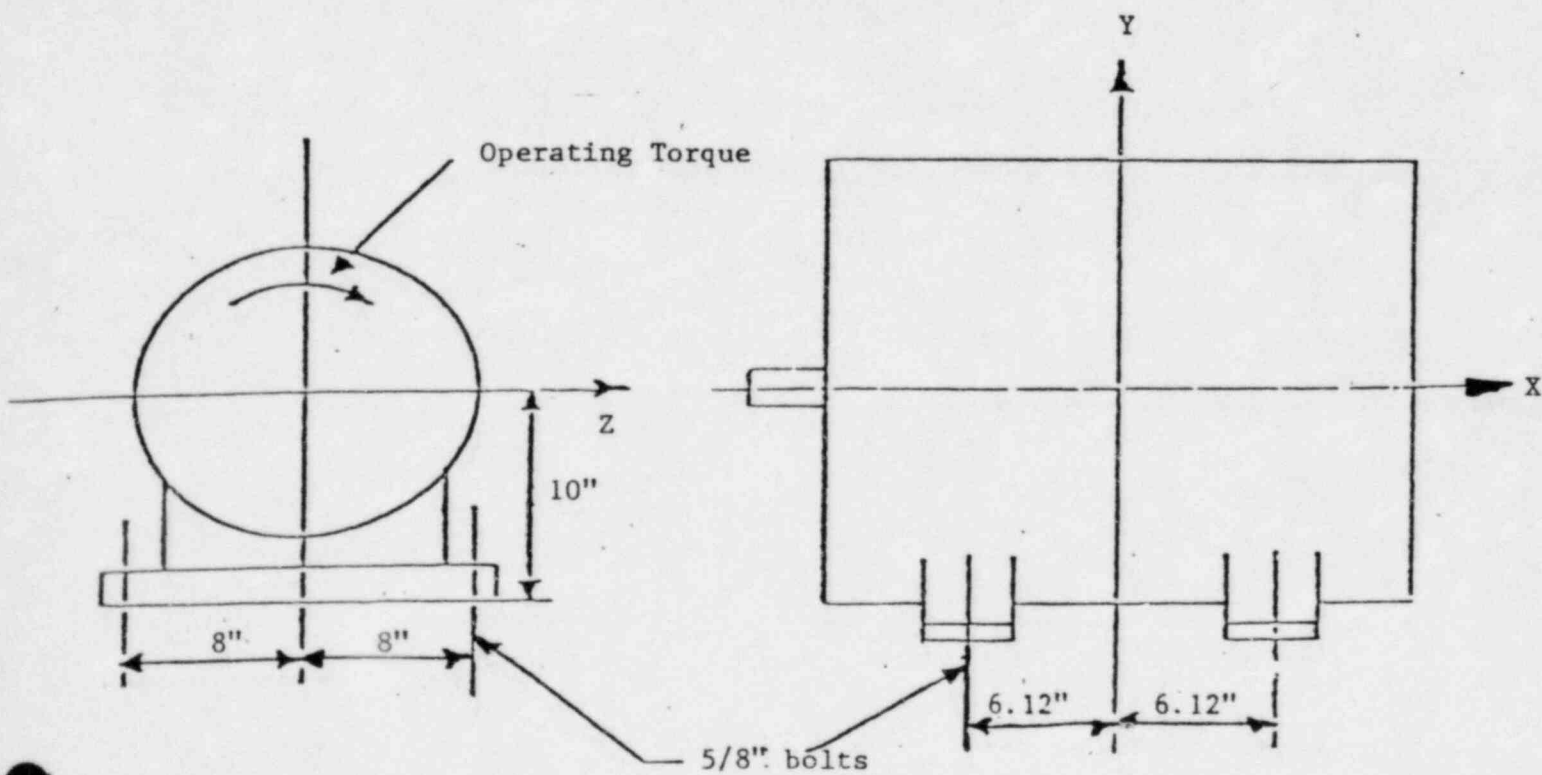
5. STRUCTURAL INTEGRITY ANALYSIS

The detailed stress analysis of the pump, supports, and motor hold down bolts is contained in this section. One loading condition is considered. The Normal Operating plus Maximum Nozzle plus SSE loads (Emergency Case) is limiting since it is held to the Normal Allowables. Thus, it is the only case given.

A computer analysis of the pump is contained in Appendix A. Some of the pertinent stresses are obtained directly from the computer output. Not all of the important stresses could be conveniently obtained from the computer analysis. Thus, some of the stresses are hand calculated.

5.1 Motor Hold Down Bolts

A sketch of the motor is shown below:



The stress due to operating torque is:

$$S = \frac{3550}{2(16)(.226)} = 491 \text{ psi}$$

The total stresses are obtained from the forces given by the computer output and the operating torque. The maximum loads on the bolts are listed below, see Appendix A, members 43 through 46.

	Tensile, Lbs.	Shear, Lbs.	
		Y	Z
Loading 1	651	1,415	541
Loading 2	347	42	125
Loading 5	<u>502</u>	<u>1,005</u>	<u>632</u>
SRSS	892	1,736	841
Loading 4	<u>61</u>	<u>34</u>	<u>369</u>
Totals	953	1,770	1,210

The tensile stress due to the above loads is:

$$S_1 = \frac{P}{A} = \frac{953}{.226} = 4,217 \text{ psi} \quad (\text{For } 5/8" \text{ bolts, } A_b = 0.226)$$

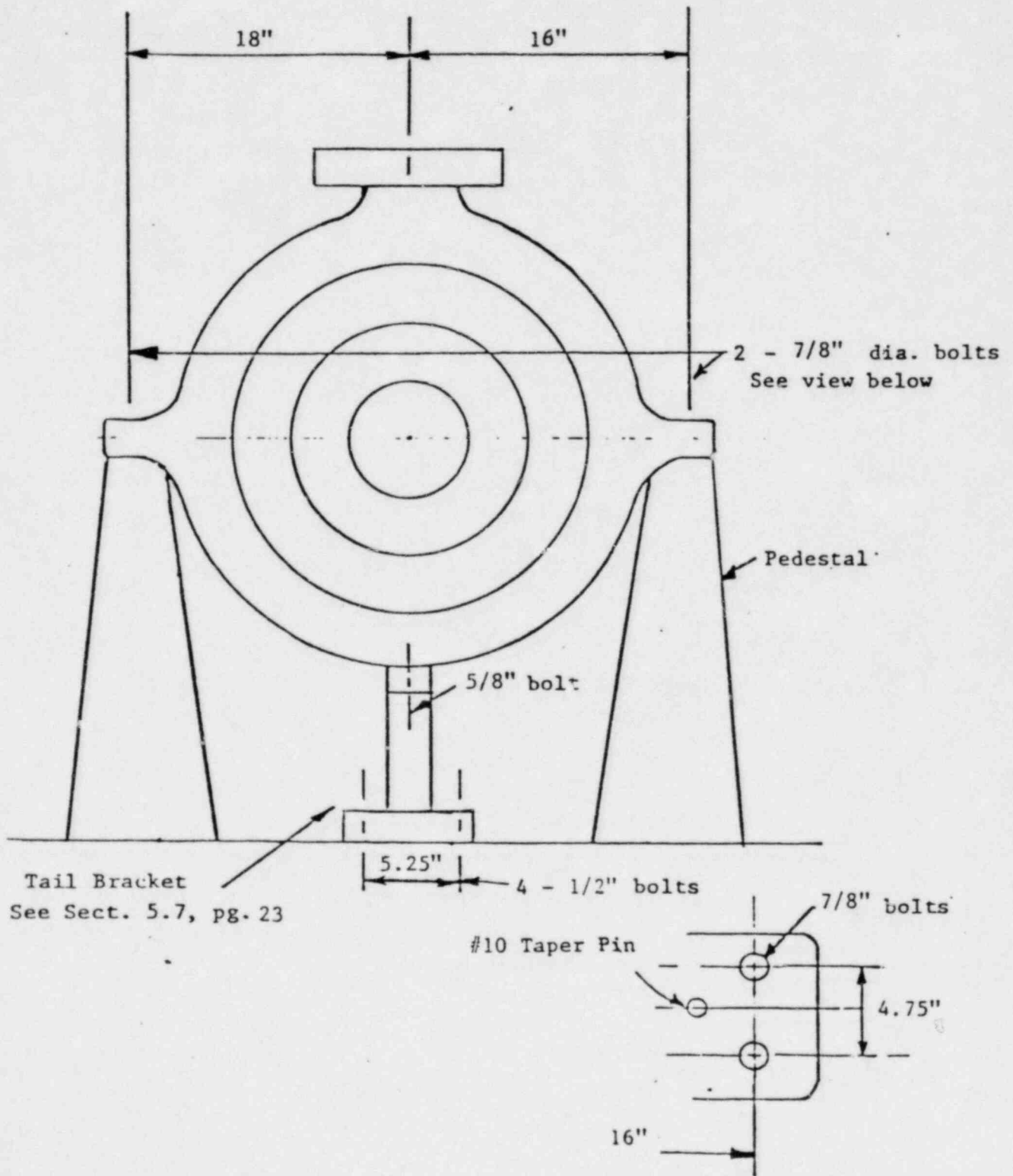
$$S = 4217 + 491 = 4,708 \text{ psi total}$$

The shearing stress is:

$$V = \frac{R}{A} = \frac{\sqrt{1770^2 + 1210^2}}{.226} = 9,487 \text{ psi}$$

The allowable stresses for A-307 bolts are 10,000 psi shear and 12,821 psi tensile per the 7th Ed. AISC Code, including the effects of shear upon the tensile allowable.

NOTE: $F_t = 28,000 - 1.6(9487) = 12,821 \text{ psi tensile allowable}$



5.2 Pump Hold Down Bolts

A sketch of the pump hold down bolts is given on page 19 . The loads in the upper end of the pedestal are the bolt loads and are obtained from Appendix A for members 24 and 25. The maximum tensile loads are in member 24.

	Axial, lbs.	Bending, in-lbs.	Shear, lbs.	
			Y	Z
Loading 1	84	2,074	764	570
Loading 2	104	2,338	842	725
Loading 5	<u>736</u>	<u>15,183</u>	<u>298</u>	<u>501</u>
SRSS	748	15,501	1,175	1,050
Loading 4	<u>6,936</u>	<u>24,859</u>	<u>7,169</u>	<u>1,603</u>
Totals	7,684	40,360	8,344	2,653

The tensile stress is:

$$\begin{aligned}
 S &= \frac{P}{2A_b} + \frac{M}{4.75A_b} + \frac{T}{2(18 + 16)A_b} \\
 &= \frac{7684}{2(.6013)} + \frac{40360}{4.75(.6013)} + \frac{3550}{2(34)(.6013)} = 20,607 \text{ psi}
 \end{aligned}$$

The shear stress is:

$$V = \frac{R}{A_{TP}} = \sqrt{\frac{8344^2 + 2653^2}{.385}} = 22,742 \text{ psi}$$

The allowable stress for A-325 bolts is 40,000 psi for tensile. The allowable stress for the cold drawn steel dowel pins is $.33(100,000) = 33,000$ psi.

5.3 Anchor Bolt Loads

The loads in the anchor bolts are given by members 2, 22, 23, 28, 38, and 41 in Appendix A.

	Tensile, lbs.	Shear, lbs.	
	Member 38	Y	Z
Loading 1, Seismic X	671	1,449	37
Loading 2, Seismic Y	971	1,529	44
Loading 5, Seismic Z	570	1,692	346
SRSS	1,311	2,702	351
Loading 4, Nozzle + Impeller	7,543	12,503	533
Totals	8,854	15,205	884

These bolts are furnished by others and must be able to withstand the above loads.

5.4 Shaft Stress

The maximum shaft stress occurs in member 55. The loads from App. A

are:	Axial	Bending	
		Y	Z
Loading 1	68	889	58
Loading 2	80	1,154	65
Loading 5	51	150	2,249
SRSS	117	1,464	2251
Loading 3	0	0	751
Loading 4	600	3,468	0
Totals	717	4,932	3,002

The tensile stress is:

$$S_t = \frac{P}{A} + \frac{M}{Z} = \frac{717}{2.76} + \sqrt{\frac{4932^2 + 3002^2}{.647}} = 8,924 \text{ psi}$$

The shear stress is:

$$V = \frac{T_r}{J} = \frac{T_r}{I_x} = \frac{3550(.9375)}{1.21} = 2,751 \text{ psi}$$

The combined stress per the maximum shearing stress theory is:

$$S = \sqrt{(2(2751))^2 + (8924)^2} = 10,484 \text{ psi}$$

The allowable stress for the A-276-410 shaft is 17,500 psi.

5.5 Stresses in Support Frame

The maximum stresses occur in member 11, see App. A for loads.

	Axial, lbs.	Bending, in-lbs.	
		Y	Z
Loading 1	437	136	8,139
Loading 2	495	130	7,906
Loading 5	<u>963</u>	<u>127</u>	<u>21,804</u>
SRSS	1,168	227	24,580
Loading 3	229	76	5,441
Loading 4	<u>5,116</u>	<u>344</u>	<u>68,581</u>
Totals	6,513	647	98,602

The stress is: (note on page F-2 that the effects of 12t of the bedplate have been included in S'_z calculation)

$$S = \frac{P}{A} + \frac{M_y}{Z_y} + \frac{M_z}{Z_z}$$

$$= \frac{6513}{3.42} + \frac{647}{1.23} + \frac{98602}{6.25} = 18,206 \text{ psi}$$

The allowable for A-36 steel is 24,000 psi.

5.6 Thrust Bearing Retainer Bolts

The thrust load imposed by the shaft and impeller is resisted by 4 - $\frac{1}{2}$ " diameter bolts. The axial load given in Section 5.4 imposes thrust in these bolts.

The stress is:

$$S = \frac{P}{A} = \frac{717}{4(.141)} = 1271 \text{ psi tensile}$$

The allowable stress is 20,000 psi for the A-307 bolts, per the AISC Code, 7th Ed.

5.7 Tail Bracket Bolt Stress

The loads in the tail bracket are given by member 29, Appendix A.

	Axial, lbs.	Shear, lbs.		Bending, in-lbs.	
		Y	Z	Y	Z
Loading 1	130	76	284	4,199	1,132
Loading 2	80	53	339	5,013	787
Loading 5	<u>831</u>	<u>541</u>	<u>49</u>	<u>726</u>	<u>8,009</u>
SRSS	845	549	445	6,579	8,127
Loading 4	<u>4,957</u>	<u>1,062</u>	<u>921</u>	<u>13,637</u>	<u>15,725</u>
Totals	5,802	1,611	1,366	20,216	23,852

(a) Upper Bolt Stress (One 5/8" bolt, see page 19)

The tensile stress is: (For 5/8" bolts, $A_b = .3068$)

$$S = \frac{P}{A} = \frac{5802}{.3068} = 18,911 \text{ psi}$$

The shear stress is:

$$V = \frac{R}{A} = \frac{\sqrt{1611^2 + 1366^2}}{.3068} = 6,884 \text{ psi}$$

The allowables for A-325 bolts are 15,000 psi shear and 38,985 psi tensile.

(b) Lower Bolts (4 - 1/2" bolts, see page 19)

$$S = \frac{P}{4A_b} + \frac{M_y}{2(5.25)A_b} + \frac{M_z}{2(3)A_b}$$

$$= \frac{5802}{4(.196)} + \frac{20216}{2(5.25)(.196)} + \frac{23852}{2(3)(.196)} = 37,505 \text{ psi tensile}$$

$$V = \frac{R}{A} = \frac{\sqrt{1611^2 + 1366^2}}{4(.196)} = 2,694 \text{ psi shear}$$

The allowable stresses for A-325 bolts are 40,000 psi tensile and 15,000 psi shear per the AISC Code.

5.8 Stuffing Box Cover Analysis

The loads on the stuffing box cover are given by member 31 at joint 13,

Appendix A.	Axial	Bending	
		Y	Z
Loading 1	509	4,658	3,409
Loading 2	598	5,818	3,775
Loading 5	<u>157</u>	<u>802</u>	<u>23,010</u>
SRSS	801	7,496	23,565
Loading 3	130	177	6,147
Loading 4	<u>462</u>	<u>16,344</u>	<u>82,999</u>
Totals	1,393	24,017	112,711

The resultant moment is:

$$M = \sqrt{24017^2 + 112711^2} = 115,241 \text{ in-lbs.}$$

The flange analysis, including the effects of external loads per the ASME Code Paragraph ND-3647.1 is included in Appendix J.

5.9 Nozzle Analysis

1. Discharge Nozzles

The discharge nozzle-casing intersection is closely approximated as a tee. The methods of ASME Code ND-3652 are used to perform the analysis. The tee is contoured similar to a welding tee but it is not exactly the same as a welding tee. Thus, to be conservative, the stress intensification factor used for this analysis will be the average between the factor for a welding tee and the factor

for a fabricated tee. The nomenclature is that of the ASME Code.

For a welding tee:

$$h = \frac{4.4(.58)}{9.0} = .284 \quad i = \frac{.9}{(.284)^{2/3}} = 2.08$$

For a fabricated tee:

$$h = \frac{.58}{9.0} = .064 \quad i = \frac{.9}{(.064)^{2/3}} = 5.62$$

Average Stress Intensification Factor:

$$i_{avg} = \frac{2.08 + 5.62}{2} = 3.85$$

$$Z = 3.1416(4.0)^2(.58) = 29.15 \text{ in.}^3$$

The total bending moment resolved at the nozzle/casing junction is:

$$M_{xt} = M_x + 22.125F_z = 1300(12) + 22.125(1050) = 38,831 \text{ in-lbs.}$$

$$M_{yt} = M_y = 3000(12) = 36,000 \text{ in-lbs.}$$

$$M_{zt} = M_z + 22.125F_x = 2000(12) + 22.125(1825) = 64,378 \text{ in-lbs.}$$

$$M_R = \sqrt{M_{xt}^2 + M_{yt}^2 + M_{zt}^2} = \sqrt{38831^2 + 36000^2 + 64378^2} = 83,357 \text{ in-lbs.}$$

Equation (8) of ND-3652.1 gives:

$$\frac{125(9.25)}{4(.58)} + \frac{.75(3.85)(83357)}{29.15} = 8,755 \text{ psi} < 1.5(.8)(17500) = 21,000 \text{ psi}$$

SA-216 WCB

2. Suction Nozzle

The suction nozzle is treated as a nozzle in a flat plate, Cases 10 and 20 of Roark's Formulas for Stress and Strain, Fourth Edition. The parameters are:

$$r_o = 6" = b \quad a = 9" \quad t = .75"$$

The stress coefficients are obtained from pages 241 and 242 of Roark. They are:

$$\beta_M = .60 \quad \beta_P = .22$$

The loads are:

$$M_{xt} = M_x = 4612(12) = 55,344 \text{ in-lbs.}$$

$$M_{yt} = M_y + 6F_z = 8219(12) + 6(1459) = 107,382 \text{ in-lbs.}$$

$$M_{zt} = M_z + 6F_y = 2486(12) + 6(1915) = 41,322 \text{ in-lbs.}$$

$$M_R = \sqrt{107382^2 + 41322^2} = 115,058 \text{ in-lbs. Resultant Bending}$$

$$R = \sqrt{1915^2 + 1459^2} = 2,407 \text{ lbs. Resultant Shear}$$

$$F = 4,868 \text{ lbs. Axial Force}$$

The stresses are:

$$S_1 = \frac{\beta_M M}{atZ} + \frac{\beta_P F}{t^2} = \frac{.60(115058)}{9(.75)^2} + \frac{.22(4868)}{(.75)^2} = 15,540 \text{ psi Bending}$$

$$V = \frac{M_x}{2(3.14)r_o^2 t} + \frac{R}{6.283r_o t} = \frac{55344}{2(3.142)(6)^2(.75)} + \frac{2407}{6.283(6)(.75)} = 411 \text{ psi shear}$$

The combined stress per the maximum shearing stress theory is:

$$S = \sqrt{(2V)^2 + S_1^2} = \sqrt{(2(411))^2 + (15540)^2} = 15,562 \text{ psi}$$

The allowable stress for SA-216 WCB is $1.5(.8)(17500) = 21,000 \text{ psi}$ including the casting factor.

5.10 Suction and Discharge Flanges

These flanges are analyzed per ND-3647.1.

(a) Discharge Flange

This flange is an 8" 300 psig ANSI.

The external loads are:

$$P = 2,250 \text{ lbs.}$$

$$M = 12 \sqrt{1300^2 + 2000^2} = 28,624 \text{ in-lbs.}$$

The analysis is given on page J-2 and the flange is adequate.

(b) Suction Flange

This flange is a 10" 300 psig ANSI. The external loads are:

$$P = 4,868 \text{ lbs.}$$

$$M = 12 \sqrt{8219^2 + 2486^2} = 103,041 \text{ in-lbs.}$$

The analysis is shown on page J-3 and the flange is adequate.

5.11 Bearing Housing to Stuffing Box Bolt Analysis

The housing is fastened to the stuffing box cover by 6 - 3/4" diameter bolts on a 9.875" bolt circle. The forces and moments acting on the bolts are essentially the same as those given in Section 5.8. Thus, the tensile stresses in the bolts are: (For 3/4" bolts $A_b = .442$)

$$S = \frac{P}{A} + \frac{4M}{NCA_b}$$

$$= \frac{1393}{6(.442)} + \frac{4(115241)}{6(9.875)(.442)} = 18,127 \text{ psi}$$

The allowable stress for A-325 bolts is 40,000 psi per AISC Code, 7th Edition.

5.12 Pump Pedestal Stress

The pump pedestal loads are given by members 24 and 25, see App. A.

	Axial, lbs.	Shear, lbs.		Bending, in-lbs.	
		Y	Z	Y	Z
Loading 1	111	764	570	11,122	13,623
Loading 2	107	842	726	14,148	14,960
Loading 5	<u>833</u>	<u>298</u>	<u>513</u>	<u>10,003</u>	<u>19,760</u>
SRSS	847	1,175	1,056	20,589	28,282
Loading 3	631	66	218	4,257	2,740
Loading 4	<u>6,936</u>	<u>7,169</u>	<u>2,127</u>	<u>41,481</u>	<u>143,631</u>
Totals	8,414	8,410	3,401	66,327	174,653

The pedestals are shown on page F-3. The stress is:

$$S = \frac{P}{A} + \frac{M_y}{Z_y} + \frac{M_z}{Z_z}$$

$$= \frac{8414}{9.74} + \frac{66327}{8.49} + \frac{174653}{41} = 12,936 \text{ psi}$$

The allowable for A-36 is 24,000 psi.

5.13 Pump Pedestal Weld Stress

The pump pedestal shown on page F-3 is welded all around to the baseplate by $\frac{1}{4}$ " fillet welds. The properties are given on page F-9.

The weld stress is:

$$V_1 = \frac{P}{A_w} + \frac{M_y}{Z_y} + \frac{M_z}{Z_z} = \frac{8414}{5.31} + \frac{66327}{5.84} + \frac{174653}{26} = 19,659 \text{ psi}$$

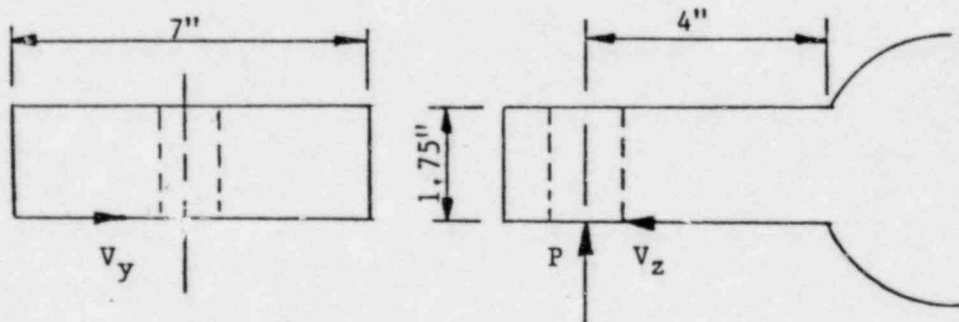
$$V_2 = \frac{R}{A} = \frac{\sqrt{8410^2 + 3401^2}}{5.31} = 1,708 \text{ psi}$$

$$V = \sqrt{V_1^2 + V_2^2} = \sqrt{19659^2 + 1708^2} = 19,733 \text{ psi}$$

The allowable stress is at least 21,000 psi.

5.14 Pump Foot Stress

The pump foot is as shown below:



The loads on the pedestal are obtained from Section 5.2 except deadweight is added to the load P. The properties are given on page F-5, Segment 1 of members 26 and 27. The stress is ($P = 7684$ (p. 20) + 675 dwt. = 8,359 lbs.).

$$S = \frac{V_z}{A} + \frac{4V_y}{S_y} + \frac{4P}{S_z}$$

$$= \frac{2653}{12.25} + \frac{4(8344)}{14.2} + \frac{4(8359)}{3.57} = 11,933 \text{ psi}$$

The allowable stress for the SA-216 WCB is $1.5(.8)(17500) = 21,000$ psi.

5.15 Motor Support Stress

The motor supports are represented by members 33 through 36, see Appendix A for loads.

	<u>Axial, lbs.</u>	<u>Bending, in-lbs.</u>	
		Y	Z
Loading 1	836	4,996	2,054
Loading 2	345	1,828	431
Loading 5	<u>660</u>	<u>5,874</u>	<u>1,803</u>
SRSS	1,120	7,925	2,767
Loading 3	223	2,128	243
Loading 4	<u>125</u>	<u>3,473</u>	<u>1,414</u>
Totals	1,468	13,526	4,424

The stress is:

$$S = \frac{P}{A} + \frac{M}{Z}, \quad A = 2.22 \text{ in.}^2, \quad Z = 1.72 \text{ in.}^3$$

$$S = \frac{1468}{2.22} + \frac{\sqrt{13526^2 + 4424^2}}{1.72} = 8,935 \text{ psi}$$

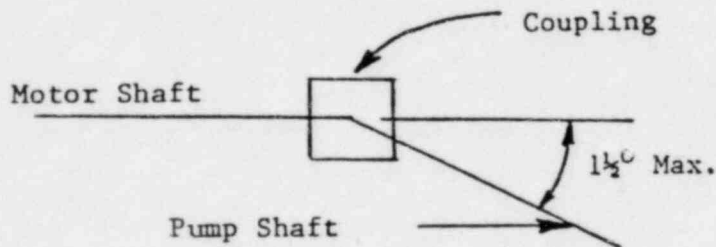
The allowable stress for A-36 is 24,000 psi.

6. FUNCTIONAL CAPABILITY ANALYSIS

The detailed functional analysis (deflection, rotations, etc.) is contained in this section. The following loading condition is considered: Normal Operating loads + Maximum Nozzle loads + SSE loads (Emergency Case). The computer analysis is contained in Appendix A.

6.1 Flexible Coupling Analysis

The coupling is adequate for the normal torsional loads. The seismic and nozzle loads do not impose any additional torsion in the shaft. However, the seismic and nozzle loads do cause bending in the pump and motor shaft, which in turn causes coupling misalignment as shown below:



The maximum misalignment must not exceed $1\frac{1}{2}$ degree (.025 radian). This misalignment can be obtained from the computer output as the vector sum of joint 33 or 34 (worst case), rotations Y and Z. These rotations are tabulated below, see App. A.

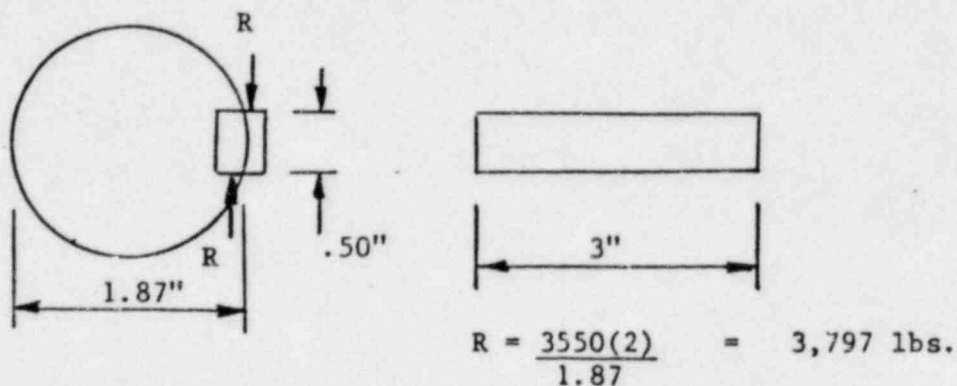
(Joint 34)

	Y	Z
Loading Case 1	.00013	.00044
Loading Case 2	.00016	.00006
Loading Case 5	<u>.00002</u>	<u>.00165</u>
SRSS	.00021	.00171
Loading Case 4	<u>.00421</u>	<u>.01688</u>
Totals	.00442	.01859

Resultant = .019 radian

6.2 Impeller Key Analysis

The torque that the shaft key must transmit is practically the same for all loading conditions. This is 3,550 in-lbs. operating torque (p. 15). The shearing forces on the key are as shown:



The shearing stress in the key is:

$$V = \frac{3797}{3(.5)} = 2,531 \text{ psi}$$

The yield stress is 30,000 psi for the A-276 Tp 316 material. Thus, the allowable stress is: $F_v = .3(30,000) = 9,000 \text{ psi}$

6.3 Impeller Clearance

The relative deflection between the impeller and pump casing is found by taking the difference of the deflections of joints 13 and 21. See Appendix A for output data.

<u>Joint 21</u>	<u>Faulted</u>	
	Y	Z
Loading 1	.00037	.00663
Loading 2	.00042	.00846
Loading 5	<u>.00201</u>	<u>.00106</u>
SRSS	.00209	.01080
Loading 3	.00186	.00008
Loading 4	<u>.00084</u>	<u>.02105</u>
Totals	.00479	.03193

<u>Joint 13</u>		
Loading 1	.00026	.00535
Loading 2	.00028	.00680
Loading 5	<u>.00195</u>	<u>.00085</u>
SRSS	.00199	.00869
Loading 3	.00084	.00008
Loading 4	<u>.00040</u>	<u>.01600</u>
Totals	.00323	.02477
Difference (Joint 21 - 13)	.00156	.00716

The total vector deflection is:

$$D = \sqrt{(.00156)^2 + (.00716)^2} = .007''$$

The available clearance between impeller and casing is .009" (minimum).

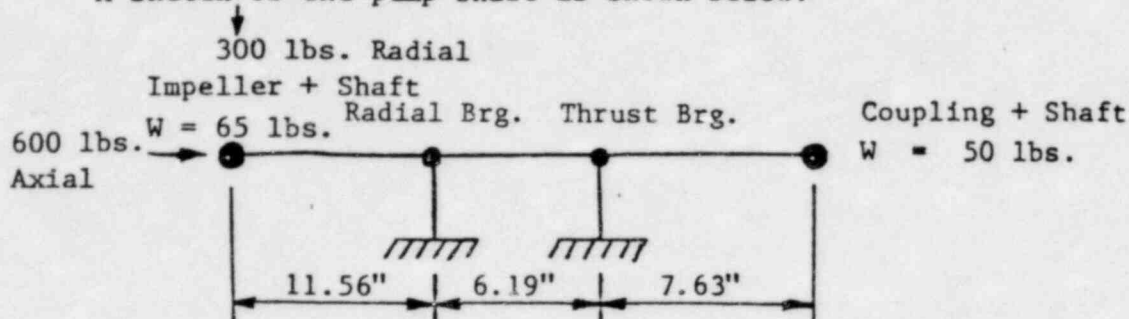
Thus, the clearance is not exceeded and the impeller does not make contact with the casing.

6.4 Shaft Mechanical Seals

The deflection of the shaft at the mechanical seal is approximately one-half that of the impeller, or .004". Experience indicates that the construction of this seal is such that leakage will not occur due to this small amount of shaft deflection.

6.5 Bearing Loads

A sketch of the pump shaft is shown below:



The accelerations of the impeller (Joint 21) and coupling (Joint 33) are obtained from Appendix E. The loads are assumed worst case for bearing loads.

Joint 21 - Impeller (units are in/sec.², or in/sec²/386 = g's)

$$A_x = 402 + 472 + 303 = 1177 = 3.05g$$

$$A_y = 29 + 33 + 491 = 553 = 1.43g$$

$$A_z = 452 + 587 + 76 = 1115 = 2.89g$$

Joint 33 - Coupling

$$A_x = 401 + 472 + 302 = 1175 = 3.04g$$

$$A_y = 218 + 190 + 2268 = 2676 = 6.93g$$

$$A_z = 476 + 572 + 92 = 1140 = 2.95g$$

(a) Radial Bearing

$$F_y = (300 + 65(2.43))(17.75/6.19) + 50(7.93)(7.63/6.19) = 1802 \text{ lbs.}$$

$$F_z = 65(2.89)(17.75/6.19) + 50(2.95)(7.63/6.19) = 720 \text{ lbs.}$$

The resultant load is:

$$F = \sqrt{1802^2 + 720^2} = 1,941 \text{ lbs.}$$

The allowable load for the ND-3313 or equal bearing is 28,480 lbs., see Appendix D.

(b) Thrust Bearing

$$F_y = 50(7.93)(13.82/6.19) + (300 + 6 \cdot 2.43)(11.56/6.19) = 1,740 \text{ lbs.}$$

$$F_z = 50(2.95)(13.82/6.19) + 65(2.89)(11.56/6.19) = 680 \text{ lbs.}$$

$$F = \sqrt{1740^2 + 680^2} = 1,868 \text{ lbs.}$$

The thrust load is:

$$600 + 65(3.05) + 50(3.04) = 950 \text{ lbs.}$$

The total load is (see ND Catalog 2C-110):

$$P = 1.37(1868) = 2,559 \text{ lbs.}$$

The allowable load for the ND-45313 or equal bearing is 57,500 lbs.

7. MOTOR SEISMIC LOADS

The motor seismic loads are given in Appendix E for Joint 36.

$$A_x = \sqrt{567^2 + 29^2 + 397^2} = 693 \text{ in./sec.}^2 = 1.80g$$

$$A_y = \sqrt{103^2 + 52^2 + 303^2} = 324 \text{ in./sec.}^2 = .84g$$

$$A_z = \sqrt{86^2 + 315^2 + 62^2} = 332 \text{ in./sec.}^2 = .86g$$

The motor coupling is a Double Flex and is designed to prevent loads, other than torsion, from being transmitted between the pump and motor.

APPENDIX A - COMPUTER OUTPUT FOR FORCES AND DISPLACEMENTS

A

 RESULTS OF LATEST ANALYSIS

JOB ID - ME-884 JOB TITLE - BINGHAM B X 10 X 14 CAP

ACTIVE UNITS - LENGTH INCH FORCE LB TEMPERATURE DEGF TIME SEC

ACTIVE STRUCTURE TYPE - SPACE FRAME

ACTIVE COORDINATES AXES X Y Z

 LADING - 1
 LATERAL X

MEMBER FORCES

MEMBER	JGINT	RESPONSE TYPE	AXIAL	SHEAR X	SHEAR Y	TORSIONAL	MOMENT BENDING X	MOMENT BENDING Y	BENDING Z
2	47	RMS ABS SUM	529.73609 744.80591	746.51338 1230.05396	393.89136 719.34473	0.0 0.0	3334.21885 3335.22286	0.00173 0.00289	0.70489 1.22395
2	49	RMS ABS SUM	929.73608 744.80591	746.51338 1230.05396	393.89136 719.34473	0.0 0.0	0.00173 0.00289	0.70489 1.22395	0.70489 1.22395
3	47	RMS ABS SUM	195.13167 213.77199	0.00847 0.00808	44.25316 82.52209	6.20202 9.13006	0.16529 0.29451	0.16529 0.29451	1488.14107 2605.77100
3	48	RMS ABS SUM	185.13162 213.77199	0.00842 0.00808	44.25316 82.52209	6.20202 9.13006	0.16529 0.29451	0.16529 0.29451	3173.38940 345.23446
4	37	RMS ABS SUM	147.97545 347.41382	25.63924 25.11670	156.37752 300.05469	230.53525 403.48877	135.77727 154.20692	135.77727 154.20692	1167.85599 2040.19165
4	47	RMS ABS SUM	145.99586 347.41382	25.63924 25.11670	156.37752 300.05469	230.53525 403.48877	135.77727 154.20692	135.77727 154.20692	1965.57349 3644.52441
5	38	RMS ABS SUM	156.33994 285.34399	25.12872 30.13235	208.75777 335.95142	373.48560 529.56201	0.16255 0.28946	0.16255 0.28946	1175.43235 2152.63232
5	48	RMS ABS SUM	156.33994 285.34399	25.12872 30.13235	208.75777 335.95142	373.48560 529.56201	0.16255 0.28946	0.16255 0.28946	2190.68018 3881.84180
6	3	RMS ABS SUM	298.93140 517.07082	19.25558 31.82892	596.45313 723.20605	124.09747 193.97035	0.17219 0.21752	0.17219 0.21752	2870.40161 5403.38281
6	5	RMS ABS SUM	298.93140 517.07082	19.25558 31.82892	596.45313 723.20605	124.09747 193.97035	0.17219 0.21752	0.17219 0.21752	4879.37891 7859.99219
7	5	RMS ABS SUM	376.03759 707.91211	2.73163 4.96474	358.89037 575.91528	60.20345 118.24777	59.28666 106.26270	59.28666 106.26270	5977.97656 9569.70234
7	14	RMS ABS SUM	399.03955 707.91211	2.73163 4.96474	358.89037 575.91528	60.20345 118.24777	30.02565 57.30376	30.02565 57.30376	4031.39135 6448.30859
8	14	RMS ABS SUM	265.84253 436.46191	1.76300 3.42365	335.66113 456.21631	430.99634 504.52441	47.30814 5.98077	47.30814 5.98077	2875.77368 2840.72914
8	24	RMS ABS SUM	265.84253 436.46191	1.76300 3.42365	335.66113 456.21631	430.99634 504.52441	47.30814 5.98077	47.30814 5.98077	2502.97095 2840.72914
9	24	RMS ABS SUM	216.85916 306.13892	8.99423 11.11102	272.17984 395.54297	639.24902 861.45068	11.69534 23.12799	11.69534 23.12799	2472.61890 2799.86304
9	37	RMS ABS SUM	216.85916 306.13892	8.99423 11.11102	272.17984 395.54297	639.24902 861.45068	11.69534 23.12799	11.69534 23.12799	1178.80273 1079.37354

10	+	RMS	336.05786	702.77368	17.88835	191.85413	0.12085	3041.92443
		ABS SUM	515.96265	963.08691	29.87126	258.87866	0.21068	5848.06250
10	8	RMS	336.05786	702.77368	17.88835	191.85413	92.72108	5657.35547
		ABS SUM	515.96265	963.08691	29.87126	258.87866	156.84216	7728.85347
11	8	RMS	436.84375	376.75635	2.75217	57.97127	60.86455	6362.21047
		ABS SUM	759.33667	613.30640	5.18097	113.85196	109.85365	10150.21094
11	16	RMS	436.84375	376.75635	2.75217	57.97127	18.38858	4144.29297
		ABS SUM	759.33667	613.30640	5.18097	113.85196	38.31720	6905.65537
12	16	RMS	253.01743	504.93359	1.59751	485.67505	22.78467	3362.83374
		ABS SUM	415.61450	525.33179	2.87226	595.19287	40.81075	5140.28125
12	25	RMS	253.01743	504.93359	1.59751	485.67505	5.68032	3033.63110
		ABS SUM	415.61450	525.33179	2.87226	595.19287	12.33409	3303.54370
13	25	RMS	197.12608	300.73682	9.48588	659.17188	8.70427	2796.36426
		ABS SUM	284.74194	420.29443	11.58805	679.87320	18.46049	3030.21948
13	38	RMS	197.12608	300.73682	9.48588	659.17188	120.27220	1175.28149
		ABS SUM	284.74194	420.29443	11.58805	679.87320	140.95459	2175.25879
14	3	RMS	65.91982	136.20016	0.00573	5.08374	0.13466	2142.62769
		ABS SUM	65.91982	136.20016	0.00810	7.94826	0.22102	3153.16870
14	4	RMS	65.91982	136.20016	0.00573	5.08374	0.13395	2126.33887
		ABS SUM	65.91982	136.20016	0.00810	7.94826	0.21502	3121.00732
15	39	RMS	23.05058	168.67982	1.43175	0.88758	11.26528	2425.58887
		ABS SUM	48.06216	269.60791	2.56135	1.57839	20.25578	3481.63940
15	42	RMS	23.05058	168.67982	1.43175	0.88758	11.64842	2425.58887
		ABS SUM	48.06216	269.60791	2.56135	1.57839	20.72577	3481.63940
16	26	RMS	107.04364	56.28900	1.37864	0.37245	11.16545	2938.73999
		ABS SUM	205.77573	85.58174	2.44137	1.28755	19.95215	3272.08179
16	29	RMS	107.04364	56.28900	1.37864	0.37245	10.92193	3272.08179
		ABS SUM	205.77573	85.58174	2.44137	1.28755	19.36497	4240.78316
17	14	RMS	54.23984	103.49689	0.61612	9.17436	13.83007	1120.11818
		ABS SUM	161.97899	193.20728	1.14670	15.03402	7.79004	1542.53266
17	15	RMS	54.23984	103.49689	0.61612	9.17436	14.75088	2175.44873
		ABS SUM	161.97899	193.20728	1.14670	15.03402	14.75088	3531.02319
18	16	RMS	33.16444	97.72647	0.60346	9.78416	7.59874	800.02637
		ABS SUM	157.81212	188.35428	1.17647	15.87253	14.59571	1217.94995
18	15	RMS	33.16444	97.72647	0.60346	9.78416	7.79004	2119.14353
		ABS SUM	157.81212	188.35428	1.17647	15.87253	14.95688	3624.90436
19	5	RMS	105.76309	898.85107	9.78884	9.0215625	52.35597	369.62744
		ABS SUM	183.97302	898.85107	13.82491	15071.44922	58.98657	501.26146
19	6	RMS	105.76309	898.85107	9.78884	9.0215625	6.94038	2902.58398
		ABS SUM	183.97302	898.85107	13.82491	15071.44922	10.17678	4351.93359
20	6	RMS	45.53304	363.92236	0.59217	1149.29443	6.94038	6270.37891
		ABS SUM	124.97211	531.38428	0.59217	1270.93848	10.17678	9075.58203
20	7	RMS	45.53304	363.92236	0.59217	1149.29443	7.22416	6105.21094
		ABS SUM	124.97211	531.38428	0.59217	1270.93848	11.42924	9079.19922
21	8	RMS	158.97556	101.842334	5.81217	16442.79297	33.65018	345.32251
		ABS SUM	158.97556	101.842334	8.98874	16442.79297	11.62425	415.08714
21	7	RMS	158.97556	101.842334	5.81217	16442.79297	17.22417	6781.10156
		ABS SUM	158.97556	101.842334	8.98874	16442.79297	11.62425	8781.50000
22	4	RMS	781.74146	1198.03076	432.99463	0.0	1948.67178	3878.09521
		ABS SUM	781.74146	1198.03076	645.20435	0.0	2903.42578	5392.71094
22	2	RMS	781.74146	1198.03076	432.99463	0.0	0.00038	1.28038
		ABS SUM	781.74146	1198.03076	645.20435	0.0	0.00065	2.34186
23	16	RMS	489.54375	1449.26416	36.73305	0.0	163.29868	6521.39844
		ABS SUM	489.54375	1449.26416	62.89891	0.0	283.04419	12633.69922
23	10	RMS	489.54375	1449.26416	36.73305	0.0	0.00008	0.57643
		ABS SUM	489.54375	1449.26416	62.89891	0.0	0.00012	0.92411

24	RMS ABS SUM	84-30205 167-96465	632-41357 931-21655	525-01270 795-32080	0-0 0-0	10337-74609 15508-75781	10457-67578 16386-38672
24	RMS ABS SUM	84-30205 167-96465	632-41357 931-21655	525-01270 795-32080	0-0 0-0	0-0 0-0	2074-20068 3767-65869
25	RMS ABS SUM	111-00575 205-08392	764-27271 1051-57568	570-36401 845-77783	0-0 0-0	11122-09766 16492-66797	13622-84375 19238-75781
25	RMS ABS SUM	111-00575 205-08392	764-27271 1051-57568	570-36401 845-77783	0-0 0-0	0-0 0-0	1351-49390 2294-71729
26	RMS ABS SUM	525-08350 795-41431	84-30215 167-96477	632-35840 931-13257	2074-19873 3767-65796	0-27351 0-28349	0-00052 0-00072
26	RMS ABS SUM	525-08350 795-41431	84-30215 167-96477	632-35840 931-13257	2074-19873 3767-65796	11382-63281 16760-66406	1517-43623 3023-36523
27	RMS ABS SUM	570-37354 845-79102	111-00230 205-07919	764-22095 1051-51733	1351-48315 2594-70630	0-16016 0-00592	0-00592 0-00599
27	RMS ABS SUM	570-37354 845-79102	111-00230 205-07919	764-22095 1051-51733	1351-48315 2594-70630	12227-67969 16824-43750	1776-04102 3281-28174
28	RMS ABS SUM	445-89990 753-53247	346-03223 567-83472	764-02295 1269-74292	0-0 0-0	0-00241 0-00428	1-26817 1-78315
28	RMS ABS SUM	445-89990 753-53247	346-03223 567-83472	764-02295 1269-74292	0-0 0-0	4199-19161 6021-86328	1132-29663 2006-94580
29	RMS ABS SUM	130-11310 286-92017	135-51292 135-51292	283-53760 406-60791	0-0 0-0	0-0 0-0	0-0 0-0
29	RMS ABS SUM	130-11310 286-92017	135-51292 135-51292	283-53760 406-60791	0-0 0-0	0-37125 0-51530	1-07596 1-43602
30	RMS ABS SUM	130-11394 286-91797	135-00661 135-00661	283-51245 406-53931	0-0 0-0	1329-73071 1906-63252	357-92261 634-36499
30	RMS ABS SUM	130-11394 286-91797	135-00661 135-00661	283-51245 406-53931	0-0 0-0	4658-08984 7189-42378	3409-08081 6038-48437
31	RMS ABS SUM	509-11816 761-51440	185-12907 317-54028	311-78731 473-20388	1331-15283 1908-95679	1077-29150 1743-35718	1314-30884 2500-50635
31	RMS ABS SUM	509-11816 761-51440	185-12907 317-54028	311-78731 473-20388	1331-15283 1908-95679	1077-14526 1743-19165	1314-29199 2500-48706
32	RMS ABS SUM	508-02935 761-14868	202-77577 349-29370	53-95636 95-30890	1328-41748 1905-04883	851-60278 1308-50171	440-31201 731-97998
32	RMS ABS SUM	508-02935 761-14868	202-77577 349-29370	53-95636 95-30890	1328-41748 1905-04883	20-87291 36-40758	440-31201 731-97998
33	RMS ABS SUM	618-45974 882-27783	270-84492 276-19946	527-62154 601-29102	20-87291 36-40758	5914-11719 5683-23047	1424-33320 1456-25952
33	RMS ABS SUM	618-45974 882-27783	270-84492 276-19946	527-62154 601-29102	20-87291 36-40758	100-04807 117-76535	1149-01587 1198-77588
34	RMS ABS SUM	618-45996 882-27783	270-84492 276-19946	527-62154 601-29102	15-23840 29-01859	5996-19141 5608-32812	1900-30151 1952-47241
34	RMS ABS SUM	618-45996 882-27783	270-84492 276-19946	527-62154 601-29102	15-23840 29-01859	109-89726 134-91734	1157-72729 1193-13721
34	RMS ABS SUM	816-49707 914-37524	321-87354 330-43774	537-25488 596-56299	22-73189 37-20764	1857-19336 2379-56519	2054-73511 2556-41604
34	RMS ABS SUM	816-49707 914-37524	321-87354 330-43774	537-25488 596-56299	22-73189 37-20764	100-04427 117-76199	1176-06628 1224-18237
35	RMS ABS SUM	572-84291 781-51392	319-88867 374-14941	205-92570 283-92676	27-73189 37-20764	109-89726 134-91734	1614-54957 2044-94702
35	RMS ABS SUM	572-84291 781-51392	319-88867 374-14941	205-92570 283-92676	27-73189 37-20764	2744-16870	1140-95723 1196-86279
36	RMS ABS SUM	731-33130 973-42769	289-23950 340-45142	194-54713 303-05984	12-78502 23-47815	109-89153 134-91093	1140-95723 1196-86279
36	RMS ABS SUM	731-33130 973-42769	289-23950 340-45142	194-54713 303-05984	12-78502 23-47815	7-18766 12-39890	1034-24658 1087-60254
37	RMS ABS SUM	22-04012 44-73726	573-01929 618-87600	1-07691 1-77532	32-10800 33-16357	10-2151 17-09880	7563-35247 8291-25000
37	RMS ABS SUM	22-04012 44-73726	573-01929 618-87600	1-07691 1-77532	32-10800 33-16357	1858-62036 2788-91284	2836-15015 5428-82031
38	RMS ABS SUM	670-55762 824-58667	628-90820 1205-89795	613-02686 619-75781	0-0 0-0	1858-62036 2788-91284	2836-15015 5428-82031
38	RMS ABS SUM	670-55762 824-58667	628-90820 1205-89795	613-02686 619-75781	0-0 0-0	0-00165 0-00228	1-77191 2-33353

39	RMS ABS SUM	23.79576 45.74999	532.01904 585.74902	0.45588 0.74946	31.22630 32.41849	4.18231 7.98213	172.86279 281.88037
39	RMS ABS SUM	23.79576 45.74999	532.01904 585.74902	0.45588 0.74946	31.22630 32.41849	5.32353 9.90896	8139.25321 8572.89451
40	RMS ABS SUM	130.87788 158.56978	225.08517 310.15137	2.01993 2.33845	30.38296 31.81497	18.08911 15.47620	649.35401 949.43160
40	RMS ABS SUM	130.87788 158.56978	225.08517 310.15137	2.01993 2.33845	30.38296 31.81497	12.94317 1.74720	2710.17310 3703.30029
41	RMS ABS SUM	471.80029 314.44263	1446.47437 2657.95288	35.36040 62.92511	0.0 0.0	159.12167 283.16187	6506.84766 11960.55469
41	RMS ABS SUM	471.80029 314.44263	1446.47437 2657.95288	35.36040 62.92511	0.0 0.0	0.00019 0.00033	0.49947 0.76319
42	RMS ABS SUM	126.88719 154.25746	194.57681 194.57681	1.00196 1.32483	30.33754 31.64763	12.44141 20.49486	516.67358 728.76831
42	RMS ABS SUM	126.88719 154.25746	194.57681 194.57681	1.00196 1.32483	30.33754 31.64763	3.46703 7.01914	1788.80727 2190.52246
43	RMS ABS SUM	449.84473 495.18404	1172.98022 1194.37964	532.4248 670.34028	0.0 0.0	0.00000 0.00000	0.00000 0.00000
43	RMS ABS SUM	449.84473 495.18404	1172.98022 1194.37964	532.4248 670.34028	0.0 0.0	5.32504 6.70493	11.72896 11.94294
44	RMS ABS SUM	650.61401 725.99170	536.17358 566.10229	541.30664 634.02368	0.0 0.0	0.00000 0.00000	0.00000 0.00000
44	RMS ABS SUM	650.61401 725.99170	536.17358 566.10229	541.30664 634.02368	0.0 0.0	5.41267 6.33978	5.36134 5.66062
45	RMS ABS SUM	390.82324 588.91187	1315.65991 1340.98901	330.30002 340.24902	0.0 0.0	0.00000 0.00000	0.00000 0.00000
45	RMS ABS SUM	390.82324 588.91187	1315.65991 1340.98901	330.30002 340.24902	0.0 0.0	2.30283 3.60222	13.15563 13.49892
46	RMS ABS SUM	548.45654 778.60713	1415.19360 1458.04541	193.44730 291.27124	0.0 0.0	0.00000 0.00000	0.00000 0.00000
46	RMS ABS SUM	548.45654 778.60713	1415.19360 1458.04541	193.44730 291.27124	0.0 0.0	1.93435 2.91251	14.15092 14.37940
47	RMS ABS SUM	340.32861 371.87427	34.22755 51.83311	18.31545 15.84735	111.71811 161.46066	841.80054 952.46484	1073.42529 1190.55420
47	RMS ABS SUM	340.32861 371.87427	34.22755 51.83311	18.31545 15.84735	111.71811 161.46066	928.07886 1004.24829	308.20996 677.50200
48	RMS ABS SUM	146.73941 166.79005	174.80914 130.04560	17.76993 30.45594	286.56787 30.82594	697.60522 881.86133	1242.83203 2045.07104
48	RMS ABS SUM	146.73941 166.79005	174.80914 130.04560	17.76993 30.45594	286.56787 30.82594	770.46631 1014.19580	975.29643 1684.90430
49	RMS ABS SUM	379.50366 407.59424	299.81543 365.47314	339.26611 373.83716	990.96826 1082.31348	157.01329 243.21588	879.11353 1046.75830
49	RMS ABS SUM	379.50366 407.59424	299.81543 365.47314	339.26611 373.83716	990.96826 1082.31348	4384.87500 4758.06250	3131.66502 3841.88096
50	RMS ABS SUM	480.68140 526.06396	389.24341 468.87109	340.69727 392.07668	777.31888 828.14624	522.35718 597.05225	509.04663 679.74467
50	RMS ABS SUM	480.68140 526.06396	389.24341 468.87109	340.69727 392.07668	777.31888 828.14624	4435.87500 4655.75781	4698.53125 5564.51906
51	RMS ABS SUM	242.73318 356.45778	322.50879 362.44102	305.28906 384.61499	880.12378 1153.22534	377.63135 636.77246	1069.66626 1716.82471
51	RMS ABS SUM	242.73318 356.45778	322.50879 362.44102	305.28906 384.61499	880.12378 1153.22534	3978.65948 4568.39844	3394.54150 4432.77344
52	RMS ABS SUM	326.96411 463.03760	411.03857 457.73047	293.04663 391.34839	777.67139 1010.56201	485.73755 877.46582	857.66794 1441.65088
52	RMS ABS SUM	326.96411 463.03760	411.03857 457.73047	293.04663 391.34839	777.67139 1010.56201	3776.36011 4358.08594	4812.14578 5998.29297
53	RMS ABS SUM	611.48608 634.92773	1096.67383 1174.78149	62.99287 114.96080	1750.67456 2955.74048	238.21660 449.24829	10310.76609 10813.89062
53	RMS ABS SUM	611.48608 634.92773	1096.67383 1174.78149	62.99287 114.96080	1750.67456 2955.74048	480.36153 800.31853	660.19849 934.07164

54	RMS	607.79639	898.03125	123.28096	1750.38647	481.52017	641.13916
	ABS SUM	639.09082	978.62349	201.88101	2954.96265	803.50781	935.03687
54	RMS	607.79639	898.03125	123.28096	1750.38647	481.52017	641.13916
	ABS SUM	639.09082	978.62349	201.88101	2954.96265	803.50781	935.03687
55	RMS	68.37967	4.97442	76.92020	0.0	0.00164	0.00010
	ABS SUM	101.68513	10.32952	121.87274	0.0	0.00228	0.00030
55	RMS	68.37967	4.97442	76.92020	0.0	889.19678	57.50450
	ABS SUM	101.68513	10.32952	121.87274	0.0	1408.84619	119.40921
56	RMS	68.37448	15.75060	206.31729	0.0	889.19922	57.50488
	ABS SUM	101.71945	33.12373	328.49243	0.0	1408.85010	119.40901
56	RMS	68.37448	15.75060	206.31729	0.0	389.24438	43.73847
	ABS SUM	101.71945	33.12373	328.49243	0.0	624.52002	98.34947
57	RMS	52.18114	28.30176	61.90311	0.0	472.32373	215.94408
	ABS SUM	71.46332	59.91779	97.29649	0.0	742.37598	457.17383
57	RMS	52.18114	28.30176	61.90311	0.0	0.00372	0.00207
	ABS SUM	71.46332	59.91779	97.29649	0.0	0.00464	0.00280
58	RMS	0.0	0.00106	0.00064	0.0	0.00000	0.00000
	ABS SUM	0.0	0.00152	0.00088	0.0	0.00000	0.00000
58	RMS	0.0	0.00106	0.00064	0.0	0.00446	0.00743
	ABS SUM	0.0	0.00152	0.00088	0.0	0.00613	0.01061
59	RMS	0.0	0.00107	0.00075	0.0	0.00000	0.00000
	ABS SUM	0.0	0.00144	0.00075	0.0	0.00000	0.00000
59	RMS	0.0	0.00107	0.00075	0.0	0.00393	0.00746
	ABS SUM	0.0	0.00144	0.00075	0.0	0.00523	0.01007
60	RMS	0.75611	0.00032	0.00008	0.0	0.00041	0.00162
	ABS SUM	1.33675	0.00034	0.00012	0.0	0.00062	0.00168
60	RMS	0.75611	0.00032	0.00008	0.0	0.00041	0.00162
	ABS SUM	1.33675	0.00034	0.00012	0.0	0.00062	0.00168
61	RMS	0.73850	0.00009	0.00001	0.0	0.00000	0.00000
	ABS SUM	1.33149	0.00009	0.00002	0.0	0.00000	0.00000
61	RMS	0.73850	0.00009	0.00001	0.0	0.00009	0.00081
	ABS SUM	1.33149	0.00009	0.00002	0.0	0.00015	0.00085
62	RMS	20.45811	0.0	188907.68750	0.0	1888.03906	0.0
	ABS SUM	42.15833	0.0	207915.87500	0.0	2078.01929	0.0
62	RMS	20.45811	0.0	188907.68750	0.0	0.0	0.0
	ABS SUM	42.15833	0.0	207915.87500	0.0	0.0	0.0
63	RMS	40.50862	39113.00000	595780.62500	851.87280	2977.98486	1876.38599
	ABS SUM	91.68353	427998.75000	725978.25000	1308.87109	3429.13843	2319.29736
63	RMS	40.50862	39113.00000	595780.62500	851.87280	2976.54956	2043.43066
	ABS SUM	91.68353	427998.75000	725978.25000	1308.87109	3426.65625	2339.56714
64	RMS	0.0	72230.87500	9605.98437	0.0	96.00703	721.91235
	ABS SUM	0.0	78788.00000	16528.91747	0.0	165.19846	781.44775
64	RMS	0.0	72230.87500	9605.98437	0.0	0.0	0.0
	ABS SUM	0.0	78788.00000	16528.91747	0.0	0.0	0.0
65	RMS	10.55100	187.64702	2.27614	109.87134	15.23731	1187.73950
	ABS SUM	19.76239	195.10326	4.26570	134.9074	29.02003	1193.14893
65	RMS	10.55100	187.64702	2.27614	109.87134	17.78598	1140.96265
	ABS SUM	19.76239	195.10326	4.26570	134.90942	23.47988	1196.86568
66	RMS	36.89782	189.85425	3.55280	100.04.95	20.87259	1149.02954
	ABS SUM	53.27824	197.76431	6.00575	117.76221	36.40662	1198.78906
66	RMS	36.89782	189.85425	3.55280	100.04495	32.73163	1176.69127
	ABS SUM	53.27824	197.76431	6.00575	117.76221	37.20680	1224.19287

LOADING - 2
LATERAL Z

MEMBER FORCES

MEMBER	JOINT	RESPONSE TYPE	FORCE			MOMENT			BENDING - Z
			AXIAL	SHEAR - Y	SHEAR - Z	TORSIONAL	BENDING - Y	BENDING - X	
2	47	RMS	341.97046	384.79810	542.80371	0.0	442.81816	1310.67280	
		ABS SUM	630.84570	631.66602	995.51953	0.0	5497.82422	2841.13794	
2	49	RMS	341.97046	384.79810	542.80371	0.0	0.00220	1.01573	
		ABS SUM	630.84570	631.66602	995.51953	0.0	0.00349	1.36795	
3	47	RMS	14.70839	57.68037	0.00231	8.99518	0.16657	1347.84106	
		ABS SUM	32.43280	94.09895	0.01251	16.74481	0.29659	2214.74487	
3	48	RMS	14.70839	57.68037	0.00231	8.99518	0.17022	1312.25366	
		ABS SUM	32.43280	94.09895	0.01251	16.74481	0.29764	2294.77075	
4	37	RMS	142.22018	185.62061	3.99517	221.08626	21.08189	935.11792	
		ABS SUM	246.39984	328.46338	7.25734	410.64526	38.38593	1449.97266	
4	47	RMS	142.22018	185.62061	3.99517	221.08626	0.16715	1497.07983	
		ABS SUM	246.39984	328.46338	7.25734	410.64526	0.29742	2330.09058	
5	38	RMS	155.04082	131.80229	3.41782	159.28748	17.99455	1175.64276	
		ABS SUM	214.72798	237.40683	7.51503	297.09741	39.89500	1706.44873	
5	48	RMS	155.04082	131.80229	3.41782	159.28748	0.16970	1666.65376	
		ABS SUM	214.72798	237.40683	7.51503	297.09741	0.29485	2191.90454	
6	3	RMS	167.38647	869.21240	25.14328	135.82303	0.18372	2904.37671	
		ABS SUM	378.25883	1035.37884	32.80666	227.38936	0.31955	5573.19922	
6	5	RMS	167.38647	869.21240	25.14328	135.82303	130.32130	6640.87891	
		ABS SUM	378.25883	1035.37884	32.80666	227.38936	169.94952	9438.75391	
7	5	RMS	463.11548	401.76025	3.12983	69.07404	72.03712	6830.10156	
		ABS SUM	744.74487	596.60474	4.29251	100.28903	100.91113	10087.77344	
7	14	RMS	463.11548	401.76025	3.12983	69.07404	30.37674	4372.84766	
		ABS SUM	744.74487	596.60474	4.29251	100.28903	33.50304	6505.34375	
8	14	RMS	140.76459	124.04425	3.01328	66.60890	23.47394	1580.92456	
		ABS SUM	281.65063	221.63974	3.71170	122.18245	40.31038	2814.87720	
8	24	RMS	140.76459	124.04425	3.01328	66.60890	122.18245	601.92212	
		ABS SUM	281.65063	221.63974	3.71170	122.18245	22.65080	1051.60448	
9	24	RMS	74.51105	81.09028	1.88682	30.36111	19.04793	597.82104	
		ABS SUM	149.02210	122.77223	2.90688	42.81247	10.02641	1039.86523	
9	37	RMS	74.51105	81.09028	1.88682	30.36111	21.51172	915.31396	
		ABS SUM	149.02210	122.77223	2.90688	42.81247	40.25063	1405.63110	
10	4	RMS	376.54688	728.56039	18.24783	274.43481	0.17437	3566.20801	
		ABS SUM	548.13310	1052.85889	28.66283	351.86680	0.31934	5274.87500	
10	8	RMS	376.54688	728.56039	18.24783	274.43481	24.53349	3789.07422	
		ABS SUM	548.13310	1052.85889	28.66283	351.86680	148.44211	7893.96234	
11	8	RMS	495.06516	457.86328	3.06475	52.38887	42.93101	7607.37500	
		ABS SUM	783.34363	674.13306	3.96475	81.38092	101.47900	11179.41797	
11	16	RMS	495.06516	457.86328	3.06475	52.38887	15.63078	5148.87500	
		ABS SUM	783.34363	674.13306	3.96475	81.38092	25.60744	7580.01172	
12	16	RMS	159.46162	129.38416	1.46248	70.23006	17.26584	1818.52051	
		ABS SUM	283.96753	228.73019	2.61297	131.86636	29.46834	3027.65674	
12	25	RMS	159.46162	129.38416	1.46248	70.23006	10.78921	433.13721	
		ABS SUM	283.96753	228.73019	2.61297	131.86636	19.91623	830.96899	
13	25	RMS	72.31508	96.72882	1.19421	30.54816	9.75207	435.88623	
		ABS SUM	119.77917	135.66994	1.70788	41.84380	16.45345	784.52856	
13	38	RMS	72.31508	96.72882	1.19421	30.54816	17.28345	1140.47168	
		ABS SUM	119.77917	135.66994	1.70788	41.84380	17.44001	1700.79393	

14	3	RMS	39-60326	117-59816	0-00772	7-37769	0-18547	2677-80337
		ABS SUM	58-25594	174-04103	0-01380	13-31063	0-32140	3991-64502
14	4	RMS	39-60326	119-59834	0-00772	7-37769	0-17328	2847-46802
		ABS SUM	58-25594	174-04103	0-01380	13-31063	0-31592	4020-12524
15	39	RMS	19-52118	115-40155	2-11339	1-66840	16-91823	1028-27661
		ABS SUM	31-28135	212-27426	3-65530	2-53059	29-27489	1967-80322
15	42	RMS	19-52118	115-40155	2-11339	1-66840	16-89616	825-62842
		ABS SUM	31-28135	212-27426	3-65530	2-53059	29-20978	1497-56812
16	26	RMS	56-72574	30-29944	1-92840	0-51153	15-79306	284-00659
		ABS SUM	88-21506	60-11371	3-42676	0-92827	27-42442	654-42065
16	29	RMS	56-72574	30-29944	1-92840	0-51153	15-86523	344-50024
		ABS SUM	88-21506	60-11371	3-42676	0-92827	27-40396	697-63354
17	14	RMS	75-51714	117-46501	0-59848	5-64052	6-60458	524-73193
		ABS SUM	140-43146	181-46440	0-77077	6-82896	9-75966	689-12427
17	15	RMS	75-51714	117-46501	0-59848	5-64052	6-67895	2447-92920
		ABS SUM	140-43146	181-46440	0-77077	6-82896	9-72441	3261-82568
18	16	RMS	88-64352	110-35443	0-57442	5-63814	8-10359	357-48315
		ABS SUM	143-27328	170-36386	0-87159	6-40197	12-18052	516-74121
18	15	RMS	88-64352	110-35443	0-57442	5-63814	6-67895	2447-92920
		ABS SUM	143-27328	170-36386	0-87159	6-40197	9-72441	3261-82568
19	5	RMS	138-26508	903-32520	13-81283	11687-97656	59-59238	485-73096
		ABS SUM	245-40310	1259-61014	17-64542	16985-29516	76-27477	635-41895
19	6	RMS	138-26508	903-32520	13-81283	11687-97656	9-76280	4106-61719
		ABS SUM	245-40310	1259-61014	17-64542	16985-29516	13-64092	6001-67187
20	6	RMS	19-64452	460-04419	0-88822	1159-41699	9-76282	7906-98437
		ABS SUM	33-12177	671-04810	0-76040	1384-64941	13-64092	11532-30018
20	7	RMS	19-64452	460-04419	0-88822	1159-41699	7-81426	7735-06350
		ABS SUM	33-12177	671-04810	0-76040	1384-64941	12-26268	11308-37500
21	8	RMS	113-38395	766-72998	5-90979	12160-26172	34-02216	348-30151
		ABS SUM	197-60413	1224-47949	9-27385	17413-71875	53-73628	427-60815
21	7	RMS	113-38395	766-72998	5-90979	12160-26172	7-81427	5087-42187
		ABS SUM	197-60413	1224-47949	9-27385	17413-71875	12-26270	8220-51172
22	4	RMS	748-12707	712-14502	520-57300	0-0	2342-73935	3205-73291
		ABS SUM	981-81934	1091-16528	915-52759	0-0	4119-67109	4911-86328
22	2	RMS	748-12707	712-14502	520-57300	0-0	0-00209	1-12518
		ABS SUM	981-81934	1091-16528	915-52759	0-0	0-00321	1-86058
23	16	RMS	407-12646	1579-26636	43-80031	0-0	197-10130	6881-10156
		ABS SUM	655-90625	2415-59985	72-65550	0-0	326-94849	10869-69161
23	10	RMS	407-12646	1579-26636	43-80031	0-0	0-00011	0-81624
		ABS SUM	655-90625	2415-59985	72-65550	0-0	0-00015	1-26568
24	6	RMS	103-88119	805-42212	680-41602	0-0	13268-10937	13389-93359
		ABS SUM	178-28627	1154-68188	1041-39868	0-0	20307-27344	19217-24609
24	11	RMS	103-88119	805-42212	680-41602	0-0	0-0	3338-38062
		ABS SUM	178-28627	1154-68188	1041-39868	0-0	0-0	5430-60205
25	7	RMS	107-11483	841-65721	725-52246	0-0	14147-68359	14960-19922
		ABS SUM	194-21092	1199-42871	1109-86621	0-0	21642-39453	21349-34766
25	12	RMS	107-11483	841-65721	725-52246	0-0	0-0	1456-79712
		ABS SUM	194-21092	1199-42871	1109-86621	0-0	0-0	2099-03687
26	11	RMS	680-42212	103-88263	805-38550	3338-41040	0-18008	0-00245
		ABS SUM	1041-40820	178-28781	1154-63989	3430-64062	0-19494	0-00274
26	13	RMS	680-42212	103-88263	805-38550	3338-41040	14497-08203	1869-88574
		ABS SUM	1041-40820	178-28781	1154-63989	3430-64062	20783-68750	3209-17798

27	PMS ABS SUM	725-49170 1109-83057	107-71155 194-20601	841-71411 1199-48804	1456-79053 2099-03369	0-30684 0-40048	0-00557 0-00812
27	PMS ABS SUM	725-49170 1109-83057	107-71155 194-20601	841-71411 1199-48804	1456-79053 2099-03369	13487-25781 19191-30444	1723-38965 3107-30444
28	PMS ABS SUM	335-57668 591-02954	444-11548 562-62646	550-88887 996-20142	0-0 0-0	2471-64917 4482-89062	1998-28345 2531-83057
28	PMS ABS SUM	335-57668 591-02954	444-11548 562-62646	550-88887 996-20142	0-0 0-0	0-00188 0-00300	0-47172 0-78668
29	PMS ABS SUM	80-11804 137-32031	53-14923 79-12289	338-50903 521-57471	0-0 0-0	5013-31641 7724-51562	787-13989 1171-81006
29	PMS ABS SUM	80-11804 137-32031	53-14923 79-12289	338-50903 521-57471	0-0 0-0	0-0 0-0	0-0 0-0
30	PMS ABS SUM	80-12941 137-33644	53-19331 79-17683	338-56543 521-61499	0-0 0-0	1-06789 1-54198	0-83141 1-22248
30	PMS ABS SUM	80-12941 137-33644	53-19331 79-17683	338-56543 521-61499	0-0 0-0	1589-31836 2448-88452	349-31247 371-21289
31	PMS ABS SUM	597-56665 856-38013	212-2499 309-93872	395-25220 624-64844	0-0 0-0	5817-54297 9215-56641	3775-33472 5486-80859
31	PMS ABS SUM	597-56665 856-38013	212-2499 309-93872	395-25220 624-64844	0-0 0-0	1263-32174 2044-25513	1320-51123 1995-24097
32	PMS ABS SUM	597-60278 856-42969	232-78493 324-70508	43-29330 83-35271	0-0 0-0	1642-51416 2642-74782	1320-42822 1995-12402
32	PMS ABS SUM	597-60278 856-42969	232-78493 324-70508	43-29330 83-35271	0-0 0-0	1094-08887 1720-08689	153-41324 350-67920
33	PMS ABS SUM	143-83334 225-93831	14-12488 23-30260	175-93484 292-91675	26-67444 45-70485	1682-23315 2804-22681	82-46019 144-28340
33	PMS ABS SUM	143-83334 225-93831	14-12488 23-30260	175-93484 292-91675	26-67444 45-70485	16-28591 32-60760	58-74632 107-62750
34	PMS ABS SUM	117-64991 236-71495	17-51311 26-88565	235-93529 235-93529	25-80124 44-77588	1356-34233 2278-48071	109-64267 193-31799
34	PMS ABS SUM	117-64991 236-71495	17-51311 26-88565	235-93529 235-93529	25-80124 44-77588	23-99347 46-70481	62-48381 103-75361
35	PMS ABS SUM	344-80433 604-21631	35-43334 73-06287	174-73433 285-20459	24-76593 42-77275	1647-81250 2678-67554	323-67554 643-32910
35	PMS ABS SUM	344-80433 604-21631	35-43334 73-06287	174-73433 285-20459	24-76593 42-77275	16-28543 32-60680	56-29407 85-29056
36	PMS ABS SUM	317-50674 599-81592	47-10117 95-09550	194-77901 339-56836	24-52785 42-10427	1828-40771 3178-67090	430-50098 833-71167
36	PMS ABS SUM	317-50674 599-81592	47-10117 95-09550	194-77901 339-56836	24-52785 42-10427	25-99387 48-70665	58-83278 108-11711
37	PMS ABS SUM	19-45842 33-43550	121-78207 197-75778	1-04617 1-76614	1-54605 2-34794	0-26857 11-09028	64-95421 118-41801
37	PMS ABS SUM	19-45842 33-43550	121-78207 197-75778	1-04617 1-76614	1-54605 2-34794	0-0 0-0	1800-84424 2934-02710
38	PMS ABS SUM	971-10254 1093-70825	645-04029 1024-18723	572-47075 923-16724	0-0 0-0	2476-11938 4154-25000	2904-15332 4611-03125
38	PMS ABS SUM	971-10254 1093-70825	645-04029 1024-18723	572-47075 923-16724	0-0 0-0	0-00174 0-00265	1-77401 2-39532
39	PMS ABS SUM	16-73526 29-75644	91-52840 149-93718	0-76667 1-45470	1-54400 2-52440	6-54872 11-53931	99-78497 151-70370
39	PMS ABS SUM	16-73526 29-75644	91-52840 149-93718	0-76667 1-45470	1-54400 2-52440	10-14766 17-37221	1338-08521 2104-16602
40	PMS ABS SUM	17-38293 37-44659	277-38232	0-60984 1-01023	1-59109 2-77401	5-37648 11-14196	301-48267 564-29639
40	PMS ABS SUM	17-38293 37-44659	277-38232	0-60984 1-01023	1-59109 2-77401	8-04986 13-68910	2229-67114 3638-44897

41	RMS	369.8665	1256.71655	44.88007	0.0	301.96937	3655.66797
	ABS SUM	620.94458	2043.11865	71.99756	0.0	323.98735	9193.52344
41	RMS	369.8665	1256.71655	44.88007	0.0	0.00028	0.72554
	ABS SUM	620.94458	2043.11865	71.99756	0.0	0.00043	0.94272
42	RMS	15.41718	89.56431	0.67690	1.51543	6.47583	313.16528
	ABS SUM	33.10312	150.98308	1.09881	2.53351	12.59678	392.69312
42	RMS	15.41718	89.56431	0.67690	1.51543	7.94107	1238.60059
	ABS SUM	33.10312	150.98308	1.09881	2.53351	13.09380	1817.91187
43	RMS	141.15826	24.61752	125.37007	0.0	0.00000	0.00000
	ABS SUM	220.02737	42.04723	258.30273	0.0	0.00000	0.00000
43	RMS	141.15826	24.61752	125.37007	0.0	1.25341	0.24616
	ABS SUM	220.02737	42.04723	258.30273	0.0	2.58284	0.62044
44	RMS	110.99330	14.06321	70.27603	0.0	0.00000	0.00000
	ABS SUM	223.15660	28.12642	140.55206	0.0	0.00000	0.00000
44	RMS	110.99330	14.06321	70.27603	0.0	0.70211	0.14062
	ABS SUM	223.15660	28.12642	140.55206	0.0	1.51591	0.28131
45	RMS	346.83325	41.61549	111.4251	0.0	0.00000	0.00000
	ABS SUM	599.27490	82.02130	211.37318	0.0	0.00000	0.00000
45	RMS	346.83325	41.61549	111.4251	0.0	1.11624	0.41612
	ABS SUM	599.27490	82.02130	211.37318	0.0	2.11337	0.82013
46	RMS	318.69092	38.20346	95.90689	0.0	0.00000	0.00000
	ABS SUM	591.37158	78.49886	200.83893	0.0	0.00000	0.00000
46	RMS	318.69092	38.20346	95.90689	0.0	0.95900	0.28711
	ABS SUM	591.37158	78.49886	200.83893	0.0	2.00824	0.78494
47	RMS	22.02937	113.87494	37.64191	117.34701	311.25122	873.02497
	ABS SUM	44.44089	153.39648	54.19640	200.23885	499.37427	1218.94995
47	RMS	22.02937	113.87494	37.64191	117.34701	294.04272	951.60474
	ABS SUM	44.44089	153.39648	54.19640	200.23885	445.72681	1308.21631
48	RMS	13.76549	195.84574	52.01707	32.83447	404.18652	1507.54883
	ABS SUM	27.60429	323.61670	62.50751	601.06738	669.98240	2605.37744
48	RMS	13.76549	195.84574	52.01707	32.83447	431.71631	1624.94973
	ABS SUM	27.60429	323.61670	62.50751	601.06738	734.93188	2596.34668
49	RMS	99.89761	86.92067	106.13145	13.76425	555.79037	739.13892
	ABS SUM	149.09567	167.05130	168.62898	25.41826	743.69722	1060.48926
49	RMS	99.89761	86.92067	106.13145	13.76425	879.76318	596.28296
	ABS SUM	149.09567	167.05130	168.62898	25.41826	1511.28862	1207.18433
50	RMS	69.67317	110.93466	99.07959	131.31224	572.75098	811.21484
	ABS SUM	137.41197	210.91930	146.51347	221.42079	754.52368	1145.93384
50	RMS	69.67317	110.93466	99.07959	131.31224	761.46387	876.34370
	ABS SUM	137.41197	210.91930	146.51347	221.42079	1208.26538	1708.15576
51	RMS	196.58707	26.43430	150.31599	32.97095	991.64941	1203.18018
	ABS SUM	342.82837	60.77568	257.39404	665.82080	1653.92383	2081.35029
51	RMS	196.58707	26.43430	150.31599	32.97095	1031.49292	1283.20160
	ABS SUM	342.82837	60.77568	257.39404	665.82080	1835.14721	2406.20752
52	RMS	183.47418	48.74392	160.37373	360.33006	1049.69219	1309.20386
	ABS SUM	342.14540	104.30728	284.75073	643.01660	1741.76660	2169.64443
52	RMS	183.47418	48.74392	160.37373	360.33006	1101.45752	1101.75586
	ABS SUM	342.14540	104.30728	284.75073	643.01660	2061.71021	2261.87476
53	RMS	30.44905	75.51797	304.51538	1645.40894	1199.71558	556.76655
	ABS SUM	48.00128	154.84960	453.38794	2951.82373	1654.90063	1007.85962
53	RMS	30.44905	75.51797	304.51538	1645.40894	1645.40894	312.17676
	ABS SUM	48.00128	154.84960	453.38794	2951.82373	2863.58765	539.42188

54	RMS	31.58870	74.47205	1643.79028	1861.03809	312.17944
	ABS SUM	54.59673	143.14905	2948.91455	2886.53613	539.38164
54	RMS	31.58870	74.47205	1643.79028	1861.03809	312.17944
	ABS SUM	54.59673	143.14905	2948.91455	2886.53613	539.38164
55	RMS	80.26515	5.60469	99.81534	0.00295	0.00043
	ABS SUM	114.86607	12.60334	161.25870	0.00403	0.00061
55	RMS	80.26515	5.60469	99.81534	1133.86255	68.79057
	ABS SUM	114.86607	12.60334	161.25870	1864.14819	143.41780
56	RMS	80.26500	17.60475	268.39722	1133.86255	68.79143
	ABS SUM	114.85194	31.78375	433.83936	1864.11133	143.41919
56	RMS	80.26500	17.60475	268.39722	507.59473	44.90343
	ABS SUM	114.85194	31.78375	433.83936	821.35254	91.06705
57	RMS	81.32474	28.65900	74.32269	547.07007	188.14853
	ABS SUM	81.75275	50.52888	119.84288	914.38257	385.53564
57	RMS	81.32474	28.65900	74.32269	0.01240	0.00010
	ABS SUM	81.75275	50.52888	119.84288	0.01772	0.00055
58	RMS	0.0	0.00036	0.00032	0.00000	0.00000
	ABS SUM	0.0	0.00051	0.00050	0.00000	0.00000
58	RMS	0.0	0.00036	0.00032	0.00227	0.00254
	ABS SUM	0.0	0.00051	0.00050	0.00348	0.00355
59	RMS	0.0	0.00030	0.00075	0.00000	0.00000
	ABS SUM	0.0	0.00036	0.00125	0.00000	0.00000
59	RMS	0.0	0.00030	0.00075	0.00525	0.00208
	ABS SUM	0.0	0.00036	0.00125	0.00874	0.00252
60	RMS	1.10042	0.00001	0.00006	0.00043	0.00006
	ABS SUM	1.10042	0.00002	0.00009	0.00043	0.00009
60	RMS	1.10042	0.00001	0.00006	0.00000	0.00000
	ABS SUM	1.10042	0.00002	0.00009	0.00000	0.00000
61	RMS	1.10042	0.00001	0.00001	0.00001	0.00010
	ABS SUM	1.10042	0.00001	0.00001	0.00011	0.00011
61	RMS	1.10042	0.00001	0.00001	1342.70117	0.0
	ABS SUM	1.10042	0.00001	0.00001	1964.94458	0.0
62	RMS	23.53974	134344.00000	166602.31250	0.0	0.0
	ABS SUM	50.67638	196602.31250	196602.31250	0.0	0.0
62	RMS	23.53974	134344.00000	166602.31250	263.83837	1316.67114
	ABS SUM	50.67638	196602.31250	196602.31250	2839.15623	2047.74780
63	RMS	38.07675	498862.25000	567985.87500	2492.05249	1352.34204
	ABS SUM	71.44722	567985.87500	567985.87500	2831.60376	2036.70947
63	RMS	38.07675	498862.25000	567985.87500	82.20705	6.07474
	ABS SUM	71.44722	567985.87500	567985.87500	139.70221	14.25234
64	RMS	0.0	8225.22266	13977.89653	0.0	0.0
	ABS SUM	0.0	13977.89653	13977.89653	0.0	0.0
64	RMS	0.0	8225.22266	13977.89653	25.90181	62.53446
	ABS SUM	0.0	13977.89653	13977.89653	44.70570	103.73442
65	RMS	10.31628	9.76336	7.02708	25.99353	58.81293
	ABS SUM	19.59779	17.29230	7.02708	48.70570	108.11720
65	RMS	10.31628	9.76336	7.02708	25.99353	58.81293
	ABS SUM	19.59779	17.29230	7.02708	48.70570	108.11720
66	RMS	9.09703	9.76336	7.02708	26.67494	58.74873
	ABS SUM	11.15809	15.74811	7.22004	32.60764	107.62799
66	RMS	9.09703	9.76336	7.02708	26.67494	58.74873
	ABS SUM	11.15809	15.74811	7.22004	32.60764	107.62799
66	RMS	9.09703	9.76336	7.02708	22.76639	59.29335
	ABS SUM	11.15809	15.74811	7.22004	42.77345	85.26972

RESULTS OF LATEST ANALYSIS

JOB ID - ME-884 JOB TITLE DINGHAM 8 X 10 X 14 CAP

ACTIVE UNITS - LENGTH INCH FORCE LB ANGLE RAD TEMPERATURE DEGF TIME SEC

ACTIVE STRUCTURE TYPE - SPACE FRAME

ACTIVE COORDINATES AXES X Y Z

LOADING - 3 IC IN VERTICAL DIRECTION

MEMBER FORCES

MEMBER	JOINT	AXIAL	FORCE X	FORCE Y	SHEAR Z	TORSIONAL	MOMENT BENDING Y	BENDING Z
1	1	1000000	0	0	0	0	0	0
1	2	1000000	0	0	0	0	0	0
1	3	1000000	0	0	0	0	0	0
1	4	1000000	0	0	0	0	0	0
1	5	1000000	0	0	0	0	0	0
1	6	1000000	0	0	0	0	0	0
1	7	1000000	0	0	0	0	0	0
1	8	1000000	0	0	0	0	0	0
1	9	1000000	0	0	0	0	0	0
1	10	1000000	0	0	0	0	0	0
1	11	1000000	0	0	0	0	0	0
1	12	1000000	0	0	0	0	0	0
1	13	1000000	0	0	0	0	0	0
1	14	1000000	0	0	0	0	0	0
1	15	1000000	0	0	0	0	0	0
1	16	1000000	0	0	0	0	0	0
1	17	1000000	0	0	0	0	0	0
1	18	1000000	0	0	0	0	0	0
1	19	1000000	0	0	0	0	0	0
1	20	1000000	0	0	0	0	0	0
1	21	1000000	0	0	0	0	0	0
1	22	1000000	0	0	0	0	0	0
1	23	1000000	0	0	0	0	0	0
1	24	1000000	0	0	0	0	0	0
1	25	1000000	0	0	0	0	0	0
1	26	1000000	0	0	0	0	0	0
1	27	1000000	0	0	0	0	0	0
1	28	1000000	0	0	0	0	0	0
1	29	1000000	0	0	0	0	0	0
1	30	1000000	0	0	0	0	0	0
1	31	1000000	0	0	0	0	0	0
1	32	1000000	0	0	0	0	0	0
1	33	1000000	0	0	0	0	0	0
1	34	1000000	0	0	0	0	0	0
1	35	1000000	0	0	0	0	0	0
1	36	1000000	0	0	0	0	0	0
1	37	1000000	0	0	0	0	0	0
1	38	1000000	0	0	0	0	0	0
1	39	1000000	0	0	0	0	0	0
1	40	1000000	0	0	0	0	0	0
1	41	1000000	0	0	0	0	0	0
1	42	1000000	0	0	0	0	0	0
1	43	1000000	0	0	0	0	0	0
1	44	1000000	0	0	0	0	0	0
1	45	1000000	0	0	0	0	0	0
1	46	1000000	0	0	0	0	0	0
1	47	1000000	0	0	0	0	0	0
1	48	1000000	0	0	0	0	0	0
1	49	1000000	0	0	0	0	0	0
1	50	1000000	0	0	0	0	0	0
1	51	1000000	0	0	0	0	0	0
1	52	1000000	0	0	0	0	0	0
1	53	1000000	0	0	0	0	0	0
1	54	1000000	0	0	0	0	0	0
1	55	1000000	0	0	0	0	0	0
1	56	1000000	0	0	0	0	0	0
1	57	1000000	0	0	0	0	0	0
1	58	1000000	0	0	0	0	0	0
1	59	1000000	0	0	0	0	0	0
1	60	1000000	0	0	0	0	0	0
1	61	1000000	0	0	0	0	0	0
1	62	1000000	0	0	0	0	0	0
1	63	1000000	0	0	0	0	0	0
1	64	1000000	0	0	0	0	0	0
1	65	1000000	0	0	0	0	0	0
1	66	1000000	0	0	0	0	0	0
1	67	1000000	0	0	0	0	0	0
1	68	1000000	0	0	0	0	0	0
1	69	1000000	0	0	0	0	0	0
1	70	1000000	0	0	0	0	0	0
1	71	1000000	0	0	0	0	0	0
1	72	1000000	0	0	0	0	0	0
1	73	1000000	0	0	0	0	0	0
1	74	1000000	0	0	0	0	0	0
1	75	1000000	0	0	0	0	0	0
1	76	1000000	0	0	0	0	0	0
1	77	1000000	0	0	0	0	0	0
1	78	1000000	0	0	0	0	0	0
1	79	1000000	0	0	0	0	0	0
1	80	1000000	0	0	0	0	0	0
1	81	1000000	0	0	0	0	0	0
1	82	1000000	0	0	0	0	0	0
1	83	1000000	0	0	0	0	0	0
1	84	1000000	0	0	0	0	0	0
1	85	1000000	0	0	0	0	0	0
1	86	1000000	0	0	0	0	0	0
1	87	1000000	0	0	0	0	0	0
1	88	1000000	0	0	0	0	0	0
1	89	1000000	0	0	0	0	0	0
1	90	1000000	0	0	0	0	0	0
1	91	1000000	0	0	0	0	0	0
1	92	1000000	0	0	0	0	0	0
1	93	1000000	0	0	0	0	0	0
1	94	1000000	0	0	0	0	0	0
1	95	1000000	0	0	0	0	0	0
1	96	1000000	0	0	0	0	0	0
1	97	1000000	0	0	0	0	0	0
1	98	1000000	0	0	0	0	0	0
1	99	1000000	0	0	0	0	0	0
1	100	1000000	0	0	0	0	0	0

LOADING - 5 VERTICAL SEISMIC

MEMBER FORCES

MEMBER	JOINT	RESPONSE	FORCE	SHEAR-Z	TORSIONAL	MOVEMENT	MOVEMENT	MOVEMENT
		AXIAL	SHEAR-Y	SHEAR-Z	TORSIONAL	REMOVING-Y	REMOVING-Z	REMOVING-Z
		MEMBER	MEMBER	MEMBER	MEMBER	MEMBER	MEMBER	MEMBER
		MEMBER	MEMBER	MEMBER	MEMBER	MEMBER	MEMBER	MEMBER
2	47	ABS SUM	519.56299	864.42603	0.0	3889.91895	0.28175	2338.28198
2	49	ABS SUM	830.10254	864.42603	0.0	0.00336	0.59927	3335.06680
3	47	ABS SUM	16.81389	0.00114	1.49192	0.07633	923.10693	1724.97998
3	48	ABS SUM	36.58601	0.00287	3.92420	0.15737	1880.93774	2652.82593
4	37	ABS SUM	261.69995	0.00184	3.92420	0.19519	127.04007	1888.73779
4	47	ABS SUM	419.85132	34.98715	265.51314	0.07602	2713.66768	3987.83228
5	38	ABS SUM	261.69995	34.98715	265.51314	0.15712	3987.83228	2713.66768
5	48	ABS SUM	419.85132	34.98715	265.51314	0.07602	2713.66768	3987.83228
6	3	ABS SUM	311.69878	33.86086	505.82837	0.10088	2983.77905	4249.06250
6	48	ABS SUM	488.63916	33.86086	505.82837	0.19511	4249.06250	2983.77905
7	5	ABS SUM	517.93262	37.58630	300.33154	0.09181	10745.58904	12626.23828
7	5	ABS SUM	911.65190	37.58630	300.33154	0.17823	12626.23828	10745.58904
7	14	ABS SUM	820.63570	7.10173	1208.98633	84.46733	14209.50781	16424.08594
7	14	ABS SUM	959.25830	7.10173	1208.98633	130.50687	16424.08594	14209.50781
8	14	ABS SUM	262.14162	5.25050	1750.32866	53.43205	8614.26953	10266.79687
8	24	ABS SUM	413.24902	5.25050	1750.32866	70.50110	10266.79687	8614.26953
8	24	ABS SUM	68.04295	6.82890	1902.54150	41.77226	357.91887	3005.59888
8	24	ABS SUM	175.06174	6.82890	1902.54150	58.24576	482.20772	3548.69824
9	24	ABS SUM	303.20068	12.72329	756.69771	38.20665	2317.93945	3184.81812
9	24	ABS SUM	402.65996	12.72329	756.69771	47.56786	3184.81812	2317.93945
9	37	ABS SUM	303.20068	16.72594	850.63770	168.17052	2042.70166	1432.81299
9	37	ABS SUM	402.65996	16.72594	850.63770	204.27052	2042.70166	1432.81299
10	4	ABS SUM	588.29175	33.86723	356.25366	0.09403	8789.74609	10702.22656
10	4	ABS SUM	1040.37490	33.86723	356.25366	0.15959	10702.22656	8789.74609
10	8	ABS SUM	651.75830	31.70923	366.25366	112.29867	6856.36519	9391.34375
10	8	ABS SUM	835.20239	31.70923	366.25366	175.61505	9391.34375	6856.36519
11	8	ABS SUM	755.08960	5.88161	1198.48779	89.63479	11295.96094	13768.51562
11	8	ABS SUM	990.41870	5.88161	1198.48779	133.42690	13768.51562	11295.96094
11	16	ABS SUM	755.08960	7.00051	1242.12562	66.20771	6951.86319	8771.82031
11	16	ABS SUM	990.41870	7.00051	1242.12562	65.39980	8771.82031	6951.86319
12	16	ABS SUM	70.34593	6.63223	1843.24805	35.53281	1439.01979	2933.21313
12	16	ABS SUM	162.30229	6.63223	1843.24805	54.04634	2933.21313	1439.01979
12	25	ABS SUM	70.34593	5.76884	1798.57397	38.73307	2209.32764	3183.99438
12	25	ABS SUM	162.30229	5.76884	1798.57397	49.58504	3183.99438	162.30229
13	25	ABS SUM	167.56689	13.08105	770.86841	44.03663	2577.19751	3562.91675
13	25	ABS SUM	264.28122	13.08105	770.86841	54.40343	3562.91675	2577.19751
13	36	ABS SUM	167.56689	13.08105	770.86841	119.71813	1429.34370	2077.84790
13	36	ABS SUM	264.28122	13.08105	770.86841	174.04565	2077.84790	1429.34370
14	3	ABS SUM	23.66447	0.00119	4.06337	0.09229	344.12016	645.04199
14	3	ABS SUM	41.99670	0.00283	6.73020	0.17912	645.04199	344.12016
14	4	ABS SUM	23.66447	0.00119	4.06337	0.08474	645.11377	1355.60263
14	4	ABS SUM	41.99670	0.00283	6.73020	0.16069	1355.60263	645.11377
15	39	ABS SUM	49.27847	1.44692	0.28784	11.57170	1921.60913	3161.93921
15	39	ABS SUM	68.32913	1.44692	0.28784	11.42719	3161.93921	1921.60913
15	42	ABS SUM	49.27847	1.44692	0.28784	11.57170	596.88672	1041.63647
15	42	ABS SUM	68.32913	1.44692	0.28784	11.42719	1041.63647	596.88672

16	RMS	184.60297	48.16051	1.50600	1.10854	12.75960	3606.49820
	ABS SUM	230.29507	77.54144	2.21658	1.43417	18.42044	4696.12891
16	RMS	184.48297	48.16051	1.50600	1.10854	11.33949	4309.61719
	ABS SUM	230.29507	77.54144	2.21658	1.43417	17.06628	5348.42187
17	RMS	85.21223	1055.46191	0.92773	100.92357	11.81396	4696.07031
	ABS SUM	130.09665	1087.98608	1.24101	103.56207	15.97888	5040.02734
17	RMS	85.21223	1055.46191	0.92773	100.92357	11.48295	21804.11328
	ABS SUM	130.09665	1087.98608	1.24101	103.56207	15.21196	22456.49219
18	RMS	79.34930	1003.13306	0.89558	101.08842	11.00620	3939.68896
	ABS SUM	110.59982	1033.27466	1.21567	103.89566	15.31049	4252.30469
18	RMS	110.59982	1033.27466	0.89558	101.08842	11.48295	21245.64553
	ABS SUM	145.50285	1070.59942	1.21547	103.89566	15.21195	21870.66016
19	RMS	93.77255	1430.38867	8.06519	24606.61672	38.28229	482.02271
	ABS SUM	145.50285	2066.55386	13.94673	24606.61672	65.46385	625.66504
19	RMS	168.65205	1430.38867	8.06519	24606.61672	2.20646	7580.14062
	ABS SUM	215.08636	2066.55386	13.94673	24606.61672	4.52589	10717.98828
20	RMS	168.65205	1430.38867	0.10781	260.12134	2.20646	1368.95605
	ABS SUM	215.08636	153.43105	0.21000	440.94482	4.52579	2724.91602
20	RMS	168.65205	1430.38867	0.10781	260.12134	1.74509	2901.48047
	ABS SUM	215.08636	153.43105	0.21000	440.94482	3.79609	4864.38672
21	RMS	89.10440	1320.05733	3.30146	18877.64453	23.63644	381.86572
	ABS SUM	147.50576	1647.91162	6.47530	21848.01953	44.20314	507.87891
21	RMS	89.10440	1320.05733	3.30146	18877.64453	3.74503	9566.29687
	ABS SUM	147.50576	1647.91162	6.47530	21848.01953	7.79605	13891.91406
22	RMS	680.97314	2065.59937	173.02356	0.0	778.60571	9566.29687
	ABS SUM	1169.69751	2536.19971	370.97412	0.0	1669.38721	11405.10156
22	RMS	680.97314	2065.59937	173.02356	0.0	0.00036	7.06224
	ABS SUM	1169.69751	2536.19971	370.97412	0.0	0.00087	7.95032
23	RMS	2067.87329	2065.59937	346.48634	0.0	1559.23242	7615.37109
	ABS SUM	2324.51855	2505.12207	359.75244	0.0	1618.89111	11273.19531
23	RMS	2067.87329	2065.59937	346.48634	0.0	0.00203	0.17179
	ABS SUM	2324.51855	2505.12207	359.75244	0.0	0.00204	0.28152
24	RMS	736.23244	253.23857	512.93829	0.0	1000.26953	19759.79647
	ABS SUM	1144.89292	421.13457	758.44214	0.0	14789.61719	23211.15625
24	RMS	736.23244	253.23857	512.93829	0.0	0.0	15183.49609
	ABS SUM	1144.89292	421.13457	758.44214	0.0	0.0	15885.12991
25	RMS	832.78857	297.58618	500.50781	0.0	9759.90234	13309.01953
	ABS SUM	1296.16626	465.30640	768.26367	0.0	14981.14844	16754.58594
25	RMS	832.78857	297.58618	500.50781	0.0	0.0	7826.95312
	ABS SUM	1296.16626	465.30640	768.26367	0.0	0.0	8247.37891
26	RMS	512.93829	736.23492	253.22293	15183.53906	0.05358	0.00553
	ABS SUM	758.445020	1144.89648	421.17353	15885.17578	0.07682	0.07822
26	RMS	512.93829	736.23492	253.22293	15183.53906	4558.03516	13253.30469
	ABS SUM	758.445020	1144.89648	421.17383	15885.17578	7581.15234	20608.12500
27	RMS	500.50479	832.78833	297.62847	8247.32422	0.10250	0.00057
	ABS SUM	768.27376	1296.16650	465.35791	8247.32422	0.12391	0.00150
27	RMS	500.50479	832.78833	297.62847	8247.32422	4761.75703	13374.61328
	ABS SUM	768.27376	1296.16650	465.35791	8247.32422	7445.60547	20734.66408
28	RMS	340.61684	467.59414	561.35033	0.0	2526.07935	3103.57668
	ABS SUM	619.58765	769.53979	972.21899	0.0	4376.97266	5462.74976
28	RMS	340.61684	467.59414	561.35033	0.0	0.00054	0.34501
	ABS SUM	619.58765	769.53979	972.21899	0.0	0.00124	0.43537
29	RMS	831.16553	540.79199	48.98870	0.0	125.67041	8008.97654
	ABS SUM	1030.44800	565.24121	96.20111	0.0	1424.73804	8371.22656
29	RMS	831.16553	540.79199	48.98870	0.0	0.0	0.0
	ABS SUM	1030.44800	565.24121	96.20111	0.0	0.0	0.0

30	RMS ABS SUM	831.34082 1030.62036	538.89526 563.35547	48.99817 96.17180	0.0 0.0	0.12053 0.14076	4.55456 4.54704
30	RMS ABS SUM	831.34082 1030.62036	538.89526 563.35547	48.99817 96.17180	0.0 0.0	279.80057 45.10962	2531.87183 2646.58984
31	RMS ABS SUM	157.73232 280.78316	1044.67778 1212.90894	52.60954 113.52654	230.00224 431.61089	802.70703 1834.72949	23009.95703 24120.59766
31	RMS ABS SUM	157.73232 280.78316	1044.67778 1212.90894	52.60954 113.52654	230.00224 431.61089	213.24719 563.06177	11008.91406 12578.55859
32	RMS ABS SUM	157.18907 280.73047	1088.84277 1477.94608	21.60713 53.20418	229.61821 420.95874	213.26221 563.09448	11007.26594 12577.18359
32	RMS ABS SUM	157.18907 280.73047	1088.84277 1477.94608	21.60713 53.20418	229.61821 420.95874	146.99950 3701.33984	4524.23516 240.62260
33	RMS ABS SUM	470.29199 700.35742	117.17751 158.89101	610.02515 789.92358	19.42160 30.11356	7400.54297	338.21289
33	RMS ABS SUM	470.29199 700.35742	117.17751 158.89101	610.02515 789.92358	19.42160 30.11356	96.83000 118.86779	994.62598 1244.02124
34	RMS ABS SUM	600.22559 908.26636	173.25111 224.42117	630.08154 842.00537	20.62258 29.24599	5873.94531 7875.44922	681.64526 978.22388
34	RMS ABS SUM	600.22559 908.26636	173.25111 224.42117	630.08154 842.00537	20.62258 29.24599	113.64085 136.63087	948.71680 1245.31593
35	RMS ABS SUM	411.52100 706.64279	301.34644 406.89258	137.35030 261.57104	23.88170 33.19452	1226.99062 2369.52026	1802.99267 2533.93896
35	RMS ABS SUM	411.52100 706.64279	301.34644 406.89258	137.35030 261.57104	23.88170 33.19452	94.82372 110.86345	1066.20068 1338.36084
36	RMS ABS SUM	604.58337 1004.01330	265.89233 359.46690	160.34109 303.43799	15.52444 24.84004	144.37302 2746.51904	1513.01147 2127.85962
36	RMS ABS SUM	604.58337 1004.01330	265.89233 359.46690	160.34109 303.43799	15.52444 24.84004	113.63879 136.62790	1016.60499 1294.00317
37	RMS ABS SUM	23.70226 30.65456	561.82104 750.00586	0.57153 1.12943	35.63276 41.03709	3.14985 5.62337	936.67310 1138.33350
37	RMS ABS SUM	23.70226 30.65456	561.82104 750.00586	0.57153 1.12943	35.63276 41.03709	6.75338 11.74724	9300.12109 11963.37422
38	RMS ABS SUM	569.53706 976.70044	2451.48828 2891.17114	142.29590 326.50269	0.0 0.0	640.33105 1469.26392	1027.32612 13005.59335
38	RMS ABS SUM	569.53706 976.70044	2451.48828 2891.17114	142.29590 326.50269	0.0 0.0	0.00025 0.00025	4.27932 4.28155
39	RMS ABS SUM	21.42109 34.26718	524.70703 713.45654	0.97342 1.26644	34.40715 39.86708	3.48007 7.86776	1866.83647 1948.90723
39	RMS ABS SUM	21.42109 34.26718	524.70703 713.45654	0.97342 1.26644	34.40715 39.86708	9.16724 12.20654	9883.42969 12446.67578
40	RMS ABS SUM	125.75063 178.74231	156.14715 294.51079	1.67379 2.47339	32.43359 37.48863	12.95484 20.79172	638.14380 881.10158
40	RMS ABS SUM	125.75063 178.74231	156.14715 294.51079	1.67379 2.47339	32.43359 37.48863	12.43102 15.49473	1767.23179 3409.62417
41	RMS ABS SUM	2174.30298 2397.57446	2178.52759 2355.61084	341.59843 355.07178	0.0 0.0	1531.19383 1591.82788	9803.54297 13210.55469
41	RMS ABS SUM	2174.30298 2397.57446	2178.52759 2355.61084	341.59843 355.07178	0.0 0.0	0.00038 0.00042	0.26496 0.20369

42	38	PMS ABS SUM	122.60687 175.55611	127.70566 227.24854	0.53180 0.93898	32.39296 37.66219	7.42472 14.05146	581.93823 745.01660
42	42	PMS ABS SUM	127.60687 175.55611	127.70566 227.24854	0.53180 0.93898	32.39296 37.66219	8.47112 0.00000	1553.52686 2687.34937
43	27	PMS ABS SUM	321.53247 517.48926	335.84180 777.65869	599.99731 777.65869	0.0 0.0	0.00000 0.00000	0.00000 0.00000
43	30	PMS ABS SUM	321.53247 517.48926	335.84180 777.65869	599.99731 777.65869	0.0 0.0	5.99953 7.77603	3.35818 3.37080
44	28	PMS ABS SUM	502.30664 730.31396	1005.93198 1057.92651	632.43921 844.50830	0.0 0.0	0.00000 0.00000	0.00000 0.00000
44	31	PMS ABS SUM	502.30664 730.31396	1005.93198 1057.92651	632.43921 844.50830	0.0 0.0	6.42393 8.44447	10.04959 10.57851
45	40	PMS ABS SUM	259.65479 497.92651	270.82227 335.62622	136.61729 258.13281	0.0 0.0	0.00000 0.00000	0.00000 0.00000
45	43	PMS ABS SUM	259.65479 497.92651	270.82227 335.62622	136.61729 258.13281	0.0 0.0	1.36607 2.58114	2.70803 3.35603
46	41	PMS ABS SUM	459.81543 798.30493	166.97514 239.73466	165.26970 320.32568	0.0 0.0	0.00000 0.00000	0.00000 0.00000
46	44	PMS ABS SUM	459.81543 798.30493	166.97514 239.73466	165.26970 320.32568	0.0 0.0	1.65257 3.20303	1.66863 2.39717
47	30	PMS ABS SUM	387.08984 495.53564	39.32585 79.94086	8.90943 20.46011	114.23174 171.02144	674.40405 931.96777	603.45117 1188.85767
47	31	PMS ABS SUM	387.08984 495.53564	39.32585 79.94086	8.90943 20.46011	114.23174 171.02144	752.36914 980.88403	317.94975 502.39941
48	43	PMS ABS SUM	113.39578 181.40341	47.52217 109.87305	12.05523 27.99648	96.91803 214.76144	479.47114 728.17310	1082.98560 2052.56738
48	44	PMS ABS SUM	113.39578 181.40341	47.52217 109.87305	12.05523 27.99648	96.91803 214.76144	592.37451 945.41362	531.56738 1194.45044
49	30	PMS ABS SUM	342.67235 537.74535	156.06519 276.34546	260.83545 358.37866	717.94312 949.22876	320.89673 513.94702	506.45337 1003.48853
49	32	PMS ABS SUM	342.67235 537.74535	156.06519 276.34546	260.83545 358.37866	717.94312 949.22876	3273.69702 4279.02734	1591.65405 2710.44556
50	31	PMS ABS SUM	435.07153 617.27710	217.87642 331.72437	302.61646 393.56228	693.73999 886.13818	588.45679 840.49438	42.15401 431.76929
50	32	PMS ABS SUM	435.07153 617.27710	217.87642 331.72437	302.61646 393.56228	693.73999 886.13818	3466.16479 4479.91797	2854.52295 4023.77856
51	51	PMS ABS SUM	175.91046 329.85254	246.49109 389.65236	210.11308 321.11108	689.08008 1102.08472	253.12108 553.59473	936.27580 1763.81104
51	52	PMS ABS SUM	175.91046 329.85254	246.49109 389.65236	210.11308 321.11108	689.08008 1102.08472	2847.44306 4228.64844	2394.29053 4006.61938
52	44	PMS ABS SUM	282.33545 492.39404	321.51514 500.56665	325.11067 351.05273	529.52407 861.22144	336.01855 673.96582	501.34719 1086.63872
52	46	PMS ABS SUM	282.33545 492.39404	321.51514 500.56665	325.11067 351.05273	529.52407 861.22144	2704.07544 4102.77734	3844.48462 6080.40234
53	32	PMS ABS SUM	404.91279 528.57813	822.92358 1144.44033	69.44779 154.21410	1422.14531 2429.14673	614.74733 869.19629	7105.62109 9196.64444
53	36	PMS ABS SUM	404.91279 528.57813	822.92358 1144.44033	69.44779 154.21410	1422.14531 2429.14673	382.33103 858.94533	1849.94458 2654.27905
54	36	PMS ABS SUM	446.47363 602.21436	712.29126 1124.95557	67.59492 150.58691	1421.94116 2428.28418	390.16602 861.67360	1867.82593 2649.17041
54	46	PMS ABS SUM	446.47363 602.21436	712.29126 1124.95557	67.59492 150.58691	1421.94116 2428.28418	103.77588 660.32959	7127.89453 10471.05469

55	RMS	51.43369	83.54770	12.98756	0.0	0.00016	0.00088
	ABS SUM	69.31851	124.27371	28.44319	0.0	0.00010	0.00115
55	RMS	51.43369	83.54770	12.98756	0.0	150.13611	965.81177
	ABS SUM	69.31851	124.27371	28.44319	0.0	328.80322	1436.60498
56	RMS	51.42162	231.26754	34.99199	0.0	150.13725	965.81079
	ABS SUM	69.30722	355.87134	77.09212	0.0	328.80176	1436.59302
56	RMS	51.42162	231.26754	34.99199	0.0	66.56664	519.92529
	ABS SUM	69.30722	355.87134	77.09212	0.0	148.39679	910.13306
57	RMS	39.29865	298.83179	11.93746	0.0	91.08592	2249.64062
	ABS SUM	53.70372	437.09326	29.17444	0.0	221.60529	3335.10620
57	RMS	39.29865	298.83179	11.93746	0.0	0.00057	0.07483
	ABS SUM	53.70372	437.09326	29.17444	0.0	0.00083	0.07673
58	RMS	0.0	0.01279	0.00012	0.0	0.00000	0.00000
	ABS SUM	0.0	0.01272	0.00026	0.0	0.00000	0.00000
58	RMS	0.0	0.01279	0.00012	0.0	0.00086	0.08600
	ABS SUM	0.0	0.01272	0.00026	0.0	0.00181	0.08906
59	RMS	0.0	0.00945	0.00008	0.0	0.00000	0.00000
	ABS SUM	0.0	0.00965	0.00017	0.0	0.00000	0.00000
59	RMS	0.0	0.00945	0.00008	0.0	0.00057	0.06615
	ABS SUM	0.0	0.00965	0.00017	0.0	0.00117	0.06756
59	RMS	6.01435	0.00089	0.00005	0.0	0.00024	0.00446
	ABS SUM	8.67152	0.00092	0.00006	0.0	0.00029	0.00458
60	RMS	6.01435	0.00089	0.00005	0.0	0.00024	0.00446
	ABS SUM	8.67152	0.00092	0.00006	0.0	0.00029	0.00458
61	RMS	5.01443	0.00002	0.00001	0.0	0.00000	0.00000
	ABS SUM	8.66927	0.00002	0.00001	0.0	0.00000	0.00000
61	RMS	5.01443	0.00002	0.00001	0.0	0.00003	0.00018
	ABS SUM	8.66927	0.00002	0.00001	0.0	0.00007	0.00020
62	RMS	314.52173	0.0	13042.24219	0.0	130.35074	0.0
	ABS SUM	484.81421	0.0	20710.01562	0.0	206.98656	0.0
62	RMS	314.52173	0.0	13042.24219	0.0	0.0	0.0
	ABS SUM	484.81421	0.0	20710.01562	0.0	0.0	0.0
63	RMS	332.68530	411013.25000	4928.19531	14.52638	214.56787	1087.59961
	ABS SUM	632.20166	462768.25000	87202.18750	33.76294	335.91377	2230.69897
63	RMS	332.68530	411013.25000	4928.19531	14.52638	214.56787	1087.59961
	ABS SUM	632.20166	462768.25000	87202.18750	33.76294	335.91377	2230.69897
64	RMS	0.0	225474.68791	1466.77399	0.0	14.65969	2257.50262
	ABS SUM	0.0	232345.00000	3414.51611	0.0	34.12633	2327.17536
64	RMS	0.0	225474.68791	1466.77399	0.0	0.0	0.0
	ABS SUM	0.0	232345.00000	3414.51611	0.0	0.0	0.0
65	RMS	53.34471	161.36700	2.93079	113.63943	20.47243	985.71729
	ABS SUM	54.72345	201.27740	4.41519	116.62959	29.24590	1245.57666
65	RMS	53.34471	161.36700	2.93079	113.63943	13.51445	1016.61279
	ABS SUM	54.72345	201.27740	4.41519	116.62959	26.85995	1296.01074
66	RMS	73.64607	168.22449	3.53385	96.82347	19.45154	994.62919
	ABS SUM	91.09952	210.80515	5.14377	116.86247	30.11369	1244.02417
66	RMS	73.64607	168.22449	3.53385	96.82347	23.86164	1066.20728
	ABS SUM	91.09952	210.80515	5.14377	116.86247	33.14456	1338.36710

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 * LOADING - 3
 * LG IN VERTICAL DIRECTION
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RESULTANT JOINT DISPLACEMENTS - SUPPORTS

JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
1	0.0	0.0	0.0	0.00000	0.00000	0.00002
2	0.0	0.0	0.0	-0.00001	0.00000	0.00002
3	0.0	0.0	0.0	-0.00040	0.00000	0.00000
4	0.0	0.0	0.0	-0.00019	0.00000	0.00000
5	0.0	0.0	0.0	-0.00003	0.00000	-0.00000
6	0.0	0.0	0.0	-0.00002	0.00000	-0.00000

RESULTANT JOINT DISPLACEMENTS - FREE JOINTS

JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
7	-0.00007	0.00003	0.00003	-0.00003	0.00000	0.00002
8	-0.00003	0.00003	0.00003	-0.00001	0.00000	0.00002
9	-0.00009	0.00022	0.00008	-0.00000	0.00000	0.00005
10	-0.00008	0.00055	0.00007	-0.00000	0.00000	0.00004
11	-0.00007	0.00078	0.00002	0.00000	0.00000	0.00004
12	-0.00037	0.00019	0.00002	0.00000	0.00000	0.00004
13	-0.00044	0.00040	0.00001	0.00000	0.00000	0.00004
14	-0.00039	0.00088	0.00004	0.00000	0.00000	0.00004
15	-0.00022	0.00084	0.00004	0.00000	0.00000	0.00004
16	-0.00055	0.00078	0.00004	0.00000	0.00000	0.00004
17	-0.00022	0.00054	0.00000	0.00000	0.00000	0.00004
18	-0.00081	0.00049	0.00000	0.00000	0.00000	0.00004
19	-0.00219	0.00056	0.00000	0.00000	0.00000	0.00004
20	-0.00220	0.00126	0.00000	0.00000	0.00000	0.00004
21	-0.00220	0.00196	0.00000	0.00000	0.00000	0.00004
22	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
23	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
24	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
25	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
26	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
27	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
28	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
29	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
30	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
31	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
32	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
33	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
34	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
35	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
36	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
37	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
38	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
39	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
40	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
41	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
42	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
43	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
44	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
45	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
46	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
47	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
48	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
49	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004
50	-0.00220	0.00220	0.00000	0.00000	0.00000	0.00004

LOADING - 4 NOZZLE + IMPELLER LOADS

RESULTANT JOINT DISPLACEMENTS - SUPPORTS

Table with columns: JOINT, X DISP., Y DISP., Z DISP., X ROT., Y ROT., Z ROT. Rows 1-50.

RESULTANT JOINT DISPLACEMENTS - FREE JOINTS

Table with columns: JOINT, X DISP., Y DISP., Z DISP., X ROT., Y ROT., Z ROT. Rows 1-50.

LOADING 5

JOINT RESPONSE TYPE	RESULTANT JOINT DISPLACEMENTS - FREE JOINTS			ROTATION		
	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
3 GLOBAL ABS SUM	0.00027	0.00003	0.00001	0.00000	0.00000	0.00000
4 GLOBAL ABS SUM	0.00011	0.00004	0.00002	0.00000	0.00000	0.00000
5 GLOBAL ABS SUM	0.00022	0.00006	0.00003	0.00000	0.00000	0.00000
6 GLOBAL ABS SUM	0.00033	0.00008	0.00004	0.00000	0.00000	0.00000
7 GLOBAL ABS SUM	0.00044	0.00010	0.00005	0.00000	0.00000	0.00000
8 GLOBAL ABS SUM	0.00055	0.00012	0.00006	0.00000	0.00000	0.00000
11 GL 3AL ABS SUM	0.00135	0.00031	0.00015	0.00000	0.00000	0.00000
12 GLOBAL ABS SUM	0.01111	0.00203	0.00101	0.00000	0.00000	0.00000
13 GLOBAL ABS SUM	0.01268	0.00222	0.00111	0.00000	0.00000	0.00000
14 GLOBAL ABS SUM	0.01385	0.00234	0.00117	0.00000	0.00000	0.00000
15 GLOBAL ABS SUM	0.00011	0.00006	0.00003	0.00000	0.00000	0.00000
16 GLOBAL ABS SUM	0.00022	0.00012	0.00006	0.00000	0.00000	0.00000
18 GLOBAL ABS SUM	0.00313	0.00016	0.00008	0.00000	0.00000	0.00000
19 GLOBAL ABS SUM	0.00517	0.00026	0.00013	0.00000	0.00000	0.00000
20 GLOBAL ABS SUM	0.01235	0.04078	0.02039	0.00000	0.00000	0.00000
21 GLOBAL ABS SUM	0.01252	0.04148	0.02051	0.00000	0.00000	0.00000
22 GLOBAL ABS SUM	0.01330	0.04318	0.02164	0.00000	0.00000	0.00000
23 GLOBAL ABS SUM	0.01251	0.04188	0.02079	0.00000	0.00000	0.00000
24 GLOBAL ABS SUM	0.01389	0.04358	0.02192	0.00000	0.00000	0.00000
25 GLOBAL ABS SUM	0.00006	0.00003	0.00001	0.00000	0.00000	0.00000
26 GLOBAL ABS SUM	0.00011	0.00006	0.00003	0.00000	0.00000	0.00000
27 GLOBAL ABS SUM	0.00022	0.00012	0.00006	0.00000	0.00000	0.00000
28 GLOBAL ABS SUM	0.00044	0.00024	0.00012	0.00000	0.00000	0.00000
29 GLOBAL ABS SUM	0.00077	0.00048	0.00024	0.00000	0.00000	0.00000
30 GLOBAL ABS SUM	0.00154	0.00096	0.00048	0.00000	0.00000	0.00000
31 GLOBAL ABS SUM	0.00308	0.00192	0.00096	0.00000	0.00000	0.00000
32 GLOBAL ABS SUM	0.00616	0.00384	0.00192	0.00000	0.00000	0.00000
33 GLOBAL ABS SUM	0.01232	0.00768	0.00384	0.00000	0.00000	0.00000
34 GLOBAL ABS SUM	0.01636	0.01024	0.00512	0.00000	0.00000	0.00000
35 GLOBAL ABS SUM	0.01859	0.01175	0.00587	0.00000	0.00000	0.00000
36 GLOBAL ABS SUM	0.01636	0.01024	0.00512	0.00000	0.00000	0.00000
37 GLOBAL ABS SUM	0.01392	0.00864	0.00432	0.00000	0.00000	0.00000
38 GLOBAL ABS SUM	0.01175	0.00720	0.00360	0.00000	0.00000	0.00000
39 GLOBAL ABS SUM	0.00958	0.00576	0.00288	0.00000	0.00000	0.00000
40 GLOBAL ABS SUM	0.00741	0.00432	0.00216	0.00000	0.00000	0.00000
41 GLOBAL ABS SUM	0.00524	0.00312	0.00156	0.00000	0.00000	0.00000
42 GLOBAL ABS SUM	0.00308	0.00192	0.00096	0.00000	0.00000	0.00000
43 GLOBAL ABS SUM	0.00154	0.00096	0.00048	0.00000	0.00000	0.00000
44 GLOBAL ABS SUM	0.00077	0.00048	0.00024	0.00000	0.00000	0.00000
45 GLOBAL ABS SUM	0.00039	0.00024	0.00012	0.00000	0.00000	0.00000
46 GLOBAL ABS SUM	0.00019	0.00012	0.00006	0.00000	0.00000	0.00000
47 GLOBAL ABS SUM	0.00009	0.00006	0.00003	0.00000	0.00000	0.00000
48 GLOBAL ABS SUM	0.00004	0.00003	0.00001	0.00000	0.00000	0.00000

APPENDIX B - NOMENCLATURE AND FORMULAS

S = Tensile Stress ; N = Number of bolts ; C = Bolt Circle

V = Shearing Stress ; A_b = area of one bolt, in.²

S_{max} = The maximum combined stress, combined by the maximum shear stress theory.

S_b = A bending stress, usually equal to M/Z ; M = moment,
 Z = Section Modulus

R = A shearing force

Y = The vertical direction

X = Lateral Direction in the plane (parallel to shaft)

V = T/J , shaft shearing stress where T = torque and J = $2Z$ = torsional modulus

F_v = Allowable shearing stress for bolts: Per AISC 7th Ed.

F_v = 10,000 psi for A-307 bolts per the Code and NF-3281 & Appendix XVII of the ASME Section III Code:

F_v = 12,320 psi for A-325 bolts per above reference

F_v = 15,000 psi for A-449 bolts per above reference

F_t = Allowable tensile stress for combined loading per the AISC Code and also per Appendix XVII-2461.3 of the ASME Section III Code. Per AISC 7th Ed.

F_t = 20,000 psi for A-307 bolts per above reference.

F_t = 40,000 psi for A-325 and A-449 bolts per above reference.

S_y, S_z, Z_y, Z_z are all used to denote section moduli, in.³

A_{TP} = Area of taper pin in shear plane

NOTE: For combined shear and tensile stresses for bolting:

$F_t = 28,000 - 1.6F_v \leq 20,000$ psi for A-307 bolts

$F_t = 50,000 - 1.6F_v \leq 40,000$ psi for A-325 bolts

Per AISC 7th Ed.

APPENDIX C - FREQUENCIES AND MODE SHAPES

C

 #RESULTS OF LATEST ANALYSES#

JOB ID - ME-884 JOB TITLE - BINGHAM 8 X 10 X 14 CAP

ACTIVE UNITS - LENGTH INCH FORCE LB ANGLE RAD TEMPERATURE DEGF TIME SEC

ACTIVE STRUCTURE TYPE - SPACE FRAME

ACTIVE COORDINATES AXES X Y Z

EIGENVALUES

MODE	EIGENVALUE	FREQUENCY	PERIOD	RADIANS
1	0.238020 04	0.749170 02	0.4993013 -01	0.158960 03
2	0.251670 02	0.251670 02	0.326970 -01	0.1917360 03
3	0.251670 05	0.251670 02	0.251670 -01	0.2526630 03
4	0.251670 06	0.251670 02	0.251670 -01	0.251670 03
5	0.251670 08	0.251670 02	0.251670 -01	0.251670 03
6	0.251670 09	0.251670 02	0.251670 -01	0.251670 03
7	0.251670 10	0.251670 02	0.251670 -01	0.251670 03
8	0.251670 11	0.251670 02	0.251670 -01	0.251670 03
9	0.251670 12	0.251670 02	0.251670 -01	0.251670 03
10	0.251670 13	0.251670 02	0.251670 -01	0.251670 03
11	0.251670 14	0.251670 02	0.251670 -01	0.251670 03
12	0.251670 15	0.251670 02	0.251670 -01	0.251670 03
13	0.251670 16	0.251670 02	0.251670 -01	0.251670 03
14	0.251670 17	0.251670 02	0.251670 -01	0.251670 03
15	0.251670 18	0.251670 02	0.251670 -01	0.251670 03
16	0.251670 19	0.251670 02	0.251670 -01	0.251670 03
17	0.251670 20	0.251670 02	0.251670 -01	0.251670 03
18	0.251670 21	0.251670 02	0.251670 -01	0.251670 03

EIGENVECTORS

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
13	GLOBAL	-0.1392753	0.0211193	0.0014446			
14	GLOBAL	-0.0025979	0.6901100	-0.0003437			
15	GLOBAL	-0.1392139	0.6924451	-0.0029261			
21	GLOBAL	-0.1396838	0.0171094	-0.0015194			
33	GLOBAL	-0.1396241	0.9999992	-0.0043770			
36	GLOBAL	0.1409754	0.0438873	-0.0025899			

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
13	GLOBAL	0.0330530	-0.0056175	-0.0113270			
14	GLOBAL	0.0715523	-0.1825716	-0.0061476			
15	GLOBAL	0.0328606	-0.1843820	-0.0105303			
21	GLOBAL	0.0310749	-0.0043977	-0.0126646			
33	GLOBAL	0.9999999	0.16666692	-0.0246231			

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
3	13	-0.8652787	0.0357693	0.6266124			
	14	-0.0192267	-0.2032689	0.1428155			
	15	-0.8652204	-0.5092313	0.8565063			
	16	-0.8652844	-0.0526813	0.7696689			
	21	-0.8646312	-0.3201405	0.9999999			
	33	0.0101244	0.0079287	0.1444733			
	36						

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
4	13	0.6719944	-0.0256667	0.8002346			
	15	0.0165755	-0.1510276	0.1820406			
	19	0.6744276	-0.1510305	0.7976906			
	21	0.6755878	-0.0329829	0.9999998			
	33	0.0147937	0.2413030	0.8395730			
	36	0.0214236	0.0144064	0.1897002			

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
5	13	-0.0109405	0.0073513	-0.1142518			
	15	-0.0037922	-0.0060546	0.1811510			
	19	-0.0123255	-0.0061346	-0.1937488			
	21	-0.0151871	-0.0174598	-0.5493999			
	33	-0.0031278	-0.0140310	0.9999999			
	36		0.1344225	0.1897002			

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
6	13	0.0234770	-0.0022731	0.2067305			
	15	0.0339511	-0.0116742	-0.0227702			
	19	0.0279427	-0.0129641	0.1861008			
	21	0.0282022	-0.0074787	0.2444544			
	33	0.0028926	-0.0215086	-0.2948553			
	36	-0.1111926	0.9999994	0.1279353			

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
7	13	-0.0191334	0.0078019	0.1164817			
	15	-0.0173706	-0.0054521	-0.0072876			
	19	-0.0174519	-0.0043371	-0.2960598			
	21	-0.0194543	-0.0132514	0.9999999			
	33	-0.0194746	0.0004681	-0.6083611			
	36	-0.0001880	0.0004681	0.1444733			

MODE	JOINT	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
8	13	0.0046438	0.0312777	-0.0017074			
	15	-0.0027516	0.0009640	0.0013140			
	19	0.0042949	0.0006389	-0.0085761			
	21	0.0048014	0.9999999	-0.0478751			
	33	0.0000041	-0.0297509	-0.0119945			
	36	-0.0000041	-0.0004319	-0.0017883			

APPENDIX D - NEW DEPARTURE BEARING ALLOWABLE LOADS

The allowable loads for Delco New Departure bearings subjected to short term seismic plus nozzle imposed loads are established in accordance with the method outlined below. New Departure Catalog 2C-110, pages 58 to 62, gives:

$$\text{Average Life, } L = 3800 \left(\frac{R_R}{R_E} \right)^4$$

$$\begin{aligned} R_R &= .866 (4190) = 3628 \text{ lbs. ND-313} \\ &= .866(8460) = 7326 \text{ lbs. ND-45313} \end{aligned}$$

$$R_E = \text{Allowable Equivalent Radial Load, Lbs.}$$

Since the maximum duration of an earthquake is no more than one minute, it is conservative to set the life, L, to be equal to one hour. Thus, solving for the maximum allowable seismic load:

$$\begin{aligned} R_E &= R_R (3800)^{\frac{1}{4}} = 3628 (7.85) = 28,480 \text{ lbs. ND-313} \\ &7326 (7.85) = 57,500 \text{ lbs. ND-45313} \end{aligned}$$

APPENDIX E - ACCELERATIONS

E

RESULTS OF LATEST ANALYSES

JOB ID - ME-884 JOB TITLE - BINGHAM 8 X 10 X 14 CAP

ACTIVE UNITS - LENGTH FORCE AMPLITUDE TEMPERATURE TIME
INCH LB CVC DEGF SEC

ACTIVE STRUCTURE TYPE - SPACE FRAME
ACTIVE COORDINATES AXES X Y Z

LOADING - 1
LATERAL X

RESULTANT JOINT ACCELERATIONS-- SUPPRIS

JOINT RESPONSE / TYPE	DISPLACEMENT--			ROTATION--		
	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
1 GLOBAL RMS	0.0	0.0	0.0	5.8193	2.0665	3.8808
1 GLOBAL ABS SUM	0.0	0.0	0.0	9.8097	3.6290	6.2926
2 GLOBAL RMS	0.0	0.0	0.0	5.6097	1.9027	3.4747
2 GLOBAL ABS SUM	0.0	0.0	0.0	10.0773	3.0823	5.7700
9 GLOBAL RMS	0.0	0.0	0.0	17.5289	1.8275	1.0053
9 GLOBAL ABS SUM	0.0	0.0	0.0	33.1899	3.0233	1.7246
19 GLOBAL RMS	0.0	0.0	0.0	12.4717	1.4252	0.9865
19 GLOBAL ABS SUM	0.0	0.0	0.0	23.4980	2.3354	1.5155
49 GLOBAL RMS	0.0	0.0	0.0	6.7751	0.5133	0.6997
49 GLOBAL ABS SUM	0.0	0.0	0.0	13.4751	0.9255	1.2240
50 GLOBAL RMS	0.0	0.0	0.0	6.5914	0.5077	0.6580
50 GLOBAL ABS SUM	0.0	0.0	0.0	13.1914	0.9173	1.1205

JOINT ACCELERATIONS-- FREE JOINTS

JOINT RESPONSE / TYPE	DISPLACEMENT--			ROTATION--		
	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
3 GLOBAL RMS	32.2517	22.4729	105.8731	2.0092	2.0463	3.8573
3 GLOBAL ABS SUM	41.2117	32.4729	191.4152	3.7124	3.7124	6.2926
4 GLOBAL RMS	40.5376	30.6119	103.4924	2.1770	2.0727	3.4747
4 GLOBAL ABS SUM	42.5767	40.6119	185.1074	4.1437	4.1437	6.2926
5 GLOBAL RMS	42.8673	195.8619	44.6246	2.1933	0.2635	1.1446
5 GLOBAL ABS SUM	42.8673	195.8619	44.6246	4.3866	0.5270	2.2892
6 GLOBAL RMS	44.6749	121.0920	24.4244	2.2998	1.1664	0.8766
6 GLOBAL ABS SUM	44.6749	121.0920	24.4244	4.5996	2.3328	1.7532
7 GLOBAL RMS	41.2266	57.1956	33.6233	1.3155	0.4216	0.6666
7 GLOBAL ABS SUM	41.2266	57.1956	33.6233	2.6310	0.8432	1.3332
8 GLOBAL RMS	33.3557	24.9823	23.6233	5.5531	0.8766	0.8766
8 GLOBAL ABS SUM	33.3557	24.9823	23.6233	11.1062	1.7532	1.7532
11 GLOBAL RMS	33.5109	61.5008	31.6552	2.2780	0.2635	0.4216
11 GLOBAL ABS SUM	33.5109	61.5008	31.6552	4.5560	0.5270	0.8432
12 GLOBAL RMS	46.3027	37.9182	31.7317	5.9255	1.0730	0.5568
12 GLOBAL ABS SUM	46.3027	37.9182	31.7317	11.8510	2.1460	1.1136
13 GLOBAL RMS	39.7310	67.6613	32.7109	0.0000	0.1816	0.5568
13 GLOBAL ABS SUM	39.7310	67.6613	32.7109	0.0000	0.3632	1.1136
14 GLOBAL RMS	29.1277	24.9236	17.0822	3.0373	1.0823	0.2240
14 GLOBAL ABS SUM	29.1277	24.9236	17.0822	6.0746	2.1646	0.4480
15 GLOBAL RMS	35.2758	167.5272	12.2923	2.7272	0.1020	0.2240
15 GLOBAL ABS SUM	35.2758	167.5272	12.2923	5.4544	0.2040	0.4480
16 GLOBAL RMS	28.5270	30.1620	12.7272	2.2681	0.0000	0.2240
16 GLOBAL ABS SUM	28.5270	30.1620	12.7272	4.5362	0.0000	0.4480
18 GLOBAL RMS	65.4503	151.0205	40.7123	2.2681	0.2737	0.5847
18 GLOBAL ABS SUM	65.4503	151.0205	40.7123	4.5362	0.5474	1.1694
19 GLOBAL RMS	50.2580	152.8022	44.1408	2.0555	0.8238	0.5847
19 GLOBAL ABS SUM	50.2580	152.8022	44.1408	4.1110	1.6476	1.1694
20 GLOBAL RMS	400.6012	341.7885	62.3333	2.0611	0.8064	0.6081
20 GLOBAL ABS SUM	400.6012	341.7885	62.3333	4.1222	1.6128	1.2162
21 GLOBAL RMS	59.4733	200.5471	44.9028	2.3779	0.2186	0.5847
21 GLOBAL ABS SUM	59.4733	200.5471	44.9028	4.7558	0.4372	1.1694
22 GLOBAL RMS	50.1935	60.2614	44.6648	2.0330	1.1694	0.5847
22 GLOBAL ABS SUM	50.1935	60.2614	44.6648	4.0660	2.3388	1.1694

JOINT	GLOBAL	ABS	RES	TYPE	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
23	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
24	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
25	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
26	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
27	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
28	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
29	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
30	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
31	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
32	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
33	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
34	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
35	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
36	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
37	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
38	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
39	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
40	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
41	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
42	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
43	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
44	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
45	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
46	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
47	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558
48	GLOBAL	ABS	SUM		17909	22558	22558	22558	22558	22558

JOINT	GLOBAL	ABS	RES	TYPE	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
1	GLOBAL	ABS	SUM		0.0	0.0	0.0	0.0	0.0	0.0
2	GLOBAL	ABS	SUM		0.0	0.0	0.0	0.0	0.0	0.0
9	GLOBAL	ABS	SUM		0.0	0.0	0.0	0.0	0.0	0.0
10	GLOBAL	ABS	SUM		0.0	0.0	0.0	0.0	0.0	0.0
49	GLOBAL	ABS	SUM		0.0	0.0	0.0	0.0	0.0	0.0
50	GLOBAL	ABS	SUM		0.0	0.0	0.0	0.0	0.0	0.0

JOINT	GLOBAL	ABS	RES	TYPE	X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.
3	GLOBAL	ABS	SUM		277.30600	277.30600	277.30600	2.22597	0.40773	0.79027
4	GLOBAL	ABS	SUM		445.23335	445.23335	445.23335	4.12208	0.55228	1.55228
5	GLOBAL	ABS	SUM		276.46338	276.46338	276.46338	2.35713	0.46445	1.07440
6	GLOBAL	ABS	SUM		276.46338	276.46338	276.46338	2.35713	0.46445	1.07440

LINE	GLOBAL	ARS	SUM
6	GLOBAL	ARS	SUM
7	GLOBAL	ARS	SUM
8	GLOBAL	ARS	SUM
11	GLOBAL	ARS	SUM
12	GLOBAL	ARS	SUM
13	GLOBAL	ARS	SUM
14	GLOBAL	ARS	SUM
15	GLOBAL	ARS	SUM
16	GLOBAL	ARS	SUM
18	GLOBAL	ARS	SUM
19	GLOBAL	ARS	SUM
20	GLOBAL	ARS	SUM
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29	GLOBAL	ARS	SUM
30	GLOBAL	ARS	SUM
31	GLOBAL	ARS	SUM
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36	GLOBAL	ARS	SUM
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45	GLOBAL	ARS	SUM
46	GLOBAL	ARS	SUM
47	GLOBAL	ARS	SUM
48	GLOBAL	ARS	SUM

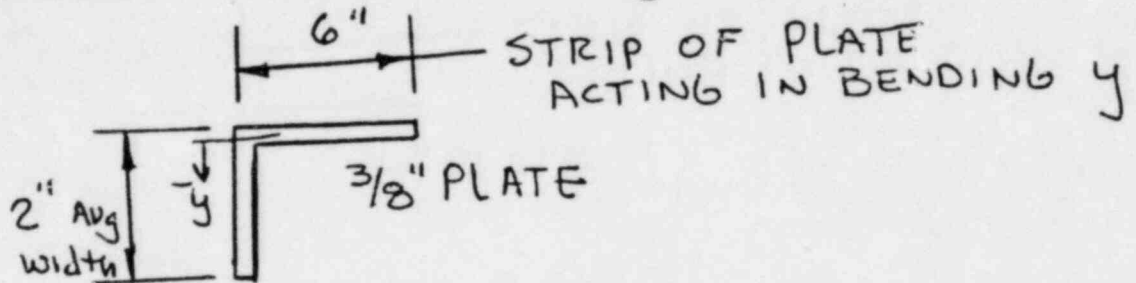
LOADING - 5 VERTICAL SEISMIC

JOINT	RESULTANT JOINT ACCELERATIONS-- RESPONSE TYPE	SUPPORTS			DISPLACEMENT			ROTATION		
		X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.			
1	GLOBAL RMS SUM	0.0	0.0	0.0	5.55252	0.08527	1.82755			
2	GLOBAL ABS SUM	0.0	0.0	0.0	3.43190	0.17293	3.08702			
9	GLOBAL RMS SUM	0.0	0.0	0.0	17.92258	0.15745	1.09215			
10	GLOBAL ABS SUM	0.0	0.0	0.0	17.89749	0.10569	1.00108			
49	GLOBAL RMS SUM	0.0	0.0	0.0	17.86884	0.1865	1.19477			
50	GLOBAL ABS SUM	0.0	0.0	0.0	3.56889	0.19260	2.0026			
	GLOBAL RMS SUM	0.0	0.0	0.0	3.56748	0.18270	1.81956			

JOINT	RESULTANT JOINT ACCELERATIONS-- RESPONSE TYPE	FPEE JOINTS			DISPLACEMENT			ROTATION		
		X DISP.	Y DISP.	Z DISP.	X ROT.	Y ROT.	Z ROT.			
3	GLOBAL RMS SUM	51.68620	26.73093	81.48480	0.15088	0.85527	1.82899			
4	GLOBAL ABS SUM	93.64534	27.71808	151.47843	4.65133	0.17213	3.33904			
5	GLOBAL RMS SUM	101.02111	33.98990	172.51098	6.82222	0.51000	3.60063			
6	GLOBAL ABS SUM	149.37117	83.17436	192.11317	6.95612	0.45270	3.49664			
7	GLOBAL RMS SUM	52.50314	128.84279	172.74978	3.33934	0.46208	3.21661			
8	GLOBAL ABS SUM	57.63506	422.69043	182.45400	3.49084	0.17384	3.28006			
9	GLOBAL RMS SUM	93.07695	523.14944	160.05800	2.51692	0.21070	3.09094			
10	GLOBAL ABS SUM	55.67004	143.76719	170.39925	2.00272	0.20647	3.24804			
11	GLOBAL RMS SUM	309.84306	320.32471	122.52029	3.27209	0.27666	3.09707			
12	GLOBAL ABS SUM	444.20728	408.45475	122.52029	3.27209	0.27666	3.09707			
13	GLOBAL RMS SUM	295.10059	480.15326	111.66147	2.75069	0.24815	3.35747			
14	GLOBAL ABS SUM	315.42374	480.15326	162.50440	2.75069	0.24815	3.35747			
15	GLOBAL RMS SUM	201.20927	254.21655	100.50440	1.60449	0.15475	3.25336			
16	GLOBAL ABS SUM	29.31101	8.00327	100.50440	1.60449	0.15475	3.25336			
17	GLOBAL RMS SUM	68.76474	156.04443	182.98260	1.01955	0.05844	3.95379			
18	GLOBAL ABS SUM	117.02070	159.04443	182.98260	1.01955	0.05844	3.95379			
19	GLOBAL RMS SUM	224.27025	4.72117	182.26755	11.69260	0.20807	3.53793			
20	GLOBAL ABS SUM	44.55445	9.55870	172.26542	11.69260	0.20807	3.53793			
21	GLOBAL RMS SUM	160.03397	145.05186	162.23127	12.56092	0.28865	3.67293			
22	GLOBAL ABS SUM	312.74609	146.57806	162.23127	12.56092	0.28865	3.67293			
23	GLOBAL RMS SUM	301.55371	154.66309	133.11734	12.56092	0.28865	3.67293			
24	GLOBAL ABS SUM	405.64331	198.60946	122.10142	12.56092	0.28865	3.67293			
25	GLOBAL RMS SUM	404.94831	120.24470	122.10142	12.56092	0.28865	3.67293			
26	GLOBAL ABS SUM	407.76634	73.02446	122.10142	12.56092	0.28865	3.67293			
27	GLOBAL RMS SUM	302.54350	94.50888	161.31319	12.56092	0.28865	3.67293			
28	GLOBAL ABS SUM	302.54350	94.50888	161.31319	12.56092	0.28865	3.67293			
29	GLOBAL RMS SUM	302.54350	120.24470	122.10142	12.56092	0.28865	3.67293			
30	GLOBAL ABS SUM	302.54350	120.24470	122.10142	12.56092	0.28865	3.67293			
31	GLOBAL RMS SUM	406.75846	146.57806	135.47200	12.56092	0.28865	3.67293			
32	GLOBAL ABS SUM	406.75846	146.57806	135.47200	12.56092	0.28865	3.67293			
33	GLOBAL RMS SUM	60.74511	20.90010	140.27275	2.75069	0.24815	3.35747			
34	GLOBAL ABS SUM	60.74511	20.90010	140.27275	2.75069	0.24815	3.35747			
35	GLOBAL RMS SUM	35.91707	7.70171	167.10324	2.75069	0.24815	3.35747			
36	GLOBAL ABS SUM	35.91707	7.70171	167.10324	2.75069	0.24815	3.35747			
37	GLOBAL RMS SUM	82.55089	37.19739	166.62802	2.75069	0.24815	3.35747			
38	GLOBAL ABS SUM	82.55089	37.19739	166.62802	2.75069	0.24815	3.35747			

APPENDIX F - MEMBER PROPERTIES

MEMBS 2, 22, 28, & 38 { SPACER between anchor bolts AND bed PLATE



$$A = (2 + 5.625)(.375) = 2.86 \text{ in}^2$$

$$\bar{y} = \frac{2(.375)(.8125)}{2.86} = .213''$$

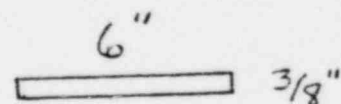
$$\begin{aligned} I_y &= \frac{.375(2)^3}{12} + 5.625(.375)(.213)^2 + 2(.375)(.5995)^2 \\ &= .615 \text{ in}^4, S_y = \frac{.615}{1.5995} = .385 \text{ in}^3 \end{aligned}$$

I_z = VERY RIGID BECAUSE PLATE IS CONTINUOUS IN THAT DIRECTION.

$$= \frac{.375(12)^3}{12} \left(\frac{1}{3}\right) = 3888 \text{ in}^4$$

$$S_z = \frac{3888}{36} = 108 \text{ in}^3$$

MEMBS 23 & 41



$$A = 6(.375) = 2.25 \text{ in}^2 \quad I_y = \frac{6(.375)^3}{12} = .026 \text{ in}^4$$

I_z, S_z ARE SAME AS FOR MEMB 2 $S_y = .140 \text{ in}^3$

Members 3 & 14

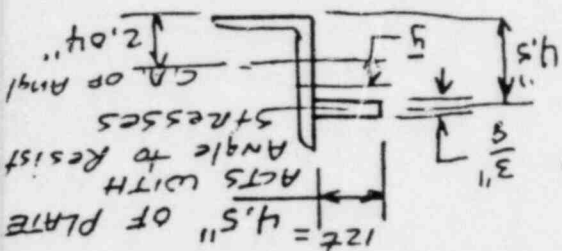
1/4" x 6" FLAT BAR

$$A = 6(2.5) = 15 \text{ in}^2, \quad I_z = .25(6)^3 = 4.5 \text{ in}^4$$

$$S_z = \frac{3}{4.5} = 1.5 \text{ in}^3$$

$$I_y = 6(2.5)^3 = .0078 \text{ in}^4, \quad S_y = .625 \text{ in}^3$$

Members 4 TO 13



Angle 6 x 3 1/2 x 3/8

$$A = 3.42 \text{ in}^2, \quad I_y = 3.34 \text{ in}^4, \quad S_y = 1.23 \text{ in}^3$$

$$I_z = 12.9 \text{ in}^4, \quad \bar{y} = \frac{(4.5 - 2.04)(4.5)(.375)}{3.42 + 4.5(.375)} = .81$$

$$I_z' = 12.9 + 3.42(.81)^2 + 4.5(.375)^2(2.46 - .81)^2 = 19.7 \text{ in}^4$$

$$S_z' = \frac{19.7}{3.15} = 6.25 \text{ in}^3$$

Members 15 TO 18, 37, 39, 40, & 42

3" [@ 5# / ft.

$$A = 1.47 \text{ in}^2, \quad I_y = .247, \quad S_y = .233 \text{ in}^3$$

$$I_z = 1.85 \text{ in}^4, \quad S_z = 1.24 \text{ in}^3$$

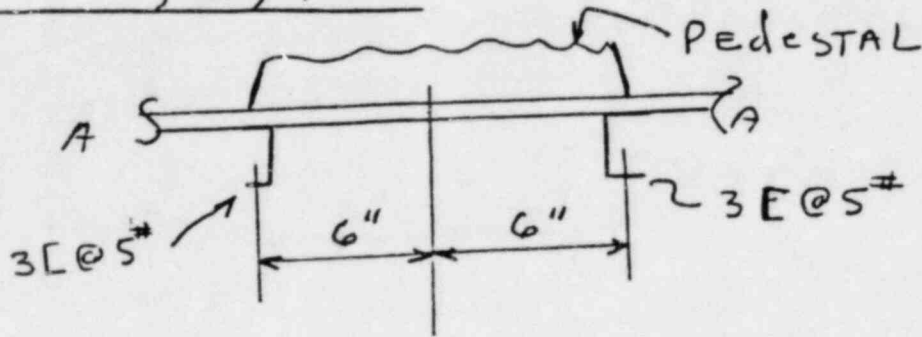
$$I_z = 1.85 + 1.47(1.5)^2 = 5.16 \text{ in}^4$$

@ Line A-A



F-3

Mems 19, 20, & 21



$$A = 2(1.47) = 2.94 \text{ in}^2$$

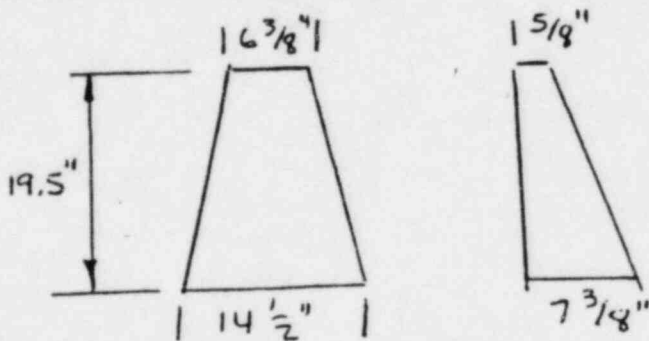
$$I_z = 2(1.85) = 3.70 \text{ in}^4 \quad S_z = 2(1.24) = 2.48 \text{ in}^3$$

$$I_z = 3.75 + 2.94(1.5)^2 = 10.32 \text{ in}^4 \text{ @ Line A-A}$$

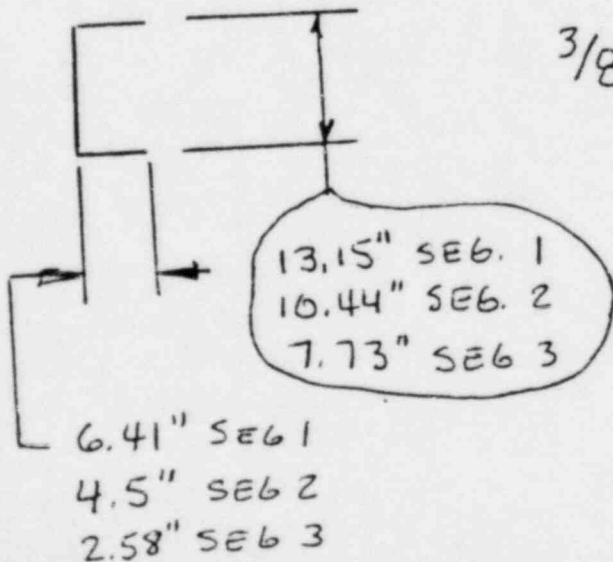
$$I_y = 2(.247) = .494 \text{ in}^4 \quad S_y = 2(.233) = .466 \text{ in}^3$$

$$I_x = 28 \text{ in}^4 \text{ (See page F-8)}$$

Mems 24 & 25



3/8" PLATE



F-4

$$\frac{\text{SEG 1}}{A} = (.375)(6.41 + 6.41 + 13.15) = 9.74 \text{ in}^2$$

$$I_z = \frac{.375(13.15)^3}{12} + 2(6.41)(.375)(6.57)^2 = 278 \text{ in}^4$$

$$S_z = \frac{278}{6.75} = 41 \text{ in}^3$$

$$\bar{y} = \frac{2(.375)(6.41)(3.20)}{9.74} = 1.58''$$

$$I_y = \frac{2(.375)(6.41)^3}{12} + .75(6.41)(1.62)^2 + 13.15(.375)(1.58)^2$$

$$= 41. \text{ in}^4 \quad S_y = \frac{41}{4.83} = 8.49 \text{ in}^3$$

SEG 2

$$A = (.375)(4.5 + 4.5 + 10.44) = 7.29 \text{ in}^2$$

$$I_z = \frac{.375(10.44)^3}{12} + 2(4.5)(.375)(5.22)^2 = 127.5 \text{ in}^4$$

$$S_z = \frac{127.5}{5.41} = 23.5 \text{ in}^3$$

$$\bar{y} = \frac{2(.375)(4.5)(2.25)}{7.29} = 1.04''$$

$$I_y = \frac{2(.375)(4.5)^3}{12} + .75(4.5)(1.21)^2 + 10.44(.375)(1.04)^2$$

$$= 14.9 \text{ in}^4$$

$$S_y = \frac{14.9}{3.46} = 4.31 \text{ in}^3$$

SEG 3

$$A = (.375)(2.58 + 2.58 + 7.73) = 4.83 \text{ in}^2$$

$$I_z = \frac{.375(7.73)^3}{12} + .75(2.58)(3.86)^2 = 43 \text{ in}^4$$

$$S_z = \frac{43}{4.05} = 10.6 \text{ in}^3$$

$$\bar{y} = \frac{2(.375)(2.58)(1.29)}{4.83} = .52''$$

$$I_y = \frac{.75(2.58)^3}{12} + .75(2.58)(.77)^2 + 7.73(.375)(.52)^2$$

$$= 3.0 \text{ in}^4$$

$$S_y = \frac{3.0}{2.06} = 1.46 \text{ in}^3$$

Members 26 & 27

SEG 1 7" x 1.75" A = 12.25

$$I_z = \frac{7(1.75)^3}{12} = 3.13 \text{ in}^4 \quad S_z = 3.57 \text{ in}^3$$

$$I_y = \frac{1.75(7)^3}{12} = 50 \text{ in}^4 \quad S_y = 14.2 \text{ in}^3$$

SEG 2 16.5" O.D. x 15" I.D.

$$A = \frac{\pi}{4}(16.5^2 - 15^2) = 37 \quad I_x = \frac{\pi}{32}(16.5^4 - 15^4)$$

$$= 2300 \text{ in}^4$$

$$I_y = I_z = \frac{I_x}{2} = 1150 \text{ in}^4$$

$$S_y = S_z = \frac{1150}{8.25} = 139 \text{ in}^3$$

Membr 29

C4 x 7.25

$A = 2.13$

$I_y = 4.59 \quad S_y = 2.29$

$I_z = .432 \quad S_z = .343$

Membr 30 & 32

8" O.D. x 7" I.D.

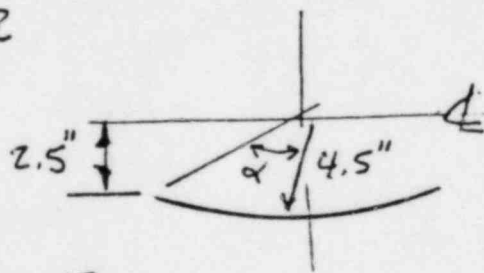
$A = \frac{\pi}{4}(8^2 - 7^2) = 11.7 \quad I_x = \frac{\pi}{32}(8^4 - 7^4) = 166$

$I_y = I_z = \frac{I_x}{2} = 83 \text{ in}^4 \quad S_y = S_z = \frac{83}{4} = 20.75 \text{ in}^3$

Membr 31

SEG 1 SAME AS SEG 2 of Membr 26

SEG 2



$\alpha = 56^\circ = .977 \text{ RAD.}$

$\sin \alpha = .83$

$\cos \alpha = .56$

 $\frac{1}{2}$ " THICKSee ROARK
4th Ed.

PAGE 76, CASE 12

$A = 2\alpha R t = 2(.977)(4.5)(.5) = 4.4 \text{ in}^2$

$I_z = 4.5^3(.5)(.977 - .83(.56)) = 23.1 \text{ in}^4$

$I_y = 4.5^3(.5)(.977 + .83(.56) - \frac{2(.83)^2}{.977}) + 4.4(3.82)^2 = 65 \text{ in}^4$

For Total Properties, mult Seg 2 by 2

$A = 8.8 \text{ in}^2 \quad I_y = 130 \text{ in}^4 \quad I_z = 46 \text{ in}^4$

$S_y = 28 \text{ in}^3 \quad S_z = 10 \text{ in}^3$

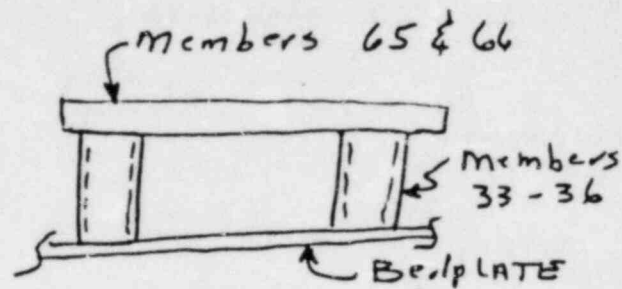
F-7

Members 33 TO 36

3" Sch 40 pipe

$$A = 2.22 \quad I_x = 6.03 \quad I_y = I_z = 3.02 \text{ in}^4$$

$$S_y = S_z = 1.72 \text{ in}^3$$



Members 43 TO 46

5/8" bolts

$$A = .226 \quad I_x = .015 \quad I_y = I_z = .0075 \text{ in}^4$$

$$S_y = S_z = .024 \text{ in}^3$$

Members 47 TO 54

MOTOR 20" O.D. X 19 1/2" I.D. CASE

$$I = 15.5 \quad I_x = 1500 \quad I_y = I_z = 750 \text{ in}^4$$

$$S_y = S_z = 75 \text{ in}^3$$

Member 55 SHAFT

$$\text{SEG 1 } 1.875" \phi \quad A = 2.76 \quad I_x = 1.21 \quad I_y = I_z = .60 \quad S_y = S_z = .64$$

$$\text{SEG 2 } 2.31" \phi \quad A = 4.19 \quad I_x = 2.80 \quad I_y = I_z = 1.40 \quad S_y = S_z = 1.21$$

Member 56, SHAFT

$$2.56" \phi \quad A = 5.14 \quad I_x = 4.22 \quad I_y = I_z = 2.11$$

$$S_y = S_z = 1.64$$

Member 57 SHAFT

$$2.125" \phi \quad A = 3.54 \quad I_x = 2.0 \quad I_y = I_z = 1.0$$

$$S_y = S_z = .942 \text{ in}^3$$

F-8

Members 58, 59, 60, 61 MOTOR SHAFT & CPLY
 2.125" ϕ , SAME AS MEMB 57

Members 62, 63, 64

Dummy members to get brg. LOADS

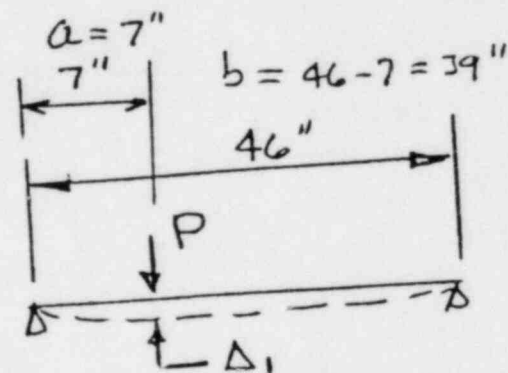
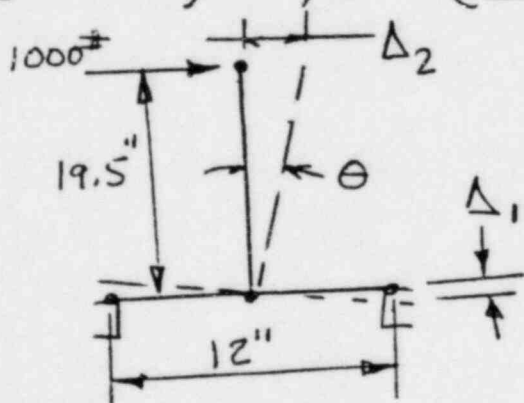
Members 65 & 66

1 1/4 x 4 BARS

$$A = 5 \text{ in}^2 \quad I_y = 6.66 \quad S_y = 3.33 \text{ in}^3$$

$$I_z = .65 \quad S_z = 1.04 \text{ in}^3$$

membr 19, 20, 21 (I_x)



$$P = \frac{19.5(1000)}{12} = 1625 \text{ Lbs}$$

$$\theta \approx \frac{\Delta_1}{6} \approx \frac{\Delta_2}{19.5} \quad \text{BY SIMILAR TRIANGLES}$$

$$\Delta_1 = \frac{Pa^2b^2}{3EIL} = \frac{1625(7)^2(39)^2}{3(29 \times 10^6)(1.85)(46)} = .016$$

$$\theta = \frac{.016}{6}$$

$$K_\theta = \frac{JG}{L}$$

$$M = K_\theta \theta \quad K_\theta = \frac{M}{\theta} = \frac{1000(19.5)}{.016/6}$$

$$J = I_x = \frac{LK_\theta}{G} = 28 \text{ in}^4 = 7312500 \text{ in}^2/\text{rad}$$

(L = 46, G = 12 x 10⁶)

LIST OF DRAWINGS - AVAILABLE AT Bingham
Willamette Co, for Audit

D-16054X	REV. 2 - PUMP ASSEMBLY
B-33851X	REV. 0 - TAIL BRACKET
H-3344	REV. B - VOLUTE CASE
H-3315	REV. 0 - STUFFING BOX
D-11294	REV. G - PUMP SHAFT
D-12090	REV. C - PEDESTAL DETAIL
D-12092	REV. E - BASE
D-12306	REV. D - CAP BASE
D-15089	REV. A - IMPELLER

PEDESTAL WELD

$$A = .707(.25)(15.5 + 14.5) = 53 \text{ IN}^2$$

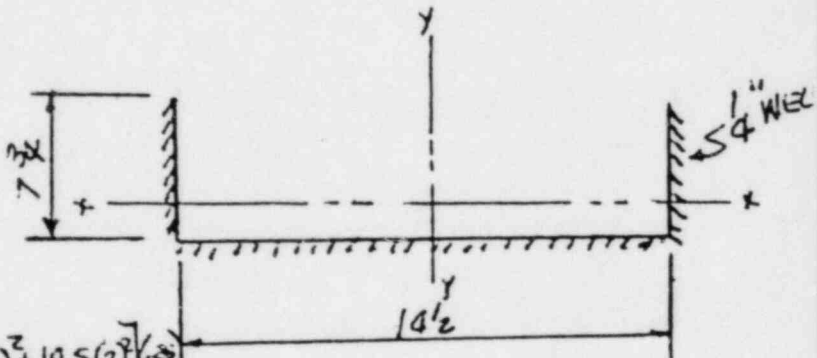
$$\bar{y} = \frac{2(7.75)(7.75)/2}{30} = 2''$$

$$I_{xx} = .707 \left[2 \frac{(7.75)^3}{12} + 2(7.75)(1.875)^2 + 14.5(2)^2 \right] (.5)$$

$$I_{xx} = 33.6 \text{ IN}^4 \quad S_x = \frac{33.6}{5.75} = 5.84 \text{ IN}^3$$

$$I_{yy} = .707(.25) \left[\frac{(14.5)^3}{12} + 2(7.75)(7.25)^2 \right] = 189 \text{ IN}^4$$

$$S_y = \frac{189}{7.25} = 26 \text{ IN}^3$$



APPENDIX G - MASSES

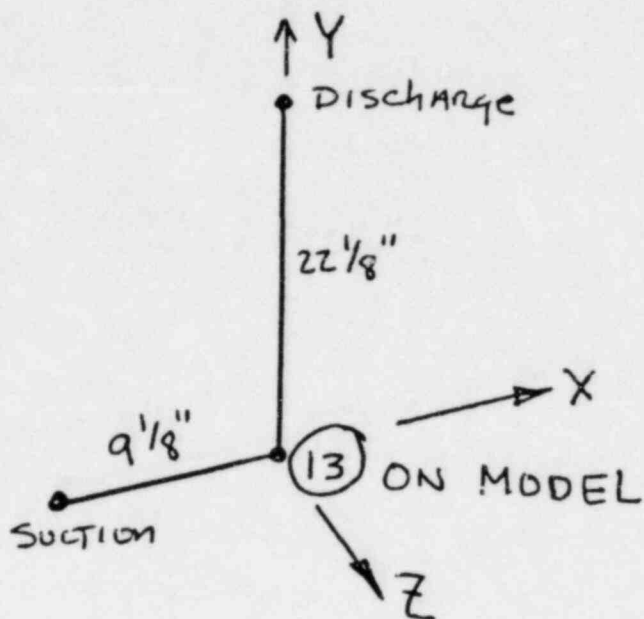
<u>COMPONENT</u>	<u>Weight, lbs</u>	<u>MASS (W/386)</u>	<u>Joint</u> (on model)
Impeller	65 (incl. shaft)	.17	21
Coupling	50 (incl. shaft)	.13	33
Pump Casing	1250		13 & 19
BEDPLATE	660	1.71	15
MOTOR	830	2.15	36
<u>TOTAL</u>	<u>2855</u>		

Joint 13, $W = \frac{2}{3}(1250)$ = 833 lbs
 $m = 2.16$

Joint 19, $w = \frac{1}{3}(1250)$ = 417 lbs
 $m = 1.08$

Joint 36, $w = 830$ lbs
 $m = 2.15$

APPENDIX H - NOZZLE LOADS



WORST CASE LOADS Resolved to Joint 13

$$F_x = F_{xd} + F_{xs} = 1825 + 4868 = 6693 \text{ lbs}$$

$$F_y = F_{yd} + F_{ys} = 2250 + 1915 = 4165 \text{ lbs}$$

$$F_z = F_{zd} + F_{zs} = 1050 + 1459 = 2509 \text{ lbs}$$

$$M_x = M_{xd} + M_{xs} + 22.125 F_{zd}$$

$$= (1300 + 4612)(12) + 22.125(1050) = 94175 \text{ in-lbs}$$

$$M_y = M_{yd} + M_{ys} + 9.125 F_{zs}$$

$$= (3000 + 8219)(12) + 9.125(1459) = 147941 \text{ in-lbs}$$

$$M_z = M_{zd} + M_{zs} + 9.125 F_{ys} + 22.125 F_{xd}$$

$$= (2000 + 2486)(12) + 9.125(1915) + 22.125(1825) = 111685 \text{ in-lbs}$$

H-2

ATTACHMENT G
Sheet 1

Supp. 3

Pipe Loads on RBCCW Pump Nozzles
(WR01PA, B, C, D)
(F in lbs., M in ft. lbs.)

<u>Suction</u>	<u>Allowables</u>	<u>SRSS</u>
F _A (X)	1,820	4,868
F _B (Y)	2,000	1,915
F _C (Z)	1,620	1,459
M _A (X)	5,600	4,612
M _B (Y)	5,200	8,219
M _C (Z)	5,000	2,486
F _R	2,530	5,431
M _R	5,700	9,746
<u>Discharge*</u>		
F _A (Y)	1,800	2,250
F _B (X)	1,620	1,825
F _C (Z)	1,440	1,050
M _A (Y)	4,200	3,000
M _B (X)	4,500	1,300
M _C (Z)	4,000	2,000
F _R	2,260	3,081
M _R	4,600	3,832

*Discharge Loads Revised

App. I

CLIENT CINCINNATI GAS & ELECTRIC COMPANY

PROJECT ZIMMER -- 1 JCD NO. 4130-15

DESIGN BY Thomas Miller DATE 02-12-81

CHECKED BY J. P. ... DATE 2-22-81 SHEET 3 OF 4

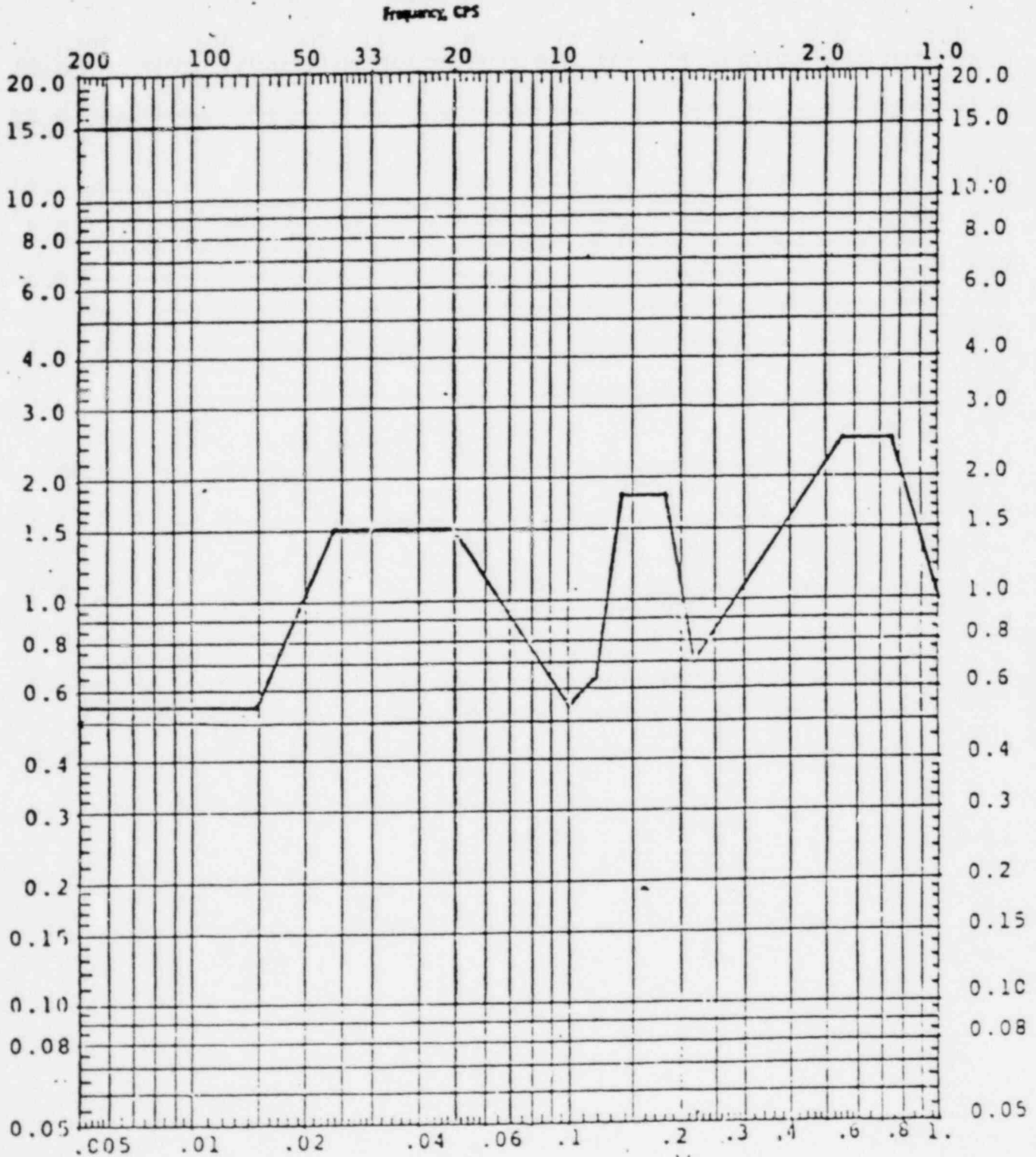
SARGENT & LUNDY

ENGINEERS

REV. NO.	DATE	INITIALS

Acceleration, g Units

Acceleration, g Units



REACTOR BUILDING-ELEVATION: 503', 570'
 RBCCW PUMP RESPONSE SPECTRA
 ENVELOPE OF UPSET AND EMERGENCY CONDITIONS - 1% AND 5% DAMPING
 REFERENCE FILE NO. EMD-024252

I-2

CLIENT CINCINNATI GAS & ELECTRIC COMPANY

SARGENT & LUNDY

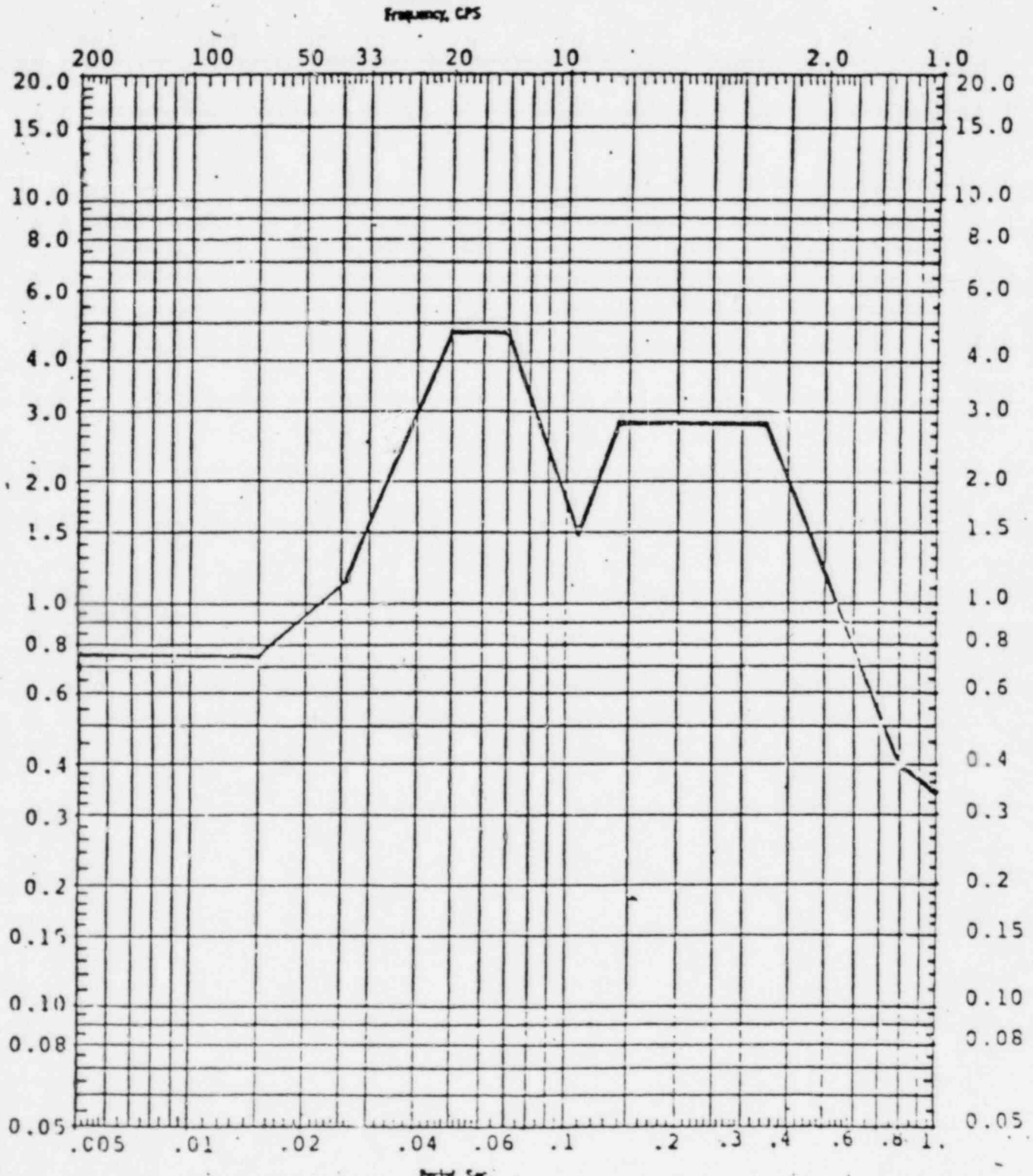
PROJECT ZIMMER - 1 JOB NO. 4130-15

DESIGN BY *James Miller* DATE 02-12-81

CHECKED BY *Tom K.../...* DATE 2-12-81 SHEET 4 OF 4

ENGINEER

REV. NO.	DATE	INITIALS



REACTOR BUILDING-ELEVATION: 503', 570' VERTICAL
 RBCCW PUMP RESPONSE SPECTRA
 ENVELOPE OF UPSET AND EMERGENCY CONDITIONS - 1% AND 2% DAMPING
 REFERENCE FILE NO. EMD-024252

Acceleration, g Units

Acceleration, g Units

Period, Sec.

APPENDIX J - FLANGE ANALYSIS

(a) Stuffing Box

FLANGE INPUT DATA (SEE ASME CODE FOR NOMENCLATURE)

A = 18.5 B = 12.5 C = 16.5 N = 10 DB = 1
 G = 14.5 AB = .551 T = 1.5 G1 = .75
 GO = .75 M = 2 Y = 10000 R = 150
 MOM = 115241 F = 1393 TEMP = 150 SMALL B = .25

OPERATING STRESSES, PSI

	ACTUAL	ALLOWABLE
LONGITUDINAL HUB STRESS, SH	13952	21000
RADIAL STRESS, SR	5623	21000
TANGENTIAL STRESS, ST	3604	21000
(SH+SR)/2	9787	21000
(SH+ST)/2	8778	21000
BOLT STRESS	10309	25000

BOLT UP STRESSES, PSI

	ACTUAL	ALLOWABLE
LONGITUDINAL HUB STRESS, SH	10144	21000
RADIAL STRESS, SR	7455	21000
TANGENTIAL STRESS, ST	4907	21000
(SH+SR)/2	12900	21000
(SH+ST)/2	11524	21000
BOLT STRESS	1721	25000

FLANGE SHAPE CONSTANTS

K = 1.49 T = 1.71938567 Z = 2.68010752 U = 5.63071829
 Y = 5.12396461 V = .550103
 F = .90392 SMALL F = 1
 G1/GO = 1 R/HO = 0

FLANGE STRESS FACTORS

SMALL D = 17.629013 SMALL E = .29685000 L (OR LAMBDA) = 1.1202393

EQUIVALENT PRESSURES

PE = 200.9 PED = 350.9

FLANGE MOMENT ARMS, INCHES

HO = 1.25 HO = 1 HT = 1.5

FLANGE LOADS, POUNDS

W1 = 69168 W2 = 110828

FLANGE MOMENTS, IN-LBS

MO = 43181 MO = 10244 MT = 23218 MTRANSMT = 112510

(b) Discharge Flange Analysis

FLANGE INPUT DATA (SEE ASME CODE FOR NOMENCLATURE)

$A = 15$ $B = 8$ $C = 13$ $N = 12$ $DB = .875$
 $G = 9.91289322$ $AB = .419$ $T = 1.5625$ $G1 = 1.125$
 $G0 = .58$ $M = 3$ $Y = 10000$ $P = 150$
 $MOM = 28624$ $F = 2250$ $TEMP = 150$ $SMALL B = .353553391$

OPERATING STRESSES, PSI

	ACTUAL	ALLOWABLE
LONGITUDINAL HUB STRESS, SH	5656	21000
RADIAL STRESS, SR	4326	21000
TANGENTIAL STRESS, ST	3101	21000
$(SH+SR)/2$	4991	21000
$(SH+ST)/2$	4379	21000
BOLT STRESS	7014	25000

BOLT UP STRESSES, PSI

	ACTUAL	ALLOWABLE
LONGITUDINAL HUB STRESS, SH	14347	21000
RADIAL STRESS, SR	12077	14000
TANGENTIAL STRESS, ST	8658	14000
$(SH+SR)/2$	13212	14000
$(SH+ST)/2$	11503	14000
BOLT STRESS	21887	25000

FLANGE SHAPE CONSTANTS

$K = 1.875$ $T = 1.55446861$ $Z = 1.79503106$ $U = 3.57874728$
 $Y = 3.25666679$ $V = .24458278$
 $F = .835125009$ $SMALL F = 1.26839011$
 $G1/G0 = 1.939655$ $H/H0 = .464238345$

FLANGE STRESS FACTORS

$SMALL D = 10.6027893$ $SMALL E = .387697052$ $L (OR LAMBDA) = 1.39278923$

EQUIVALENT PRESSURES

$PE = 178.8$ $PPD = 328.8$

FLANGE MOMENT ARMS, INCHES

$HD = 1.9375$ $HG = 1.54355339$ $HT = 2.0217767$

FLANGE LOADS, POUNDS

$WM1 = 35268$ $WM2 = 110048$

FLANGE MOMENTS, IN-LBS

$MO = 32906$ $MG = 15297$ $MT = 17881$ $MO+MG+MT = 65174$

(c) Suction Flange Analysis

FLANGE INPUT DATA (SEE ASME CODE FOR NOMENCLATURE)

A = 17.5 B = 10 C = 15.25 N = 16 DB = 1
 G = 12.0428932 AB = .551 T = 1.8125 G1 = 1.31
 G0 = .53 M = 3 Y = 10000 P = 150
 MOM = 103041 F = 4868 TEMP = 150 SMALL B = .353553391

OPERATING STRESSES, PSI

	ACTUAL	ALLOWABLE
LONGITUDINAL HUB STRESS, SH	8190	21000
RADIAL STRESS, SR	5352	21000
TANGENTIAL STRESS, ST	4138	21000
(SH+SR)/2	6771	21000
(SH+ST)/2	6164	21000
BOLT STRESS	7733	25000

BOLT UP STRESSES, PSI

	ACTUAL	ALLOWABLE
LONGITUDINAL HUB STRESS, SH	16172	21000
RADIAL STRESS, SR	11475	14000
TANGENTIAL STRESS, ST	8871	14000
(SH+SR)/2	13824	14000
(SH+ST)/2	12522	14000
BOLT STRESS	15165	25000

FLANGE SHAPE CONSTANTS

K = 1.75 T = 1.60463733 Z = 1.96969697 U = 4.00224229
 Y = 3.64204801 V = .197194121
 F = 1.31544237 SMALL F = 1.51227017
 G1/G0 = 2.258620 H/H0 = .519034249

FLANGE STRESS FACTORS

SMALL D = 16.4429314 SMALL E = .338594014 L (OR LAMBDA) = 1.36777074

EQUIVALENT PRESSURES

PE = 343.1 PFD = 493.1

FLANGE MOMENT ARMS, INCHES

HD = 1.97 HG = 1.60355339 HT = 2.1142767

FLANGE LOADS, POUNDS

WM1 = 68182 WM2 = 130695

FLANGE MOMENTS, IN-LBS

MD = 76270 MG = 19294 MT = 126860 MD+MG+MT = 132424

ATTACHMENT